A faint, light-colored map of the Northeast United States, including parts of New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, and Georgia, serves as the background for the title. The map shows state boundaries and major geographical features like the Atlantic coast and the Chesapeake Bay.

Ballast Water Management Workshop: REGIONAL SOLUTIONS

**September 26, 2002
Boston, Massachusetts**

**edited by
Judith Pederson, Massachusetts Institute of Technology**

BALLAST WATER MANAGEMENT
WORKSHOP:
REGIONAL SOLUTIONS

September 26, 2002

Boston, Massachusetts

Workshop Co-Conveners:

Judith Pederson, MITSG

Captain Franklin Bradley Wellock, Massport

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Foreward

We are pleased to present this summary of the Workshop on Regional Ballast Water Management held at the Black Falcon Terminal, Massachusetts Port Authority, Boston Massachusetts on September 26, 2002. It includes presentations of the speakers and summaries of roundtable discussions, a background paper on ballast water in the north Atlantic and links to relevant web sites.

The issue of ballast water management is accepted as necessary, but how to achieve results that are beneficial and cost efficient is still being debated. Because of the lack of enforceable action on the part of the international community and individual countries, some of the U.S. states are adopting their own regulations to achieve greater compliance with voluntary measures (specifically ballast water exchange at sea prior to vessels entering the Economic Exclusive Zone). Another option being considered is to develop regional ballast water management plans and approaches that improve record keeping, improve compliance with voluntary guidelines, and achieve other goals of interest to the management, environmental, and shipping community.

There are many fine publications and web sites that were used as background for how we might address the outstanding issues. It is our hope that we have captured the specific issues important to the region and that this will serve as background information as we move forward to both develop a regional ballast water management approach and identify scientific data that will support management options.

We are grateful to Dror Angel and Stephanie Parrish who prepared written materials and to Gayle Sherman for cheerfully assisting in the organization of the workshop.

Sincerely yours,

Judith Pederson, Ph.D.
MIT Sea Grant College Program

Captain Bradley Wellock,
Manager, Contracts and Regulatory Affairs
Massachusetts Port Authority

Sponsors

This workshop was co-convened by Judith Pederson, MIT Sea Grant College Program, and Captain Franklin Bradley Wellock, Massachusetts Port Authority.

Judith Pederson, Ph.D. is Manager of the Center for Coastal Resources at the Massachusetts Institute of Technology Sea Grant College Program. Her research interests are in coastal pollution and marine biological invasions and developing new approaches to evaluating impacts. For several years she was the Coastal Ecologist at the Massachusetts Coastal Zone Management Program facilitating the integration of scientific and technical advice in management and policy decisions. She served as an editor for *Estuaries*, has edited several conference proceedings, chairs the International Conference on Marine Bioinvasions, has served as Chair of the state's Outfall Monitoring Task Force, was Chair of the Regional Association for Research in the Gulf of Maine, and has been appointed to several federal and state committees. At MIT she continues to facilitate opportunities for students, the public, and agencies to access scientific information through a variety of outreach and educational opportunities.

Currently she has research projects on the relative risk posed by vectors that introduce marine nonindigenous species, assessing non-indigenous species, and is exploring the use of geographical information systems to develop new interactive tools for displaying geographical information in ways that can facilitate decision making.

Captain Franklin Bradley Wellock graduated from the Massachusetts Maritime Academy in 1974 with a Bachelor of Science in Marine Transportation; a United States Coast Guard issued Third Mates License, and a Commission in the United States Navy Reserve. His first shipboard position was as a Third Mate on the US Army Corps of Engineers Dredge COMBER. In 1977, he started an eleven-year career on tankers working for the Gulf Oil Company, the

Amoco Oil Company, the Glenn Eagle Ship Management Co. and the Crest Tanker Corp, respectively. During that time he sail as Third Mate, Second Mate, Chief Mate and Master on black oil tankers, clean product tankers and chemical tankers. When not at sea Captain Wellock worked as a consultant to various oil industry companies, as a cargo surveyor and expeditor.

In 1992, Captain Wellock accepted a tenure track position at the Massachusetts Maritime Academy, in the Marine Transportation Department. He served on the committee to develop only the second new degree in the 100-year history of the Academy. Captain Wellock also taught in the Academy's two centers for industry training: the Center of Maritime Training (CMT) and the Center for Marine Environmental Protection and Safety (CMEPS). He was the only faculty member ever certified to operate and develop programs for the Academy's new \$3,000,000.00, NORCONTROL designed, Oil Spill Management Simulator. At that time, it was only the second of its kind in the world. While working for CMT, Captain Wellock helped develop a special training program for The Massachusetts Harbormasters Certification and a program on Merchant Vessel Orienteering and Systems Control for the U. S. Navy Seals.

In 1997, Captain Wellock joined the Maritime Department of the Massachusetts Port Authority as the Manager, Contracts and Regulatory Affairs. In that position, he is the Maritime Department's primary point of contact with all Federal, State, and Municipal Agencies. In 2001, he was awarded the Commonwealth Award for his work in planning and execution of SAIL BOSTON 2000. In 2002 was recognized by the U.S. Coast Guard's Marine Safety Office Boston was his work related to port security for passenger vessels after the incidents on 11 September 2001.

Acronyms

ANPRM	Advance Notice of Proposed Rulemaking
CSLC	California State Lands Commission
DOD	Department of Defense
EEZ	Exclusive Economic Zone
ETV	Environmental Technology Verification program
IMO	International Maritime Organization
MARAD	U.S. Maritime Administration
MEPC	Marine Environmental Protection Committee
NANPCA	Nonindigenous Aquatic Nuisance Species Convention and Control Act (1990)
NAS	Nuisance Aquatic Species
NISA	National Invasive Species Act (1996)
NOBOB	no ballast on board
NPDES	National Pollution Discharge Elimination Systems
SERC	Smithsonian Environmental Research Center
TAG	Technical Advisory Group
TBT	Tributyl Tin
USCG	US Coast Guard
USEPA	US Environmental Protection Agency

REGIONAL BALLAST WATER MANAGEMENT APPROACH

Executive Summary

Over \$130 billion is spent each year on control, management and prevention of introduced pests (invasive species) that impact the environment and human health. Ballast water is one of the significant vectors transporting introduced species around the world. National and international efforts have focused on management of ballast water releases. However, passage of effective regulations has been delayed by a lack of international agreement; uncertainty about the effectiveness of treatment alternatives; inefficiencies in ballast water exchange; and a lack of supporting data to definitively mitigate these concerns. Although several guidance documents and regulations enforcing ballast water exchange in the Great Lakes and some other regions are in place, these do not minimize the risks associated with the other regions that face a greater risk of introduced pests. Given the slow pace of the national and international efforts, several states have begun to pass their own legislation requiring ballast water treatment, initially requiring exchange at sea prior to port arrival. In the Northern Atlantic, it is unlikely that all states and provinces will act unilaterally in passing laws or that such an approach will achieve regional protection. Rhode Island has a law requiring a ballast water management plan and New York is considering ballast water regulations.

The purpose of the Regional Ballast Water Workshop was to discuss the need for a North Atlantic Regional Ballast Water Management Plan that is consistent with current regulations and guidance, but provides additional levels of protection through a plan of action. There is ample evidence of economic and environmental impacts of introduced species in marine ecosystems, most of which have life history stages that could be transferred by ballast water. Under current treaties, agreements, and legislation, not all

vessels are subject to reporting and managing discharges. This workshop explored the current status of ballast water management in Canada and the United States through presentations on regulations at the national and state levels, examined the shipping community's perspective, and provided opportunities to explore ways of developing a regional approach to reduce or prevent release of introduced species from ballast water. Attendees included representatives from state and U.S and Canadian federal agencies, shipping community representatives, scientists and other stakeholders.

SUMMARY OF PRESENTATIONS

INTERNATIONAL AND NATIONAL REGULATIONS

The International Maritime Organization (IMO) has developed policies and guidelines related to international trade and commerce. Member countries of IMO (including the U.S.) have adopted voluntary guidelines for control and management of ships' ballast water to minimize the transfer of harmful organisms and pathogens. These guidelines have served as a model for ballast water management in many countries, but since they were adopted in 1997 have not led to enforceable agreements.

UNITED STATES REGULATIONS

The U.S. passed the Nonindigenous Aquatic Nuisance Prevention and Control Act (NAN-PCA) of 1990 and its reauthorization (the Nonindigenous Species Act (NISA) of 1996) established several important programs and guidelines that are the basis of the current ballast water management program in the U.S. The key elements are

- designation of the U.S. Coast Guard as the agency responsible for ballast water management;
- mandatory reporting of all ballast water treatment for vessels entering the Exclusive Economic Zone (EEZ);
- mandatory exchange of ballast water for

- vessels entering the Great Lakes;
- surveys of ecological impacts and ballast water discharges;
- a ballast water management information clearinghouse;
- research programs that examine alternative treatment technologies;
- establishment of an Aquatic Nuisance Species Task Force and regional panels; and
- funds for states to prepare state invasive species management plans.

In 1999 the Clinton administration issued Executive Order 13112 that established a National Invasive Species Council charged with integrating all federal agencies that have responsibilities for managing introductions of invasive species. The Council's major task has been to examine cross cutting budgets and develop a comprehensive approach to minimizing or reducing pests that impact agriculture, human health, and ecosystems.

Although progress has been made in the number of ships with ballast water exchange, there are several areas that are not covered under current regulations and are potentially important conduits for continuing to release species from ballast water discharges in ports and harbors. In addition, the analysis of the mandatory reporting reveals that only about 35% of ships required to report are doing so. The U.S. Coast Guard has responsibility for recommending new regulations to address this lack of compliance.

CANADIAN REGULATIONS

In 2000 Transport Canada and Fisheries and Oceans Canada issued a set of guidelines to protect waters under Canadian jurisdiction from pests that could be harmful to existing ecosystems. The Canadian guidelines are based on the IMO's Guidelines for the Control and Management of Ships' Ballast Water to Minimize the Transfer of Harmful Aquatic Organisms and Pathogens and were compiled following consultation with relevant stakeholders, including shipowners and operators, environmental organizations, government officials, and the U.S. Coast Guard.

The Canadian Guidelines include:

- all ships are required to have a ballast water management plan that is specific to each ship and recognizes that the ship's master has responsibility for stability and other safety considerations;
- mandatory reporting forms must be submitted and ships may be boarded to ensure compliance;
- no discharge of ballast water taken outside Canadian waters is permitted unless it is demonstrated that exchange occurred within 200 nm or due to safety consideration within a designated alternative exchange zone;
- ballast water exchange must be documented and appropriate for the type of tanks (e.g. sequential exchange or flow through exchange tanks) or retained on board; and
- sediment disposal should be carried out in mid ocean outside Canadian waters or disposed at approved land dumpsites if inside Canadian waters.

Although there is great improvement in compliance of reporting ballast water exchanges, several issues still persist that are threats to Canadian waters. Two major issues include the environmental safety of alternative ballast water exchange sites and lack of compliance of ships making coastal transits.

STATE REGULATIONS

Several states have passed legislation designed to enforce voluntary compliance of ballast water exchange and improve mandatory reporting as required by the U.S. Coast Guard. These states include California, Washington, Oregon, Michigan and Maryland. Several other states are considering passing legislation to regulate ballast water reporting and treatment.

California was one of the first states to pass legislation that prevents discharging ballast water within state waters unless it has been treated or exchanged at sea. The legislation is consistent with the U.S. Coast Guard regulations; ship masters use the completed Coast Guard form for reporting to California officials. The legislation has several unique features that have improved responses from shippers and their agents:

- funds are provided for hiring inspectors to

- ensure compliance;
- fees assessed per ship voyage are used for research on alternative technologies and research;
- fines are levied for ships failing to report and to comply;
- an active educational program focuses on ship agents and other stakeholders; and
- a summary of effectiveness is required within four years (i.e. accountability of the state's management).

Although the regulations have greatly improved reporting compliance (>90% compared to 30% nationwide), ships that enter the EEZ from Mexico are exempt as is all coastal traffic. In addition, states to the north (Oregon and Washington) and Canadian provinces are concerned about coastal traffic that passes through San Francisco Bay, known for its high number of introduced marine species. In addition to state regulations in Oregon and Washington, new regional efforts are underway to examine alternative discharge sites to address some of the coastal transit economic and ecological issues.

Although there are regulations that apply indirectly to vessel discharge, only Rhode Island has passed legislation - Act to Commence Process of Developing a Ballast Water Management Program (Rhode Island Statutes, Title 46, Waters and Navigation, Chapter 46-17.3). A report back to the Assembly is due in 2002.

REPORTING COMPLIANCE IN THE NORTH ATLANTIC

The majority of vessels calling on ports in the Northwestern Atlantic are primarily domestic, but also includes traffic from the U.S. Caribbean Islands and from Europe (Ruiz et al. 2001, Transport Canada 2002). By contrast, ships entering the Gulf of St. Lawrence also include ships from ports in Central America, the South Pacific and the South American Atlantic coast (Harvey et al. 1999). Summarizing information about vessels, ballast water management, and areas of exchange is challenging because of low compliance with voluntary U.S. reporting and limited access to data from other sources. In the **Northwest**, compliance is around 30% which is insufficient for drawing conclusions. Of those

that are reporting, nearly half of those discharging ballast water have performed some type of management, usually exchange, prior to entering the EEZ. Better reporting compliance in Canada has resulted from enforcement, but in both the U.S. and Canada, it is difficult to document ballast management with vessels making coast-wise transits.

In general only 2.4% of total tonnage in the US comes through New England ports and only two ports are ranked in the top 50; Portland, Maine (25) and Boston, Massachusetts (35). Within these two New England ports, different vessel types are more typical. While bulk carriers commonly visit in Portland ports, container ships are more common in Boston ports; by contrast, tankers are the major vessels discharging ballast water in Atlantic Canada (USCG data; Transport Canada 2002). Cruise ships, which are a major concern on the West Coast, were not included in either study. Although the total volume is small, 500,000 million tons per year (small relative to the total volume of an estimated 2-3 billion tons), the risk of introduction is not necessarily associated with how much ballast is released, but factors relating to sources and inoculums. It is generally agreed that ballast taken on in the Northeast and Atlantic Canada should not be allowed to contribute to introductions elsewhere.

A complex set of factors are involved in risk assessment. From the current U.S. reporting data we do not have sufficient information to draw many conclusions. Canadian vessels are more likely to discharge larger volumes than the ships visiting Northeast U.S. ports. Ballast water discharge for both the Northeast (U.S.) and Canada are drawn from Nova Scotia region, Northeast U.S., and Southeast U.S. (Transport Canada 2002; USCG data). Ballast tank discharges in Canada originated from ports (42%), coastal waters (16%) and open ocean (42%) (Transport Canada 2002). The study reported that between 20-33 phytoplankton taxa and between 7-10 zooplankton taxa were in the tank's ballast water (Transport Canada 2002). Approximately 15% of the phytoplankton species were identified as toxic or harmful (Transport Canada 2002). The Canadian study also noted that species are present in all ballast water tanks within the range of concentrations recorded, supporting the concern

that all volumes present risk of inoculation. Similar current data for the Northeastern US are not available for comparison and further analysis of risks to the region. In the North Atlantic, ballast releases from coast-wise traffic, cruise ships, and tramp ships, are largely unknown quantities and from unknown sources.

SHIPPING COMMUNITY PERSPECTIVE

The shipping community has adopted the voluntary guidelines that are consistent with IMO Guidelines. The International Maritime Organization recommends that each ship prepare a Ballast Water Management Plan that protects the environment and ensures the safety of the crew and ship. Industry strongly supports global regulations and guidance rather than individual country or state regulations.

Concern about ship and crew safety is a major concern for the shipping industry. There are many factors that would prevent exchange at sea, but generally less than 5% of the vessels entering the Great Lakes are not exchanging at sea because of safety issues. Although ballast water of two to three tanks may be exchanged during a voyage (lasting 8-9 hours), vessels rarely conduct a full ballast exchange (usually > than 24 hours). Vessels traveling from ports along the east coast or Atlantic Provinces would not be able to conduct full ballast exchange outside the 200 nm limits of the EEZ and are currently exempt. For example, oil tankers operating out of St. John and traveling to Boston are rarely out of sight of land with the trip taking approximately 21 hours.

Although new treatment technologies are promising, at this time, without a national or international standard, installation of treatment systems is a gamble for the ship owner. In the interim, selecting alternative sites for ballast water exchange within the EEZ is a preferred option. Onshore options, such as are used for ballast from oil tankers without dedicated ballast tanks, should also be examined.

RECOMMENDATIONS FOR FUTURE CONSIDERATION AND ACTIONS

There was a consensus among the group that ballast water should be managed to minimize ecological impacts. The approach should be consistent with the U.S. Coast Guard regulations and guidance and with the IMO Guidelines. Several other key groups were identified that have a role in ballast water treatment and ship safety; the Marine Environment Protection Committee (MEPC), INTERTANKO, the Canadian Ballast Water Advisory Committee, the Northeast Aquatic Nuisance Species Panel and the ANSTF, the Gulf of Maine Council on the Marine Environment, the International Joint Commission, the Great Lakes, the National Aquatic Invasive Species Council, as well as several states that have adopted management plans and shipping organizations.

Some of the key issues highlighted were:

- industry, agencies, and other stakeholders prefer a regional approach to a state by state approach, but see this as a global issue;
- need for a national and international standard to be used for adopting ballast water treatments (including ballast water exchange);
- guidance and regulations should incorporate the limits on time it takes to exchange ballast tanks for coastal ships;
- mandatory reporting should be streamlined;
- vulnerability and risk should be evaluated;
- both import and export of ballast water should be managed;
- initiate implementation of education and training programs to protect ship safety and convey the economic and ecological impacts of introduced pests;
- a database and data exchange should be available to the region;
- dockside inspections that take several hours should be coordinated among agencies to minimize time;
- document successes and shortcomings of ongoing monitoring, evaluation and reporting systems;
- explore the option of exchanging at 50 nm offshore for coastal vessels.

Throughout the discussions, the importance of including the shipping community in the

planning and implementation of any regional ballast water management plan was stressed. There were also several areas where data or information were lacking for effective management. A small working group was identified to continue the dialogue and develop an action plan for implementing a regional ballast water management plan.

Judith Pederson, Ph.D.
Co-convener, MIT Sea Grant College Program
Center for Coastal Resources

BALLAST WATER MANAGEMENT IN THE NORTHEAST

Introduction

Introduced species are a growing threat to the environment and economy. Currently \$130 billion is spent annually on management, control and prevention of non-native species, and this does not fully reflect costs spent on marine invasions. Ballast water has been implicated as one of the important vectors transporting species from one geographic region some of which become established and spread to every major coastal ecosystem. This recognized threat has prompted the promulgation of national and international regulations and guidelines that are intended to prevent or minimize introductions. In the U.S. the National Invasive Species Act of 1996 (NISA) expanded the regulations of the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) requiring exchange of ballast at sea for all ships entering the Great Lakes from beyond the 200-mile Exclusive Economic Zone (EEZ) and requires mandatory reporting of ballast water management practices for all foreign vessels entering from outside the EEZ. The U.S. Coast Guard (USCG) in compliance with NISA regulations (a) requires mandatory reporting, (b) provides voluntary ballast water management current regulations and guidelines, and (c) promotes good management practices.

The USCG in collaboration with the U.S. Environmental Protection Agency (USEPA) is expanding its research and development efforts to evaluate ballast water management technologies and ways to verify exchange or treatment. In addition to reaching consensus on the scientific and technical issues of performance standards, politics is also a component. Ballast water exchange is 60-90% effective, but for those who want zero discharge this is not acceptable. Other

technologies may not be effective against all taxonomic groups and therefore may not meet zero performance standards. How best to proceed is an ongoing debate both internationally and nationally. The delay in taking action on adopting standards, mandating ballast water exchange, enforcing reporting and addressing other issues has led to some political entities to adopt their own regulations.

In the U.S. some states have adopted regulations that require ballast exchange at sea that surpasses the current federal requirements. California and Washington require vessels that enter the EEZ to exchange ballast at sea in at least 3000 feet of water. Oregon has proposed a similar bill and states on the East Coast have or are beginning to propose regulations to manage ballast water discharge. Nearly all of the regulations use the U.S. Coast Guard or the International Maritime Organization form for reporting ballast water exchanges. However in the New England and northeastern Atlantic coast response to ballast water reporting has been poor, with only 30% of the vessels completing the forms.

In response to the recognized need for improved management and response to reporting, the MIT Sea Grant College Program and Massachusetts Port Authority convened a workshop to provide a forum for the northeastern Atlantic regional maritime community to actively participate in discussions about the scope and nature of the problem and solutions to the increasing likelihood of unwanted introductions. This document presents papers and summarizes discussions of working groups that identified issues and provided suggestions for future actions.

U.S. Coast Guard's Ballast Water Management Program

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Good morning. I am the coordinator for the U.S. Coast Guard National Program for Ballast Water Management. Today, I am going to talk to you about the basics of the U.S. Coast Guard program. My discussion will include what is current in the national voluntary program, some of the work we are doing in the regulatory process for ballast water discharge standards and ballast water technologies, and I will also touch lightly on the research and development activities since Dr. Richard Everett, who is our alternative treatment expert, is in the audience. In addition, I will discuss a little bit of the work we are doing at the International Maritime Organization (IMO) for International Treaty.

It looks like we have a very experienced crowd here, but just in case, I want to touch on the basics of the origins of ballast water management. Most of you are already familiar with this. In 1990, the Nonindigenous Aquatic Nuisance Species Convention and Control Act (NANPCA 1990) was passed. That is what mandated the Great Lakes program for mandatory ballast water exchange for any vessels coming in from outside the Exclusive Economic Zone (EEZ), and also created the Aquatic Nuisance Species Task Force. In 1996, the National Invasive Species Act (NISA 1996), which reauthorized NANPCA 90 was passed. It established a program for National Ballast Water Management, this program had to be voluntary for a minimum of two years.

*Bivan Patnaik is the current Coast Guard contact.

The Coast Guard was required to report to Congress on the voluntary program as part of the regulations. The regulations are contained in 33 CFR Part 151, subpart C and subpart D. Subpart C applies to the Great Lakes and Hudson River north of George Washington Bridge. That is where we have mandatory exchange and vessels report to the Captain of the Port. There are penalties for failure to do an exchange or the vessel may retain the ballast water on board, and penalties for failing to report. Subpart D is the national program, which does include the Great Lakes and Hudson River. There are certain applications in there that do duplicate some subpart C, but there are no penalties associated with the national program currently. It promotes voluntary ballast water management guidelines, which also include precautionary practices for ships, not just for vessels coming in from outside the EEZ, but for any vessel that operates on U.S. waters.

I would like to break it down a little bit and to clarify where which portions apply. In Figure 1 the gray areas are the National Voluntary Program, the black area in the Continental US is where the Great Lakes Mandatory Ballast Water Management Program is, and also black, is Alaska which has a unique requirement. Any vessel that is carrying Alaskan North Slope Crude Oil and selling it in a foreign port must do a mandatory exchange; any other vessel in Alaska waters is under the voluntary program. So that is why they are a little bit different there.

Currently, we recognize ballast water exchange in an area over 200 miles from any shore and in waters greater than 2000 meters in depth with either empty refill or flow through method. Vessels can also retain the ballast water on board. We are also encouraging alternative compliance technology, however, none have been approved as of yet. There may be some changes to these which I will get to a little bit further on, based on a report to Congress where we have made some recommendations.

One of the things the Coast Guard strongly supports in NISA is the safety exemption. We really do not want to blow up ships or kill people or crack ships in half to enforce ballast water management. We feel that is a little bit extreme. For the national program, that means any vessel that does claim the safety exemption cannot be

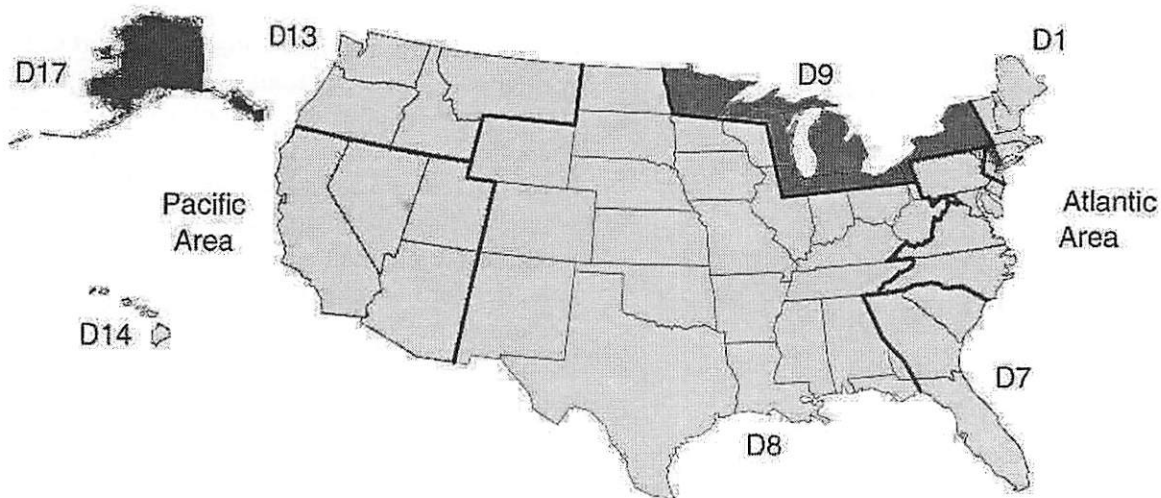


Figure 1. This map of the United States shows the National Voluntary Program compliance areas in gray, the black areas indicate mandatory federal programs. The black area in the Continental US is where the Great Lakes Mandatory Ballast Water Management Program is, and also black, is Alaska, which has a mandatory ballast water exchange for any vessel that is carrying Alaskan North Slope Crude Oil and delivering to a foreign port.

prohibited from discharging its ballast. For the Great Lakes they must do some type of alternative treatment such as retaining on board, or utilize alternative treatments. But it is a case-by-case basis, which is approved by the Captain of the Port at this time, until we have approved technology standards.

The precautionary practices that we ask every vessel to do, a lot of them are just good housekeeping, are intended not to transport organisms from one area to another. We recommend practices such as cleaning off your anchor chain as you retrieve it, and some other common sense precautions. For example do not ballast in an extremely environmentally sensitive area such as a sanctuary or waters that may affect those areas. And if you want to do cleaning, dispose of any sediment that you clean out properly in accordance with the state regulations.

Now for the mandatory reporting, if you are going into the Great Lakes or Hudson River north of George Washington Bridge currently you report directly to the Captain of the Port if you are coming in from outside the EEZ. For the rest of the nation if you are coming in from outside the EEZ you report to the National Ballast Water Information Clearinghouse, which is located in Edgewater, Maryland. That is a cooperative effort between the Coast Guard and the

Smithsonian Environmental Research Center (SERC). We basically fund it and they provide all the expertise.

Vessels equipped with ballast water tanks are required to report. I know there was some confusion when the program first started because we used the phrase carrying ballast water. So some vessels that had only residual ballast water on board were not reporting. We modified the regulation to capture the whole population of vessels equipped with tanks coming in from outside the EEZ. There are a few exemptions such as crude oil tank vessels engaged in coastwise trade, and certain DOD (Department of Defense) and US Coast Guard vessels which must comply with their own programs. Vessels must submit detailed information about their ballast water such as the source of their ballast water, if the water has been exchanged, where it was exchanged, how much and where ballast water will be discharged, was there any other treatment, and they must retain all these records on board for two years.

Formerly we had a random ballast water boarding program. However, we have now more fully incorporated the ballast water program into our other activities such as Port State Control boardings and inspections. During almost all of our standard boardings, ballast water management

is incorporated by checking documentation, checking charts, checking logs, and sometimes doing ballast water sampling. However, there is no penalty provision if a vessel is in violation unless it is on the Great Lakes. Again, that is what is required currently. If anybody has read the Report to Congress on the Voluntary Program, US Coast Guard (2002), you will know that that is not going to be lasting very much longer.

Now we get to the Report to Congress. We had to keep the program voluntary for a minimum of two years. Those two years ended June 30, 2001. We drafted the report to Congress on how well the program had worked, on a voluntary basis. It was submitted to Congress on June 3, 2002. The Coast Guard made some very specific recommendations in the report, and some possibly not surprising conclusions based on the data that were received from all of the vessels that reported. When we compared the vessel reports that we received with the myriad data of how many vessels actually entered the waters of United States from outside the EEZ, we see that only 31% of vessels reported. There were some variations in that, the west coast, California, had a much higher reporting than the other areas, and that might have to do with the fact that there are penalties in California for failure to report. When I discuss some of the conclusions we reached in the report, I want to qualify that it is on the approximately 30% of the vessels that reported. It is very dangerous to extrapolate any of this information to think that it covers the whole population. Because we do not know what that other 70% actually did. They may have retained no ballast on board (NOBOB), they may not have had any ballast water to discharge or they may have all been fully loaded with ballast and discharged it. Based on that, and the fact that we could not determine a true consensus to what is actually happening, the Coast Guard does have the authority to go forward and make the program mandatory with penalty provisions. That is the way NISA was written.

Of the vessels that did report, which is basically only the 30% or 34% of the vessels that entered U.S. ports from outside the EEZ, almost 74% reported that they were not going to discharge any ballast water. So, they are in compliance

with the voluntary guidelines. Out of the 26% that were going to discharge ballast water about 13% reported exchange and 12.9% did not do an exchange. During the two-year period of the data collection there was very little variation in those numbers. We did not see any increase in those complying with the voluntary guidelines. For those vessels that did report there was approximately 37 million metric tons of ballast water discharged in the waters of the United States. Out of that almost 70% reported that they exchanged, and about 30% that they did not exchange. That stayed pretty stable during the whole three-year period also.

One of the other pieces of information that we gathered was how many vessels claimed the Safety Exemption. There was some concern about abuse of the safety exemption. There were less than five percent of the vessels that utilized it. Most people that supplied reasons they could not conduct an exchange reported it was due to the operating parameters of the ship. The vessels did not transit in areas that would allow for a good open ocean exchange; for example, they were in too shallow, too close to shore, or it was not economically feasible for them to go out 200 miles, stay there to conduct an exchange, then come back in, when the vessels were only on a 12 hour trip. We were able to gather a lot of that information, which we expected, but needed to confirm.

Criteria developed by the Aquatic Nuisance Species Task Force on the effectiveness of the voluntary management program was one of the items used in drawing conclusions and developing recommendations from the data obtained. One of their recommendations is that we compare it to an existing program, such as the Great Lakes, which already had an existing mandatory ballast water management program. There were some differences. The Great Lakes as you all know has a choke point. Any vessel coming through the Seaway has to report, so basically you have 100% compliance for reporting, because if they do not report they are not going through the Seaway and they are not coming into the Great Lakes. Of vessels bound for the Great Lakes, 93% arrived or reported in compliance, the other 7% were not allowed to enter until they came into compliance. So basically you have got a

very high compliance rate for the Great Lakes, and a very low (less than 40%) that comply with even the reporting requirements of the rest of the nation. Due to the consistently low rate of reporting for the national program it was impossible to accurately assess the compliance with the voluntary ballast water management guidelines. Congress anticipated that this might occur when they wrote the law. The Coast Guard was given the authority to precede forward with a mandatory ballast water management program with penalties if it occurred.

We had four public meetings to gather the public input on the ballast water management program. We needed input on how the general public, industry, and affected stakeholders felt about the voluntary ballast water management program. Most people supported the need for a mandatory national ballast water management program. Even many that you would not expect to ask for mandatory compliance are concerned that in the absence of a strong Federal program, we may end up with conflicting regulations between different States and countries. This would result in vessels having to spend exorbitant amount of money trying to come into compliance with a myriad of different requirements.

Our recommendations and what we reported to Congress are that we will be making the voluntary program mandatory, and the Coast Guard will be providing the necessary enforcement. We intend to implement a robust national ballast water management program. We are going to use the techniques that are already available such as ballast water exchange and we really are encouraging and trying to support the development of alternative technologies. We are working with the US Environmental Protection Agency (USEPA) because there is a lot of crossover with developing standards, and they are the experts in some areas. We have a lot of expertise, especially in Dr. Rich Everett.

There are four key regulatory projects that we are working on now. One is ballast water reporting. One thing that has been very absent in the data we collected is what is occurring in the domestic traffic. So in the report, we recommend that we will go forward with applying the reporting requirement to vessels that travel from one U.S. port to another U.S. port if they go outside

one Captain of the Port zone. We will also be attaching penalties to failure to submit the reports. Another regulatory project is the mandatory ballast water management. We had to separate each regulation, because behind every regulation we have to do environmental assessments, potential environmental impact statements, regulatory assessments, their impact on other laws and regulations, and economic assessments. We needed to separate these out so that the ones that are going to need extensive environmental analysis do not hold up the ones that could be developed more quickly. The mandatory ballast water management rulemaking is expected to take longer for the assessments and the analysis, than the reporting penalty. We expect to publish the mandatory ballast water management notice of proposed rulemaking in the fall of 2003; whereas with the reporting penalties, we are hoping the notice of the proposed rulemaking will be published within the next couple months.

The other two other regulatory projects we are working on are proposed rulemaking for developing standards and an interim rule for the approval for experimental technologies on ships. It is quite an investment for any ship that is putting any of these ballast water treatment technologies on board. We want to give them some security that if they invest the money and move this forward, they are going to be able to use the technology or approach for at least enough time to recoup what they invested. Otherwise, we feel there may be a deadlock to anyone actually investing into the technologies. An Advance Notice of Proposed Rulemaking (ANPRM) on standards was published on March 4, 2002. We received 41 letters on it with multiple comments which all had to be considered. Currently they are being reviewed. The next step will come out in the Federal Register. If you read the advance notice for proposed rulemaking on standards, you know that, by the way the law is written for the Coast Guard, we need something that is at least as effective as ballast water exchange. We could have every vessel that adds a ballast water technology, do a side-by-side comparison, every time. However that would be extremely slow and cost prohibitive. We are trying to look for a quantitative standard that produces predictable results, removes or inactivates a high number of

organisms, and functions under the operating conditions of the ship, because they are so extremely varied. If you want to look at the ANPRM, or any other rulemakings, they can be found at the Docket Management Services web site.

Another program we are working on is the ETV program, the Environmental Technology Verification program, which is supported by USEPA. We are working with a few other entities on that, and it is not an experimental approval program. It is completely voluntary on the part of a manufacturer to put a technology on board a ship, and to verify the performance characteristics of a technology that is ready for commercial sale. It is not research or bench top field-testing. This program is to actually put something out to market. But it is an approach that we (the Coast Guard) see as advantageous to support, one in the developing of protocols, and something that makes it consistent for the testing of technologies. We are supporting this financially and with personnel.

The other regulatory project for experimental approval has published a request for comments. This basically targeted ship owners, and it is to provide assurance. However, there are certain things that we need provided from the applicant up front before a treatment or technology can be accepted for consideration. We are not going to accept things that do not demonstrate they are theoretically capable of reducing the risks from invasive species. We do need certain things up front such as letters of commitment, the system description, the results of previous testing, lab bench and field testing and all that, and proof that discharge complies with water discharge standards from USEPA. Basically we do not want anyone dumping super nasty poison right in the middle of San Francisco Bay. If you do not start any of this work within one year of after you received approval from the USCG then it expires and you need to reapply. We are not just going to do a paper approval and let it stand. We can only do it for U.S. waters and also there has to be some work with the states because there may be some mandatory regulations for them also, as in California. We are retaining the right to inspect a vessel and we want regular submissions of reports on how this technology is working.

We need to know what is going on, and that it has no adverse affects on the ecology or on human health. We really do not want a lot of gas coming up through the vents and killing all the people on deck.

On the West Coast, there is a lot of collaboration that I will not go into deeply as we have a later speaker who will be addressing that issue. Also, some of the research we sponsored is at the USCG Research and Development Center. Gail Roderick (USCG R&D Center) who is in the audience can discuss this further, so I am just going to touch on it here. There were some scientific audits, verification of exchange, and evaluations of treatment processes.

One of the provisions of NISA is that we work with the international community because this needs to be standardized throughout the world. If we have ships, (1) we do not want to put the U.S. at an economic disadvantage, (2) we are also affected by the water from these other nations, and (3) really we do not want to, just hold it, the not in my backyard syndrome. So, we engage in foreign negotiation, and we do that through the International Maritime Organization, Marine Environmental Protection Committee (MEPC). Joe Angelo from the U.S. Coast Guard is the U.S. delegate and he has his committee of advisors, which my boss, Commander Scott Newsham, and Dr. Everett. They will be attending the next meeting of the MEPC (MEPC 48) in London in the next few weeks. Between the last MEPC meeting and this meeting there was a correspondence group that worked on the ballast water issue. The whole week before this IMO meeting, or most of the week, they are going to be having a working group meeting on harmful aquatic organisms transported by ballast water. Much of the discussion is going to be on standards. The working group recognizes that internationally there is a barrier to developing new technologies if they the developers do not know what standards the technologies need to meet. This is necessary before they can actually go forward. And we want to make sure that what these technologies do actually protects the environment. We really do not want just to have a ship be required to put a piece of technology on and find out two years down the road that it has not done a thing. They wasted their money, their time, our

time, and a lot of research money. Now we really want to protect the environment with these alternate technologies. If you want to see copies of the documents from your PC, go through our main web site, which would be on the last page. The MEPC documents do not just cover ballast water so there are other issues that maybe of interest. For example, the Tributyl Tin (TBT) issue and anything else that is on the agenda for the IMO MEPC committee, you can gain access to papers on those subject through <http://www.uscg.mil/hq/qm/mso/mso4/mepc48ag.html>. These papers are not just U.S. positions on certain issues, you will have multiple nations perspectives. I think there were about 30 papers on ballast water from different nations for this meeting. The United States does have a certain position and we are going to be at the IMO MEPC meeting to discuss and present our viewpoint. We are not sure how much compromise we will be willing to do but we really need to push forward in developing standards.

One thing I ask when you are participating in this workshop and its discussion groups is please take into consideration the Federal program, look at the regional differences, consider the domestic traffic, the coastal traffic, and the foreign traffic also. Do not just tunnel vision on the foreign traffic. There may be regional differences here that at the federal level we are not aware of, so please note that the Coast Guard is available to you. Contact Paul Mucha at District 1. You can also provide input through the Federal Register, with your comments through the workshops, through the regional panel, and through the task force (ANSTF). We do not want any surprises, such as, finding out that we did not consider an extremely environmentally sensitive area and are allowing vessels to discharge there. Bring the issues to your legislators. NISA is up for reauthorization, so if there are regional concerns, make sure they are addressed in the law. We want a consistent standard program for the nation and hopefully some day for the whole world but we do not want it to jeopardize the vessels, the environment, or the U.S. economy. We do not want to create conflicts in our laws and our regulations and we do not want duplicate efforts. If we are responsible for the national program and if one of the states has their own

approach, then we have two different people doing the same things on the same ship. Maybe those resources could be better used elsewhere.

We need to improve on the education and outreach that we provide to the ships. Right now we still distribute the USCG Ballast Water brochure but it will be in error when new regulations are implemented. We will be pulling that one of course and modifying it. We will not be releasing the floppy disks again until the next time the regulations are modified to reflect what was in the report to Congress. And of the course, there is a partnership for research with the Coast Guard and with Sea Grant. A lot of information is out there, so look for it, do not duplicate efforts, and do not reinvent the wheel. Let us keep moving the information program forward.

And finally, for more information you can go to our web site. For any of the regulatory actions, you can go to the DOT docket management service web site. For information on the ETV program go to the EPA site on ETV, and of course the National Ballast Water Information Clearinghouse. When you are retrieving information from the ballast water reports from ships, you can run a query on specific regions, ports, and States. If the capability is not there for what you are specifically looking for then e-mail the Clearinghouse, describe exactly what type of information you are trying to retrieve from the database, and they will help you. This database is intended to be usable by the whole public, the industry, and the states and to reduce duplication of efforts. Thank you very much

For more information, see the following web sites:

USCG Aquatic Nuisance Species Program
<http://www.uscg.mil/hq/g-m/mso/mso4>

DOT Docket Management Service
<http://dms.dot.gov>

Environmental Technology Verification Program
<http://www.epa.gov/etv>

National Ballast Information Clearinghouse
<http://invasions.si.edu>

LITERATURE CITED

US Coast Guard 2002 Report to Congress

US Coast Guard 2001 Standards for Living Organisms in Ship's Ballast Water Discharged in U. S. Waters (USCG-2001-10486), Federal Register, March 4, 2002

LCDR Mary Pat McKeown coordinates the U.S. Coast Guard National Ballast Water Management and Species Task Force Ballast Water and Shipping Committee. She has a B.S. in Biology from the State University of New York at Brockport, NY and 2 years of graduate work in Natural Resources at Cornell University specializing in ballast water issues. She has over 18 years of experience in the U.S. Coast Guard Marine Safety Program, in locations ranging from Morgan City, Louisiana to Kodiak, Alaska and two years previous military service as a U.S. Marine.

Ballast Water Management in Canada

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I work with Transport Canada Marine Safety. And I am an acting manager for the Compliance and Enforcement Section in the Atlantic region. I will give you a brief description of what we are doing. Transport Canada Marine Safety is the marine safety part of Transport Canada rather than the Canadian coastguard which was part of Transport Canada until 1996. At that time the organization was separated and the coastguard is now part of DFO – Canadian Department of Fisheries and Oceans. So in order to be able to regulate commercial shipping in Marine Safety, we have to work with the Canadian Coast Guard though we are part of different departments, and sometimes there are issues with regard to communications. Transport Canada regulates ships and our marine inspectors are appointed as steamship inspectors, container ship inspectors, port wardens, examiners of masters and mates as well as dangerous goods inspectors, and pollution prevention officers. As part of the pollution prevention officer program and environmental protection under Part 15 of the Canada Shipping Act, Transport Canada was involved in establishing guidelines for ballast water exchange since the early 1990s. At that time the main issue was to protect the Great Lakes following the outbreak of zebra mussel invasions of the Great Lakes.

Lately, starting with 1998 - 1999, under the auspices of Canadian Marine Advisory Council, it was decided to establish regional groups, including the regional ballast water committees in certain areas of the country. At this time we have groups on the West Coast, we have another group on the Great Lakes, central region of

Canada, and a group on the East Coast. Transport Canada was instrumental in getting together a good mix of agencies and people with different backgrounds, mainly scientific backgrounds, including scientists from Fisheries and Oceans (DFO), such as Dr. Andrea Locke; Ross Alexander from Muncton; and representatives from the shipping industry. Ivan Lantz, from the Shipping Federation of Canada, was a very active member of the group as was Sonia Simard, who is now involved with FEDNAV in Montreal. We invited also a non-government organization such as the Ecology Action Centre from Halifax and of course, Transport Canada. We worked together for one year toward establishing national guidelines. In September 2000 the national guidelines were published, and they are supposed to be applicable to the whole country: West Coast, East Coast, Arctic, Central. It was decided that in order to have a better approach and good results to combine the application of standards published with the International Maritime Organization (IMO) resolution 868, with regard to ballast water management to combine them with regional application. There were four regional annexes covering: West Coast, the Arctic, Central Canada and Quebec and East Coast of Canada.

Transport Canada in the Atlantic Region was mandated under the auspices of Canadian Marine Advisory Council to find ways of implementing the guidelines throughout the Atlantic Region of Canada. It has to be noted that these are just guidelines, so they are not mandatory, therefore not enforceable under the Canada Shipping Act. However, there are provisions under the Canada Shipping Act enabling the minister to establish regulations, if necessary. Presently, consultations are taking place through the Canadian Marine Advisory Council (CMAC) in order to establish regulations applicable for the Great Lakes and Saint Lawrence basin. These regulations were circulated through the stakeholders and now they are at the stage where the principles were approved. We are waiting for legal advice in order to decide upon the wording and there will be a second phase of consultation. We had quite a contentious issue regarding the use of Laurentian Channel for ballast water exchange. Based on the scientific advice from scientists on

the East Coast and other interested parties in the Atlantic Region, there is a strong opposition with regard to the continual use of the Laurentian Channel for ballast water exchange purposes. At this time, we were told, there is not enough scientific data available to enable a decision.

Our group recommended that the national group should delay any decision with regard to the continual use of Laurentian Channel for ballast water exchange purposes. At this point I would like to mention that the Laurentian Channel was offered as an alternative to exchange ballast water for ships going to the Great Lakes for technical reasons, under extraordinary circumstances. The main reason for including this clause, was in order to protect the safety of the vessel, recognizing that Atlantic waters may present considerable dangers for ships conducting this type of procedure in the winter or at any time under inclement weather conditions. So it was offered as an alternative just for these reasons, for the safety of the vessel, in particular. Later on I will mention some instances when the Laurentian Channel was used by ships engaged in the coastal traffic, between the Eastern Seaboard of the United States and the Great Lakes for different reasons; i.e., for protecting U.S. waters. We feel that this is not the best way to approach these issues. There is a need for a dialogue with our counterparts, U.S. Coast Guard, or any other U.S. agencies. We feel that we should investigate other alternatives to protect US and Canadian coastal waters, rather than advising ships to exchange their ballast in the Laurentian Channel.

As I said, these guideline are voluntary, it is just a standard for best practices approved by Transport Canada (TC). Just remember: reporting requirements are mandatory or may become mandatory under provisions of the Canada Shipping Act which enable the Commissioner of Canadian Coast Guard to request information under a "direction" through Marine Communications and Traffic Services (Coast Guard Radio). This requires that the master of the vessel or whoever is in charge of the vessel at that time, is responsible for providing accurate information as requested. In 1995 our department was successful in prosecuting a vessel for providing misleading and false information with

regard to ballast waters. So the reporting requirements may become quite forceful. During our discussions in drafting the guidelines, we removed any inference that this is a mandatory process, in view that guidelines were considered to be voluntary standards, and we did not want to mix those concepts. But, if necessary Transport Canada has enabling legislation to make them mandatory. Reporting of information is mandatory and it can become quite an issue. If no information is provided the act enables the judicial system to levy fines up to 50 thousand Canadian dollars.

Under this program in order to investigate initially all the possibilities for establishing alternative ballast water exchange on the East coast of Canada, we were advised that it was impossible to make any decision based on the fact that there were some data available but not enough in order to enable any decision. Based on subsequent consultation, Transport Canada was funded a research and development program. First we looked at vessel traffic and shipping traffic for ships coming from outside the Canadian Exclusive Economic Zone (EEZ) and we found that most of the traffic arriving at Canadian ports is coming from U.S., mainly from the eastern seaboard ports of the United States.

Based on the shipping report recommendations, Transport Canada funded a ballast water sampling project on ships, a pilot project in 2000 when we sampled ships at the ports of Halifax, Hantsport in the Bay of Fundy, and Point Tupper, which is quite an active oil trans shipments site. Most of the tankers arrive from the US, discharge their ballast water, and load clean oil products. These tankers are bringing ballast water from the Eastern Seaboard, Boston area, mainly Newark Bay, New Jersey, and loading that oil to deliver to U.S. markets. Those ships are coming in with ballast pumped in the ship's tanks at US locations and that ballast is discharged at the loading port. So these are locations where there is a huge impact of ballast water coming from outside the EEZ zone.

Based on 2001 results of this pilot project, we decided ballast water sampling could be done in locations around the ports in the Maritime Provinces and Newfoundland. Last year, scientists and contractors sampled 98 ships at 15 ports around the Maritimes. I am not a scientist and I

forgot to mention that our department is not in possession of any scientific knowledge and we base all our decisions on advice from DFO, and from contractors that worked on ballast water sampling. They have a very good reputation so I am not going to provide you with many details. I have hard copies or CDs that can be distributed to anybody who is interested as well as we can distribute it in a PDF format through E-mail.

There are four main recommendations of this report. The main one was to delay again any decision on establishing ballast water exchange zones, because the scientists felt that more data are needed. A good point, which actually enabled us to make some operational decisions, was the fact that it was discovered during this sampling that ships arriving at the Bras d'Or Lakes – Cape Breton, Nova Scotia, bring un-exchanged water from the Chesapeake Bay, North Carolina and Virginia. This unexchanged ballast water, discharged in the Bras d'Or Lakes adjacent to the east coast of Nova Scotia, may contain harmful species that have a very good chance to establish and harm local ecosystems. These are enclosed water systems and the flushing of water into the sea is very poor. It may become an issue of how and where this ballast water is exchanged. Of course there may be other means of transferring organisms, one being under the ship's anchors, but the main vector is the vessel's ballast water. The conclusion was to discourage the transfer of unexchange ballast water from the Eastern Seaboard of the United States to the Bras d'Or Lakes. Ships should be encouraged to exchange ballast water en route or in transit.

Another good point was to develop educational material. These scientists went aboard 98 ships and their conclusion was that more or less most of the crew members, masters, and the chief officers which were in contact with them appeared to be willing to comply with any guidelines. Actually, the general belief is that they have to comply with mandatory regulations. Crewmembers indicated their willingness to comply, and they wanted more information. We were not in a position to provide that at that time, but this was a good recommendation: to provide applicable educational and materials. I concur with the conclusion suggested by many attendees that we have to do a better job of send-

ing the message to the shipping industry and not only to the owners, but to the crew members on board the vessel.

At the same time some people believe that ballast water was not recognized as the best means of eliminating the risk of invasive species or providing the final solution. Our contractors recommended that we should encourage the development of the Research and Development (R&D) with regards to treatment equipment to be fitted on board ships. Future research as it is shown in the next slide was to expand the scope of sampling and develop sampling techniques, standardized if possible to better assess organisms that go through different stages of life, such as cysts and to assess the risk associated with ballast water exchange in various regions and seasons. It was recognized that due to this significant seasonal variation in seawater temperature, the risks are very high in the summer season and of course some regions are more vulnerable than others. Also to come back to the sampling locations, there is potentially a varying impact in areas where large amounts of un-exchanged ballast water are discharged directly into the harbor. We know where the ballast water is discharged, we know that vessels navigate sometimes three or four days before discharging ballast water at a destination. Now we have better knowledge with regard to where the ballast water is coming from. The recommendation was to determine what areas may be considered more vulnerable and to conduct regular monitoring/sampling of impacted areas.

Starting with September 2000, when ballast water guidelines became operational in Canada, Transport Canada in cooperation with the Coast Guard, in charge of communications, started a program of collecting ballast water information from ships via satellite, telex, and other means of communication. In July, 2001, we were able to put together a procedure of obtaining that information. Ships coming to Canadian waters under the vessel traffic services regulations had to be cleared through the so-called Eastern Canada Traffic Regulations [ECAREG] system on the east coast. In order to obtain clearance, the master of any vessel must answer several questions related to safety on the vessel, as well as protection of the environment. And we included in this

ECAREG reporting system questions regarding ballast water, based on the provisions of the Canada Shipping Act and Ballast Water Guidelines. The Commissioner of the Coast Guard would make a decision and if the vessel is not compliant with parts of the guidelines, coast guard officers compile a noncompliance report, send it to Transport Canada and if possible they contact the master directly via e-mail or through the shipping agents. If necessary Transport Canada inspectors would board the vessel and have a conversation with the master or the person responsible on board, make them aware with regard to understanding the regulatory requirements, and especially reporting the requirements, as I said mandatory under a direction of the Commissioner of Coast Guard. This information is part of the verification program that was started in July, 2001. The data available between July and December showed a tremendous increase in compliance, with a higher percentage of compliance from ships. The compliance rate for the shipping industry started at less than 50% in July 2001, and it went up to 60% at the end of August, September, and by the end of the year it reached 84% of ships. Again we must be careful when looking at this data because a number of ships may not have been captured through this system. These figures are compiled based on the number of reports received by Transport Canada, through fax or e-mail and the number of non-compliance reports provided by Canadian Coast Guard.

In January 2002 we started to compile information entered in the computer database up to mid-August. We can report that the compliance rate went up again and now stays at about 94%. This may not be again 100% accurate but what I can say is that we received less and less noncompliance reports and I would suggest this is related only to reporting requirements, not compliance with the guidelines in general. In 2001 in five months we captured 1700 ships; this year in the first 8.5 months we captured 2000 ships in the database. Only 100 noncompliance reports were received from Coast Guard. Within those reports not all of them are related to reporting, 93 – represented ships that did not provide any reports, and no reasons from the vessel for not reporting. Only five reports indicated concerns

with regard to safety of the vessel. Two vessels indicated nonperformance of ballast water exchange due to unfavorable bad weather. And one indicated that there is no procedures on board thus, indicating that the vessel did not have a ballast water management plan approved by a classification society. This confirms what was actually concluded from our shipping data, i.e., that most of the ships coming through Canadian waters to Canadian destinations are arriving from U.S. In 2000, 997 ships arrived from U.S. ports. Out of those 997 records, 500 ships reported as being in ballast, i.e., having ballast on board; some of them indicated that they are going to be transferring the ballast within ship's tanks; some ships, especially container ships, due to their way of operation, indicated that from time to time, they are not able to provide actual information considering that the ballast will be discharged and operated in accordance with the cargo loaded on board. Container ships in particular may have to transfer some of the ballast in order to maintain stability and sometimes they need to add ballast in order to maintain a lower center of gravity in accordance with their stability requirements. The interesting part is that regardless of the fact that we strongly recommend ships to exchange their ballast outside the Canadian EEZ zone, upon arrival at a Canadian port, a majority of these vessels, 266, or 50% indicated no exchange and the excuse was the fact that they are engaged in coastal voyages. Indeed it is difficult to comply with the guidelines as a whole, where it is stipulated that ships should exchange their ballast in waters 2000 meters in depth and as far as possible off the nearest land. For these ships, deep waters would be quite offshore during that type of voyage and would require deviation from the optimal route. The dark dotted line in Figure 1 indicates waters more or less east of that line that would be 2000 meters or deeper. A coastal voyage coming up the continental shelf offshore of the United States coast, would not be in 2000 meters but more likely 300 meters. Therefore, we recommended that if it is practical and if the safety of the vessel is not being imperiled, a ship should exchange ballast water on their pre-planned optimal route in areas approved by the U.S. Coast Guard or other U.S. regulators.

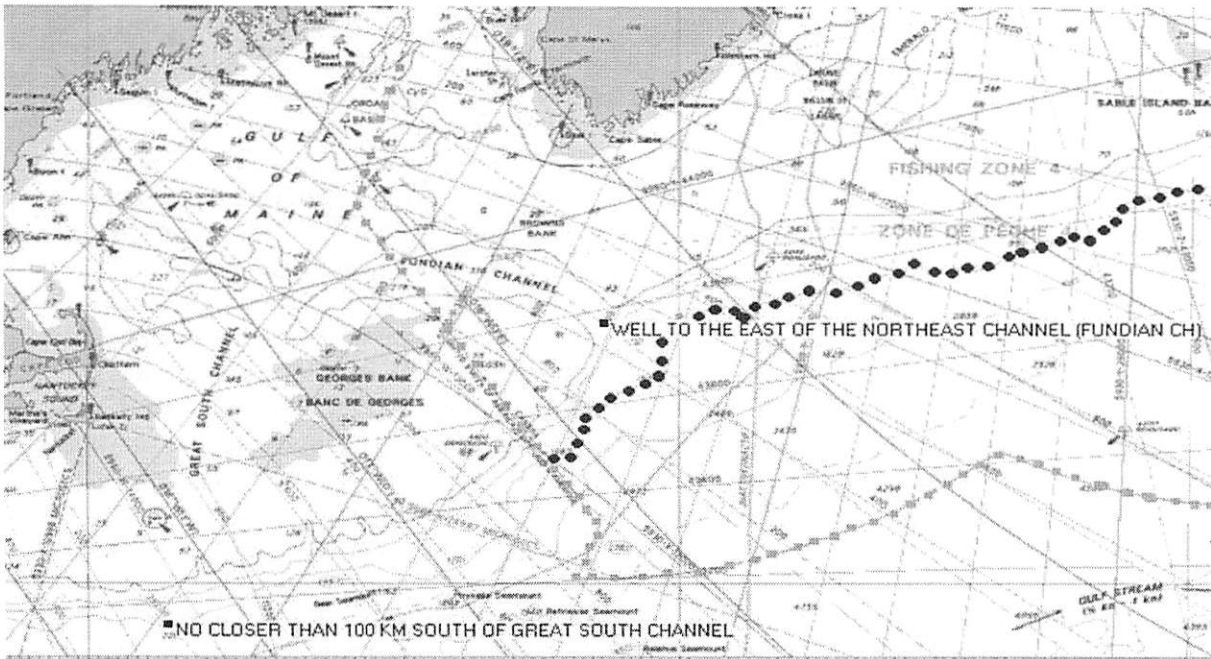


Figure 1. The North-South shipping traffic between Canada and the United States. Areas to the right of the dark dotted line are the suggested ballast water exchange areas.

This summer, based on the studies provided and based on the conclusions of the scientific report in conjunction with consultation within the region and within our group we decided to amend the guidelines so as to reflect the new data and new scientific evidence available to us. In the revised guidelines Transport Canada – Atlantic included strong recommendations that ships should exchange ballast water prior to arrival at certain location in order to protect sensitive areas, such as the Bras d’Or Lakes, southern gulf of Saint Lawrence, including the Bay of Fundy, as well as Placentia Bay in southern Newfoundland. Also we reiterated the requirement of the report about activity and ballast water situation on board the vessel, under provision of the Canada Shipping Act. As I said this may become mandatory and considered to be a direction issued by the Commissioner of Coast Guard. We included a strong recommendation to exchange ballast water when ships are engaged on the north-south traffic between eastern seaboard and Canadian destination. In addition, we identified the vulnerable areas around the Maritime Provinces and Newfoundland. Transport Canada also recommended that ships exchange ballast water prior to entering Canadian EEZ. We identified the areas already

affected, in the Maritime Provinces, and further we recommended ships apply extreme caution when pumping in water around those areas. For example, in the Bay of Fundy there is the danger of pumping into the ship’s tanks ballast water containing a paralytic shellfish poisoning algae. There is also a statement included regarding no alternative ballast water exchange zone within Canadian waters. There are stipulations regarding ballast sample and collection for scientific purposes only. The ballast water committee made a commitment to continue investigating these possibilities and, if necessary, will make a recommendation regarding exchange zones.

Mike Balaban is a Master Mariner on different types of commercial vessels, including: general cargo, container, bulk carriers, tankers, passenger ferries. He sailed around the world to ports around the Mediterranean Sea, Arabian Sea and Persian Gulf to Far East locations, including Japan, China and Korea as well as ports located on both sides of the Atlantic. In 1989 Mr. Balaban moved to Canada, and from 1990 - 1994 did work as a fishery observer for the

Department of Fisheries and Oceans in Canada. During this time Mike had an opportunity to become acquainted with fisheries and wildlife related issues, as well as the operations of a large variety of fishing vessels: from 45 foot draggers to long-liners and large factory freezers. During 1994 and 1998 he broadened his expertise by being master on ships operating in the Caribbean Sea including US locations and Western Europe, across the English Channel and around the English Isles.

In 1998 he accepted a position with Transport Canada, as a senior marine inspector with the Marine Safety Branch in the Atlantic Region. As part of the marine safety team, Mike was responsible of implementing Canadian environmental policies, verify compliance with Canadian and international regulations, investigate alleged incidents and initiate prosecutorial action, if necessary. During the period, Mike was involved in the Canadian Port State Control Program and was instrumental in obtaining higher fines for pollution violations.

Since 1999, Mike has been involved with Transport Canada - Ballast Water Program, as part of the Ballast Water Committee established in the Atlantic Region under the auspices of the Canadian Marine Advisory Council. He actively participated in drafting and revising Canadian Ballast Water Guidelines, prepared a report on Vessel Traffic and Shipping Patterns for Ships Arriving at Canadian Ports and administered the ballast water R&D program in connection with sampling of ballast water from ships at different locations throughout Atlantic Region. Presently Mike is Acting Manager for the Compliance and Enforcement section of Transport Canada and chairs the Ballast Water Committee in the Atlantic Region.

California's Ballast Water Management and Control Program

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I am going to talk briefly about the California program and then some West coast ballast water issues.

As was already mentioned, our program went into effect January 1, 2000. It sunsets in January 2004. The primary reason for the sunset date was to evaluate data and develop a better long term, comprehensive ballast water management program in California. Originally, the legislation being developed looked like an National Pollution Discharge Elimination Systems (NPDES) permit for every vessel. Understandably, the maritime industry was not happy about that. How do you apply that kind of permitting, at least at this point, on an international community? The Governor threatened to veto the bill unless significant changes were made. Changes were made, and the California Ballast Water Management for Control of Nonindigenous Species Act establishing a statewide mandatory program was enacted in October 1999. It is a multi-agency program, which has pluses and minuses, and I will discuss a little bit of those down the road. The law applies to all vessels, U.S. or foreign, that enter California waters after operating outside the Exclusive Economic Zone (EEZ). There are some exemptions, same as the Coast Guard.

The California law is based loosely on the Coast Guard's national program with some key differences. If you look at the Coast Guard's program, anywhere it says voluntary, put in mandatory and that is the California program. We collect a fee. Our program is paid for by the industry. Right now, the fee stands at \$200 per qualifying voyage. As you might imagine that was one of the more contentious parts of the law,

but as you will see in a little bit compliance is quite high. One of the things that industry did say is if we were going to be charging them a fee and we were going to implement this four-year program, they wanted more than just submitting ballast water report forms and being inspected. The industry wanted base-line biological surveys conducted, to determine the status of California waters and determine if the program is successful in reducing and monitoring the introduction of nonindigenous species. The industry was also very interested in research on alternative technologies. However, they did not want us to recreate the wheel. They wanted us to look at other areas, not duplicate ongoing work, but start helping advance the research technologies for vessels. One of the reasons, the California law has been successful is we do have civil penalties. There is a \$500 fine per penalty per day for not filing the ballast water report form. There is a \$5,000 fine per violation for not accurately filling out the ballast water report form. So, we have a variety of ways that we can use to keep the industry moving forward and complying with the law.

Four agencies were identified with responsibilities under the law. The Board of Equalization (BOE) is responsible for collecting the per voyage fee. They have done an excellent job working with the industry. This is the first time they have dealt with this kind of an international community and they have the highest compliance rate within their program of any of their other state programs. That says a lot for both the Board of Equalization and the maritime industry -working together on this.

The Department of Fish and Game is responsible for conducting the statewide biological surveys to assess the status of nuisance aquatic species (NAS) in California. The State Water Resources Control Board is responsible for identifying alternative treatment technologies. They have done a literature review of existing technologies and will report on those technologies in their legislative report. They have also worked closely with the State Lands Commission, on technology research, which I will discuss a little later. My agency, California State Lands Commission (CSLC), is responsible for implementing the inspection and monitoring components of

the law. We function similarly to the U.S. Coast Guard regarding operations. We have inspectors in the field. All of our inspectors are either ex-Coast Guard or ex-Navy folks, so they are familiar with vessels. We also are responsible for establishing the fee amount, which I will explain later. All of the agencies are required to prepare reports to the legislature. Those reports are due at the end of this year, allowing the legislature time during 2003 to make changes, if necessary, to the existing law.

As I mentioned CSLC was responsible for setting the fee amount. In January 2000, we were instructed by our Commission to form a Technical Advisory Group (TAG) to assist in establishing an appropriate fee amount in which to fund the ballast water program. The TAG is composed of representatives from the maritime industry: the shipping lines, ship agents, Port authorities, environmental organizations, and State regulators. We also brought in staff from the Attorney General's office, who works with us on this program. We looked at the budget for the program and came up with an estimate on how much the program was going to cost over four years. We then looked at the estimated number of qualifying voyages annually. We discussed several different fee schedules, but in the end decided on a flat fee schedule per qualifying voyage. CSLC is responsible for collecting voyage-specific data on each vessel that enters California water. We utilize the same federal form required under the U.S. Coast Guard's program. As part of the vessel inspection program, we are involved in research, although under the law, we were not necessarily mandated to do so. As such, we work with researchers from around the country, facilitating access to vessels and crew. Outreach and education has been key to the Program's success. That is currently the number one job of the inspectors; outreach and education is one of my most important responsibilities.

The following slide shows the budget breakdown for each agency over four-years. Initially, the TAG estimated 6000 qualifying voyages annually and a 75% compliance with submitting the required fee amount. Based on the cost of the program and those estimates, the fee amount was set at \$400/voyage through regulations. In March 2002, the BOE reported a compliance exceeding

Table 1. Compliance rates in California, based on the number of forms received.

CA Port	Yr 2000 QVs	Yr 2001 QVs	Yr 2002 QVs through Aug.
Humboldt	24 (69%)	13 (100%)	17 (82%)
Sacramento	57(82)	50 (96)	27 (100)
Stockton	103 (90)	108 (97)	79 (95)
Carquinez	224 (89)	264 (94)	168 (86)
Richmond	169 (89)	153 (93)	88 (95)
Oakland	571 (88)	542 (96)	404 (94)
San Francisco	95 (87)	72 (93)	55 (93)
Redwood	24 (72)	24 (96)	13 (100)
Hueneme	266 (97)	268 (92)	201 (89)
LA-LB	4868 (90)	4620 (94)	2939 (92)
San Diego	309 (95)	231 (97)	125 (99)
Total	6710 (90%)	6345 (94%)	4117(92%)

95%. Based on this high compliance, the fee amount was reduced to \$200/voyage in July 2002.

Table 1 shows compliance in California, based on the report forms that we get into our office. As Mary Pat was saying, the national program indicates 30% compliance on submitting the required ballast water report form. In California, as you can see, we are up more around 90 to 94%. One of the reasons we have a high compliance is that within our law, if the vessel owner-operator does not submit a ballast water report form, the ship agents - the local agents - are required to do so. The ship agent is identified in the law as a responsible party as well, allowing us to go after the agent. We had to do that early in the program. Initially compliance was 40 - 45%. We sent out letters of concern to the industry. There was little change in compliance. We sent out warning letters. As I mentioned at the beginning, we have \$500 per day violation if you do not submit the forms. Some of these vessels were two months overdue in filing the form. Based on potential violations, we calculated the amount of a potential fine and included that information in the warning letters. The letters were sent to nine different owners or ship agents. As a result of those letters and subsequent meetings with the industry, CSLC

Table 2. Last Port of Call information for all vessels entering California waters.

Last Port of Call	Yr 2000	Yr 2001	Yr 2002 through Aug.
Asia	2023	2115	1446
US West Coast	1403	1638	1069
Mexico	897	976	580
Canada	414	391	287
South America	357	342	232
Central America	307	286	202
Hawaii	237	279	163
Pacific Islands	121	104	62
US Gulf Coast	69	70	29
Caribbean	49	71	48
New Zealand	48	58	28
Europe	40	55	37
Australia	32	51	35
Middle East	21	43	28
US East Coast	18	20	10
Pacific Lightering Zone	1	46	46
Africa	1	10	10

established a system where we contact, via email, the ship agents that we work with every month. We tell them what forms are overdue. They get those to us within five days. We established better communications. If forms are inaccurate, or illegible my staff calls up, or emails, the agents. So, compliance has significantly improved, as you can see in the table, our compliance rate increased over the past two years. It has also significantly improved the data that we are getting. We are working with the Smithsonian Environmental Research Center, (SERC) comparing the National Ballast Survey database and our database to identify the differences between our data. The inspectors follow up as well in the field. So overall, we are doing pretty well.

California primarily sees container vessels. Oakland, Los Angeles and Long Beach receive the lion's share of those vessel calls, but we also have a good number of tank vessels with all of the refineries along the coastline. Table 2 shows Last Port of Call information. As you can see,

Table 3. Metric Tons of ballast water discharge, by port.

Port	Year 2000	Year 2001	Year 2002 through Aug.
Carquinez	377,925.72	454,656.20	305,509.74
Hueneme	20,281.30	9,966.24	14,505.43
Humboldt	42,451.30	101,286.99	121,121.69
LA-LB	5,577,384.81	5,160,090.36	3,851,799.02
Oakland	575,093.85	724,675.16	504,265.11
Redwood City	24,468.13	60,695.22	25,257.73
Richmond	126,657.98	193,893.05	24,7829.49
Sacramento	371,826.53	224,179.38	141,726.21
San Diego	154,544.15	178,582.04	9,020.50
San Francisco	509,357.70	830,980.92	683,124.49
Stockton	118,846.33	160,271.83	131,806.72
Total (MT)	7,898,837.80	8,099,277.39	5,992,256.15

the majority of vessel arrivals are from Asian ports. However, we receive a large number of vessels from other US West Coast ports. Vessels engaged in coastal traffic are not covered under the California law. However, some vessels are submitting reporting forms for each port call in California. You will see one of our recommendations is to require ballast water report forms for all vessels, coast-wise and foreign at every port of call. That will make our data collection much more accurate. This slide also shows you the number of vessel voyages that we are dealing with on an annual basis that are coast-wise. There is the whole coast-wise issue where vessels do not travel far enough off shore, where to ballast, and everything else.

Table 3 shows the amount of ballast water discharged by port - Los Angeles-Long Beach received the greatest amount of discharge. However, the amount discharged per vessel is relatively small, approximately 500 to 1,000 metric tons per vessel. Whereas places like the Carquinez, Redwood City and Richmond, which have larger bulk vessels, these vessels bring in large amounts of ballast water per vessel. Fewer vessels are discharging, but they are releasing larger amounts.

Figure 1 is from the Smithsonian

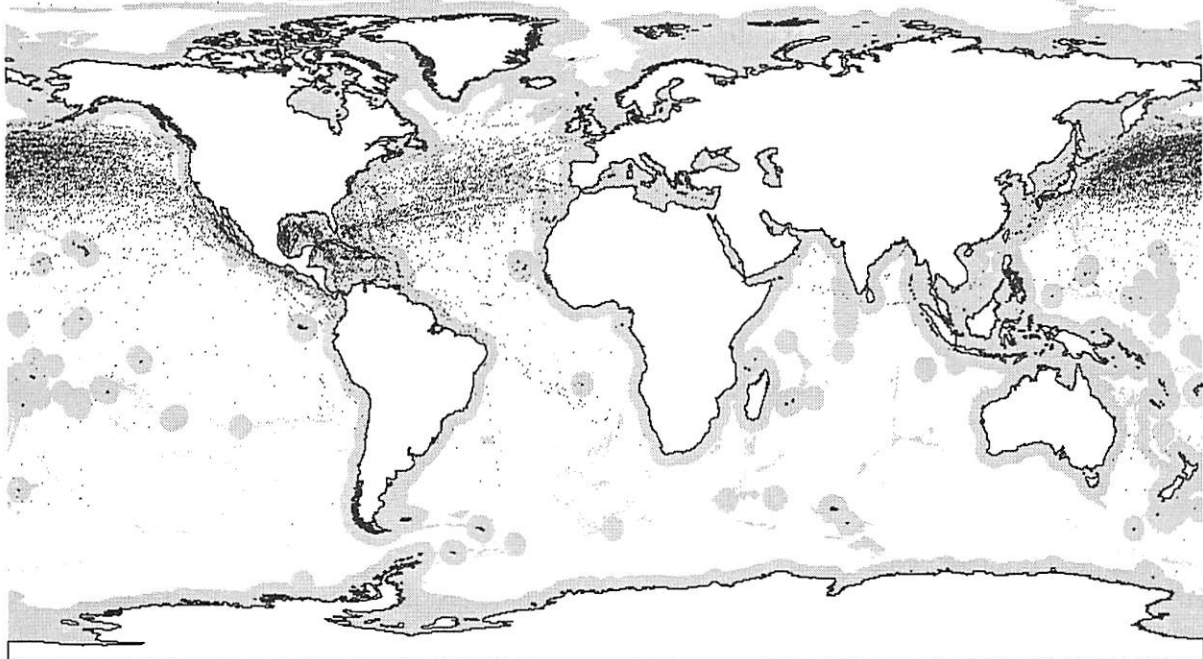


Figure 1. The black dots indicate reported ballast water locations. The gray areas are where water depth is less than 2000 m, or within 200 nm of the coastal boundary. Figure provided by the Smithsonian Environmental Research Center.

Environmental Research Center. This shows you some of the problems we are dealing with in California. We have a lot of vessels that are coming up from South and Central America. They travel along the shoreline. These black dots are where the vessels are discharging, or conducting ballast exchanges. Those are close to shore. The gray identifies the 200 nautical mile zone off of all these shorelines. So you can see there are a lot of vessels that are conducting exchanges along the West Coast of California within 200 nautical miles of shore. Few vessels operating in the Gulf of Baja California or the Gulf States can comply with the Coast Guard voluntary guidelines right now. It is a big issue.

Our inspection program, as I mentioned before, our inspectors are an important factor responsible for the Program's success. We have 16 inspectors that board approximately 25% of all the vessels by port and by class. Inspectors go on board those vessels. We have internal web-based database system that the inspectors use to pull up information on the vessels that are coming into California waters. They get that information from the Marine Exchanges. They can pull up information and see when was the last time the

vessel was boarded, if at all. If it is a brand new vessel, it is a high priority vessel. They are automatically required to inspect those vessels primarily for outreach and education purposes. We still get a lot of tramp vessels and they are the ones that are, not aware of California's regulation. Vessel inspections are determined using a stratified random method, with some targeted inspections of vessels. The inspectors coordinate with the Coast Guard. They usually contact the Coast Guard office that morning and ask them if they are going to be boarding any vessels at these various ports, because they do not want to double up. The last thing the crew needs is to have another uniform standing in line, number 24, especially now with the Homeland Security issues and all. So, we try to coordinate as best we can. Once the Inspector is on board, he reviews paperwork associated with the vessel's ballast water management. The inspector interviews the crew and samples the ballast water. Right now, we are using salinity, which is a lousy verification technique, to determine if an exchange has been conducted. We working with the Coast Guard and a small technology developer and hopefully a better verification technique will

be available in the next year or two. Again, I want to emphasize the importance of outreach and education. Inspectors provide the vessels with the Stop Ballast Water brochure, which was distributed to the participants. The inspectors also provide the vessel with a sample ballast water management plan and copies of the law. The inspectors meet with crew responsible for filling out ballast water report forms and explains to them what all of the fields mean and or how best to fill the form.

The number of inspections conducted since the inception of the program is illustrated in Table 4. Note that the inspectors have been on over 2,100 different vessels since the program started. We are still identifying violations. However, most of these violations are administrative in nature. For example, the vessel does not have the IMO resolution on board. Or they may not have a complete ballast water management plan. Or the plan may not be vessel specific.

We do have a number of ballast water exchange violations-a small number considering the number of vessels we see monthly. Most violations associated the mandatory ballast water management provision are committed by passenger vessels arriving from Mexican ports. We are working with some of the passenger vessels companies to find solutions to this problem. Passenger vessels are also being sued by a couple of environmental organizations. Perhaps the lawsuit will correct the cruise ship actions.

Table 4. California vessel inspections, by field office reporting.

<u>Vessel Compliance Monitoring (through 08/30/2002)</u>	
Northern CA Field Office	Inspected 810 (~ 25%) Qualifying Vessels
Southern CA Field Office	Inspected 3220 (~ 23 %) Qualifying Vessels
Violations noted = 589	
	521 - BW Management Plan &/or IMO
	68 - BW Exchange
2132 different vessels have been boarded	

I would like to summarize my points. As I mentioned, I am in the process of putting together a legislative report and these are some of the recommendations that I am going to be making in that report. These are Draft recommendations, a continuation of the state program. As Mary Pat said, it is going to be a while before the federal program gets on board. And there is no point at this time in ending our program, at least no time in the foreseeable future, and we plan a continuation of the fee-based program. However, if the other states on the West Coast adopt a fee-based program, we will need to sit down and ensure that there is no double charging of the industry if we are all kind of trying to comply with one law. We are going to apply the California law it to all vessels, coast-wise and foreign.

I am just going to briefly discuss some research activities. I am not going to go into this in depth, because I am running out of time and I know there are talks to follow me. We have the West Coast demonstration project. We went out and, working with several different shipping companies, identified two companies interested in participating in the demonstration project. Both the vessels have chosen to use an Optimar system, which is a UV system and a Hydrocyclone, the large object in Figure 2. This system is currently installed on the Sea Princess and the R.J. Pfeifer. The Sea Princess had two evaluation voyages by a team of researchers that we have contracted with to look at the efficacy

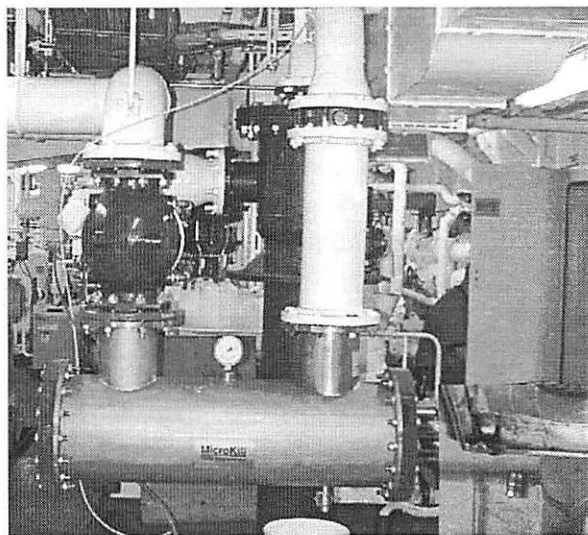


Figure 2. A close-up of the Optimar system.

of that system. There have been some problems with that system. From the two preliminary voyages, we saw no difference between treated and untreated water and most of the effect was due to the tank effect. Now, to be fair, we had some major problems on the Sea Princess. Gray and black water contamination, because of unsegregated piping fouled the UV lamps. Additionally, corrosion of the UV chamber, as a result of incompatible metals, further fouled the lamps. The UV systems was faced with conditions that it was not designed to treat. They have subsequently segregated the ballast water system from the gray and black water systems and they have replaced the plumbing, galvanized the pipes to prevent further corrosion and replaced the entire UV chamber. Right now, (Sept. 2002) the researchers are somewhere going down the Mexican coastline, conducting a third evaluation of the Optimar System

The R.J. Pfeifer had her own suite of problems associated with the installation and operation of the treatment system. Ultimately the UV portion of the system will be replaced. We are hoping that a new system, or a re-engineered system will be installed at the end of this year. Once installed, the Research Team will conduct evaluation voyages, hopefully in early 2003-beginning of next year.

This may be of interest to you if you are forming a regional group, so I will describe West Coast partnerships. California was the first West Coast state to get a ballast water management law in place. Washington followed and included coast-wise traffic in their law with certain requirements. Then this year Oregon implemented their mandatory program, which also included a coastwise traffic component. Unfortunately, there are some differences between the two state laws with regards to coastwise traffic. California, Oregon and Washington have adopted the federal guidelines and have made them mandatory. However, ballast water management of coast-wise traffic is problematic. Washington requires that vessels exchange their ballast at least 50 nautical miles offshore. Oregon on the other hand, requires that vessels exchange their ballast before entering Oregon waters. The Oregon law does not include a distance offshore condition for exchange. For example, a vessel that leaves San

Francisco must conduct an exchange once it gets through the gate and complete that exchange before it reaches Cape Mendocino. There is no way a tank vessel can conduct a complete exchange prior to reaching the Cape. Of greater concern is that vessels are discharging ballast water into several marine sanctuaries located between San Francisco and Cape Mendocino. This requirement may therefore hasten the spread of NAS along the West Coast of North America.

We are working with West Coast Ballast Outreach Project and Pacific Ballast Water Group on the issue of coastal traffic and ballast water. Additionally, California and Oregon are discussing the development of a regional web-based database. The West Coast Ballast Outreach Project put together this great brochure and that great poster. They have also put together newsletter that comes out quarterly. Karen McDowell runs the ship there basically. Additionally, they have helped organize workshops and conferences and develop educational material that is distributed to the industry. The Pacific Ballast Water Group is a regional group, and includes representatives from Washington, Oregon, California, Port of Vancouver and Alaska. The goal is to coordinate ballast water management and associated research along the West Coast and that leads to the next issue, which is ballast water and coastal traffic. Ballast water management of coastal traffic is challenging. As I mentioned early, most of the violations California sees are from passenger vessels coming from Mexican ports. From Oregon and Washington's perspective, the last thing they want is San Francisco water, often cited as one of the most highly invaded estuaries in the United States, with over 250 identified NAS. Vessels traveling along the West Coast between Mexico and Vancouver, BC do not generally travel 200 nautical miles from shore. Mid-ocean exchange therefore is not an option. Everybody recognizes that down the road shipboard treatment is going to be where we need to go. But right now, there is no technology. Mary Pat McKeown mentioned that in her talk. There is currently no technology that the state of California would approve. We are dealing with experimental stuff, but there is nothing wholesale that we could put on vessels.

So, although this is the ultimate solution, we are years from getting there. You could conduct a ballast water exchange, but as I already mentioned some of the problems, such as exchanging too close to shore could result in increased inoculations along the coastline. It could be that San Francisco water stays in San Francisco. It does not come out. But if we start doing exchanges along the coastline, are we going to be spreading those species up the coastline and down.

Karen McDowell from West Coast Ballast Outreach and Mark Sytsma from Portland State University, who is also the lead for the Pacific Ballast Water Group, organized oceanographers along the west coast. They were able to pull in Washington, Oregon, and California oceanographers at a meeting. They have also been working with oceanographers that have expertise in Alaska and Canadian waters, as well as contacting folks down in Mexico. The goal was to identify from a strictly science-biological basis what is going on out there off the coastline? Are there areas that can be identified for alternative exchange? Another meeting is planned in December, which will include the maritime industry and discuss the results. This is a figure from the draft report. The oceanographers identified areas - the black line on the slide is the 1,000-meter isobath - where they believe ballast could be discharged (exchanged) that would be a lower risk - less likely for organisms to actually move into shore. These waters are believed to be significantly different from the coastal waters. Additionally, the oceanographers identified these retention zones that based on the oceanography likely retain organisms. They recommend that no ballast water exchange occur in these zones within 50 nautical miles of shore. If you think back to the Washington and Oregon laws, a vessel coming from San Francisco, is required to exchange in this area. These are areas of high biological diversity, likely because they are retention zones. They are great places for organisms to grow and prosper. Our goal is to sit down with the stakeholders and management options. California currently has no coastal exchange requirement and vessels continue to dump coastal ballast in California waters. What are the problems associated with that? The other thing is the coastal exchange option. How far off shore

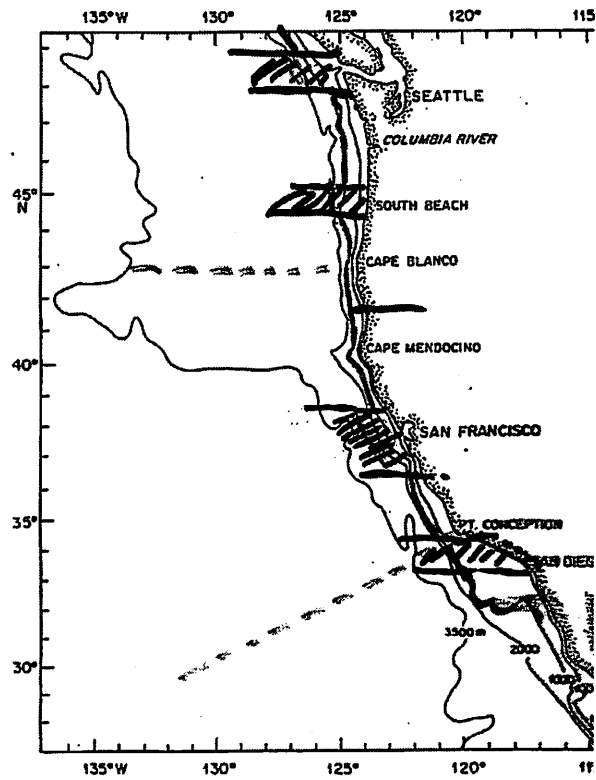


Figure 3. Map of the California coastline, with the dashed lines marking proposed ballast water exchange zones.

should this occur? How much can we use the coastal oceanographic information coupled with the maritime industry's information? How far out can you go? What does it mean to go 50 nautical miles off shore? What does that mean for shippers? What is the cost? So, we are going to have this meeting. The industry is very interested in participating and in a constructive way to sit down and come up with a solution, because they just see this whole process as getting worse. The shipping industry wants consistent regulations. The oceanography report is expected out at the end of October, or early part of November. The report will be posted on the West Coast Ballast Outreach website.

I mentioned earlier the web-based regional database. Oregon and California are teaming up to write a proposal to integrate Oregon's data into California's database. We currently operate an SQL-based database, which can handle large volumes of data. We propose to put a web-based front end on the existing database that will allow

Oregon to input data remotely. Additionally, several built in queries will be designed allowing quick access to the data. If we can get that program up and running without problems, then we are proposing to get Washington involved as well. The Port of Vancouver has also indicated they are very interested in participating. Hopefully, within the next six or eight months, this web-based system for the West Coast of North America will be launched allowing ready access to all ballast water management data.

I already mentioned the Coast Guard (and the TAG group at the Coast Guard) and I work with Rich Everett on a weekly basis on advanced approval processes, verification technology, and all the things that Mary Pat's discussed in her presentation. Under our advanced approval process, we have three vessels that have submitted applications. CSLC has asked US Coast Guard to also review these applications and provide their input. We still want to know that we are all going down the same path and be fair.

We are working with the Smithsonian Environmental Research Center, doing ballast water efficacy studies and ballast water exchange studies. Our inspectors assist in providing access to vessels. Researchers boarded about 35 vessels this past summer over a two-week period characterizing ballast water. We are also trying to identify some vessels that will allow more intensive surveys of their ballast water and hull fouling organisms. Addressing the issue of hull fouling is a bit problematic – just getting divers in the water is difficult. The ports are understandably nervous. They do not really want divers in the water within an operational port and around vessels. They might lose somebody to a sea chest. These are some of the challenges we face.

Maurya B. Falkner is a Staff Environmental Scientist with the Marine Facilities Division of the California State Lands Commission. She is the Program Manager for the Ballast Water Management and Control Program. The program was inaugurated as a result of the passage of the State's Ballast Water Management for Control of Nonindigenous Species Act in October 1999. Ms. Falkner is a member of the Ballast

Water Shipping Committee of the Aquatic Nuisance Species Task Force, the West Coast Ballast Outreach Project, and the State of Oregon's Ballast Water Task Force. She has been with the Commission since December 1996, where in addition to her ballast water program management duties, she is responsible for the design of scientific investigations, reviewing proposed research and monitoring projects, lease applications and environmental impact reports.

Ballast Water Management Practices of Foreign Flag Vessels

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The Shipping Federation of Canada is an association of ship owners, commercial operators and agents who represent 95% of Canadian-owned oceanic traffic moving to and from ports on the East Coast, the St. Lawrence and the Great Lakes. The Federation has been an active player in the implementation of ballast water management regulations for the Great Lakes, and is keenly interested in the development of a regionally coordinated approach to ballast water management that is based on internationally accepted standards and practices. In 2000, the Federation developed a "Code of Best Practices for Ballast Water Management," which is a voluntary program used by ocean voyaging ships as a means of minimizing the risk of introducing non-indigenous aquatic organisms and pathogens into the Great Lakes. The code enumerates a variety of measures that ships agree to undertake in this respect, including the cleaning of tanks, commitments with regard to areas and periods for ballast water intake, and agreement to conduct ballast water management at every practical opportunity.

Oceanic shipping is an international activity by its very nature, with ships sailing many different routes throughout the world. The masters and crews of those vessels are subject to an increasing number of standards, procedures and regulations. As a result, it is important to ensure that such rules and regulations are as simple and user friendly as possible.

Foreign-going vessels rarely have to conduct full ballast exchange along the East Coast (which would take 24 to 30 hours, or some 350 nautical miles, to complete). They more frequently

exchange ballast from two or three tanks (which takes 8 to 9 hours). However, coastal vessels coming from ports along the east coast or the Atlantic provinces usually find it impossible to conduct a full exchange outside the Economic Exclusive Zone (more than 200 nm from shore) due to their trading limits. Thus, such vessels have, until now, been exempted from requirements to comply with Canadian and US ballast water guidelines.

We believe that the most viable means of addressing cases in which vessels are unable to exchange ballast water at sea (due to safety considerations or coastal trade limitations) is to define a clear alternative ballast water management option. Effective development and use of such a zone or procedure would, however, require bi-national coordination.

It is extremely important that any effort to develop new measures governing ballast water management be consistent with the guidelines and regulations that are either already in place or under development at the international and national level. Legislators should also bear in mind that frequently changing limits and reporting procedures over a short period of time would lead to confusion and a reduction in compliance. A common approach from the Atlantic provinces and the States on the East Coast is absolutely essential.

Ballast water treatment systems are probably the more promising tool for effective ballast water management. The Shipping Federation supports the development of efficient treatment options and some of its members have installed trial systems on their vessels. However, at this stage, none of the systems that is available on the market has proven to be sufficiently effective to be installed on a large scale. In addition, treatment systems represent major financial investments that shipowners are not likely to undertake until an international or national standard has been developed. It is also important to remember that the installation of treatment systems on board fleets could take several years given the extensive dry-docking that might be required. Thus, given the highly competitive environment in which shipping takes place, any effort to impose a treatment requirement on vessels calling at a particular state or region would result in a

**THE SHIPPING FEDERATION OF CANADA
CODE OF BEST PRACTICES FOR
BALLAST WATER MANAGEMENT**

RECOGNIZING that discharge of ballast water from ships is viewed as a principle vector for the introduction and spread of harmful aquatic organisms and pathogens, RECOGNIZING the role shipowners and vessel operators can play in minimizing the introduction and spread of non-indigenous organisms and protecting the Great Lakes waters,

CONSIDERING the current status of technology for the treatment of ballast water and the need to develop standards against which to measure efficiency of management procedures;

VESSELS entering into the Great Lakes commit to the following Code of best Practices For Ballast Water Management.

1. To conduct ballast water management whenever practical and at every opportunity even if the vessel is not bound for a port where such a procedure may be required. This process will ensure that residual ballast on board will, to the greatest extent possible, be subjected to these practices. This process will also aid to minimize sediment accumulations in ballast tanks, and there mid-ocean exchange is practiced, subject fresh-water organisms to an extended exposure to salt water. Where mid-ocean ballast water exchange is the, or one of the management practices used as required by IMO, USCG, Canadian or other regulations, the safety of the ship shall be a top priority and management shall be practiced according to recognized safe practices.
2. To regular inspection of ballast tanks and removal of sediment, if necessary, to at least the level comparable to that required by the vessel's Classification Society in order to conduct a "close-up" Enhanced Survey, Ballast Tank Structural and Coating Inspection.
3. To ballast water exchange procedures as provided for in US legislation and approved and enforced through United States Coast Guard Regulations.
4. To record keeping and reporting according to United States Coast Guard Regulations (ballast water report forms) - the master to record all uptake and discharge of ballast water in an appropriate log book; Ballast Water Report Forms to be completed and submitted as per Regulations; inspection and cleaning of ballast tanks to be recorded and records to be made available to inspectors upon request.
5. To provide information and logs to authorized inspectors and regulators for the purposes of verifying the vessel's compliance with this Code of Best Practices.

6. To apply a precautionary approach in the uptake of ballast water by minimizing ballasting operations under the following conditions:
 - a. In areas identified in connection with toxic algal blooms, outbreaks of known populations of harmful aquatic organisms and pathogens, sewage outfalls and dredging activity.
 - b. In darkness, when bottom dwelling organisms may rise in the water column.
 - c. In very shallow water.
 - d. Where a ship's propellers may stir up sediment.
 - e. In areas with naturally high levels of suspended sediments, e.g. river mouths, and delta areas, or in locations that have been affected significantly by soil erosion from inland drainage.
 - f. In areas where harmful aquatic organisms or pathogens are known to occur.
7. To the disposal of accumulated sediments as provided for in the existing IMO Ballast Water Protocols during ocean passages outside International Ballast Water Management Areas or as otherwise approved by Port State Authorities.
8. To foster and support scientific research sampling programs and analysis - Facilitate access to on board sampling and testing of ballast water and sediment including opening of ballast tank covers and safe access to ballast tanks following safety procedures for entering enclosed spaces. Sampling, testing and inspection to be planned and coordinated to fit within vessels' operational program and minimize any delays.
9. To cooperate and participate in standards development and treatment systems testing and approval processes, including, but not limited to mechanical management and treatment systems, and pesticide management systems as well as improved techniques for ballast water exchange and their scientific assessment.
10. To strive toward global, integrated ballast water management strategies in conformity with internationally agreed principles that respect national and regional aquatic ecosystems.

This Code of Best Practices is endorsed by the undersigned and represents our common goal to attain the highest standards of safe ballast water management to minimize the introduction and spread of aquatic nuisance species in the Great Lakes.

The Shipping Federation of Canada
September 28, 2000

diversion of cargo to other ports and threaten the economy of the region as a whole.

Anjuna Langevin graduated from the Institut Maritime du Québec and started her career as a cadet and navigation officer. She sailed on Great Lakes carriers, research vessels and foreign-going merchant vessels until 1997. She completed a mastership in Maritime resources management at Université du Québec à Rimouski (UQAR). She studied more specifically the interrelations between shipping and the marine environment.

Since 1999, she worked as a Fleet Operator and Environment Advisor for Fednav, a commercial operator and ship owner engaged in International trades. In relation to her functions, she became a member of the Regional advisory group and Canadian working group on ballast water management.

She recently joined the Shipping Federation of Canada as Director of Navigation and Environment. She serves as the Chairperson of the Federation Committees on Ballast management, Navigation systems and Prevention of Oil Pollution and is also a delegate to the National Marine Advisory Council (CMAC).

A Vessel Operator's Perspective in the Context of a Regional Approach on Ballast Water Management for the North-West Atlantic

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I would like to thank this assembly very much on behalf of Kent Lines for this opportunity to present our point of view and talk briefly from the vessel operator's perspective on the topic of Ballast Water Management.

The company I represent in this area is Kent Line. We operate six vessels in this region: three oil tankers operating out of Saint John and servicing the US East Coast market, generally as far south as Boston, but with the odd foray to Providence and New York. One of these vessels, the Irving Canada is a Segregated Ballast tanker, having been converted just last year. This vessel, alone of the three, will discharge its ballast directly overboard in Saint John. The other two oil tankers, the Irving Eskimo and Wellington Kent, discharge the vast bulk of their ballast directly to the Saint John Refinery.

When these vessels leave Saint John, they are rarely out of sight of the land, and a trip to Boston is only 21 hours from port to port. The only ballast water discharged into US waters is a small amount from time to time to assist with trim and stability issues.

We also operate two container ships, which leave Saint John for West Palm Beach, Florida, and a break-bulk carrier which operates throughout the Atlantic, north, south, east and west.

Last week I attended the Marine Log Conference in Washington, D.C. Ballast Water was an item on the agenda, but the bulk of the time, the entire first day, was spent on Security. There was a substantial Coast Guard presence, but the greater proportion of attendees were from

industry, and there was genuine concern for not overreacting on Security issues to the point of scaring business away from some ports. In other words, whatever measures are brought in should be uniform throughout the country, and hopefully, the region. Canada and the U.S. work together in many areas of concern. I am presently on a Work-Group in Boston discussing Security matters in the Bulk-Oil carriage, as well as working on the Customs-Trade Partnership Against Terrorism for the JD Irving Group of companies. The recurring theme is that of improving security, without hindering trade. So it is encouraging to see such a wide spectrum of interests here.

At the Conference we heard from Captain Mike Brown from the Office of Operating and Environmental Standards regarding the present status of ballast water management in the U.S. The voluntary reporting system has not been a success, and mandatory reporting, currently in use on the Great Lakes, will likely soon be spread to the whole country. Also ballast water management, including ballast water exchange (BWE) will be required throughout the nation. A Ballast Water Standard has to be established. It seems to me that the last item should be defined prior to imposing any regulations on vessels.

Australia has a programme in place whereby the water conditions of their ports are kept in a database, and vessels have to adjust their Ballast Plans accordingly. Captain Brown made mention of creating a database, with 'similar ports' listed, which would be of great benefit to the shipowner, and master. It might well also lead to a change in trading patterns. If Saint John and Portsmouth were considered 'similar' but Saint John and Boston were not, would that affect any trade decisions? Undoubtedly.

We 'manage' ballast a fair distance away from these comfortable chairs, and this lovely auditorium. The fact that it is some distance from here does not lessen the need for us all to understand that this is the common medium and the common enemy. This workshop is on the subject of a "Regional Approach", but the topic is global in impact. 12.5 billion tonnes of ballast is transported around the world – a truly global problem. Any resolutions and recommendations that come into effect, must also take into consideration the safety of the vessel, her crew and cargo.

Unless applied carefully, some of the measures being urged for ballast management can affect a ship's safety, either by creating forces within the hull that are greater than the design parameters, or by compromising the stability of the ship. The Irving Canada, when she was designed twenty-five years ago, was never expected to exchange her ballast two hundred miles off-shore on a voyage from Boston to Saint John. It is because of concern about this that the IMO became involved in what would otherwise be a purely quarantine matter. It has been recognised by governments and the shipping industry that an individual country's needs should be harmonised with the greater need to ensure the safety of ships, their crews and passengers.

DETAILS OF BALLAST WATER MANAGEMENT PLAN

IMO recommends that each ship should be provided with a Ballast Water Management Plan, detailing the way that the ship can comply with any measures demanded by a port state. Once it has been established that the management of ballast is necessary to meet the quarantine requirements of a port state, preparation for it should be treated with the same seriousness as preparation of a cargo plan. All concerned with the operation and safe passage of the ship can thereby be assured that they are both protecting the marine environment and ensuring the safety of the ship and crew.

The IMO Resolution includes guidance on safety aspects of Ballast water exchange at sea. The safety points outlined below are intended to emphasise that the consequences of an inadvertent error at sea can be more significant than the same error in port.

The stresses a vessel is under, are much more significant when in the open ocean, subject to swell, waves and wind, than alongside a dock in a well protected harbour. Ballast water exchange at sea is a comparatively new development, and a sense of familiarity with the mechanics of ballasting should not be allowed to induce complacency in this new procedure.

Conditions in which ballast water exchange at sea is NOT to be undertaken are:

- In heavy weather conditions actual or

anticipated before the operation would be completed.

- If calculations indicate that the value of GM or KG would fall below minimums at any point during the operation, or that open water shear stress or bending moments would be exceeded, or that hog or sag would be excessive, or that excessive trim would be experienced, or that the propeller would be exposed enough to cause racing. Free surface effect must be allowed.
- Ballast water Exchange at Sea is NOT to be undertaken
- In areas of visible plankton or algal bloom
- In sub zero weather or icing conditions (comment??)
- For'd draft to be sufficient to avoid pounding damage
- If time constraints prohibit
- At any time if in doubt
- If the Master prohibits

I have just listed a number of problems that to the layperson will make little sense. I do not intend to explain them, but merely point out that to any seafarer, each and every one of them is as serious a threat to his safety, as a fire. Every oil tanker that pollutes a shoreline is fodder for the front pages. But the hundreds of lives lost by bulkers that break up and disappear, are only mentioned in the trade papers

Now here is a reality for the assembly to consider: Within the context of the above, with the best will in the world, sometimes **it simply cannot be done**. The vessel simply cannot comply. The voyage may be too short. The weather may be too bad. What then? Are our legislators going to force the receiving/loading terminals in all trades to provide ballast reception facilities, and are charterers willing to accept increased charges, increased delays, etc.?

We sometimes get the feeling in the shipping industry that because we are relatively slow moving and large – the ships as well as the operators – that we are a natural target. As an example compare the facilities for receiving slops. With our tankers in Saint John it is a fairly simple operation. Hook up your slops hose to the slops manifold and commence pumping. No problems, no questions, and best of all, no bill. But we are the lucky ones. Last week in Washington Robert

Ostrom, the Chief Counsel for the Maritime Administration, was asked by industry to look into this problem. At our Work-Group on Safe-Commerce in Boston, the Terminals representative felt it perfectly reasonable to argue that nobody should enter the property to service the vessel; rather, that the vessel be removed to some, as yet to be named, dock for the delivery of all stores and service calls. We are perceived as the enemy.

A lot is spoken about the standards of ships and about the way they are run, but we feel in many cases this is a convenient smoke screen for some terminal operators, among others, to hide behind. The ship is always wrong. Remember that in the majority of contentious cases the vessel is in a foreign country speaking to the authorities through an interpreter. How then do the vessels and the shipping companies see the 'Region'?

On our vessels we are subject to Classification Society Requirements, flag state requirements and requirements of international law and are compelled to adhere to their minimum requirements. Also our tankers are vetted annually by the Oil-majors. We, who operate ships, accept that these are in fact basic minimum requirements, and in many cases exceed them.

In our office we have a vice-president, Mr George Hill, who has an extensive photo collection of all the Kent Line vessels throughout the years. It is up to his Secretary to catalogue them all. She visits my desk at least once a week with a handful of pictures, requiring information. I can invariably identify the vessel, but more interestingly, I can usually date the picture fairly accurately, by establishing which new features, are shown or not shown. Ships are not like cars. We do not have too many grandfather clauses. At some point, regardless of how old your vessel is, you have to retrofit. The Irving Arctic was retired this last winter because the years of service available, did not justify the millions we would have had to spend on her.

When I first went to sea, the ships library was where you went to pick up a tattered paperback, because the transatlantic trip had exhausted your own supply of reading. Nowadays it is a stack of books, publications and

procedures that requires the Master's constant attention. And he better know what is in there, because somebody invariably walks onboard, someone who is thoroughly familiar with 5% of those books, and points out where the vessel is failing to comply. The Ballast Water Management Plan is just the latest.

As ship operators, those at the sharp end of this problem we contend that:

- 1) The existing regulatory authorities are more than enough to lead the fight in this field.
- 2) The IMO is the only correct body to legislate and set the standards, worldwide. Harkening back to last week in Washington, there was recognition that the IMO was fast-tracking the International Ship and Port Facilities Security regulations, but there was a thinly veiled acknowledgement that the United States is more than prepared to go it alone.
- 3) The Region must work together within a global perspective.
- 4) That attention should be given now to reception facilities for ballast water.
- 5) That changes in Regional regulation must reflect reality. Reality includes the ability of the vessel operator to comply.

Captain Neil Graham has been with Kent Line for over twenty years. He worked his way "up the hawse pipe" joining the Aime Gaudreau in 1975 as a seaman. A graduate from the University of New Brunswick in 1978 with a BBA, he served as Chief Officer on several Irving tankers, before taking command of the Wellington Kent in 1995.

Captain Graham was Master of the Irving Arctic for four years before coming ashore in 2001 as Fleet Manager for the Tankers, and now serves as Fleet Safety Officer, responsible for Safety Training and Security at Kent Line, Ltd.

ROUNDTABLE DISCUSSION SUMMARY

Following a short presentation on marine invasive species, the participants were separated into three groups, each representative of the various stakeholder interests. Each of the three Roundtable Discussion groups was asked to consider the following three questions:

- 1) What is the process for enhancing regional communication and problem solving?
- 2) What are the components of a regional ballast water management plan?
- 3) What strategic and creative approaches to improving on ballast water exchange should be considered?

The responses of the three Roundtable Discussion groups are summarized in each section. In addition, other topics emerged from the discussions and these are included as future considerations. The consensus of the participants was that there should be a regional approach, although the form and breadth of issues for consideration need to be further discussed as the plan takes shape. There should be a working group that has broad representation that meets regularly to address how to proceed. Three other items were stressed as key elements to address: outreach and education materials for all levels of individuals involved in ballast water management, scientific information to support risk assessments and proposed technologies, and data management that is easily accessible. Those who were not enthusiastic about a regional approach expressed concern that confusion would arise from differences in regional approaches (including state regulations) and concern about fees or regulations at the regional level.

Two key elements were seen as high priorities: (1) establish a stakeholder working group that meets regularly and (2) develop a framework for a regional ballast water management plan. The steering committee should be composed of representatives from the shipping community, provincial, state and federal agencies, scientists, and non-government organizations

from Canada and the U.S. It was recommended that ties be formed with the Canadian Marine Advisory Committee (CMAC) and the Northeast Aquatic Nuisance Species (NEANS) panel. [Since this workshop (September 26, 2003), we have formed a Ballast Water Committee within NEANS that has the membership composed of U.S. and Canadian representatives and will continue to add members to the committee. Several members of the NEANS Ballast Water Committee are on the CMAC and serve as liaisons between these two groups.]

The steering committee would be charged with developing a framework for a regional ballast water management plan that (1) identifies the region, (2) analyzes traffic patterns, assesses vulnerable areas and risks associated with exchange, no exchange, and other treatments, (3) develops an outreach and education plan, and (4) identifies those who will be responsible for each segment. In addition, the plan should incorporate a champion from one of the regional entities (e.g. New England Governors and Eastern Canadian Premiers or the Gulf of Maine Council for the Marine Environment) that institutes a process for enforcing agreed upon goals, but also incorporates ways to reward those who comply. There should be political consensus and agreement on implementation of the plan.

PROCESSES FOR ENHANCING REGIONAL COMMUNICATION AND PROBLEM SOLVING

There were several recommendations on communication issues that were specific to target audiences (Table 1). These recommendations range from detailed information and translation of scientific information for managers, crew members, shippers, shipping agents and others. The outreach efforts should be ongoing and incorporate fresh material to reach and broaden the informed audience base. The committees will, in turn, keep scientists and the public involved. Based on the California experience, preparing materials for shipping agents was successful in modifying their behaviors and improving response. All Roundtable groups identified currently available materials that may be modified or used as models for a New England regional ballast water outreach program.

Table 1. Communication approaches for specific audiences.

Audience	Recommended Action
Shipping agents and ballast officers	Develop concise, clear guidelines
	Clarify mandatory versus voluntary information
	Clarify where to send reports
	Include educational information in reports with OPA, ETA and other required forms
Ballast officers and crew members	Provide safety information
	Provide training as appropriate
	Stress the importance of accurate reporting
	Create visual reminders, e.g. posters
Managers	Encourage enforcement officers to assist with compliance
	Translate scientific information to assist with decisions
Broad audience	Inform the general public of issues through multimedia approaches
	Develop simplified risk assessments for options under consideration (especially those that require public approval)
	Prepare brochures and fact sheets
Future merchant mariners	Develop educational programs for maritime academies

COMPONENTS OF A REGIONAL BALLAST WATER MANAGEMENT PLAN

A successful regional plan is dependent on sound scientific information and accessible data on shipping patterns and traffic. Specific elements identified in the Roundtable discussions were:

1) Establish baseline traffic routes.

Understanding traffic routes, both from overseas and along the coast, are key elements in developing a realistic approach to management. Data on traffic routes exist for Halifax and the Canadian region and can serve as models for the U.S. Although much of the data in

the U.S. exists, it is relatively inaccessible and should be made available. The U.S. Maritime Administration (MARAD), the U.S. Coast Guard, and occasionally local groups have the data but are unwilling to make it available. The mandatory ballast water reports of U.S. Coast Guard are available on line through the Smithsonian Environmental Research Center. However, the data are not available in a reasonable time frame and only a small percentage of the vessels (30%) report on the status of ballast water. Accessing shipping data has become more of a problem since the September 11, 2002 terrorist attack.

- 2) Evaluate “safe” exchange zone feasibility. This feasibility of safe exchange zones in the Northwestern Atlantic is a major concern. Insights will be gained from interpretation of existing data and creation of new data to fill in the gaps in our understanding. Managing ballast water exchange at sea, changes in ship design, takes time, and adding new technologies are costly and require time to implement. Scientific and technical information should be translated for the target audiences (e.g. shipping community, port authorities, regulators, policy makers, environmental groups and the public). Bringing together physical and biological oceanographers, shippers (captains and ballast water operators), risk assessors, and regulators in a workshop setting would assist with communicating the issues and proposed solutions to reducing and preventing release of marine organisms from ballast water. Through open discussions, new areas of uncertainty will be identified for future study. A source of funding to address these issues also is part of the effort to enhance scientific understanding.
- 3) Create a management team. In order to accomplish development of a regional ballast water management plan and its implementation, a “management team” needs to be created and endowed with authority to implement the plan. Given that this is a bi-national program, the governance should be representative of Canada and the U.S.
- 4) Include an enforcement mechanism.

This is related to the identification of a management team that will have authority to enforce and agreements or regulations that may evolve.

- 5) Provide incentives for those that comply. A fee for inspections was assessed in California, but the use of funds to support research and provide information on the scientific and technical issues is considered a benefit by the shipping community. An incentive for those who comply should be incorporated into the implementation plan.
- 6) Establish a database. The difficulty in obtaining information on shipping patterns speaks to the need to develop a database that is accessible for all. There are several models and these should be adapted to the region's needs.
- 7) Use existing groups and data (e.g. GloBallast). The studies and findings from GloBallast and other groups should be incorporated into the plan. Analysis of what is working and how to economically and efficiently achieve improved reduction and prevention is a goal.
- 8) Coordinate with existing ballast water committees. The coordination is underway (as of May 2003) and should continue as this effort moves forward.

STRATEGIC AND CREATIVE APPROACHES TO A BALLAST WATER MANAGEMENT

Ballast water exchange is considered an interim management approach. Other options are possible, but these require funding, standards, or new infrastructure. Several of the alternatives suggested by the Roundtable groups are based on available technologies; some are in trials at the vessel level. All require political will to implement. Specific alternative technologies are not reviewed here, but information is available on the web (e.g., <http://massbay.mit.edu/exoticspecies/invaders/ref.html>). Technology treatment is preferred by the shipping community, but many technologies have not been adapted for vessels. Those who are interested in adopting their technology for vessels are reluctant to make investments until the standards have been adopted

(e.g. 100% kill of all organisms, water quality standards for microbes, levels that meet three times empty-refill). Similarly, shippers are reluctant to purchase new technologies if the proposed standards are modified and their technology does not meet the new standards.

Land-based treatments are favored by some and may involve special tanks, hook up to sewage treatment facilities, or rover treaters. Older oil tankers that do not have dedicated ballast water tanks are required to treat ballast at the land-based facility where the oil is loaded. This could serve as a model for a land-based ballast water treatment. Another option is to use a "rover treater" similar to the vessels that empty waste water tanks from recreational vessels in ports, harbors and marinas where discharge is prohibited.

FUTURE CONSIDERATIONS

Some other comments by the Roundtable groups addressed other issues. One recommendation was to involve non-government organizations that have been absent at these discussions, especially in the Northwest Atlantic. Another group wanted legislation considered more fully as an alternative to voluntary regional approaches. Because there are so many fishing boats on the water, one group suggested that fisheries should be more involved in the discussions and plan development.

CONCLUSIONS

Although there is concern that regional approaches are cumbersome for shippers, it was recognized by all groups that regional differences need to be addressed in ballast water management. The consensus was to move forward with a regional ballast water management plan and to work cooperatively with CMAC, NEANS and other groups in developing a plan that is enforceable, effective, and reasonable.

Appendix A

Agency Regulations and Guidelines

Although international organizations have limited authority in the United States and in other countries, the International Maritime Organization (IMO) is one organization that has developed policies and guidelines related to international trade and commerce.

In response to the threats posed by invasive marine species, the United Nations (UN) Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992, called on the International Maritime Organization (agency within the UN responsible for the international regulation of ship safety and the prevention of marine pollution) and other international bodies to take action to address the transfer of harmful organisms by ships. The member countries of IMO (including the USA) developed voluntary guidelines for the control and management of ships' ballast water, to minimize the transfer of harmful aquatic organisms and pathogens. These guidelines were adopted by the IMO Assembly in 1997, by resolution A.868(20) and have served as a model for ballast water management in many countries. The Marine Environment Protection Committee (MEPC) is the major technical forum within IMO that focuses on prevention and control of pollution from ships, including ballast water management and the transport of AIS.

THE GULF OF MAINE COUNCIL ON THE MARINE ENVIRONMENT (GOMC)

GOMC was created in 1989 by the governors and premiers of the jurisdictions that border the Gulf of Maine, including: Massachusetts, New Hampshire, Maine, New Brunswick, Nova Scotia. The Council's mission is "to maintain and enhance environmental quality in the Gulf of Maine and to allow for sustainable resource use by existing and future generations..." Although GOMC has no regulatory authority, it is the only

organization in this region that works on common interstate and binational problems related to AIS issues and it serves as the host agency for the Northeast Regional Panel of the Federal ANS Task Force.

INTERNATIONAL JOINT COMMISSION

Canada and the United States formed the International Joint Commission in order to jointly manage the St Lawrence River, the Great Lakes and other associated waters along the U.S.-Canada border. The 1998-1999 IJC Binational report on protection of the great lakes water quality includes specific guidelines related to ballast water.

GREAT LAKES COMMISSION (GLC)

The GLC is a binational agency that is concerned with integrated management of the Great Lakes, taking into consideration the needs of the various stakeholders on both sides of the international and interstate borders. This commission is based in the USA; its members are the 8 Great Lake states while the Canadian provinces of Ontario and Quebec assume associated member status. The Great Lakes Panel on Aquatic Nuisance Species was established in response to section 1203 of the 1990 Nonindigenous Aquatic Nuisance Prevention and Control Act and it focuses on prevention and control of ANS.

THE FEDERAL AQUATIC INVASIVE SPECIES MANAGEMENT PLAN

Section 1204 of the NANPCA of 1990 (amended as NISA of 1996) calls for states to develop comprehensive Nonindigenous Aquatic Nuisance Species Management Plans and provides funds (75:25 federal to state match of funds) to encourage this activity. Massachusetts serves as a good model for this initiative. The Massachusetts Aquatic Invasive Species Working Group followed the Guidance for State and

Interstate Aquatic Nuisance Species Management Plans developed by the ANS Task Force (2000), targeting both marine and freshwater AIS. The need for interstate and international cooperation to prevent the introduction and spread of AIS throughout the region is recognized. The plan describes efforts to coordinate AIS prevention among the Northeastern US states and the bordering Canadian provinces through the Northeast Regional Panel of the Federal ANS Task Force (see below).

NORTHEAST REGIONAL PANEL, FEDERAL AQUATIC NUISANCE SPECIES TASK FORCE

In view of the need for interstate and international cooperation on AIS issues in the northeastern U.S.A., the Massachusetts Office of Coastal Zone Management (CZM) and the AIS Working Group formed the Northeast Regional Aquatic Nuisance Species Panel. This Panel consists of state, federal and regional government representatives and non-government organizations from New York, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, Maine, Nova Scotia, New Brunswick, and Quebec. This panel was recognized by the federal ANS Task Force in July 2001 and is charged (by Section 1203 of NANPCA 1990) with: 1) identifying regional priorities re aquatic nuisance species, 2) making recommendations to the Task Force regarding education, monitoring, prevention, and control of nuisance species, 3) developing an emergency response strategy for federal, state, and local entities to prevent new invasions of AIS, 4) Provide advice to public and private entities concerning prevention and control of AIS, aquatic nuisance species infestations.

STATE AUTHORITIES AND PROGRAMS

Many states have recently developed and adopted nonindigenous aquatic invasive species management programs. In the following, we present an example of such initiatives at the state and local levels in Massachusetts. As illustrated in this example, Massachusetts AIS management activities are largely skewed toward aquatic invasive species in lakes and ponds.

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

The Department of Environmental Management (DEM) is the leading land management and natural resource planning agency in Massachusetts. State law requires DEM to establish an “aquatic nuisance control program” which is geared towards freshwater species and is administered by the DEM Lakes and Ponds Program.

DEPARTMENT OF ENVIRONMENTAL PROTECTION

The Department of Environmental Protection (DEP) is involved in monitoring surface waters for native and invasive macrophytes and where bioinvasions are discovered, to suggest remediation activities. In addition, it administers the Wetlands Protection Act, overseeing all activities that occurs within the wetland buffer.

DEPARTMENT OF FOOD AND AGRICULTURE

The Department of Food and Agriculture (DFA) monitors and regulates plant imports to Massachusetts and provides technical assistance to the aquaculture industry.

DIVISION OF MARINE FISHERIES

The Division of Marine Fisheries (DMF). Under state law, DMF has the authority to regulate the sources of shellfish for aquaculture. This legislation was passed to protect native shellfish populations from exotic diseases and predators, and to prevent genetic dilution of endemic shellfish stocks.

MASSACHUSETTS OFFICE OF COASTAL ZONE MANAGEMENT

The Massachusetts Office of Coastal Zone Management (CZM) has a suite of federally approved coastal policies regarding water quality, habitat, protected areas, coastal hazards, port and harbor infrastructure, public access, energy, ocean resources and growth management, and all of these are legally supported by other state agencies. By virtue of having a federally

approved coastal plan, CZM has jurisdiction over projects located in the state coastal zone. Strangely enough, however, CZM does not have independent authority to regulate any aspect of the AIS problem.

MASSACHUSETTS BAYS NATIONAL ESTUARY PROGRAM

The Massachusetts Bays National Estuary Program (MBP) compiled a Comprehensive Conservation and Management Plan (CCMP) and designated aquatic invasive species issues as a high-priority action item. MBP was involved in carrying out the MIT SeaGrant sponsored 2000 Rapid Assessment Survey of Invasive Species in coastal waters and has provided support for development of the AIS Management Plan.

DIVISION OF FISHERIES AND WILDLIFE

The Division of Fisheries and Wildlife (DFW) is charged by law to conserve, maintain, and protect nature for the benefit and enjoyment of the people. Its authority is shared with the USFWS for migratory birds, anadromous fish (in fresh water), and endangered species. DFW regulations relate to: import of vertebrates, fish release and transport, bait fish sale and harvest, aquaculture, aquarium fish sales. DFW is also involved in: identifying "problem" species in natural ecosystems, educating the public about invasive species; identifying habitats threatened by invasive species and actively removing invasive species through ongoing land management activities and the Habitat Restoration Program.

MASSACHUSETTS PORT AUTHORITY

The Massachusetts Port Authority (Massport) is an independent, public authority that manages and develops Massachusetts airports, the Port of Boston, and portions of the regional transportation infrastructure. The Maritime Department of Massport addresses port-related environmental issues, including ballast water management, and engages in outreach and education efforts with the shipping community in relation to these issues.

BALLAST WATER MANAGEMENT IN THE SHIPPING INDUSTRY

The shipping industry has been very active in helping to address invasive marine species and participates actively in the IMO Marine Environment Protection Committee Ballast Water Working Group. The International Chamber of Shipping (ICS) and the International Association of Independent Tanker Owners (INTERTANKO) have published a Model Ballast Management Plan (1998) which assists the maritime industry in implementing the IMO voluntary guidelines on board ships.

LEGISLATIVE EFFORTS RELATED TO BALLAST WATER

INTERNATIONAL GUIDANCE

In response to the threats posed by invasive marine species, the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992, in its Agenda 21 called on the International Maritime Organization (IMO; agency of the United Nations responsible for the international regulation of ship safety and the prevention of marine pollution) and other international bodies to take action to address the transfer of harmful organisms by ships. The member countries of IMO developed voluntary guidelines for the control and management of ships' ballast water, and in 1997 the IMO MEPC resolution A.868(20) "Guidelines for the Control and Management of Ship's Ballast Water to Minimize the Transfer of Harmful Aquatic Organisms and Pathogens" was published. It is noteworthy that these are voluntary guidelines and are not enforced in any way.

US FEDERAL LEGISLATION

The following illustrates the complexity of federal regulation of aquatic invasive species. At the federal level, no single U.S. agency has authority over the management of AIS. Rather, multiple agencies have developed invasive species programs, largely in reaction to severe

AIS issues.

The Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA) was written largely in response to the massive zebra mussel invasion in the Great Lakes. It includes regulations for controlling ANS and indicated that ballast water is an important source of ANS. In this act, the U.S. Coast Guard (USCG) was directed to establish regulations to prevent BW introductions into the Great Lakes. NANPCA also established the federal interagency ANS Task Force (ANSTF), charged with coordinating federal aquatic nuisance species management efforts with the private sector and other North American interests. The ANSTF is responsible for initiating research programs and policy direction for the prevention, detection, monitoring and control of ANS and operates through regional panels and specific working groups that address certain ANS. In 1993 the USCG ballast water management regulations were activated, dictating that ships travelling to the Great Lakes from outside the Exclusive Economic Zone (EEZ) must exchange ballast water before entering the EEZ, unless the ship's safety is in jeopardy. In October 1996, NANPCA was amended to create the National Invasive Species Act of 1996 (NISA) which expanded ballast water issues beyond the Great Lakes region, to include all waters of the U.S.A. As of July 1999 all vessels entering US waters from outside the EEZ were required to file a ballast water management report. Moreover, the Coast Guard published a set of voluntary guidelines aimed at controlling the spread of AIS through recreational activities (boating, fishing, etc.). In 1999 federal executive order 13112 established the National Invasive Species Council, a federal interagency organization that includes the Departments of the Interior, Agriculture, Commerce, State, Treasury, Transportation, Defense, and Health and Human Services, the Environmental Protection Agency, and the U.S. Agency for International Development.

The Council issued the National Invasive Species Management Plan early in 2001 to provide guidelines for Federal action. The National Aquatic Invasive Species Act (NAISA 2002) is currently going through advanced stages of revision and it encompasses ballast water issues for

all ships: a) in the Great Lakes, b) entering US ports from outside the EEZ and c) ships operating within the US EEZ.

CANADIAN REGULATIONS

A set of guidelines regarding ballast water management were issued in September 2000 (and amended in June 2001) by Transport Canada and Fisheries and Oceans Canada within the context of the Canadian Marine Advisory Council. These guidelines were compiled following extensive consultation with the relevant stakeholders, including shipowners and operators, environmental organizations, government officials and the U.S. Coast Guard. The guidelines incorporate many of the principles laid out in the IMO resolution A.868(20) and the Model Ballast Water Management Plan published by the International Chamber of Shipping and INTER-TANKO. Special provisions are made in these regulations for ships operating in the various coastal regions of Canada (East, Northeast, Northwest and West).

U.S. INTERSTATE REGULATIONS

A suite of federal laws dealing with interstate and international transport of potentially harmful organisms existed prior to 1990 and the NANPCA. These laws were passed mainly to protect American agriculture, fisheries, aquaculture and endangered species. These laws include:

- The Lacey Act of 1900 is a permitting process that is administered by the US Fish and Wildlife Service which regulates the transport of vertebrates, mollusks, and crustacea that are "injurious to human beings, to the interests of agriculture, horticulture, forestry, or to wildlife or the wildlife resources of the United States."
- The Federal Seed Act of 1939 prohibits the import of seeds of unknown type and origin to minimize chances of bioinvasions.
- The Endangered Species Act of 1973 may be used to authorize destruction or control of invasive species if a given species is threatened by a bioinvader.
- The Plant Protection Act of 2000 empowers

the US Department of Agriculture (USDA) to prohibit import and interstate transport of species included on the USDA Noxious Weed List.

Several government agencies have recognized the severity of the invasive species problem and are involved in management and control of invasive species.

- The US Fish and Wildlife Service (USFWS) provides technical assistance to states in developing invasive species control plans.
- The US Geological Survey (USGS) is involved in designing new strategies for prevention, early detection, and prompt eradication of new invaders. The USGS maintains an extensive database of nonindigenous species, accessible via the Internet.
- The US Department of Agriculture works in conjunction with the APHIS Cooperative Agricultural Pest Survey (CAPS) and state agricultural agencies to monitor for agricultural pests and noxious weeds.
- Massachusetts Institute of Technology (MIT) Sea Grant College Program plays an active role in research on, and management of, invasive species issues in the United States at large, and in particular with regard to ANS in the New England region.
- National Sea Grant College Program funds a variety of research and outreach projects related to ANS in all parts of the U.S.

LIMITATIONS OF CURRENT BALLAST WATER REGULATIONS

While ballast exchange guidelines issued under NISA will likely help reduce current amounts of organisms introduced into U.S. coastal waters, there are several problems these regulations do not address. The domestic legislation does not address coastal trade, for example shipments from Alaska to San Francisco, or Virginia to South Carolina. These boats are moving ballast from one U.S. port to another and are potentially introducing nonindigenous species into these aquatic areas. Furthermore, coastal port-to-port exchange may increase the potential for species establishment because of more similar conditions (salinity, temperature). The

“greater the difference in the physical and chemical states of the donor (source) and receiver (target) regions, the lesser the probability of survival” (Stemming the Tide, 1996).

There are no regulations or requirements for treating the sediment at the bottom of the tank, which is habitat for many species. These species include bloom-forming dinoflagellates that can produce toxins harmful to humans and marine organisms. If environmental conditions are unfavorable, as may occur in the dark, oxygen limited environment of the ballast tank, a dinoflagellate may form an inert cyst. When dumped into an estuarine habitat, the cyst may germinate and establish in this new location.

BALLAST WATER TREATMENT

Ballast water treatment technologies have reached a point that enables the transfer of the scientific knowledge to the engineers in order to design practical and cost-effective systems. However, due to the complexity of ballast water treatment, there is still a large need to carry on scientific testing of the treatment technologies while developing the treatment systems, i.e. the field of ballast treatment is still evolving. The Glostén-Herbert & Hyde Marine study (2002) provides a few full-scale examples of ballast water treatment systems with valuable lessons regarding the efficacy of BW treatment and the associated economics of treatment. However, the report hastens to warn that the costs of ballast water treatment cannot be standardized using such metrics as “\$/ton of ballast pumped”. Instead, the authors conclude that the cost should be calculated in terms of “% increase in operating cost” since actual costs vary a great deal across ship types and the cost calculation must take into account the type of vessel, the individual ship within a type category and the individual owners.

ECONOMIC CONSIDERATIONS ASSOCIATED WITH BALLAST WATER MANAGEMENT

The marine industry and the scientific community view shipping and its impacts on aquatic environments in different ways. Whereas the scientific

community holds the dangers associated with aquatic nuisance species and bioinvasions as an acute issue, the shipping community also has to consider the safety of ships, cargo and personnel; overall costs; other environmental impacts. In order to attain workable solutions regarding ANS elimination in ballast water, the scientific community and the marine industry must collaborate closely and the scientists must consider the logistical details and the economics of shipping.

SUMMARY

This document identifies some of the key issues associated with preventing or reducing introductions from ballast water. New national regulations would enhance reporting requirements, increase the number of ships required to treat ballast and lead to treatment options in addition to ballast water exchange.

Implementation of these new provisions will take from a few years to nearly a decade, but would have only limited impact on reducing new invasions in the interim. One option is for the region to identify areas where changes can be made and risk of new introductions reduced through regional efforts. A collaborative effort by all stakeholders can lead to a reasonable and effective approach. We see this as the challenge for the region.

Appendix B

Ballast Water: A Global and Northeast Perspective

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Revised 10/02/02

Globally, ballast water is considered to be one of the primary vectors responsible for the introduction of aquatic invasive species. Studies have demonstrated the presence of nearly all taxonomic groups in ballast water from microbes and pathogens to 12 inch mullets, many of which survive for months in the water and may form resting stages that allow them to survive in the sediments for even longer periods. On a worldwide basis the rate of introductions appears to be increasing and new organisms are found frequently in coastal and marine ecosystems.

What do we know about ballast water exchange in the northwestern Atlantic? Can we demonstrate economic damage? How much ballast water is released and is the amount related to risk? Can we predict what species will cause damage? How does this region compare with the rest of the U.S.? What types of ships arrive in major ports of New England and Atlantic Canada? What do we know about ballast water exchange in the region? This short document examines ballast water exchange in New England and Atlantic Canada as a first step in identifying what we know and gaps in our information.

ORIGIN OF FOREIGN AND DOMESTIC VESSELS

Two maps provide an overview of foreign and domestic vessels entering the U.S. and Atlantic Canada ports (Figure 1). The majority of vessels calling on ports in the U.S. Northwestern Atlantic are primarily domestic, including U.S. Caribbean islands (Ruiz et al.

2001). From a sample of 98 ships entering ports in New Brunswick, Nova Scotia, and Newfoundland, the majority were from the Northwestern Atlantic and Europe (Figure 1b from Carver and Mallet 2002), whereas a broader study of ships entering the Estuary and Gulf of St. Lawrence included vessels from the Pacific Central and South America as well as the Caribbean and South Atlantic (Harvey et al. 1999). The East Coast of the U.S. receives 38% of the 95,471 foreign arrivals based on data from July 1999 to June 2001 (Table 1). However in terms of short tons, only six New England ports ranked in the 100 leading U.S. Coastal, Great Lakes, or Inland ports in 2000 (<http://www.iwr.usace.army.mil/ndc/usforeign/pcsfles.htm>). The percent of the top 100 ports total tonnage in New England ports is 1.6% of domestic trade, 3.9% of foreign trade and 2.5% of total trade. Of all ports, Portland, Maine has the greatest number of foreign in-transits vessels of all ports.

The lack of specificity on the origin of ships and ballast water exchange led to guidelines and development of ballast water management forms. However, these have fallen short of providing the detailed information necessary for accurate assessment of risk for introduced species.

Table 1. Short tons from domestic or foreign locations for six New England coastal ports in the list of leading 100 ports from vessels entering U.S. ports (MARAD data).

Rank (of 100)	Coastal Port	Domestic (t)	Foreign (t)	Total (t)
25	Portland, ME	2.3	27.0	29.3
35	Boston, MA	8.4	12.4	20.8
55	New Haven, CT	6.9	3.7	10.6
61	Providence, RI	5.6	3.2	8.8
86	Bridgeport, CT	3.3	1.0	4.3
100	Fall River, MA	2.7	0.7	3.4
Total	New England ports	29.2	48.0	77.2
TOTAL	Top 100 ports	1874.8	1231.8	3106.6

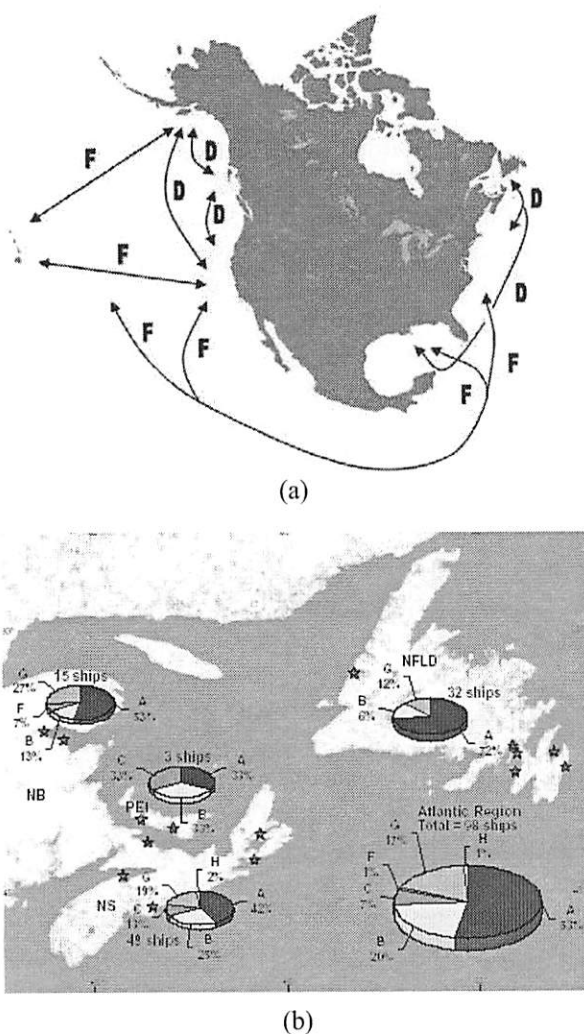


Figure 1. Maps showing the origins of ballast water based on the Food and Agriculture Organization of the United Nations (FAO) regions for the U.S. and Canada. (a). MARAD data of vessels entering the U.S. from outside the EEZ where F is ballast of foreign origin and D is domestic origin (as reported in Ruiz et al. 2001). (b). FAO regions identified for 98 vessels entering ports in three Canadian provinces where A/G are U.S. and northern South America, B is northern Europe, C is Mediterranean, D is Russia and the Far East, F is Africa, and H is Persian Gulf (Carver and Mallett 2002).

BALLAST WATER REPORTING FORMS

The International Maritime Organization (IMO), U.S., Canada, and a few other countries and states have ballast water reporting forms that are mandatory (most are variations of the U.S. Coast Guard or the IMO's form) or recommended

for ships entering ports from outside the Exclusive Economic Zone (EEZ). None of the forms address the concerns associated with no ballast on board (NOBOBs) and this continues to be a problem and they do not apply to vessels making coastal transits or with NOBOBs (Ruiz et al. 2001).

The U.S. response to the mandatory USCG Ballast Water Reporting Form is about 30% for the nation. Compliance for the East Coast is about 29% and for California, Oregon and Washington it is about 66.5%, reflecting enforcement in West Coast states that is lacking in the East Coast. An estimated compliance rate increase of 5.2% for the East Coast from 1999 to 2000 translates into a 14.8-year project time frame for 100% compliance (Ruiz et al. 2001). Because of the low reporting rate and the exemptions to ballast water reporting, it is not possible to extrapolate and determine much about compliance, level of treatment, and effectiveness. Over a two-year period for the five New England states, the number of ships releasing ballast water and treating ballast water varies considerably (even excluding New Hampshire, Rhode Island and Connecticut) (Table 2). For Maine and Massachusetts, a small percentage of the arriving vessels report discharging ballast (13.5 and 11%, respectively) at all (Ruiz et al. 2001). The percentage of the discharged ballast water that is treated is 82% for Maine and 24% for Massachusetts of which 46% and 20% report exchange at sea. This is confusing because few vessels have any alternative treatment methods on board. It has been difficult to gather information on the total number of vessels entering Massachusetts ports (and other New England ports) because MARAD did not reply to requests for data; similar problems were reported by Burke (2001). Since the creation of the Department of Homeland Security, it is even more difficult to get this data. Without these data, it is difficult to make accurate assessments.

In a study of 98 ships entering three Atlantic Canada provinces (NB, NS and NFLD), 17% lacked a ballast water management plan for the vessel or a report form, which suggests that compliance is approximately 83% (Carver and Mallett 2002).

Table 2. Summary of forms received from vessels entering New England state ports, number of vessels reporting discharges, number reporting treatment of discharged tanks, and number of discharges with exchange as treatment (Ruiz et al. 2001).

State	Dates of data	No. forms	Discharges (no., %)	Treated (no., %)	Exchange (no., %)
ME	10/99-6/01	409	55 (13.5)	45 (82)	25 (45.5)
NH	7/99-8/99	39	3 (8)	1 (33)	1 (33)
MA	7/99-6/01	230	25 (11)	6 (24)	5 (20)
RI	8/99-6/01	22	1 (4.5)	0 (0)	0 (0)
CT	7/99-8/01	66	4 (6)	3 (75)	1 (33)

DISCHARGE BY SHIP TYPE

Data from the USCG Ballast Water Reporting Forms (National Ballast Water Information Center) were summarized for New England over the time period of 7/99 to 3/01 (Figures 2). Rhode Island and New Hampshire were not included because of the small volume and low number of vessels arriving at these ports. Bulk carriers were the major type of vessel reporting discharge in New England; the majority of these arrive in Maine. For Massachusetts, container ships reported the largest volume of discharge. In a Canadian study, the proportion of tankers discharging ballast was greater than bulkers, container ships, or general cargo ships (Carver and Mallett 2002; Figure 3). Cruise ships were not included in that study, but the number of visits is increasing.

The total volume released in New England was approximately 500,000 mt annually, a small proportion of the total released nationwide (Figure 4; Ruiz et al. 2001). As noted above, there were not enough data from those reporting to extrapolate to the total number of ships visiting New England ports and the amount of ballast water released.

ASSESSING THE RISK FROM BALLAST WATER RELEASES

A complex set of factors are involved in risk assessments. Some are outside of the purview of this discussion (the biology of the organism, its

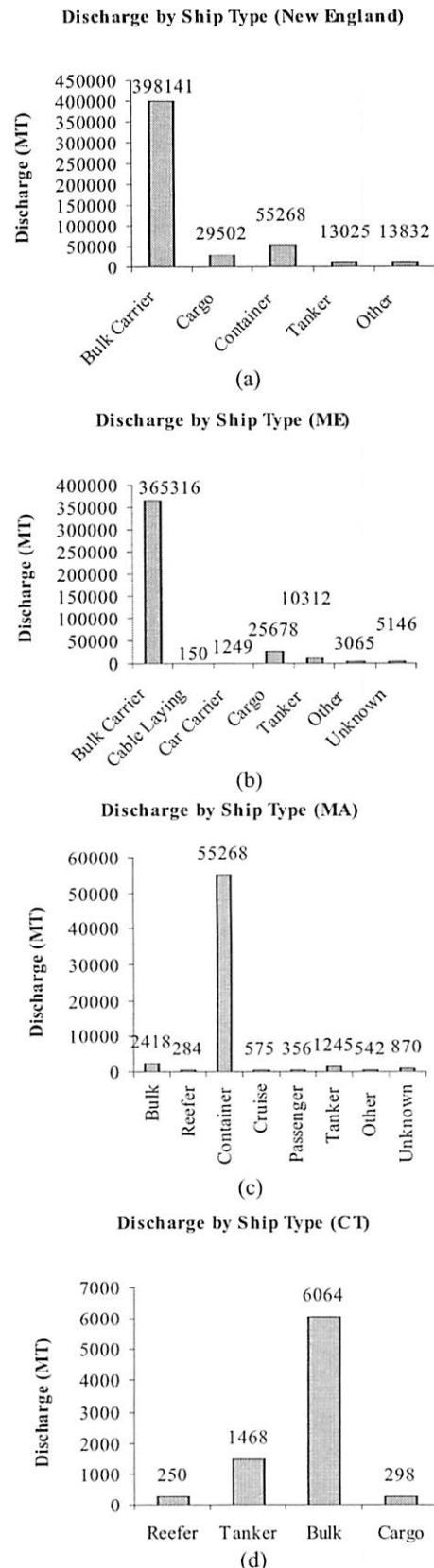


Figure 2. Total discharge of ballast water by ship type in New England (a), Massachusetts (b), Maine (c), and Connecticut (d).

genetic make up etc.), but we can examine three issues briefly: the source of the ballast water; the survivability of organisms, and issues related to “safe havens” or areas designated for exchange in lieu of open ocean disposal. The Transport Canada study (Carver and Mallet 2002) identified the sources of ballast water as coastal, open ocean or port by FAO region (see earlier text) for each of the three provinces (Figure 5). The number of zooplankton and phytoplankton organisms per liter and the average number of species are for each type of vessel (Figure 6). Assessment of risk for ships entering the Great Lakes through the Estuary and Gulf of St. Lawrence (EGSL) suggests that a high proportion of plankton species are non-native; however, many of these have not been identified to species thus the assessment is relative. Nonetheless, risk of introduction in EGSL is potentially high because many ships discharge there when they are unable to do so at sea (Harvey et al. 1999).

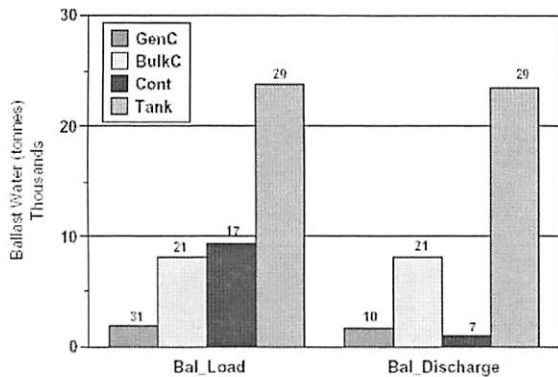


Figure 3. Average volume (MT) of ballast water discharge by ship type from a study of 98 Canadian ships; numbers are ships in each category (Carver and Mallet 2002).

REGIONAL AND MASSACHUSETTS NONINDIGENOUS SPECIES

In an unpublished document, Carlton (2000) lists approximately 60 introduced species from the Bay of Fundy through Long Island Sound, including pathogens and brackish water species. The period before the late 1800s is poorly documented in terms of what species may have arrived by what vectors, so it is difficult identify what percentage may have been introduced by

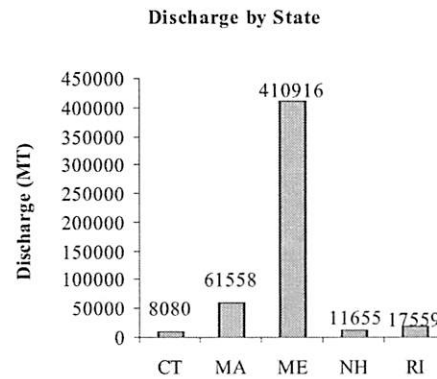


Figure 4. Total volume of discharge in New England by state (Ruiz et al. 2001).

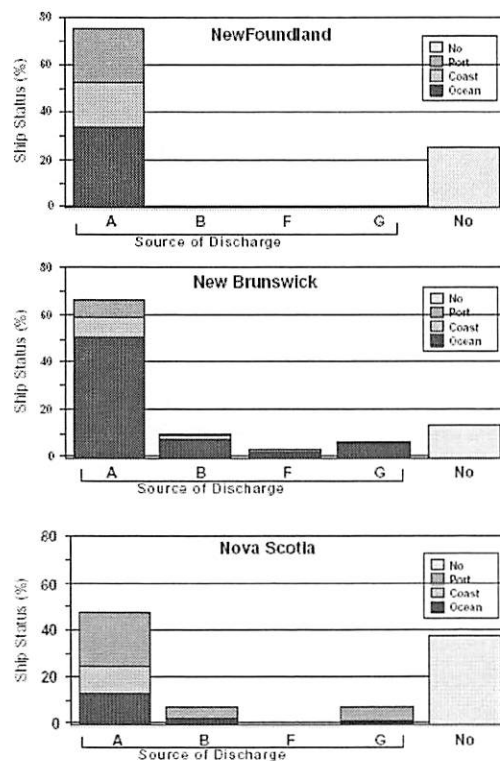
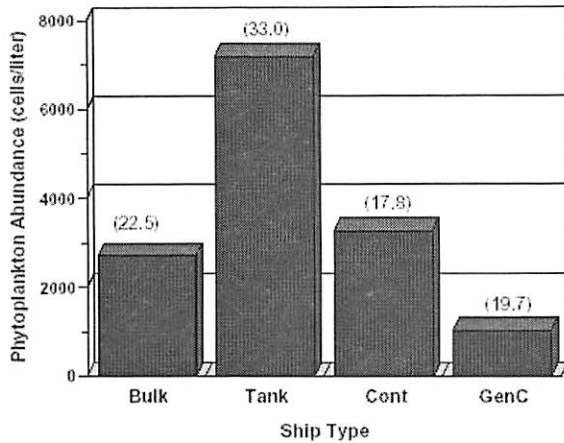
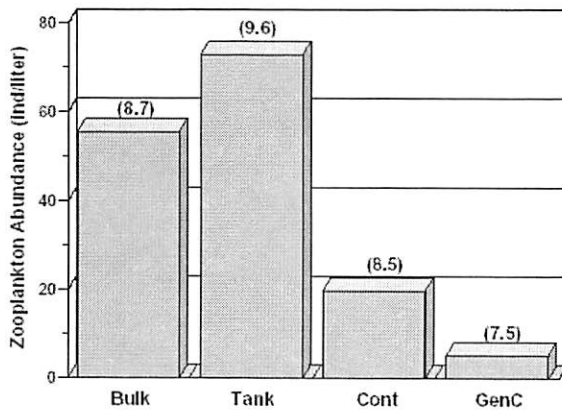


Figure 5. Proportion of ballast from coastal, open ocean and port areas by FAO region (see text). Percentage of ships not discharging are included (Carver and Mallet 2002).

ballast (solid or water), ship fouling, aquaculture, or other vectors. A recent rapid assessment of Massachusetts and Rhode Island fouling communities (marinas, harbors and ports) identified approximately 25 introduced species and another 30 whose origins are unknown and referred to as cryptogenic species, out of a total (including the introduced and cryptogenic species) of 260



(a)



(b)

Figures 6. Phytoplankton (a) and zooplankton (b) abundance and number of species present by ship type (Carver and Mallett 2002).

species. Of the four new species identified in this survey conducted during the summer of 2000, two were likely released by ballast water, one may have been released by ballast or ship fouling and the fourth may have been ship fouling. The two species most likely of ballast water origin were an isopod (*Ianiropsis* sp.), a pericaridan amphipod (*Caprella mutica*) and the third species possibly from ballast water is an anemone (*Sagartia elegans*). The fourth species is a colonial tunicate (*Didemnum vexillum*) that appears to be of Pacific origin and most likely was introduced from ship fouling. A new species of bryozoan that fouls offshore aquaculture cages (*Aleyonidium* sp.) was discovered off New

Hampshire's coast this past summer (L. Harris, University of New Hampshire, pers. comm. 2002). In addition, the Asian shore crab (*Hemigrapsus sanguineus*) that arrived in the Cape May, New Jersey and Delaware Bay area in 1988 has since spread north to Southern Canada and south to North Carolina. This crab is implicated in feeding on small barnacle spat, clams and mussels, and may impact shellfish in cobble areas. There continue to be new species introductions, some of which are likely to impact shellfishing, aquaculture, and commerce.

SUMMARY

Based on the National Ballast Information Clearinghouse data, the responses for the New England states imply that ships discharge less ballast water in New England than in other regions; however, with only 30% reporting it is not possible to extrapolate to the total amount released or exchanged. Similarly it has been difficult to provide a total volume of ballast discharges in the Atlantic Canadian provinces (reflecting my U.S. bias). We have little or no information on the number of coastal ships that discharge ballast water, nor the volumes that are exchanged—and we need to ensure that others are not the recipients of our invasive species. The Canadian data show that species are present in all types of ships' ballast tanks, irrespective of the volume, and further indicate that 25% of the phytoplankton species present may be nonindigenous (Carver and Mallett 2002).

Although the New England states do not discharge as much ballast water as other areas, this does not imply that fewer species will be released. For example, the amount of ballast discharged into San Francisco Bay is less than other major ports, but it is one of the most highly invaded estuaries in the U.S. (and possibly the world). This is consistent with studies that have found no relationship between the volume of ballast water releases and rates or actual numbers of introductions for a region (Carlton 2001). This short document does not include other scientific data and information that is relevant to understanding potential vulnerability and likelihood of introductions.

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- Carlton J. 2001. Introduced Species in U.S. Coastal Waters. Pew Charitable Trust, Washington, D.C.
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- Ruiz GM, Miller AW, Lion K, Steves B, Arnwine A, Collinetti E, Wells E 2001. Status and Trends of Ballast Water Management in the United States. First Biennial Report of the National Ballast Information Clearinghouse. Smithsonian Environmental Research Center, Edgewater, MD.
- Carver, CE and Mallet, AL. 2002. An Assessment of the Risk of Ballast Water-Mediated Introduction of Non-Indigenous Phytoplankton and Zooplankton into Atlantic Canada Waters, Final Report. Transport Canada, Dartmouth, Nova Scotia.

Appendix C

Ballast Water Management and Invasive Species Web Links

- NorthEast MidWest Institute, Biological
Pollution
<http://www.nemw.org/biopollute.htm>
- State-by-State Laws regarding Invasive Species
<http://www.nemw.org/ANSstatelaws.htm>
- Great Lakes Protection Fund, Preventing
Biological Pollution
<http://www.glpf.org/GLPFbiological.htm>
- Aquatic Nuisance Species Task Force
<http://www.anstaskforce.gov/>
- Ballast Water Treatment Systems: A Feasibility
Study (1997)
<http://www.anstaskforce.gov/ballaststudy.htm#>
- Great Lakes Ballast Water Demonstration
Project-Filtration Experiment
<http://www.nemw.org/biopollute.htm#ballastproject>
- NRC Report: "Stemming the Tide: Controlling
Introductions of Nonindigenous Species by
Ship's Ballast Water"
<http://www.nap.edu/catalog/5294.html>
- National Invasive Species Council
<http://www.invasivespecies.gov/council/main.shtml>
- Ballast water and Exotic Species Web Site
(GOMC)
<http://www.gulfofmaine.org/library/exotic.htm>
- Northeast Aquatic Nuisance Species Panel
<http://www.northeastans.org/>
- USGS Nonindigenous Aquatic Species Database
<http://nas.er.usgs.gov/>
- Aquatic Invaders in the southern Gulf of St.
Lawrence
[http://www.glf.dfo-mpo.gc.ca/sci-sci/inva-
enva/index-e.html](http://www.glf.dfo-mpo.gc.ca/sci-sci/inva-
enva/index-e.html)
- Western Regional Panel on Aquatic Nuisance
Species
<http://www.wrp-ans.org/>
- Great Lakes Regional Panel on Aquatic
Nuisance Species
<http://www.glc.org/ans/anspanel.html>
- Gulf of Mexico Panel on Aquatic Nuisance
Species
<http://pelican.gmpo.gov/nonindig.html>
- Massachusetts Aquatic Invasive Species
Management Plan
[http://www.state.ma.us/czm/invasivemanage-
mentplan.htm](http://www.state.ma.us/czm/invasivemanage-
mentplan.htm)
- Aquatic Nuisance Species in Vermont
[http://www.anr.state.vt.us/dec/waterq/ans/ans-
index.htm](http://www.anr.state.vt.us/dec/waterq/ans/ans-
index.htm)
- Invasive Aquatic Plants in Maine
[http://www.state.me.us/dep/blwq/topic/invasive.h
tm](http://www.state.me.us/dep/blwq/topic/invasive.h
tm)
- New Hampshire Watershed Management Bureau
Watershed Management Program
<http://www.des.state.nh.us/wmb/exoticspecies/>
- Maine Department of Environmental Protection
Invasive Aquatic Plants Program
[http://www.state.me.us/dep/blwq/topic/inva-
sive.htm](http://www.state.me.us/dep/blwq/topic/inva-
sive.htm)

Maine Department of Inland Fisheries and
Wildlife Invasive Aquatic Plants
<http://www.state.me.us/ifw/wildlife/milfoil.htm>

Global Ballast Water Management Programme
<http://globallast.imo.org/>

Gulf of Maine Ballast Water and Exotic Species
Web Sites
<http://gulfofmaine.org/library/exotic.htm>

Invasive Plant Atlas of New England
<http://invasives.eeb.uconn.edu/ipane/>

New York Sea Grant National Aquatic Nuisance
Species Clearinghouse
http://www.cce.cornell.edu/programs/nansc/nan_ld.cfm

World Resources Institute: Bioinvasions -
Stemming the Tide of Exotic Species
<http://www.wri.org/wr-98-99/bioinva2.htm>

International Joint Commission Canada-USA
<http://www.ijc.org/>

Marine Bioinvasions Fact Sheet: Ballast Water
<http://massbay.mit.edu/ExoticSpecies/ballast/fact.html>

The National Ballast Survey
<http://massbay.mit.edu/resources/pdf/NABSdatasheet.pdf>

National Ballast Water Information
Clearinghouse
<http://invasions.si.edu/ballast.htm>

INTERTANKO Ballast Water Requirements
<http://www.intertanko.com/tankerfacts/environmental/ballast/ballastreq.htm>

International Maritime Organization, United
Nations
<http://www.imo.org/index.htm>

International Commission Shipping
<http://www.marisec.org/>

1 (<http://www.anstaskforce.gov/>)

2(<http://www.wsg.washington.edu/outreach/mas/aquaculture/pathways.html>)

3 (www.ANSTaskForce.gov); Carlton, JT 2001
Introduced species in U.S. coastal waters. Pew
Oceans Commission; Pimentel et al. 2000
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nous species in the United States. *Bioscience*
50:53-65.

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Steves, A. Arnwine, E. Collinetti, E. Wells.
<http://invasions.si.edu/NBIC/NABSBienRpt1.pdf>
4a <http://www.epa.gov/region5/water/cwa.htm>
5 (<http://www.imo.org/>)

6 (<http://www.gulfofmaine.org/>)

7 (www.ijc.org)

8 (<http://www.glc.org/ans>)

9 (<http://www.northeastans.org/>)

10 (<http://ballast-outreach-ucsgep.ucdavis.edu/>)

11 Full-Scale Design Studies of Ballast Water
Treatment Systems. Design Study Report
Prepared for Great Lakes Ballast Technology
Demonstration Project; Northeast-Midwest
Institute and the Lake Carriers' Association by
Glosten-Herbert & Hyde Marine, April 2002

12 (taken from the 1998-1999 Binational Report
On Protection Of The Great Lakes Water
Quality; IJC Canada-USA)



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