New Tools for Responsible Shipping in the Great Lakes

Using Financial Responsibility Policies to Prevent Ballast-Borne Biological Pollution

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I. Introduction

The Great Lakes are the largest surface freshwater body in the world. Together, Lakes Superior, Michigan, Huron, Erie, and Ontario constitute approximately one-fifth of the world's surface freshwater supply and nine-tenths of the U.S. supply.[1] Bordering eight U.S. states and two Canadian provinces, the lakes are an invaluable cultural and aesthetic resource. In addition to being used for a variety of sustenance and recreational activities, they give rise to important economies. The regional maritime commerce system directly employs over 40,000 people, indirectly supports an additional 100,000 jobs, and generates over $7 billion annually in personal income and transportation-related business revenue.[2] Many additional jobs depend on Great Lakes shipping for transportation of their goods in both domestic and international commerce. In addition, the Great Lakes support multibillion-dollar industries unrelated to shipping, ranging from the $11 billion commercial and sport fishing industries to utilities providing electrical power and drinking water.

Ballast-Borne Biological Pollution in the Great Lakes

The environmental and economic stability of the Great Lakes is threatened by a proliferation of aquatic invasive species (AIS). As of 2006, 182 nonindigenous species were known to inhabit the Great Lakes, and a new species is discovered every 28 weeks – the highest rate of introduction ever recorded in a freshwater ecosystem.[3] Moreover, no AIS is known to have disappeared from the Great Lakes once an initial population was established.[4] As a result, some commentators have suggested that the Great Lakes system "may have entered an 'invasional meltdown' phase."[5] Under this hypothesis, "previous introductions can facilitate the introduction and success of subsequent arrivals. Together, [nonindigenous species] can leverage each other's impacts, creating synergistic disruptions."[6]

Since the Saint Lawrence Seaway opened in 1959, 65 percent of AIS introductions have been attributed to the ballast water that marine vessels carry from their origins to their destination ports.[7] Ocean-going vessels transport a vast array of organisms, representing nearly all major phyla, between continents each day.[8] Studies have shown that a single ballast tank may harbor organisms – many of them viable – from up to 500 distinct taxonomic groups.[9] Given that marine vessels discharge on the order of 70 million metric tons of ballast water into the Great Lakes in a given year (see Figure 1),[10] it is unsurprising that nonnative species commonly establish reproducing populations in the Great Lakes.

AIS cause tremendous environmental and financial damage to regional ecosystems and economies. Invasive species are estimated to cost the United States $137 billion per year, of which the zebra mussel alone accounts for $100 million.[11] According to recent research, estimates of economic harm caused by AIS introduced by shipping in the Great Lakes in particular are also severe and exceed $200 million annually.[12] Damages from

other, recent AIS have yet to be quantified but may be equally or more extensive. For example, viral hemorrhagic septicemia (VHS) has spread rapidly since its discovery in the Great Lakes in 2003; it has devastated game fish populations in several Great Lakes and significantly harmed the region's economy and environment. VHS threatens the very existence of the $4 billion Great Lakes commercial fishing industry and $7 billion sportfishing industry—the latter of which is already stressed by quagga mussels, round and tubenose gobies, sea lampreys, Asian carp, and a multitude of other invaders.[13] These stressors have resulted in a 75% decline in sportfishing effort in Lake Huron, with similar losses expected in other lakes.[14] Despite the seriousness of the invasive species problem in the Great Lakes, the region remains at risk of future invasions: the National Center for Environmental Assessment, part of the Environmental Protection Agency, recently found suitable habitat in the Great Lakes for fourteen species that present a moderate or high potential to spread and cause ecological impacts.[15]

In addition to economic damage, AIS present other forms of risk. For example, cholera was imported via ballast water from Bangladesh to Peru in 1991 and subsequently killed thousands as it spread through Latin and South America.[16] Cholera and other known human pathogens are now known to be discharged in U.S. ports in the Gulf of Mexico, the Chesapeake Bay, and the Great Lakes.[17] Invasive species can also directly affect water quality, recreational use, and other aspects of the environment. Zebra mussels, in addition to clogging intake pipes, promote algal blooms, including those of *Cladophora*, which destroys recreational and real estate values of the Lake Michigan shoreline,[18] and more toxic strains such as *Microcystis aeruginosa* that have been shown to increase the levels of toxins in lake water, causing risks to human and animal health.[19] These diverse natural resources damages are difficult to monetize but are undoubtedly substantial, likely ranging into the billions of dollars in the Great Lakes states.

Preventing Introduction of AIS

State agencies – and therefore ultimately taxpayers – currently bear the costs of biological pollution prevention, detection, and control. As a practical matter, biological polluters externalize the damage their biological pollution causes to the economies or environments of the Great Lakes states. Instead of polluters compensating for the harms they impose on the states and their citizens, innocent parties—states, port authorities, citizens, water-related businesses, and companies that use ships to transport their goods—must pay for these damages.

Discharge of biological pollution is contrary to the established law in every Great Lakes state. Each bordering state prohibits the unauthorized discharge of biological pollution, both as part of its Clean Water Act and through other statutes and regulations.[20] These prohibitions are echoed both in federal laws and regulations and in international conventions. Unfortunately, application of existing legal authorities has been stymied by enforcement challenges and a lack of vessel-specific regulations. In particular, efforts to determine individual culpability for biological discharge have heretofore faced

daunting – and likely fatal – hurdles to successful prosecution. Connecting newly-detected AIS populations to particular ballast water discharges has been well-nigh impossible due to the multitude of potential responsible parties and long lag times between introduction and detection of new species.[21] Even if this causation hurdle can be overcome, the prospective litigant would have difficulty accurately assessing the damages caused by a particular discharge. To date, these challenges have precluded any attempt to alter behavior through liability regimes or existing legal authorities.

Vessel-specific regulation promises to ease the enforcement of prohibitions on biological pollution. Despite the diversity of legal authorities applicable to vessel discharges, until recently, few jurisdictions attempted to regulate such discharges directly. In some cases, agencies have long-standing regulations excluding vessels from consideration as point sources of pollution.[22] In recent years, however, legal developments on both the state and federal levels have radically changed the regulatory landscape. As a result of judicial action and proactive regulation, the Great Lakes are on the cusp of a new regulatory paradigm for regulation of vessel discharges. New federal legislation is now possible, and the federal Environmental Protection Agency's (EPA) new ballast-specific regulations and associated state regulations have taken effect. In addition, the United States Coast Guard (USCG) may issue its pending regulations on discharge. In this new status quo, focus will shift from the creation of specific legal authorities to address ballast water discharge to the implementation and enforcement of those authorities.

Agencies will face several systemic challenges in implementing ballast water regulation. Agencies use inspections to detect violations and enforce them through civil and criminal penalties. As a result, regulations will only be as successful as their inspection systems. Agency resources are often limited, however, as are early detection and rapid response programs to evaluate whether new regulatory programs are effective. Even where inspections are effective, enforcement is not assured: it may be difficult to assess adequate penalties due to statutory limits, burdens of proof, or the expense of using a judicial forum.

Whether relying on developing tools to aid in the enforcement of existing legal authorities or using new, vessel-specific regulations to aid in compliance, agencies and the broader public are gaining new tools to enforce limitations on biological pollution. However, challenges to successful implementation remain, and policies are needed to ensure that shipping practices change apace with regulatory systems.

The development of new monitoring and enforcement tools and the creation of new, vessel-specific regulations may be changing the ability of states and citizens to determine fault for biological invasions. Through concerted effort, researchers are making dramatic headway to reduce the barriers to effective means for compliance with and enforcement of existing laws. Ballast water treatment technologies have increased rapidly in sophistication and effectiveness, and both Michigan and California have

identified treatment systems that can meet their stringent standards for ballast water discharge.[23] In addition, federal and state regulators are beginning to obtain and use sophisticated rapid sensing tools to evaluate the contents of ballast tanks.[24] In the future, widespread use of ballast water treatment systems and enhanced monitoring programs will enable legal causation, easing the enforcement of existing laws. This development creates the potential for massive liability for damages resulting from AIS introduction. This liability will accrue not only to carriers, but also to ports, marine terminals, and even companies contracting for shipment of their goods.

Recent litigation in the oil spill context suggests that contractors that hire ships to carry their goods may be liable for the full amount of the natural resource damages if they fail to investigate the safety of the vessels with which they contract. For example, the tanker *Erika* broke in half and sank, spilling up to 15,000 gallons of crude oil; in the ensuing litigation, a court held the ship classification society and the oil company that hired the vessel liable for the damages. Such decisions foreshadow potential future liability for parties other than vessel owners and operators in other pollution contexts. If these precedents carry over to the biological pollution context, Great Lakes manufacturers, port authorities, exporters, importers, and water users may all be at risk of significant liability should they contract with vessel owners or operators that do not use effective ballast water treatment mechanisms. These companies risk millions in potential liability for negligence under these precedents unless they investigate the environmental management systems their carriers implement and select those carriers that have a history and policy of responsible practice.

Financial Responsibility: A Possible Solution?

New legal tools can assist states in enforcing their prohibitions on biological pollution and can enable Great Lakes marine facilities and businesses to avoid liability. Specifically, practical and cost-effective financial responsibility mechanisms (FRMs) provide a powerful tool for leveraging private behavior to drive cost internalization. FRMs come in a variety of forms and are suited for a wide range of contexts. In general, FRMs can provide incentives for regulated entities to comply with regulations – and even to voluntarily go beyond compliance – ensuring that polluters internalize costs that they might otherwise impose on society. Businesses will be able to obtain information on the risks that particular vessels pose, and can make contracting decisions on that basis. FRMs can also protect the environment and local economy by requiring that regulated parties have adequate funding to pay for environmental harm they might cause. They are particularly useful where regulated parties are traditionally undercapitalized or otherwise avoid liability, or where expensive environmental remediation is necessary at the completion of natural resources extraction projects. As an associated benefit, FRMs ensure that responsible agencies can rapidly obtain sufficient funding to respond to environmental degradation and otherwise assure compliance with environmental protection laws and regulations, thereby limiting the potential damages associated with biological invasion. Finally, FRMs often co-opt

private markets to determine and correctly price the risks posed by particular firms' activities, thus providing a competitive advantage to low-risk firms.

Environmental regulations have long incorporated financial responsibility policies to ensure that regulated parties use safe and responsible practices. To date, state and federal governments have implemented FRMs to address oil spill prevention, hazardous chemical releases, mine remediation, wetlands mitigation site performance evaluation, and nuclear facility safety, among others. Policymakers have adapted these FRMs to properly incentivize responsible action under the unique conditions of each regulatory area. As a result, FRMs take a variety of forms, including bonding requirements, reserve funds, penalties, permit bars, mandatory liability insurance, strict, joint and several liability standards, and monitoring and response fees.[25]

FRMs show promise for mitigating the harms caused by the illegal discharge of biological pollution. Biological pollution causes significant natural resource damages but is difficult to detect and enforce, and no attempt to collect adequate damages from vessel owners and operators has been successful to date. When combined with the developing regulations and enforcement tools that will enable agencies to effectively detect and prosecute violations, an FRM could substantively benefit Great Lakes states. FRMs can ensure that adequate funds are available to support full damage assessment and rapidly make those funds available to regulators. In addition, FRMs could use private insurance markets to determine the risks posed by certain vessels, allowing carriers with good safety records to experience cost savings compared to their less diligent competition and generating incentives for carriers to install state-of-the-art ballast water treatment systems before they are required by law to do so. Differential pricing would also enable Great Lakes companies to assess the effectiveness of each carrier's environmental management systems and thereby avoid potential liability risks. Together, these benefits could relieve states and their taxpayers from the full burden of preventing, detecting, and controlling AIS introductions.

In this paper, we first introduce the Great Lakes shipping system. We then outline the legal framework that currently regulates discharges of biological pollution. Third, we discuss the potential liability for vessel discharges and its potential for expansion due to increased ability to determine causation for the introduction of invasive species. Finally, we introduce financial responsibility mechanisms as a potential tool to enable effective enforcement, ensure the availability of funds to remediate damages, and enable transparent pricing of shipping to aid downstream users in avoiding potential liability. We describe different types of financial responsibility mechanisms and several existing model mechanisms.

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[1] Great Lakes Information Network, *Overview*, http://www.great-lakes.net/lakes/ (last visited Feb. 20, 2009).

[2] *Written Statement for the Record Before the Subcomm. on Water Resources And Environment of the H. Comm. on Transportation and Infrastructure,* 110th Cong. (Mar. 7, 2007) (statement of Collister Johnson, Adm'r, Saint Lawrence Seaway Dev. Corp.), *available at* http://www.greatlakes-

seaway.com/en/pdf/SLSDC_STATEMENT_3-7-07_HEARING_FINAL.pdf; *see also* ALLEGRA CANGELOSI & NICOLE MAYS, GREAT SHIPS FOR THE GREAT LAKES?: COMMERCIAL VESSELS FREE OF INVASIVE SPECIES IN THE GREAT LAKES-ST. LAWRENCE SEAWAY SYSTEMS 11–12 (Northeast-Midwest Institute 2006).

[3] Anthony Ricciardi, *Patterns of Invasion in the Laurentian Great Lakes in Relation to Changes in Vector Activity*, 12 DIVERSITY & DISTRIBUTIONS, 425, 425–33 (2006); *see also* John M. Drake & David M. Lodge, *Rate of Species Introductions in the Great Lakes via Ships' Ballast Water and Sediments*, 64 CAN. J. FISHERIES AND AQUATIC SCI. 530 (2007) (collecting organisms from ships' ballast tanks in the Great Lakes and finding 93 distinct taxonomic groups, 13 to 39 of which had never been collected from the Great Lakes).

[4] Ricciardi, *supra* note 3, at 431.

[5] Anthony Ricciardi, *Facilitative interactions among aquatic invaders: Is an ''invasional meltdown'' occurring in the Great Lakes?* 58 CAN. J. FISHERIES AND AQUATIC SCI. 2513 (2001); Kristen T. Holeck et al., *Bridging Troubled Waters: Biological Invasions, Transoceanic Shipping, and the Laurentian Great Lakes*, 54 BIOSCI. 919, 927 (2004).

[6] Kristen T. Holeck et al., *supra* note 5, at 927 (2004).

[7] Ricciardi, *supra* note 3, at 425-33.

[8] *See, e.g.* James T. Carlton & J.B. Geller, *Ecological Roulette: The Global Transport Of Nonindigenous Marine Organisms*, 261 SCIENCE 78 (1993); Gregory M. Ruiz & James T. Carlton, INVASIVE SPECIES: VECTORS AND MANAGEMENT STRATEGIES 479 (2003)

[9] CANGELOSI & MAYS, *supra* note 2.

[10] This number and the data in Figure 1 were obtained by adding the discharges that were self-reported in 2007 in Minnesota, Michigan, Wisconsin, Ohio, Pennsylvania, Ohio, New York, Indiana, and Illinois, as tabulated by the National Ballast Information Clearinghouse. Smithsonian Environmental Research Center & United States Coast Guard, *NBIC Online Database*, http://invasions.si.edu/nbic/search.html (search conducted Oct. 7, 2008).

[11] David Pimentel et al., *Environmental and Economic Costs of Nonindigenous Species in the United States*, 50 BIOSCI. 53 (2000).

[12] David Lodge & D. Finnoff, *Annual Losses to Great Lakes Region by Ship-borne Invasive Species at least $200 Million* (2008), *available at* http://www.glu.org/sites/default/files/lodge_factsheet.pdf (last visited May 8, 2009).

[13] GARY E. WHELAN, MICH. DEP'T OF NATURAL RES., VIRAL HEMORRHAGIC SEPTICEMIA (VHS) BRIEFING PAPER (2007), *available at* http://www.michigan.gov/documents/dnr/Viral-Hemorrhagic-Septicemia-Fact-Sheet-11-9-2006_178081_7.pdf; Michael Hawthorne, *Fish Die-Off Near Milwaukee Signals Latest Lakes Invader may be Advancing on Chicago Shores*, CHI. TRIB., June 18, 2008.

[14] AM. SPORTFISHING ASS'N, TODAY'S ANGLER 216 (2008) (compiling U.S.Census Bureau data collected on behalf of fish and game agencies); Dan Egan, *The Beach Speaks For Itself*, MILWAUKEE J. SENTINEL, June 28, 2008.

[15] NAT'L CENTER FOR ENVTL. ASSESSMENT, PREDICTING FUTURE INTRODUCTIONS OF NONINDIGENOUS SPECIES TO THE GREAT LAKES (2008) (EPA/600/R-08/066F).

[16] S. MATTHEWS & K. BRANDT, GLOBAL INVASIVE SPECIES PROGRAMME, SOUTH AMERICA INVADED: THE GROWING DANGER OF INVASIVE ALIEN SPECIES (2006), *available at* http://www.gisp.org/casestudies/showcasestudy.asp?id=271&MyMenuItem=casestudies&worldmap=&country=.

[17] CANGELOSI & MAYS, *supra* note 2, at 66.

[18] Wisconsin Dep't of Nat. Res., Nuisance Algae (*Cladophora*) in Lake Michigan, http://dnr.wi.gov/org/water/greatlakes/cladophora/ (last visited Feb. 20, 2009).

[19] Lesley B. Knoll et al., *Invasive Zebra Mussels (*Dreissena polymorpha*) Increase Cyanobacterial Toxin Concentrations in Low-Nutrient Lakes*, 65 CAN. J. FISHERIES AND AQUATIC SCI. 448 (2008).

[20] SUELLEN KEINER, REPORT FOR THE GREAT LAKES FUND: POTENTIAL FEDERAL PREEMPTION OF LAWS IN THE GREAT LAKES STATES (Envtl. L. Inst. 2006) (considering the impact of proposed federal legislation on existing State laws relevant to ballast water discharge in the Great Lakes region). ELI's Invasive Species Program has extensive expertise in the analysis of State policies for prevention and control of invasive species.

[21] Peter T. Jenkins, *Paying for Protection from Invasive Species*, ISSUES IN SCI. & TECH., Fall 2002, at 67.

[22] *See* EPA, DECISION ON PETITION FOR RULEMAKING TO REPEAL 40 C.F.R. § 122.3(A) (2003), *available at* http://www.epa.gov/owow/invasive_species/ballast_report_petition_response.pdf.

[23] N. DOBROSKI ET AL., 2009 ASSESSMENT OF THE EFFICACY, AVAILABILITY AND ENVIRONMENTAL IMPACTS OF BALLAST WATER TREATMENT SYSTEMS FOR USE IN CALIFORNIA WATERS (2009).

[24] For example, the Ballast Exchange Assurance Meter (BEAM) is a handheld device that measures water salinity and organic content. Inspectors use it to monitor compliance with ballast water exchange requirements. See EPA & Dakota Technologies, Inc., *ETV Joint Verification Statement: Ballast Water Exchange Screening Tool* (2007), *available at* http://www.epa.gov/etv/pubs/600etv07057s.pdf.

[25] *See* JAMES BOYD, FINANCIAL RESPONSIBILITY FOR ENVIRONMENTAL OBLIGATIONS: ARE BONDING AND ASSURANCE RULES FULFILLING THEIR PROMISE? (Resources for the Future, Discussion Paper 01-42, 2001), *available at* http://www.rff.org/Documents/RFF-DP-01-42.pdf (reviewing FRM usage) [hereinafter BOYD, FULFILLING PROMISE].

II. The Great Lakes Shipping Industry

Maritime commerce generates significant economic benefits for the Great Lakes states. A complete review of Great Lakes shipping and infrastructure is beyond the scope of this paper, but some consideration of the nature of the industry, its financial conditions, and its physical morphology is necessary to the development of context-appropriate policies. A more complete picture of the Great Lakes shipping system is available from the Northeast-Midwest Institute and is the primary source for this section.[26]

Until recently, the five Great Lakes were not connected to each other or to the sea in a manner permitting transport throughout the system. Beginning in the late 1800s, Canada and the U.S. began building a system of locks and canals connecting the waterbodies and bypassing natural hazards to navigation, such as Niagara Falls. The components of the contemporary system include locks and canals under the jurisdiction of both the U.S. and Canada. U.S. regulatory authority rests with the Saint Lawrence Seaway Development Commission, a division of the Department of Transportation; the federally-owned non-profit Saint Lawrence Seaway Management Corporation administers the seaway on behalf of Canada.

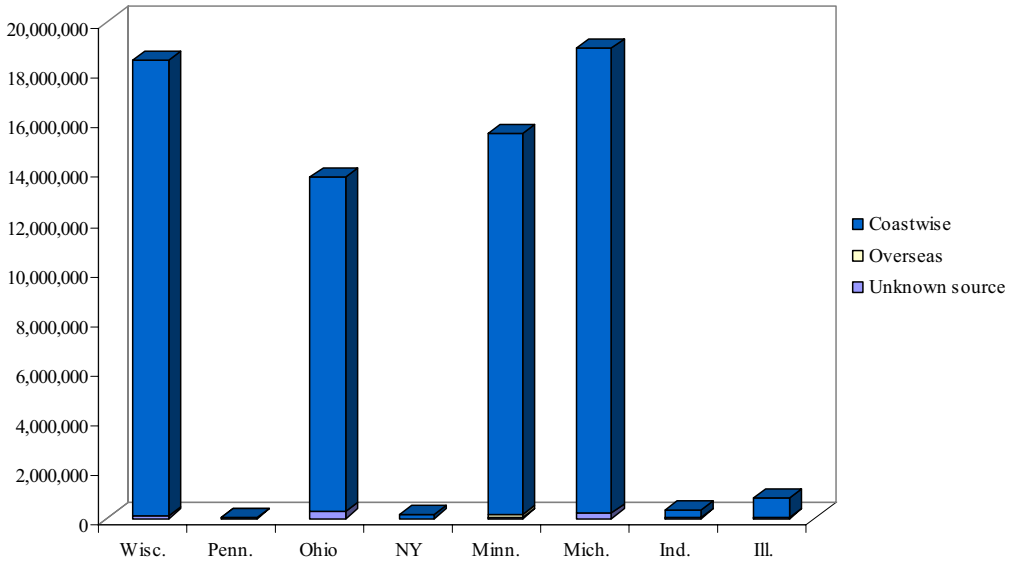
The seaway system was largely completed in 1959 and has remained relatively unchanged since then. The Seaway currently permits passage by vessels up to 24 meters wide and 225 meters long, with 8 meters of draft. These dimensions are large enough to admit almost 70 percent of the world's shipping fleet, but Seaway-capable vessels comprise just 13 percent of world cargo capacity due to increasing vessel sizes since the Seaway was completed. As a result, the Seaway's capacity may be increased in the future to admit passage of larger cargo ships. Others advocate for closure of the Seaway rather for expansion, arguing that the potential harmful effects of biological pollution that may be brought in outweigh the economic benefits associated with oceangoing vessels.[27]

The Seaway's physical environment constrains the nature of shipping that occurs in the Great Lakes. There are two main types of vessels currently plying the Seaway – "Lakers" and "Salties." Lakers are vessels that rarely or never leave the Seaway and therefore operate exclusively in fresh water. Salties, by contrast, are intercontinental vessels that carry Great Lakes trade in international commerce. While Salties outnumber Lakers, Lakers account for the vast majority of both vessel arrivals and ballast water discharges in the Great Lakes (Fig. 1-2).

The approximately 60 vessels in the U.S.-flagged Laker fleet are the largest vessels in the Great Lakes – some are more than 300 meters long. These vessels are too large to transit the Welland Canal connecting Lake Ontario to Lake Erie. As a result, these vessels trade exclusively in the upper four lakes, carrying coal, iron ore, and stone between northern regions of Michigan and Minnesota and more southerly industrial cities. They often travel in ballast to the northerly ports. Canadian Lakers are typically

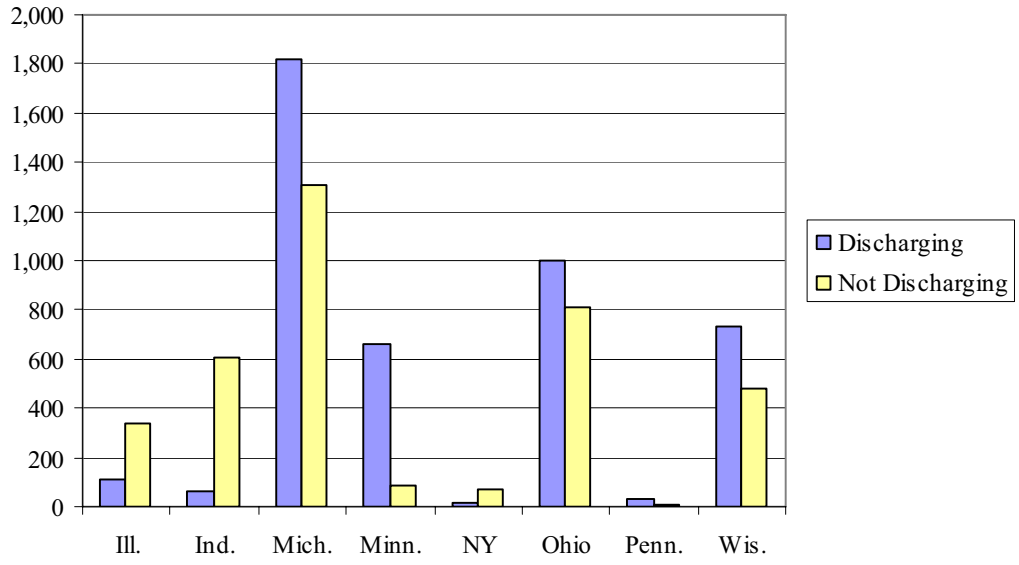
smaller than their American counterparts and are capable of transiting the Seaway's canal system. These 80 vessels generally carry bulk cargo from Lake Superior to ports along the Saint Lawrence River – and sometimes Canadian ports outside the Seaway. The third Laker fleet is by far the most numerous, and is composed of approximately 6,000 U.S.-flagged barges. Carrying bulk cargoes, these barges enter the Great Lakes via the Illinois River and travel as far north as Milwaukee and as far east as Muskegon, Michigan.

Figure 1. **Reported Ballast Water Discharged—Great Lakes, 2007 (metric tons)**



The Salty fleet is composed of approximately 220 vessels, primarily bulk cargo carriers. These vessels are flagged in one of about 30 countries. Averaging about 180 meters in length, Salties are the smallest non-barge vessels operating on the Great Lakes. Sixty percent of these vessels import steel from European ports to industrial cities in the U.S. for manufacturing; they then travel in ballast to ports in the upper Great Lakes, where they pick up grain for export. The remaining transoceanic vessels are tramp steamers – vessels that do not follow a stable, continuing pattern of trade, instead contracting to carry goods from one place to another as needed. Tramp steamers are generally smaller than other transoceanic carriers and therefore are capable of accessing not only the Seaway, but also numerous ports that are inaccessible to larger vessels, particularly in the developing world.

Figure 2. **Vessel Arrivals in Great Lakes Ports, 2007**



The Seaway system's physical constraints and vessel design interact with land-based shipping demand to influence how trade moves through the Great Lakes system. The Great Lakes shipping trade uses a large number of ports that specialize in certain commodities and patterns of trade. These ports vary in terms of governance and location in the supply chain.

Most ports in the Great Lakes are privately owned, often by shippers themselves. These shippers are mostly steel and mining operations that transport goods using U.S. and Canadian Lakers. While private ports are the most numerous, these ports are predictably small in terms of cargo shipped. Most large commercial ports in the Great Lakes are publicly owned and are managed by public agencies. These ports may be both owned and operated directly by states (e.g., Indiana), counties (e.g., Green Bay, Wisconsin), or municipalities (e.g., Milwaukee, Wisconsin). Most public ports, however, are operated by a port authority created by state legislation. Port authorities generally operate under a corporate model using a board of directors. Canadian ports are similar, operating as fully-independent authorities subject to public ownership. Regardless of their governance structure, Great Lakes shipping facilities are "landlords" – they do not directly operate the docks, but rather lease dock space to marine terminals that in turn hire the necessary longshoremen and stevedores and operate the dock.

Some Great Lakes ports primarily serve as the terminus of the shipping process where the imported goods are used. Others are intermediate ports where goods are debarked from ships and transshipped or transferred to another form of transport. For example, large Salty cargo carriers may offload products at the entry to the Seaway system, where they are picked up by smaller Lakers capable of transiting the Seaway locks or by

rail or truck for overland transportation. These ports thus serve as intermediate venues rather than as the ultimate destination of the goods. By contrast, Salty carriers may offload finished steel in Detroit, Toledo, or other industrial centers for use in those locations for the manufacture of consumer goods like automobiles. These ports can thus be construed as destinations rather than intermediates.

The intercontinental Great Lakes trade roughly follows a pattern of "steel in-grain out." Thus, European steel and iron – as well as specialty finished products such as windmills, heavy machinery, and some wood and paper products – are discharged in lower-lakes destination ports. Grain is then collected, primarily but not entirely at upper-lakes ports such as Duluth and Thunder Bay, Ontario. Great Lakes shippers also export a variety of finished manufactured products.

Depending on their needs, shippers use different types of vessels and contracting mechanisms. For example, a large percentage of the grain trade is carried out by large companies like Cargill and General Mills. These companies are likely to have established patterns of trade and may enter into long-term leases with vessel owners to operate their vessels as part of complicated supply chains. Cargill, for example, formerly owned its own fleet of Laker vessels. These chains may combine Canadian Lakers and large container ships or be limited to single shipments via transoceanic Salties. On the other hand, specialized companies that rarely or unpredictably ship goods may be more likely to take advantage of the tramp cargo fleet, hiring a vessel to carry goods to a particular location on a one-time basis and signing a short-term contract for that purpose.

The contractual relationships between vessel owners and shippers come in three forms. In bareboat charter, the shipper treats the vessel as its own, handling crewing and costs. This allows companies to avoid large capital outlays to purchase vessels and keeps the assets off company balance sheets. Time charters are more restrictive than bareboat charters, and allow shippers to operate the vessel for periods that may range to years. Generally, the chartering shipper pays fuel, operational, and port costs, while the owner remains responsible for capital and running expenses to keep the ship in good condition. Finally, in voyage charters a shipper hires a vessel to move a specific cargo from one place to another for a certain sum. In voyage charters, the vessel owner supplies the crew and retains responsibility for all the costs of operating the vessel. Both time charter and voyage charter arrangements involve matching of cargo and vessel on the charter market and use of vessels in the "tramp" trade.

All vessels are insured against a variety of risks regardless of their type or use. As a condition of underwriting by an insurance provider, ships are built to specific standards identified by classification societies, such as the American Bureau of Shipping. Classification societies inspect vessels regularly for safety, continued compliance with class requirements, and operation of auxiliary systems. If they determine that a vessel is in compliance, it is certified. Classification allows insurance providers to gauge the risks

posed by particular vessels and provides a signal to shippers that a particular vessel is suited to certain purposes.

At present, most vessels carry general liability insurance. The structure of the insurance is relatively novel, a form that emerged to meet the unique needs of the shipping industry. Today, vessel insurance is primarily provided by protection and indemnity (P&I) clubs. P&I clubs are generally mutuals, in which vessel owners join together to insure themselves. By contributing into a common pay-out fund, the vessel owners bind their individual premiums to the actions of everyone in the insurance club. P&I insurance covers the general risks of casualty to covered vessels, but not specialized liability such as that required by oil pollution laws. Instead, specialty guarantors have been created for these risks and provide coverage for a reasonable price. P&I coverage, however, is generally a prerequisite to coverage by a specialty insurer, whose risks are limited solely to enumerated liabilities. Specialty insurers may be either mutuals or traditional insurance companies; regardless, "[p]remiums [for oil pollution coverage] . . . are largely determined by the reinsurance market and are a function of the vessel's volume (the basis of the coverage requirement), age, and technical characteristics (such as single or double hull) and the cargo it carries."[28] Although these factors would certainly differ for ballast water liability risk, the determination of premiums for oil pollution insurance provides a useful model.

The Great Lakes shipping trade is complex, involving multiple distinct vessel types, cargoes, trade patterns, regulatory entities, and legal relationships. These patterns will influence the design of appropriate financial responsibility mechanisms in the Great Lakes, in concert with existing laws and regulations governing vessel operation.

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[26] CANGELOSI & MAYS, *supra* note 2.

[27] For a discussion of the economics of the Seaway and projections for what its closure would cost. *See* JOHN C. TAYLOR & JAMES L. ROACH, OCEAN SHIPPING IN THE GREAT LAKES: TRANSPORTATION COST INCREASES THAT WOULD RESULT FROM A CESSATION OF OCEAN VESSEL SHIPPING (2005), *available at* http://lakersports.gvsu.edu/cms3/assets/C6D78A67-0AEF-0264-A38619EC6FB0793A/OceanShippingReport091105.pdf. Taylor and Roach predict that closing the Seaway would result in a net transportation cost of $54.9 million annually. The 12.3 million metric tons of cargo that are currently borne by ocean-going vessels would instead require an additional 7.4 Lakers worth of capacity and 1.18 million metric tons of barge traffic per year, as well as 1.6 trains and 197 trucks per day. The authors contend this would be a relatively minor increase. For an example of the reactions that closure suggestions have generated. *See* Terry Johnson, Jr., *Closing Seaway is an Absurd Suggestion*, MILWAUKEE J. SENTINEL, Oct. 24, 2008, *available at* http://www2.jsonline.com/story/index.aspx?id=809549.

[28] JAMES BOYD, FINANCIAL ASSURANCE RULES AND NATURAL RESOURCE DAMAGE LIABILITY: A WORKING MARRIAGE? 35 (Resources for the Future, Discussion Paper 01-11, 2001), *available at* http://www.rff.org/documents/RFF-DP-01-11.pdf (internal citation omitted) [hereinafter BOYD, FINANCIAL ASSURANCE RULES].

III. Existing Ballast Water Treatment Authority

Shipping in the Great Lakes and through the Saint Lawrence Seaway is currently governed by a complex suite of international, national, state, and local authorities. These authorities govern discharge of ballast water and establish liability for carriers that discharge biological pollution. A basic understanding of how these authorities operate is a crucial prerequisite to creating and applying any tailored financial responsibility policy. Moreover, each type of authority has regulated or has the power to regulate how the shipping industry operates in the Great Lakes. This section is organized by regulator but also introduces relevant laws relating to financial responsibility at each level of governance (see Table 1). Together, these descriptions provide a coherent look at both the levels of governance and the availability of policies to these regulators.

	Ballast Discharge Limits	**Mandatory Vessel Insurance**	**Vessel Fees**
International	• Ballast Water Convention • MARPOL		
Federal	• NANPCA/NISA • Clean Water Act • SLSDC	• SLSDC • Oil Pollution Act	
State	• Michigan—Legislation • Minnesota—Regulation • All —CWA Section 401	• California—Oil	• California—Ballast
Local		• California ports	• Hawaii ports • California ports

Table 1. **Ballast Water Laws and Regulations Relating to Financial Responsibility**

International Law

The release of biological pollution is governed by Article 1 of the International Convention for the Prevention of Pollution from Ships, 1973, as modified in 1978 (MARPOL 73/78). MARPOL 73/78 is not self-executing, but requires parties to the convention to "take all necessary measures to prevent the pollution of the marine environment either through the discharge of harmful substances or effluents containing such substances."[29] The convention defines "harmful substance" to include "any substance that is liable to create hazards to human health, harm living resources and marine life, damage amenities or interfere with other legitimate uses of the sea." "Discharge" includes "any release, howsoever caused, from a ship." These discharges include pumping, emitting, and emptying.[30] Thus, the prohibition on pollution applies to the discharge of aquatic invasive species in ballast water. The International Maritime Organization (IMO) administers MARPOL. The IMO, however, has not directly regulated ballast water under MARPOL 73/78. The United States is a party to MARPOL 73/78 and

implements it through a number of statutes, including the Act to Prevent Pollution from Ships.[31]

In 2004, the international community strengthened ballast water treatment through the adoption of the International Convention for the Control and Management of Ships Ballast Water and Sediments (Ballast Water Convention). The Convention established standards for the treatment of ballast water to eliminate biological pollution but has not yet entered into force.[32] The U.S. is not a party to the Ballast Water Convention, nor has it yet mandated the use of treatment technologies. U.S. treatment standards may be created by federal legislation, but have yet to be enacted; a bill with significantly stricter standards than those of the Ballast Water Convention was passed by the House in 2008 but failed in the Senate. In any case, the development of more stringent standards would not conflict with the Ballast Water Convention. Under the Convention's terms, its treatment standards are a minimum, and states may require more stringent measures.[33]

In addition to establishing treatment standards, the Ballast Water convention includes a number of other substantive requirements, including the mandatory availability of sediment reception facilities at ports, promotion of research and monitoring, and mandatory surveys, certification, and inspection of vessels. The convention does not, however, address the use of financial responsibility systems. As a result, it is unlikely that domestic development of financial responsibility provisions—whether at the local, state, or federal level—will conflict with MARPOL or the Ballast Water Convention.

Federal Law

A variety of federal statutes and programs affect ballast water treatment and vessel insurance programs. Ballast water treatment is currently regulated by the U.S. Environmental Protection Agency (EPA) under the Clean Water Act (CWA) and the U.S. Coast Guard (USCG) under the Non-Indigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA) and National Invasive Species Act of 1996 (NISA).[34] These statutes and agencies combine to create a complex and interdependent regulatory system. Federal ballast water regulation is currently undergoing rapid change, however, due to congressional action and judicial determinations. These developments could affect not only federal ballast water regulation, but state policies as well.

NANPCA, NISA, and H.R. 2830

The Federal government began explicitly regulating ballast water in 1990 with the passage of the Non-Indigenous Aquatic Nuisance Prevention and Control Act (NANPCA). In NANPCA, Congress attempted to minimize the introduction of invasive species in ballast water through ballast water exchange, wherein vessels in transoceanic travel either empty and fill their tanks repeatedly at sea or allow seawater to flow through their tanks during transit. NANPCA recommended but did not mandate exchange. In 1996, Congress strengthened NANPCA by enacting the National Invasive Species Act

(NISA). In NISA, Congress reauthorized NANPCA, mandated ballast water exchange in the Great Lakes, and instituted a ballast water reporting system, which is maintained by the Coast Guard in collaboration with other public entities, such as the Smithsonian Environmental Research Center (SERC) (see inset). In addition, NISA authorized USCG to promulgate regulations as necessary to protect against invasion. While USCG has drafted regulations prescribing numerical standards for ballast water discharge, it has not published those regulations and their substantive provisions remain unknown.

National Ballast Information Clearinghouse

Pursuant to NISA, in 1997 the USCG and the Smithsonian Environmental Research Center (SERC) established the National Ballast Information Clearinghouse (NBIC). The NBIC collects reporting forms from all commercial vessels arriving in U.S. ports, and then compiles the embedded information in an online searchable database. For several years, the reporting rate of compliance fell below 40%. In June of 2004, however, the USCG instituted a civil penalty regime whereby noncompliant vessels faced $27,500 daily fines. The compliance rates have since been estimated to have risen to above 80%.

Aside from general origin, destination, and capacity information, the reporting form asks for the following data: the source, volume, and temperature of ballast water taken on; the location and volume of ballast water exchanged; and the location and volume of ballast water discharged. The vessel must also indicate whether there is a ballast management plan, if it has been adhered to, and if the IMO ballast water guidelines are on board. Both Salties and Lakers must submit these forms. There are still potential data gaps resulting from administrative difficulties coordinating the collection and transfer of data between the United States and Canada.

The NBIC remains the only U.S. source of ballast water intake, management, and discharge. The USCG is required to submit a biannual congressional report detailing ballasting practices and conclusion drawn, although as of the writing of this paper the last published report dates from 2001.

NISA remains the law of the land, but has been criticized heavily in recent years as invasive species have caused ongoing damages despite ballast exchange requirements. To further strengthen ballast water regulation, in April, 2008, the House of Representatives passed the Ballast Water Treatment Act of 2008, as part of a larger Coast Guard reauthorization bill (H.R. 2830). However, the Senate corollary was not enacted during the 110th Congress.

Although H.R. 2830 was not enacted, it is worth noting its key provisions as an example of what a USCG-based federal approach to its ballast water program might be in the near future. H.R. 2830 would have significantly strengthened NISA's provisions, primarily by mandating the implementation of ballast water treatment standards. It operated in two stages. First, it required mandatory exchange or ballast retention for all vessels, including those originating within the U.S. Exclusive Economic Zone (EEZ).[35] While vessels entering the Great Lakes from outside the EEZ are already required to exchange or retain ballast water, this would have presented a change insofar as coastwise trade would be newly subject to exchange. However, the requirement contained a specific exception for vessels operating exclusively in the Great Lakes—i.e., the Laker fleet.[36] As a result, the Great Lakes would not have been affected.

The second phase of H.R. 2830 would have implemented numerical ballast water treatment requirements, from which the Laker fleet was once again specifically exempted. The treatment requirements were scheduled to come into effect in stages, depending upon when each vessel entered dry dock. Each vessel was required to install a ballast water treatment system that was USCG-approved [37] and in compliance with the Ballast Water Convention[38] at its first dry dock between December 31, 2008[39] and December 31, 2011. Any vessel that did not drydock during that period was required to install approved treatment technology to meet the more stringent performance standards described in subsection (f)(1) of the bill by December 31, 2013.[40] The standards in subsection (f)(1) were approximately 100 times stricter than those agreed to in the Ballast Water Convention but less stringent than those required by some state laws. Once installed, vessels could continue using their treatment systems for ten years without upgrading.[41]

Development and timing of ballast water treatment technologies is uncertain. To counter claims that vessels would be unable to comply with the bill due to unavailability of technology, the bill required USCG to determine, by 2010, whether treatment technology could meet the stringent standards set forth in subsection (f)(1).[42] If USCG deemed the technology unavailable, the bill mandated installation of the best-performing technology available and extended the date by which vessels were required to comply with the Act.[43] On the other hand, if treatment technology were found to exceed the performance standards in (f)(1), USCG was required to upwardly revise its performance standards so as to require use of the best available technology.[44]

H.R. 2830 also allowed for the creation and use of ballast water reception facilities. These land- or water-based facilities would accept and treat water for ships at the dock and would allow vessels to forego shipboard treatment.[45] While these facilities could avoid costs for individual vessel owners, they may be difficult to implement due to waste disposal and other challenges. In addition, reception facilities would potentially expose marine terminals to expanded liability and would allow vessels to continue their existing practices in areas beyond U.S. control, thus facilitating the continued global spread of AIS. Further, these reception facilities may not be effective for all ports; in some locations, vessels may need to partially deballast during the approach to a port. This practice may be associated with apparent invasion hot spots in the Lakes and would not be addressed by land-based reception facilities.[46] Nonetheless, land-based facilities remain an intriguing option due to their superior ability to filter biological organisms and lower technological hurdles.

Finally, H.R. 2830 included provisions for the experimental use of unapproved devices.[47] Notably, the USCG would have been required to perform a risk analysis to determine vessels with the highest risk of invasion and encourage their participation in an experimental program through incentives.[48] The USCG would likely obtain important insight into the effective operation of a risk-analysis system that could eventually be applied to a financial responsibility system, for example, by reducing financial bonding

requirements applicable to participating vessels. While the U.S. would not have been the first country to consider such a risk analysis framework, the provision was nonetheless progressive.

H.R. 2830 contained a variety of laudable provisions, but it also raised questions about its relationship to state laws. It contained a limited general clause providing that state and local regulation of ballast water is preempted if it is "inconsistent with" or "conflicts with" subsections (e) and (f) of the bill (the ballast water exchange and ballast water treatment provisions, including the numerical treatment standards). For states with active ballast water treatment regulation as of January, 2007, state standards were not to be preempted until 2012. In the Great Lakes, Michigan alone satisfied this exception.

H.R. 2830's apparently broad preemption provision has created questions about the continuing validity of state laws. The extent of the provision may be subject to some debate due to uncertainty over how broadly the terms "inconsistent" and "conflict" should be construed, but the provision is likely to preempt almost any substantive state or local law on ballast water, including those that currently apply in a number of Great Lakes States. Regardless of what effect these preemption provisions would have had on state regulations generally, financial responsibility policies would not be affected. H.R. 2830 exempted from preemption state imposition of penalties and fees, provision of incentives for compliance, and development of regulations relating to reception facilities—which in tandem would have covered almost any financial responsibility policy. Under the bill, states were also permitted to seek approval from USCG to administer their own "inspection and enforcement authority for ballast water discharges."[49]

In short, financial responsibility regulation appears to be an area where state action was not only tolerated, but explicitly championed. While H.R. 2830's preemption provision would likely have restricted Great Lakes States' existing regulatory programs, it would have supported financial responsibility regulation at the state or local level.

Clean Water Act

The federal Clean Water Act (CWA) prohibits any discharge of a pollutant from a point source without a permit.[50] The definition of "pollutant" includes "biological materials."[51] Although EPA has not elaborated on the definition of "biological materials," a plain reading of the statutory language and common sense both suggest that invasive species should be considered biological material. In addition, the term "point source" expressly includes a "vessel or other floating craft."[52] Thus, discharge of viable organisms from a vessel is properly subject to regulation under the CWA.[53] Nonetheless, EPA has not historically agreed. Instead, the agency issued a rule exempting vessels from obtaining a National Pollutant Discharge Elimination System (NPDES) permit, which point sources must obtain before discharging pollutants. This policy was recently overturned in *Northwest Environmental Advocates v. EPA*, where the

Ninth Circuit upheld the district court's ruling that EPA's policy was contrary to the CWA.[54] While EPA did not dispute that vessels constitute point sources or that ballast water may contain pollutants, including biological materials, this case is nonetheless telling because it has prompted EPA to reconsider its regulation of ballast water on a national basis. In its holding, the court explicitly referred to invasive species as biological pollution.

As a result of *Northwest Environmental Advocates*, EPA was required to develop a NPDES permit for vessel discharges. Its permit was finalized on December 19, 2008.[55] The permit is general – it applies uniformly to all large vessels, including the entire Great Lakes shipping fleet. EPA's permit is technology-based and uses non-numeric effluent limits rather than setting numeric standards for ballast discharges (EPA did specifically request comments and information on numeric standards during the permitting process). EPA chose not to use numeric limits because of the lack of commercially available ballast water treatment technologies. "Once technologies are commercially available and economically achievable, EPA would require that these standards be met as a [Best Available Technology] effluent limit for ballast water discharges under subsequent iterations of this permit."[56] More recently, in response to criticism of the permit and this determination in particular, Administrator Jackson has indicated that EPA will revisit and potentially revise the permit.[57]

Substantively, the EPA permit contains several innovations. All vessels must maintain a vessel-specific ballast water management plan, and plans must be followed and made available for inspection. EPA also limits some ballast treatment technologies. Specifically, EPA notes that "chlorination is a commonly used disinfection technology and is known to be proposed for use in ballast water treatment systems."[58] The permit therefore limits the concentration of chlorine in ballast effluent to avoid damage to the environment; other biocides in discharged ballast water are subject to similar limitations. The permit also strengthens existing ballast water exchange requirements, making exchange mandatory for all vessels entering U.S. waters from outside the EEZ. While a positive step in general, this development has little impact on the Great Lakes, as NISA already requires ballast exchange for these vessels in the Lakes.

Vessels that violate the permit may be subject to the general administrative, civil, or criminal penalties laid out in the CWA.[59] Liability levels under the CWA differ depending on the type of enforcement action initiated; while these penalties were originally established by statute, EPA has periodically increased them through regulatory action.[60] EPA can impose administrative penalties up to $177,500 if it holds an administrative hearing on the record.[61] Civil penalties require judicial action, may be issued at a maximum rate of $37,500 per day in addition to any economic benefits obtained, and are not capped.[62] Criminal penalties differ for negligent and knowing violations and can result in a $250,000 fine and three years in jail per felony violation for an individual, or $500,000 for an organization.[63] Finally, enhanced penalties are available for discharge of certain hazardous materials, and these discharges have no maximum limit.

Unfortunately, invasive species are unlikely to qualify as hazardous substances, so these enhanced penalties are likely unavailable to EPA to enforce the CWA against biological pollution in ballast water.[64]

Section	Type	Min/day	Max/day	Total Max	Other
309(b)/(d)	Civil Action		$37,500	Not capped	Injunctive relief
309(c)(1)	Criminal negligence	$2,500	$100,000	Per viol.	Up to 1 yr. prison
309(c)(2)	Criminal knowing	$5,000	$250,000	Per viol.	Up to 3 yr. prison
309(g)(2)	Class I permit		$16,000/violation	$37,500	No hearing
309(g)(2)	Class II permit		$16,000	$177,500	Hearing on record
311(b)(7)	Hazardous materials	$25,000	$140,000	Not capped	Plus remediation

Table 2. **Clean Water Act Penalties for Biological Pollution Discharges**

By design, EPA's issuance of the NPDES permit does not conflict with existing federal laws. "EPA is aware of the existing regulations and requirements and in this draft permit has made its best effort to enable commercial shipping operators to comply with all applicable requirements. . . . In developing this draft permit, EPA took care to avoid any conflicts with U.S. Coast Guard regulations or international law."[65] Given the minimal nature of the new substantive requirements in the permit, EPA's approach to administration of the CWA against vessels will likely be to piggyback on USCG programs, allowing it to join in any enforcement action with a minimal administrative burden.

The NPDES permit is equally unlikely to significantly affect state laws or to preempt them. States generally act as the primary implementing agency for the CWA by developing programs that are authorized by EPA. States are specifically protected in their ability to promulgate state standards that are more stringent than federal limits—the CWA thus represents a floor, not a ceiling, for pollution control standards.[66] This is no less true for vessel regulation. "EPA will continue to work with state CWA permitting authorities on authorization . . . and plans to provide guidance on such issues in the near future. In particular, EPA plans to outline how states are to obtain approval to implement NPDES permitting for vessel discharges within their jurisdictions."[67] As a result, states that do use more stringent standards, such as Michigan, are likely to be allowed to continue operating those programs under an authorized CWA program. The relationship of state laws and EPA's general permit is considered more fully below.

The Saint Lawrence Seaway Development Corporation

The Saint Lawrence Seaway (Seaway) is a series of canals that allow ocean-going vessels to enter the Great Lakes. As described earlier, the operation and management of the Seaway between Montreal and Lake Erie is a joint enterprise of Canada and the United States carried out through twin Seaway corporations.[68] The primary role of the U.S. Saint Lawrence Seaway Development Corporation (SLSDC)[69] and Canada's Saint Lawrence Seaway Management Company (SLSMC)[70] is to govern vessel transit through

the Seaway. Vessels entering the Seaway are subject to numerous American and Canadian statutes and regulations, as well as voluntary best management standards that the corporations have adopted as mandatory provisions.[71] The SLSMC is not discussed below since this paper focuses on proposals to be implemented at the U.S. state or federal level.

SLSDC's enabling statute charges the Corporation with ensuring the safety and smooth operation of the Seaway.[72] It also administers several specific statutes relating to safety, bridges, and pollution within the Seaway.[73] Rather than engage in notice-and-comment rulemaking to implement its delegated programs, in practice SLSDC often uses Memoranda of Understanding (MOUs) with other U.S. and Canadian agencies to simplify its administrative burden.[74] SLSDC enforces its legal authorities through civil fines, detention of ships, and, where necessary, seizure and sale of vessels.[75]

SLSDC does not have explicit statutory authority over ballast water, but acknowledges that ballast water regulation is "of prime importance to [its] mission of moving vessels safely into the Great Lakes."[76] Although its administrator has disclaimed direct statutory authority to regulate ballast water, SLSDC can take some regulatory action relevant to ballast water treatment pursuant to its general authority to ensure the smooth flow of trade. It is likely that this authority encompasses the imposition of financial responsibility policies. To date, SLSDC has limited its rulemaking on ballast water while USCG "completes its ballast water discharge standard rulemaking and the U.S. Congress continues work on National legislation to address this important issue."[77]

Notwithstanding its hesitance to impose substantive regulation of ballast water given USCG's—and now EPA's—role in regulation and the continued development of federal ballast treatment legislation, SLSDC actively assists in implementing existing federal ballast water policy. SLSDC requires vessels moving in international commerce to flush their ballast tanks before transiting the Seaway and requires that all vessels adhere to best practices for ballast water management (developed by nongovernmental entities) as a condition of transit.[78] SLSDC is also active in the "Enhanced Seaway Inspection" (ESI) program under an MOU with USCG, SLSMC, and Transport Canada. ESI inspections address both safety and environmental issues and are integrated with USCG's ballast water reporting program.[79]

In addition to its ballast-related activities, SLSDC has established liability insurance requirements using its own regulatory authority. Vessels are required to provide proof of insurance for general liability at the rate of $100 per gross ton.[80] This liability insurance requirement is not currently intended to protect against damage resulting from ballast water discharge, and even if it were, its liability coverage requirements are currently too low to internalize potential damage due to biological pollution. However, the same authority that enables the use of liability insurance for potential physical damage to the Seaway likely could be extended to permit SLSDC to require insurance against damage resulting from ballast water discharge.

State Law

Every Great Lakes state has established laws and regulations prohibiting the discharge of biological pollution, including invasive species. These laws differ in the specificity of their application to ballast water. For example, Michigan and Minnesota state laws specifically prohibit discharge of untreated ballast water, while other states limit discharge of biological material through more general pollution control laws and regulations. A comprehensive review of applicable state laws is beyond the scope of this discussion paper, but existing regulatory structures do warrant some consideration.[81]

State Clean Water Acts

In the wake of the Ninth Circuit decision in *Northwest Environmental Advocates v. EPA* (see above), EPA issued its vessel general permit under the federal CWA. Under the CWA's cooperative federalism framework, the states are authorized to require more stringent environmental protections than those mandated by federal law. Thus, section 401 of the CWA allows states to condition the operation of EPA-created nationwide permits to the extent required by state law.[82] In other words, section 401 certification enables states to strengthen federal nationwide permits that are not sufficiently stringent to comply with state law.

In the ballast water context, many states – including all of the Great Lakes states – determined that state laws mandated the creation of conditions on ballast water discharge. The states determined that numerical standards were required and required treatment to standards in existing state law; to standards established in the Ballast Water Convention; or to standards advocated by the U.S. delegation to the IMO deliberations regarding the convention (a level 100 times more stringent than those agreed in the Convention). These treatment requirements in most cases are scheduled to take effect in 2012. As a result of these actions, every Great Lakes state has acknowledged that its state laws encompass ballast discharges – and every state has acted to implement those laws. However, these regulations have not yet taken effect and they are in many cases limited to oceangoing vessels.

While the certification decisions have been the key actions with respect to state governance of ballast water, state legislation and regulation outside the CWA context has also been important, both within and outside the Great Lakes region.

Table 1: Great Lakes State Certification Decisions

State	Standard Adopted
Illinois	Convention
Indiana	Convention
Michigan	State Law
Minnesota	Convention
New York	100x IMO
Ohio	Convention
Pennsylvania	100x IMO/Convention mixture
Wisconsin	100x IMO*

* Proposed pending regulation; currently no conditions

Michigan: Stringent, Immediate State Ballast Water Treatment Standards

Michigan has established state legislation governing ballast water discharge. The state ballast water laws prohibit discharge of "any waste or waste effluent" into state waters except by a person in possession of a valid permit."[83] Ballast water discharges from oceangoing vessels constitute *prima facie* evidence of a violation.[84] The Michigan Department of Environmental Quality (MDEQ) issues permits to all "oceangoing vessels engaging in port operations" in Michigan. To obtain a permit, vessels must demonstrate that they "will not discharge aquatic nuisance species or if [they] discharge[] ballast water or other waste or waste effluent, that the operator of the vessel will utilize environmentally sound technology and methods . . . to prevent the discharge of aquatic nuisance species."[85] MDEQ has issued a Ballast Water Control General Permit for all oceangoing vessels that meet its criteria, which identify four specific, acceptable treatment methods.[86]

Michigan's ballast water law includes severe penalties for violators, including both civil and criminal relief and natural resources damages.[87] Negligent discharge can result in penalties and injunctive relief, while knowing violations are criminal felonies and require payment of a mandatory financial penalty (up to $25,000 per violation or per day of discharge for first-time violators and up to $50,000 for recidivists). Criminal violators may also be imprisoned.[88] Where a violator's actions "pose or posed a substantial endangerment to the public health, safety, or welfare," significant financial penalties are possible. These range from a minimum of $500,000 to a maximum of $5,000,000 for civil defendants and not less than $1,000,000 for criminal defendants.[89] Finally, the Michigan attorney general is empowered to file a suit "to recover the full value of the injuries done to the natural resources of the state and the costs of surveillance and enforcement by the state resulting from the violation."

Michigan's ballast water law represents a quantum leap in the stringency of restrictions on ballast water discharge. As a result, it has been challenged on several grounds. In *Fednav v. Chester*, the United States District Court for the Eastern District of Michigan upheld the law against constitutional challenges based on the Eleventh Amendment,

due process, preemption, and the dormant commerce clause.[90] In so holding, the court strongly supported the state's right to protect itself from harm caused by biological pollution:

> [Michigan] is facing a serious threat to its environment caused by [aquatic nonnative species], has determined the likely avenues by which those species are being introduced, and has taken measures to stop this introduction . . . . I find no constitutional problem with a state implementing a permit scheme to protect its ports that requires payment of fees by each entity that uses its ports, including from an entity that promises not to engage in the activity that directly causes the ports harm.[91]

Importantly, the court ruled that Michigan's law was not preempted by NISA or NANPCA. The court found that "NISA established concurrent jurisdiction by which the federal and state governments each address the problems of ANS, and therefore NISA cannot occupy the entire field of ANS control."[92] In particular, the court emphasized the importance of NISA's savings clause as evidence that Congress intended concurrent jurisdiction.[93] The court placed its decision in context, explaining that "particularly in light of the long history of concurrent regulation of environmental issues in legislation such as the Clean Water Act it is clear that Congress intended concurrent regulation to address the ANS problem, and not to exclusively occupy this field."[94]

Michigan's ballast water proscription is among the world's strongest laws on discharge of biological pollution from oceangoing vessels. While the potential preemptive effect of federal legislation remains unclear, Michigan's law is an important precedent for development of financial responsibility policy, notably through its inclusion of large financial penalties and explicit authorization of natural resources damages resulting from ballast water discharge and recovery of monitoring and enforcement costs. These provisions provide both a potential source of funding for monitoring and enforcement and a minimum liability amount that could be used to develop financial assurance rules.

Minnesota: Applying Future Standards to Salties and *Lakers*

In September, 2008, the Minnesota Pollution Control Agency (MPCA) Citizens' Board approved regulations aimed at controlling AIS.[95] All vessels over 50 meters long, with a ballast capacity of eight cubic meters or more, are required to treat their ballast water before discharging it beginning January 1, 2016; new vessels built after January 1, 2012, must immediately have such technology onboard before entering Minnesota's waters.[96] The treatment technologies must be sufficient to enable compliance with the Ballast Water Convention's biological performance standards.[97] A survey of developing treatment technologies found that such systems would be available within the timeframe put forth by the regulation.[98] In the interim period (i.e., until the 2012/2016 requirements come into effect) the rules require each vessel to implement a Ballast

Water and Sediment Management Plan delineating "operating procedures and practices to control the spread of AIS."[99]

Minnesota's rules were not implemented under the NPDES permitting system, because EPA informed the MPCA that it did not have NPDES permitting authority.[100] Rather, they were instituted under the State Disposal System Permit Program and the MPCA's general power and duty to administer and enforce all laws relating to pollution of state waters.[101] In contrast with Michigan's regulations, these requirements apply to *any* vessel, regardless of whether it is a Laker confined to the freshwater lakes or a Salty coming in from outside the EEZ.[102] There is a $350 permit application fee, and an annual fee of $345.[103]

The water pollution control statutes in Minnesota state that if a relevant permit is violated, the violator will be found guilty of a misdemeanor and subjected to civil fines of up to $10,000 per day ($25,000 if hazardous waste is involved). The defendant may also be held responsible for any cleanup or other such expenses, and for compensating the state in the event of any loss or destruction of wildlife. Furthermore any violation of a permit is considered a public nuisance thus the state attorney general may obtain an injunction against it.[104]

California: State-Based Ballast Fees and Performance Standards

California is home to a unique ballast water program. In the Ballast Water Management Act of 1999 (as amended and renamed the Marine Invasive Species Act), the state created a broad system managed by the California State Lands Commission (CSLC). The law requires vessels, *inter alia*, to minimize their discharge of ballast in the state, avoid uptake in areas with high risk of infestation, clean ballast tanks regularly in mid-ocean, permit sampling of ballast, and maintain a ballast water management plan prepared specifically for the vessel. It also includes notable provisions requiring treatment approved by the CSLC and reporting of a broad array of information to the Commission.[105]

The California State Lands Commission also adopted performance standard regulations to take effect for a first category of vessels beginning January 1, 2010.[106] In addition to paying a fee for the right to discharge[107] and engaging in ballast water exchange (or an equivalent measure),[108] vessels will also have to meet stringent standards that mandate maximum levels of zooplankton, phytoplankton, and bacteria that discharged water may contain.[109] The timeline for enactment varies with vessel size and construction date. For vessels constructed before January 1, 2009, if the vessel has a capacity of between 1500-5000 metric tons, then the standard applies starting in 2014; if its capacity is smaller or larger, then the standard applies starting in 2016. For vessels constructed on or after January 1, 2009, if the vessel has a capacity less than or equal to 5000 metric tons, then the standard applies immediately; if the vessel has a greater capacity, then the standard is delayed until 2012.[110]

In addition to its substantive ballasting limits, the California Act requires vessels to pay a fee for the privilege of ballasting in California ports. These fees are deposited into the Marine Invasive Species Control Fund, which is used to fund the CSLC's ballast program.[111] The program requires payment of a flat fee for each "voyage" – that is, "any transit for a vessel destined for a California port or place from a port or place outside of the coastal waters of the state."[112] Since 1999, the fee program has been extended several times and the fee amount has varied from $200 to the current rate of $625; by statute it is capped at $1000. Violations of the fee statute may result in administrative penalties up to $27,500.

While fees are currently flat for each voyage, the CSLC appears authorized to vary fees by risk presented. Thus,

> [t]he commission may establish lower levels of fees and the maximum amount of fees for individual shipping companies or vessels. Any fee schedule established . . . shall take into account the impact of the fees on vessels operating from California in the Hawaii or Alaska trades, the frequency of calls by particular vessels to California ports within a year, the ballast water practices of the vessels, and other relevant considerations.[113]

Risk appears in the form of "ballast water practices"—but only as one of several considerations authorizing variable fees. This limits the utility of California's fee program as a model for a financial responsibility mechanism in the Great Lakes.

State versus Federal Regulation

The debate over ballast water treatment is a microcosm of a larger debate over the appropriateness of state versus federal regulation in the environmental context. On one hand, industry argues that the federal government is the appropriate regulator for an inherently international industry; that a uniform, national standard would be easier to abide by; and that a single standard would be simpler to implement, administer, and enforce. Advocates seeking to ensure the primacy of the federal role in particular may point to the disparity in the stringency of the standards established by Minnesota and proposed by Wisconsin, where the twin ports of Duluth and Superior would be required to enforce different standards.

On the other hand, states note that Congress has failed to act and EPA's permit is not a sufficient protection; as a consequence, state action is effectively mandatory to protect state resources and livelihoods. The Minnesota Pollution Control Agency summarized its stance in response to public comments submitted to the agency while its Citizen Board was deliberating over ballast water rules proposed earlier this year.

> The MPCA has long stated its preference for a federal solution that is adequately protective of Minnesota waters to address AIS in ballast water. Efforts by Congress to pass more stringent ballast water laws have been ongoing over the past few years, yet no such law is in effect to date. The MPCA believes the National Pollutant Discharge Elimination System (NPDES) vessel discharge general permit proposed by [EPA] on June 17, 2008, will not result in additional protections from AIS in ballast water for the Great Lakes over required existing practices. The MPCA believes its permit is the appropriate regulatory vehicle to protect the Minnesota State waters of Lake Superior because its permit includes substantive treatment requirements rather than relying solely on best management practices. . . . MPCA continues to work with other Great Lakes states and all authorities that have regulatory jurisdiction over the Great Lakes to promote uniformity with the overriding goal of having sufficiently protective regulatory standards.[114]

The determination of whether state or federal regulation is more appropriate is beyond the scope of this discussion paper. Regardless, at this point in time, the decision has at least been temporarily been made: states have chosen to use either independent legal action or the CWA certification process to implement treatment requirements. Enforcement of state laws and regulations thus remains the key outstanding question for ensuring the effectiveness of these regulatory regimes.

Local Law: Port Authority Regulation

In addition to state regulations, local jurisdictions may be empowered to address their liability. Most notable among these are port facilities. Whether operated as a department of a city (as in Long Beach, California or Milwaukee, Wisconsin) or directly governed under state law (as in Detroit, Michigan), port authorities are generally authorized to set the conditions for use of port facilities under their powers as landlords. These facilities may also be heavily regulated—for example, in California they are required to carry liability insurance, and are at risk of liability for failing to take sufficient action to prevent natural resource damages.

Some laws require port facilities to ensure that their users engage in responsible practices. The Hawaii legislature, for example, enacted a law requiring importers to pay $1 per container landed in the port of Honolulu.[115] The container fee is intended to support inspection of cargo containers for invasive species and early detection and rapid response programs, and is collected at the port. Similarly, California has an oil spill prevention act that requires ports to verify that each vessel is covered by a financial assurance certificate.

In other cases, port authorities voluntarily use their own authority to address environmental concerns or to provide adequate funding for port environmental programs. The ports of Long Beach and Los Angeles, for example, each began imposing

a container fee of $35 per container on June 1, 2008, to fund the use of cleaner-burning trucks in port operations, and they have imposed additional fees to fund infrastructure improvements. These programs were implemented under the ports' authorities as landlords. The Port of Cleveland also recently took action to begin addressing environmental concerns by appointing an environmental and sustainability manager, the first such position in any Great Lakes port. Cleveland is an independent agency, authorized by state legislation and created by the city and county. [116]

Existing port programs are closely analogous to potential ballast water programs—whether through the collection of container or ballast discharge fees to support monitoring and rapid response actions or through administration of certification or other financial assurance programs crafted at the state agency level.

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[29] G. Anthony Olagunju , *Criminalization Of Seafarers For Accidental Discharge Of Oil: Is There Justification In International Law For Criminal Sanction For Negligent Or Accidental Pollution Of The Sea?*, 37 J. MAR. L. & COM. 219 (2006).

[30] *Id.*

[31] 33 U.S.C. § 1901 *et seq*.; *see also U.S. v. Royal Caribbean Cruise Lines, Ltd*., 108 F.3d 290 (11th Cir. 1997); David G. Dickman, *Recent Developments in the Criminal Enforcement of Maritime Environmental Law*, 24 TUL. MAR. L.J. 1 (1999).

[32] *See* IMO, *International Convention for the Control and Management of Ships' Ballast Water and Sediments*, http://www.imo.org/conventions/mainframe.asp?topic_id=867 (last visited Feb. 20, 2009).

[33] International Convention for the Control and Management of Ships' Ballast Water and Sediments, Feb. 16, 2004.

[34] 16 U.S.C. § 4711 (2006).

[35] Regulations must include "at least 1 empty-and-refill cycle, outside the exclusive economic zone or in an alternative exchange area designated by the Secretary, of each ballast tank that contains ballast water to be discharged into waters of the United States; or [where such requirement is] impracticable, a sufficient number of flow-through exchanges of ballast water, outside the exclusive economic zone or in an alternative exchange area designated by the Secretary, to achieve replacement of at least 95 percent of ballast water in ballast tanks of the vessel," H.R. 2830, 110th Cong. § 1101(e)(1)(B)(i)(I)-(II) (2008), or use of "a contingency procedure that requires the master of a vessel to use the best practicable technology or practice to treat ballast discharge." H.R. 2830 § 1101(e)(1)(B)(ii). Note that exchange is already required for entry to the Great Lakes.

[36] H.R. 2830 § 1101(e)(7).

[37] H.R. 2830 § 1101(f)(4).

[38] H.R. 2830 § 1101(f)(3)(A).

[39] H.R. 2830 § 1101(f)(3)(A) ("IMO STANDARD IMPLEMENTATION.— A vessel to which this section applies shall have a ballast water treatment system that meets the standards provided under Regulation D–2 of the International Convention for the Control and Management of Ships' Ballast Water and Sediments as signed on February 13, 2004, beginning on the date of the first drydocking of the vessel after December 31, 2008.").

[40] H.R. 2830 § 1101(f)(3)(B); *see also* H.R. 2830 § 1101(f)(1) ("A vessel to which this section applies shall conduct ballast water treatment . . . before discharging ballast water . . . so that the ballast water discharged will contain—

(A) less than 1 living organism per 10 cubic meters that is 50 or more micrometers in minimum dimension;

(B) less than 1 living organism per 10 milliliters that is less than 50 micrometers in minimum dimension and more than 10 micrometers in minimum dimension;

(C) concentrations of indicator microbes that are less than—

(i) 1 colony-forming unit of toxicogenic Vibrio cholera (serotypes O1 and O139) per 100 milliliters or less than 1 colony-forming unit of that microbe per gram of wet weight of zoological samples;

(ii) 126 colony-forming units of escherichia coli per 100 milliliters; and

(iii) 33 colony-forming units of intestinal enterococci per 100 milliliters; and

(D) concentrations of such additional indicator microbes and of viruses as may be specified in regulations issued by the Secretary and the Administrator, after consultation with other appropriate Federal agencies as determined by the Secretary and the Administrator, that are less than the amount specified in those regulations.")

[41] H.R. 2830 § 1101(f)(3)(C).

[42] H.R. 2830 § 1101(f)(6)(A) ("For these purposes the secretary shall consider: (i) the effectiveness of a technology in achieving the standards; (ii) feasibility in terms of compatibility with ship design and operations; (iii) safety considerations; (iv) whether a technology has an adverse impact on the environment; and (v) cost effectiveness").

[43] H.R. 2830 § 1101(f)(6)(B).

[44] H.R. 2830 § 1101(f)(6)(C). An acceleration requires at least 24 months notice.

[45] H.R. 2830 § 1101(f)(2).

[46] CANGELOSI & MAYS, *supra* note 2.

[47] If a vessel participates in an approved technology evaluation program, the vessel shall be allowed to use that technology for ten years, subject to termination if the Secretary determines that the approved technology is insufficiently effective or is causing harm to the environment. H.R. 2830 § 1101(f)(7). No more than five percent of vessels may be allowed delay from the new standards as a result of participation in such a program. H.R. 2830 § 1101(f)(6)(B)(ii).

[48] The USCG is directed to consider "the origin of their voyages, the frequency of their voyages, the volume of ballast water they carry, the biological makeup of the ballast water, and the fact that they frequently discharge ballast water under an exception to subsection (e)." H.R. 2830 § 1101(f)(9)(A).

[49] H.R. 2830 § 1101(i)(4)(A).

[50] 33 U.S.C. § 1311(a), 1362(6).

[51] § 1362(6).

[52] § 1362(14).

[53] 40 C.F.R. § 401.11(f) (echoing statutory definition in regulations). *See also Nat'l Wildlife Fed'n v. Consumers Power Co.*, 862 F.2d 580 (6th Cir. 1988) (finding that dead fish discharged from power plant constitute biological material).

[54] *Nw. Envtl. Advocates v. EPA*, 537 F.3d 106 (9th Cir. 2008).

[55] Although congressional action on H.R. 2830 could still exempt vessels from the CWA, EPA is under a court-mandated final rulemaking deadline of September, 2008, and was required to issue the proposed permit in advance to comply with Administrative Procedure Act (APA) requirements.

[56] EPA, 2008 FINAL ISSUANCE OF NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) VESSEL GENERAL PERMIT (VGP) FOR DISCHARGES INCIDENTAL TO THE NORMAL OPERATION OF VESSELS: FACT SHEET, 65 (2008) [hereinafter VGP FACT SHEET].

[57] *See* John Flesher, *EPA Chief Reconsidering Ship Ballast Permit* (Feb. 24, 2009), *at* http://www.michigan.gov/minewswire/0,1607,7-136-3452-209536--,00.html.

[58] VGP FACT SHEET, *supra* note*, 56* at 101.

[59] Administrator may commence a civil action for damages or injunctive relief. Clean Water Act § 309(b), 33 U.S.C. § 1319(b). Negligent or knowing violations may result in criminal penalties. *Id*. at § 1319(c)(1)–(2).

[60] This action is required by the Federal Civil Penalties Inflation Adjustment Act of 1990, 28 U.S.C. § 2461, as amended. *See* EPA, *Civil Monetary Penalty Inflation Adjustment Rule*, 74 Fed. Reg. 626 (Jan. 7, 2009) (amending 40 C.F.R. § 19.4).

[61] 33 U.S.C. § 1319(g).

[62] 33 U.S.C. § 1319(d).

[63] 18 U.S.C. § 3571. The federal alternative fine statute overrides the lower maximums written into the CWA statute at 5 U.S.C. § 554. *See* Susan F. Mandiberg, *Fault Lines in the Clean Water Act: Criminal Enforcement, Continuing Violations, and Mental State*, 33 ENVTL. L. 173 (2003).

[64] Section 311 of the CWA regulates the discharge of oil and other hazardous substances into navigable waters and provides for enhanced penalties for unlawful discharge. 33 U.S.C. § 1321; BOYD, FINANCIAL ASSURANCE RULES, *supra* note 28, at 7 n.17. Unfortunately, EPA must designate hazardous substances by rule, and biological pollution does not appear to meet the requirements for designation. *United States v. Ohio Barge Lines*, 410 F. Supp. 625, 627 (W.D. La. 1975). Hazardous substances must be an element or compound, be discharged into navigable waters or affect natural resources, and present an imminent and substantial danger to public health or welfare. 33 U.S.C. § 1321(a)(14). Invasive species are unlikely to be considered an element or compound. As a result, governance and enforcement of discharge of these species under the CWA cannot proceed under the enhanced provisions of section 311.

[65] VGP FACT SHEET, *supra* note 56, at 10.

[66] In its initial determination to exclude vessel discharges from the CWA, EPA noted that "nothing in the CWA prevents states from independently regulating ballast water discharges under State law, should they choose to do so, pursuant to CWA section 510." VGP FACT SHEET, *supra* note 56, at 10; *see also* 33 U.S.C. § 1370 ("except as expressly provided in this chapter, nothing shall preclude . . . the right of any State . . . to adopt or enforce any standard or any requirement . . . ; except . . . [one] which is less stringent. . . ; [or] impairing . . . any right of or Jurisdiction of the States with respect to the waters (including boundary waters) of such states.").

[67] VGP FACT SHEET, *supra* note 56, at 13.

[68] Great Lakes St. Lawrence Seaway System, *Management of the Seaway*, http://www.greatlakes-seaway.com/en/management/index.html (last visited Feb. 20, 2009).

[69] Saint Lawrence Seaway Act, 83 P.L. 358, 68 Stat. 93 (1954) (codified at 33 U.S.C. § 981-90); Dep't of Transp. Act, 89 P.L. 670, §8(g)(1), 80 Stat. 931, 943 (1966) (amending 33 U.S.C. § 981).

[70] Great Lakes St. Lawrence Seaway System, *300 Years of History, at* http://www.greatlakes-seaway.com/en/seaway/history/index.html (last visited Oct. 3, 2008).

[71] ST. LAWRENCE SEAWAY MGMT. CO., SEAWAY HANDBOOK (Feb. 2008), *available at* http://www.greatlakes-seaway.com/en/pdf/SeawayHandbook2008.pdf. 33 U.S.C. §§ 981–90; Canada Marine Act, S.C. 1998, c.10, s. 98-99. The Seaway regulations have adopted recommendations from the Intergovernmental Maritime Consultative Organization, the Shipping Federation of Canada, and the Lake Carriers Association and Canadian Shipowners Association. *See* Seaway Regulations; *Miscellaneous Amendments*, 44 Fed. Reg. 35,256, 35,256 (June 19, 1979) (proposing rule to revise 33 C.F.R. pt. 1 "provisions concerning the transportation of hazardous cargo in accordance with the International Maritime Dangerous Goods Code"); 33 C.F.R. § 401.31(e)(1); 33 C.F.R. § 401.31(e)(2) (mandating acceptance of voluntary practices). The Intergovernmental Maritime Consultative Organization, now the International Maritime Organization, is a United Nations' agency responsible for improving ship safety and preventing pollution. International Maritime Organization, http://www.imo.org/ (last visited Feb. 20, 2009). The Shipping Federation of Canada is a private organization representing the interests of ship-owners involved in overseas trade. The Shipping Federation of Canada, *Mandate*, http://www.shipfed.ca/eng/mandate/ (last visited Feb. 20, 2009). The "Lake Carriers' Association is the trade association representing U.S.-Flag vessel operators on the Great Lakes." Lake Carriers' Association, http://www.lcaships.com/ (last visited Feb. 20, 2009). Canadian Shipowners Association is a private organization aiming to "promote an economic and competitive Canadian marine transportation industry." Canadian Shipowners Association, *CSA Mandate*, http://www.shipowners.ca/profile/csamandate.asp (last visited Feb. 20, 2009).

[72] St. Lawrence Seaway Act, 33 U.S.C. §§ 981–90. SLSDC lacks general rulemaking authority but is authorized to set and collect toll revenues, operate and maintain the Seaway, and carry out generic corporate business, such as setting bylaws and entering into contracts. 33 U.S.C. §§ 983(a), 984, 988.

[73] 49 C.F.R. § 1.52(a)–(c). This section delegates SLSDC portions of Port and Tanker Safety Act of 1978, 33 U.S.C. § 122 (precluding Secretary of Transportation from delegating implementation of the statute in

Seaway to any agency other than SLSDC); International Bridge Act, Pub. L. No. 92-434, § 5, 86 Stat. 732 (1972) (requiring approval of international bridges after the President's approval); Act to Prevent Pollution from Ships, 33 U.S.C. § 1902(d) (allowing proscription of regulations applicable to ships not a party to the International Convention for the Prevention of Pollution from Ships). DOT has attempted to delegate additional laws to SLSDC, but this delegation was held to be beyond DOT's authority. *Halverson v. Slater*, 129 F.3d 180 (D.C. Cir. 1997) (invalidating then existing 49 C.F.R. § 1.52(d)–(e) after applying *Chevron* "step one" to find that USDOT cannot delegate administration of Great Lakes Pilotage Act, 46 U.S.C. §§ 9301 et seq., to SLSDC when the act specifies it may only be administered by the USCG).

[74] ST. LAWRENCE SEAWAY DEV. CORP., 2007 ANNUAL REPORT 8 (2008), *available at* http://www.greatlakes-seaway.com/en/pdf/fy2007ar.pdf (MOU signed 1997 coordinating vessel inspection between USCG, Transport Canada, SLSMC, and SLSDC).

[75] SEAWAY HANDBOOK, *supra* note 71, at 36–37 (codified at 33 C.F.R. §§ 86–88, 101–02). SLSDC exercised this authority under the Port and Tanker Safety Act of 1978, §§ 4–8, 12–13. The Canadian Marine Act has similar provisions.

[76] Johnson, *supra* note 2 ("While the SLSDC does not have statutory jurisdiction over ballast water regulation, which is the domain of the USCG, aquatic invasive species is an issue of prime importance to our mission . . . .").

[77] Seaway Regulations and Rules: Periodic Update, Various Categories, 73 Fed. Reg. 9950 (Feb. 25, 2008) (responding to comments to 33 C.F.R. § 401.30(e)–(h), which stated that "while the regulation is an important step in the right direction, more needs to be done to reduce invasions of aquatic nuisance species").

[78] 33 C.F.R. § 401.30 (requiring: "(e) To obtain clearance to transit the Seaway:

> (1) . . . must agree to comply with the "Code of Best Practices for Ballast Water Management" of the Shipping Federation of Canada. . . .
>
> (2) . . . must agree to comply with the "Voluntary Management Practices to Reduce the Transfer of Aquatic Nuisance Species Within the Great Lakes by U.S. and Canadian Domestic Shipping" of the Lake Carriers Association and Canadian Shipowners Association. . . .
>
> (f) . . . after having operated outside the exclusive economic zone (EEZ) every vessel that carries only residual amounts of ballast water and/or sediment that were taken onboard the vessel outside the EEZ shall:
>
> (1) Conduct a saltwater flushing of their ballast water tanks that contain the residual amounts of ballast water and/or sediment in an area 200 nautical miles from any shore . . .
>
> (2) Maintain . . . final salinities of at least 30 ppt . . .
>
> (g) Every tank that is found not in compliance with 401.30(f) shall retain any ballast water until it exits the Seaway.").

[79] Johnson, *supra* note 2.

[80] SEAWAY HANDBOOK, *supra* note 71, at 12 (codified at 33 C.F.R. § 401.23, last modified by 45 Fed. Reg. 52376 (Aug. 7, 1980)). SLSDC also requires several form of insurance for subcontractors. Seaway Webpage, *supra* note 70, *"I"—Insurance Conditions*, *at* http://www.greatlakes-seaway.com/en/pdf/i_insur_conditions.pdf.

[81] More in-depth information is available in the Environmental Law Institute's recent report on potential preemption of state laws. *See* KEINER, *supra* note 20.

[82] Generally, nationwide permits are not created where states operate federally delegated CWA programs; instead, state permits are created independently in each state. EPA has determined that, due to its regulation exempting vessels from the CWA, it has not delegated vessel discharge authority to the states. Examination of the validity of this position is beyond the scope of this paper.

[83] MICH. COMP. LAWS ANN. 324.3112(1).

[84] MICH. COMP. LAWS ANN. 324.3109(5).

[85] MICH. COMP. LAWS ANN. 324.3112(6).

[86] MICHIGAN BALLAST WATER CONTROL GENERAL PERMIT 1 (Oct. 11, 2006), *available at* http http://www.michigan.gov/documents/deq/wb-npdes-generalpermit-MIG140000_247256_7.pdf. The four treatment methods identified are: (1) hypochlorite treatment, (2) chlorine dioxide treatment, (3) ultraviolet light radiation treatment preceded by suspended solids removal, and (4) deoxygenation treatment.
[87] MICH. COMP. LAWS ANN. 324.3115(1).
[88] MICH. COMP. LAWS ANN. 324.3115(2).
[89] MICH. COMP. LAWS ANN. 324.3115(3)-(4).
[90] *Fednav, Ltd. v. Chester*, 505 F. Supp. 2d 381 (2007).
[91] *Id*. at 391–92.
[92] *Id*. at 393.
[93] *Id*. at 394. ("[NISA] contains a saving clause that specifically preserves 'the authority of any State or political subdivision thereof to adopt or enforce control measures for aquatic nuisance species, or diminish or affect the jurisdiction of any State over species of fish and wildlife.' 16 U.S.C. § 4725. The saving clause alone makes it difficult to comprehend that Congress intended to occupy this entire field.").
[94] *Id*. at 394.
[95] The new regulations were prompted by a lawsuit filed against the MPCA by the Minnesota Center for Environmental Advocacy (MCEA) for failure to regulate ballast water discharges. At the time of the drafting of this paper, MCEA had again initiated legal action, citing the new standards as insufficient to protect the waters of Lake Superior. For more information on MCEA's activities, *see* www.mncenter.org.
[96] Minnesota Pollution Control Agency, State Disposal System Permit MNG300000, *Ballast Water Discharge General Permit* (issued Sept. 24, 2008); Minnesota Pollution Control Agency, *Discharge of Ballast Water to Minnesota State Waters of Lake Superior – Request for Approval of Findings of Fact, Conclusions of Law, and Order, and for Authorization to Issue State Disposal System General Permit No. MNG300000* (Sept. 23, 2008), at 4, *available at* http://www.pca.state.mn.us/about/board/packet/ballast-boardpacket.pdf; Minnesota Pollution Control Agency, Ballast Water Discharge Permit: FAQs for Vessel Owners and Operators (Oct. 2008), *available at* http://www.pca.state.mn.us/publications/wq-s8-03.pdf.
[97] Permit MNG300000, *supra* note 96, at Table A; *Order—General Permit No. MNG300000*, *supra* note 96, at 8. For more information on the Ballast Water Convention, *see Order—General Permit No. MNG300000*, *supra* note 96, at 10-11.
[98] *Order—General Permit No. MNG300000*, *supra* note 96, at 9.
[99] Permit MNG300000, *supra* note 96, at § 13; *Order—General Permit No. MNG300000*, *supra* note 96, at Attachment 1, ¶ 21, 50–51.
[100] As noted previously, delegation issues are beyond the scope of this paper. However, we note that Wisconsin has proposed a regulation under its state CWA mandating ballast water treatment to a level 100 times more stringent than the Ballast Water Convention. If finalized in its proposed form, this regulation may produce litigation that could test EPA's position on this contested issue.
[101] *Order—General Permit No. MNG300000*, *supra* note 96, at 4.
[102] Permit MNG300000, *supra* note 96, at § 1.
[103] Minnesota Pollution Control Agency, Ballast Water Discharge General Permit: FAQs for Vessel Owners and Operators, Water Quality/Surface Water #8.03 (Oct. 2008), *available at* http://www.pca.state.mn.us/publications/wq-s8-03.pdf.
[104] MINN. STAT. § 115.071 (2007).
[105] Cal. Pub. Res. Code §§ 71200 *et seq* (West 2008).
[106] Marine Invasive Species Control Act, Articles 4.5–4.7, §§ 2270–71, 2280–84, 2291–96. The date of implementation was extended from January 1, 2009 by the California legislature in Senate Bill 1781 (Ch. 696, 2008). *See* N. Dobroski, C. Scianni, et al., 2009 ASSESSMENT OF THE EFFICACY, AVAILABILITY AND ENVIRONMENTAL IMPACTS OF BALLAST WATER TREATMENT SYSTEMS FOR USE IN CALIFORNIA WATERS ii (2009).
[107] *Id.* at § 2271.
[108] *Id.* at § 2284.
[109] *Id.* at § 2293.

[110] *Id.* at § 2294.
[111] Cal. Pub. Res. Code § 71215 (West 2008).
[112] Cal. Pub. Res. Code § 71200 (West 2008).
[113] Cal. Pub. Res. Code § 71215 (West 2008).
[114] MPCA, *supra* note 96, at Attachment 1, MPCA Findings of Fact, Conclusions of Law, and Order, ¶ 44–45.
[115] HAW. REV. STAT. § 150A-5.3 (2008). Note that Hawaiian ports are controlled by the state rather than by local jurisdictions.
[116] *See* Natalie Bruckner-Menchelli, *US Great Lakes port announces new appointment*, Oct. 15, 2008, www.portworld.com/news/2008/10/73645; CANGELOSI & MAYS, *supra* note 2, at 46.

IV. Liability for Environmental Damage from Biological Pollution

Discharge of biological pollution in ballast water risks massive harm to the environment and is illegal in every Great Lakes state, as discussed in the previous section. Illegal discharge of AIS has already imposed billions of dollars in direct and indirect costs on federal, state, and local governments. However, affected jurisdictions have long been unable to determine who is responsible for causing these damages or to hold responsible parties liable. This causation hurdle is rapidly weakening, however, and identification of specific discharges is likely to be possible in the near future, enabling liability for specific responsible parties. These responsible parties include, but are not limited to, vessels that are the proximate source of invasion; other potentially liable parties include downstream users of the shipping industry, including local governments, marine terminals, grain companies, and other businesses that contract with discharging vessels. These downstream users could be held liable for damages if they are negligent in considering the possible environmental impacts of contracting with vessels that foreseeably discharge AIS. Where damages are extensive, as in the biological pollution context, the potential liability amounts may represent a significant threat to the stability of local and regional economies.

This section provides background and precedent explaining how downstream users may be liable for environmental damage caused by vessels. Specifically, we examine the 1999 *Erika* oil spill to illustrate liability expansion to shippers in the oil spill context. We then consider how the legal theories from the *Erika* case might apply to potential liability for discharge of biological pollution.

The Erika *Case*

In 1999, the oil company Total SA hired the tanker *Erika* to convey a shipment of oil from Dunkirk, France, to Livorno, Italy. While Total owned the ship's cargo, the *Erika* was owned by Italians, crewed by Indians, sailed under a Maltese flag, and chartered by a Bahamian company. Before it sailed, the vessel had been declared seaworthy by a classification society despite significant variances from minimum standards resulting from corrosion. The *Erika* never made it to Livorno, instead breaking in half and sinking off the coast of Brittany, France. The resulting 12,000 to 15,000 tons of oil discharge caused massive ecological and economic damages to the area.[117]

In the wake of the disaster, France and environmental intervenors sued not only the ship's owner and operator, but also the classification society and Total itself. After a four-month trial, on January 16, 2008 the Parisian court issued a groundbreaking decision, piercing the traditional bar on classification society and chartering entity liability and holding both accountable for both direct and punitive damages. Underlying this determination was a finding that Total and the class society deliberately engaged in unacceptably risky behavior.

Classification societies generally avoid liability by pointing to full control over the vessel by unscrupulous ship owners, immunity under flag state law, contractual limitations on liability, and the fact that classification is solely intended to allow vessels to take advantage of favorable insurance rates.[118] In the *Erika* case, however, the class society was found to have manipulated its steel thickness measurements and ignored the owner's lack of liquidity in order to issue a certificate, despite the owner's having insufficient funds to properly maintain the vessel. As a result, the court held that the class society conspired with the vessel owner to manipulate the system of controls protecting against catastrophic vessel failure.

Total, the court determined, was responsible for improperly vetting its choice of vessel. Total largely and appropriately relied on the issuance of a classification certificate, but imprudently failed to recognize the dangers presented by using an old ship that had gone through several changes of ownership, management, and class societies, all of which were signals of potential risk. In fact, Total had an established vetting system to supplement the class society inspection, which banned the charter of vessels that had not been vetted or that had been negatively vetted. However, the company chartered the *Erika* after its vetting approval had expired. The combination of this decision, the failure to consider the *Erika*'s checkered past, and Total's willingness to contract with a Bahamian shell company with no connection to vessel operation convinced the court that the oil company had deliberately placed the environment and economy at risk and should be held liable for the resultant damages. Total was ultimately fined €375,000 for maritime pollution and held responsible for a share of the €200 million damages award.[119] Although Total appealed the ruling, it paid the full judgment amount, recognizing that it was the only party with sufficient financial resources.

The *Erika* decision is a leading example of how liability can be expanded beyond just carriers. Despite a previous longstanding exclusion from potential liability, the classification society was found to be a legal and proximate cause of the accident, while the contracting shipper was criminally responsible for imprudent choices that failed to avert the accident. As a Total press release disapprovingly stated, the decision "forces users to become inspectors."[120] To avoid liability, entities throughout the supply chain must carry out due diligence and control the behavior of their contractors, to the extent possible, to avoid potential liability in case of accident. Failure to act prudently can result in both civil and criminal liability.[121] In one sense, this lesson is specific to the oil pollution industry and to specific charter relationships,[122] but it may indicate a more general willingness to shift the allocation of responsibility for environmental degradation and to increase the severity of accompanying civil and criminal punishments.

Downstream Liability for Biological Pollution?

Oil pollution and biological pollution are not identical, but they are analogous. Oil and biological pollution share several important similarities. First, both oil spills and AIS

introductions have the potential to cause hundreds of millions of dollars of damage. Second, spills and AIS introductions require rapid responses to prevent serious and ongoing environmental and economic harm to affected communities. In the oil spill context, rapid response teams are established and funds are available to enable these teams to quickly act to contain spills; even with these teams, oil spills may be correlated with long-lasting impacts on aquatic ecosystems and the coastal communities that depend on them. No similar mechanisms exist to control or respond to vessel-initiated biological invasions, although these invasions persist for an indefinite term and cannot be eradicated once established. Finally, vector for pollution is the same in each case, with the same types of actors engaging in similar contracting behaviors.

Oil and biological pollution also differ in significant ways. The environmental horrors of oil spills—oiled seabirds, toxic beaches, and destroyed fisheries—are immediate and observable. By contrast, AIS are secretive, growing from nearly undetectable levels until they break into public consciousness, sometimes years after their initial introduction. Further, oil spill causation and responsibility are clearly determinable, while determination of responsible parties for AIS introductions has heretofore been impossible, even if the mechanism of introduction is well known. The majority of the nonnative invasive species discovered in the Great Lakes have been connected to an initial introduction in ship-borne ballast water.

Despite the differences in the nature of their effects, oil spills and biological pollution from ballast discharge are more similar than different. The mechanisms of discharge, degree of risk to the environment and economy, and responsible parties are all analogous. As a result, while oil spill and biological pollution precedents cannot be applied interchangeably, discharges should be governed by similar legal theories, result in similar types of liability, and be redressed by similar regulatory tools. Thus, similar policies can prevent and control oil spills and biological invasions. To date, regulatory responses have not recognized these underlying similarities because the damage caused by oil spills is immediate and obvious and because causation bars to recovery in biological pollution cases have limited effective responses. As causation bars decrease and more sophisticated treatment technologies are introduced, oil spill prevention precedents will likely represent a useful model for ballast water policy development.

Ballast water treatment and monitoring systems are progressing rapidly and will be commercially available within the next few years.[123] This assumption is well-founded; as noted previously, Minnesota recently conducted a survey of developing technologies, and found it was reasonable to conclude they would be ready by the first deadline of January 1, 2012, set by its new ballast water regulations. Similarly, Michigan has identified four existing treatment methodologies that support compliance with its current ballast discharge authority. The availability of operational treatment systems and imminent increases in monitoring requirements as expressed in state laws and regulations will lower the barriers to determination of causation and, as a consequence, barriers to litigation. States and citizens will be able to effectively enforce ballast

treatment requirements against specific vessels, and ports and Great Lakes businesses will be exposed to liability if they fail to carry out due diligence on or ensure the responsible operation of vessels with which they contract.

Discharges of biological pollution are increasingly preventable, and the *Erika* case teaches that a failure to plan for and take remedial action to avoid foreseeable damage is a potential source of liability for entities throughout the shipping industry. Rapid increases in the transparency of shipping operations may soon expose myriad regional entities to liability due to biological pollution. Soon, companies will have access to the details of ship port history, port disease outbreaks, ship operation, ship ballasting history, ship ballast contents, ship owner financial reserves, cargo destination, comparative risks, and alternative choices before they decide whether to use a specific ship. Vessel owners and operators, port facilities, classification societies, and shippers that fail to consider these factors could expose themselves to liability for natural resource and other damages. The scale of these liabilities may be potentially catastrophic, so corporations and facilities in the Great Lakes states that rely upon marine carriers may cease using uninsured ships for fear of exposing themselves to huge liabilities.

Existing legal authorities unambiguously declare that the discharge of biological pollution is unlawful in every Great Lakes state. Unfortunately, the shipping industry has not adopted preventive treatment technologies voluntarily, and neither state nor federal governments have implemented comprehensive enforcement programs for these authorities. As a result, governments and citizens have been forced to cover the damages incurred due to the unlawful introduction of biological pollution into one or more of the Great Lakes. To date, enforcement and cost recovery from responsible parties have been limited by the difficulty in determining which vessel or vessels caused a given introduction.

Increases in the ability to determine causation and increased transparency of global shipping operations will likely reduce the barriers to enforcement and cost recovery in coming years, producing a *de facto* expansion in the potential liabilities facing regional corporate shippers, marine facilities, and carriers. In particular, ports generally have broad authority over operations at their facilities. They are significant engines for economic development, providing a disproportionate number of jobs in proportion to their gross economic output.[124] Ports may also be liable for the actions of both the marine terminals that lease their docks and the vessels that contract with the terminals. Thus, they may be particularly subject to damages resulting from invasion – as well as being directly subject to damage by invasive species.

The expansion and magnitude of biological pollution liability suggest that responsible carriers, facilities, and contractors may begin seeking insurance against liability for biological pollution via ballast water, as they have done for other risks ranging from casualty to oil discharge. Voluntary insurance markets therefore may be likely to

develop in the near future, aided by the increasing availability of transparent information that will allow insurance providers to assess risk effectively. Unfortunately, voluntary insurance will be insufficient to fully address the problems presented by ballast water discharge because not all carriers will be sufficiently insured. Fully insured carriers will be subject to unfair competition from underinsured vessels, which may continue to save money by externalizing the costs of their biological pollution. Underinsured vessels will distort vessel pricing, as they continue to price their services based on their ability to externalize the damages they cause. If subjected to liability, these underinsured vessels will be likely to be similarly undercapitalized and will declare bankruptcy upon a liability finding, as illustrated in the *Erika* case, resulting in full liability falling on downstream users.

New, mandatory financial responsibility mechanisms are needed to compel all carriers to internalize their costs. These mechanisms could require participation in an insurance market or other processes. Without compulsory regulations, these parties will continue to engage in risky behavior, and market distortions will make it difficult for potentially liable parties to determine what risks they are taking when they allow a vessel to dock or hire a vessel to carry their goods. Distorted pricing thus can undermine the transparent pricing systems that contractors could otherwise rely on, in part, to determine the risk posed by a particular vessel. Mandatory minimum financial responsibility mechanisms therefore may be vital to ensure that all shippers achieve a minimum level of financial responsibility, that the playing field between carriers is level, and that Great Lakes facilities and corporations can use transparent pricing to determine the risk presented by particular vessels.

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[117] Doreen Carvajal, *Oil Company Held Liable in 1999 Spill off French Coast*, INT'L HERALD TRIB. (Jan. 16, 2008), *available at* http://www.iht.com/articles/2008/01/16/europe/tanker.php; Olagunju, *supra* note 29.

[118] *See* Vincent J. Foley, *The ERIKA Judgment: A Sea Change in Environmental Liability for the Maritime Community* (Holland & Knight 2008) (*citing Sundance Cruises Corp. v. Am. Bureau of Shipping*, 7 F.3d 1077 (2d Cir. 1993); Great Am. Ins. Co. v. Bureau Veritas, 478 F. 2d 235 (2d Cir. 1973)).

[119] Carvajal, *supra* note 117.

[120] *Erika: Total Compensates Third Parties*, Press Release, Jan. 25, 2008, http://www.total.com/en/press/press_releases/pr-2008/080125-erika-compensates-third-parties_14529.htm (last visited Oct. 1, 2008) (Total stated that the transformation of users into inspector was undesirable because it could "potentially weaken[] the responsibility of those who have the expertise, duty and actual power to inspect tankers.")

[121] Foley, *supra* note 118.

[122] The implications of the decision for liability in bareboat, time, or voyage charters are uncertain but are likely to generate differing levels of responsibility. For explanation of the different charter types, *see infra*.

[123] For an example of systems currently undergoing testing, see the Maritime Environmental Resource Center, http://www.maritime-enviro.org (last visited Oct. 6, 2008). *See also* LLOYD'S REGISTER, BALLAST WATER TREATMENT TECHNOLOGY: CURRENT STATUS (2008).

[124] CANGELOSI & MAYS, *supra* note 2.

V. Financial Responsibility Mechanisms

In this paper, we have considered the legal prohibitions on discharge of biological pollution and the limitations on enforcing those prohibitions. We concluded that biological pollution has long been illegal, and that recent and ongoing technological developments will enable determination of responsibility for biological pollution, potentially subjecting vessels, as well as myriad downstream users, to liability. These potential liabilities are likely to support new forms of vessel insurance, but that market will be insufficient, alone, to protect society against pollution from undercapitalized vessels. Financial responsibility mechanisms (FRMs) promise a potential solution to the problems related to ongoing biological pollution in the Great Lakes.

FRMs, if properly designed, can ensure that responsible parties internalize the costs that they might otherwise avoid and can provide financial incentives for responsible parties to reduce their risk profiles. Once carriers fully internalize the damages they previously imposed on the public, shipping costs will accurately reflect risk to the environment and economy—including potential liability for biological pollution. FRMs can therefore drive the voluntary adoption of biological pollution controls, including those that go beyond minimum compliance with the law. Shippers, ports, and other contractors in the supply chain can then select vessels that are environmentally responsible and represent a low risk of pollution and of liability.

Ballast water regulation does not present a unique challenge; governments have struggled to ensure that polluters internalize the costs of their activities across a wide spectrum of industries. Wherever governments have been unable to collect remuneration for environmental damages, they have developed financial responsibility mechanisms (FRMs) to ensure that businesses engaged in risky activities set aside funding to redress potential future harm. Governments use numerous permutations of these policy tools to ensure that responsible parties internalize the economic costs of their actions and to ensure that funds are available to pay for damages without recourse to the public fisc. The efficacy of particular FRMs depends on the types of activities they cover, the nature of harm that may result from those activities, and the identity of the potentially responsible parties they regulate.

The following discussion describes common types of FRMs and their potential utility in the Great Lakes region. In addition, we introduce five model FRM systems to illustrate the operation and interaction of various FRMs in the real world.

Types of Financial Responsibility Mechanisms

Financial responsibility mechanisms can be divided into three broad categories: penalties, fees, and assurance. Each category carries inherent advantages and disadvantages, both generally and in the specific context of biological pollution.

Expanded Penalties and Natural Resource Damages

State and the federal governments have established a variety of laws designed to prevent environmental damage from pollution. These laws contain two forms of financial penalties, as well as criminal sanctions. Financial penalties may be either compensatory or punitive. Compensatory damages seek to recover the costs of cleaning up pollution. Punitive damages, however, go beyond mere remedial costs and impose additional monetary sanctions to dissuade polluters from polluting in the future. These penalties generally vary depending on the gratuitousness of the violation, with knowing and intentional violations resulting in more extensive sanctions than merely negligent actions. Criminal sanctions are often available for the most blatant violations.

Penalties can act as financial responsibility requirements. Provisions that remove barriers to collecting full compensatory damages, for example, ensure that polluters must consider the full extent of the damage they cause, thus internalizing the effects of their pollution, assuming that a penalty is detected and penalized. Thus explicit provisions in state laws permitting the recovery of natural resource damages by the state may encourage vessels to consider the full costs of their actions and price the risk of damage into their contracts. These natural resource damages provisions exist for ballast water in some states, such as Michigan (as discussed below). In addition, they are widely used in a number of other contexts, notably including oil spill liability, where damages can run into the billions. Expanded punitive damages can also provide potent incentives to comply – in particular, criminal sanctions or loss of transit privileges may give pause even to unscrupulous parties.

In addition to providing full compensation for damages, some statutes enhance incentives to act responsibly by expanding liability. This is often achieved by lowering burdens of proof and expanding the range of potentially responsible parties. In most cases, damages require showing that the polluter acted negligently or intentionally. However, some statutes eliminate that requirement, instead instituting a strict liability regime. In strict liability systems, the government can collect upon showing that a party caused the damage – the polluter's state of mind is unimportant. Some laws also expand the parties that may be potentially held liable. Joint and several liability regimes provide that every party that is potentially responsible for the damages incurred is liable for the entire amount of damages, without regard to their percentage responsibility; if damages are collected from any one party, that party can then independently collect contributory shares from the other defendants. Joint and several liability rules can effectively generate systematic pressure to abide by regulations, as more attenuated parties begin to favor less risky business partners to avoid possibly being held liable for the entirety of a massive damages award. Although a liability framework is not traditionally considered a "penalty," the reductions in the applicable burdens of proof and expansions of potentially responsible parties are penalizing elements that can be added to a variety of structures and are particularly relevant in cases such as vessel discharge, where potentially liability may extent to attenuated parties.

CERCLA, or the Superfund law, is the best-known example of a strict, joint and several liability regime. Congress enacted CERCLA in 1980, establishing a system to respond to environmental damage caused by pollution on private land. CERCLA provides that all owners, past and present, of a polluted parcel of land are liable for the full costs of cleaning up hazardous materials present on it, regardless of how much of the pollution they caused or the degree of care they used in carrying out their business. Thus, each past owner is potentially responsible for the entire cleanup. The strict liability CERCLA model could be applied to the shipping industry, which has struggled with enforcement due to the difficulty of connecting invasions to particular vessels. The use of joint and several and strict liability for all vessels that discharged ballast without using the best available technology could provide a potent incentive for shipping companies to implement control technology voluntarily.

Natural resource damages have a notable advantage over other financial responsibility mechanisms in that they permit full internalization of costs. Other mechanisms – whether fees, insurance, or other financial assurance rules – require a limited amount of fee or financial assurance, which historically has been less than the full cost of cleanup.[125] On the other hand, fees and financial assurance are prospective in nature, while penalties, regardless of the liability rules or extent of potentially responsible parties, are retroactive and dependent on effective enforcement. As a result, regardless of how extensive the compensatory or punitive damage law, potential violators are likely to under-represent the potential risks their activities pose, based on their perceived likelihood of detection and prosecution. Moreover, unscrupulous entities can pollute until caught, leading to the danger that, if poorly capitalized, such parties may simply go bankrupt rather than pay a fine. As a result, enhanced penalty regimes are unlikely on their own to enable full and uniform cost internalization or to enable transparent, accurate pricing of shipping costs that include the full environmental costs of the industry.

Fees and Taxes

Taxes and fees refer to charges levied for the privilege of engaging in a particular activity. These charges are typically directed towards efforts to safeguard that use. For example, the proceeds of fees paid to enter a national park are used for research, monitoring, and restoration efforts. As implemented, taxes and fees differ very little, and we refer to them collectively as "fees" in this discussion paper.

Commentators have supported the creation and strengthening of fees or taxes to fund invasive species prevention and response for many years.[126] Fees work by asking the user who benefits from the use of a resource (in this case, state waters) to fund efforts to mitigate damages caused by that use. As Peter T. Jenkins argues:

The costs associated with imported goods . . . are not being borne by those directly benefiting from th[is] activit[y]. Policymakers . . . should look to those who benefit from the activities that bring invasive species into the country. Put simply, they should charge the trade and travel sectors for the funds needed to prevent biological invasions, to compel global industries and their customers to take some responsibility for the side effects of their operations, and to increase consumer awareness of the problem so that they make more informed choices.[127]

Fees for ballast water discharge thus would work on the polluter pays principle: those who cause damage should fund the means to prevent or redress the problems they cause. If set at appropriate levels, fees also result in more accurate pricing of imported goods, as the cost of the fee is passed on to consumers. If behaving as rational economic actors, consumers (in this case, firms contracting with vessels) in turn purchase goods that are more environmentally responsible.

Fees have several strengths. First, they create a fund that is immediately available to government agencies to engage in rapid response and inspection programs – both of which historically have suffered from an inability to obtain adequate funds on a short time scale. Currently, most rapid response programs are handled through state or federal appropriations. Even on an emergency basis, the appropriations process is lengthy and may ultimately result in allocations that are insufficient to adequately respond to an infestation.

Ballasting fees respond to a second weakness sometimes found in other forms of financial responsibility regulation, in that they avoid difficulties in assigning fault for particular detections of nonnative species. We have noted the difficulty of tracing inoculation of a particular AIS to a specific vessel or discharge. Although the causation barrier is rapidly weakening, FRMs that require collection of damages after the fact are inherently subject to a number of defenses based on individual conduct – causation among them. Fees provide pre-damage funding that is immune from this concern.

While fees are a compelling response to some challenges in ensuring responsible ballast water management, they do have several notable weaknesses. It may be difficult to establish exactly how large a fee to charge and, as a practical political matter, fee amounts are subject to significant downward pressure. The costs of aquatic invasive species detection and response, however, may vary extensively based on the timing of detection, availability of response, and other factors. Financial responsibility measures operate best when regulated parties fully internalize their costs, but *ex ante* determination of fees that match future damages from AIS is likely to be a functional impossibility. The Pew Oceans Commission, for example, estimated needed funds at $50 million per year for aquatic invasive species. Fees assessed at such high level would likely be politically unpalatable -- and might even underestimate need. While significant, the $50 million figure represents only half of the annualized damages caused by zebra mussels in 2000.[128] The purpose of the ballasting fee, of course, is to prevent

damages on the scale of the zebra mussel, but the gap between projected need and potential damage indicates that fees alone are unlikely to be a sufficient spur to full cost internalization.

Second, it is difficult to determine how to charge fees in an equitable fashion that reflects the risks presented by ballasting. In most cases, fees are charged by cargo container or another measure of the use of a resource. In the ballast water context, the analogous measure would be in gallons of ballast water discharged, number of ballast tanks discharged, or similar metrics. It is not clear, however, that the size or number of ballast tanks is a reliable indicator of environmental risk. For example, "no ballast on board" (NOBOB) vessels may present no less a risk than vessels with full ballast tanks, because species may remain in the damp ballast tank even after it has supposedly been emptied.

Fees can probably be structured to respond to this weakness, potentially by charging different fees for vessels using different treatment technologies. For instance, a vessel ballasting without any treatment or exchange could be charged one rate, a vessel that exchanged ballast water a lower rate, a vessel complying with the ballast water convention standard a yet lower rate, and a vessel complying with California or New York treatment standards the lowest rate. Legitimate differential rates thus could be determined through reference to existing or forthcoming ballast treatment standards. These fees could be tiered to encourage vessels to undertake treatment beyond that required for legal compliance in some states. It is possible that to provide adequate incentives to produce voluntary adoption of strong ballast water treatment methodology, the fees on legal discharge would have to be significant. However, political resistance would likely increase resistance to such a program.

Challenges in structuring fee programs and assessing sufficient fees to require adequate cost internalization do not mean that fee systems are useless. Instead, fee systems are most appropriately used as complementary elements of comprehensive FRM programs. In this role, fees may support enhanced enforcement and early detection capacity. Existing fees in use for invasive species management are intended to recover the costs of operating inspection programs. Several jurisdictions have instituted shipping fees to address environmental concerns in recent years. Most notably, California currently charges $625 to vessels entering state ports from outside state waters. Permit fees are also used in Michigan and will be required to obtain CWA permits in other Great Lakes states. In addition, Hawaii has imposed a fee on shipping container imports to fund its invasive species prevention and response, and a number of ports – notably Los Angeles and Long Beach – have instituted fees on shipping to subsidize other environmental programs, including clean air initiatives. None of these programs are tiered based on the risks presented by particular vessels; they function as a funding mechanism for the state agency rather than as a method by which to force cost internalization or differential risk pricing.

Given these precedents, the imposition of a limited fee regime is well underway for vessels engaging in ballast discharge or recharge in the Great Lakes. However, existing permit requirements in the Great Lakes do not directly fund enforcement of ballast permits, as they do in California. A per-discharge fee system on the California model could generate a quickly accessible fund that could ensure directed enforcement of vessel discharge requirements and support reduction of causation barriers to liability. Tables 3a and 3b approximate the annual revenue such a system could generate for the Great Lakes states, at varying fee levels. The first table is based on the total number of ballast water discharges in the Great Lakes reported to the National Ballast Information Clearinghouse in 2007, while the second is based on the total number of arrivals in Great Lakes overall.

Table 3a. **Approximate Annual Revenue that would be Generated by a Per-*Discharge* Fee in the Great Lakes states** [129]

	Fee: $5	**Fee: $50**	**Fee: $625**[1]	**Fee: $1,000**
Ill.	$545	$5,450	$68,125	$109,000
Ind.	$315	$3,150	$39,375	$63,000
Mich.	$9,080	$90,800	$1,135,000	$1,816,000
Minn.	$3,295	$32,950	$411,875	$659,000
NY	$75	$750	$9,375	$15,000
Ohio	$4,990	$49,900	$623,750	$998,000
Penn.	$170	$1,700	$21,250	$34,000
Wisc.	$3,660	$36,600	$457,500	$732,000
TOTAL	$22,130	$221,300	$2,766,250	$4,426,000

Table 3b. **Approximate Annual Revenue that would be Generated by a Per-*Arrival* Fee in the Great Lakes states** [130]

	Fee: $5	Fee: $50	Fee: $625	Fee: $1,000
Ill.	$2,220	$22,200	$277,500	$444,000
Ind.	$3,345	$33,450	$418,125	$669,000
Mich.	$15,600	$156,000	$1,950,000	$3,120,000
Minn.	$3,745	$37,450	$468,125	$749,000
NY	$410	$4,100	$51,250	$82,000
Ohio	$9,055	$90,550	$1,131,875	$1,811,000
Penn.	$190	$1,900	$23,750	$38,000
Wisc.	$6,055	$60,550	$756,875	$1,211,000
TOTAL	$40,620	$406,200	$5,077,500	$8,124,000

Financial assurance rules (FARs):

Financial assurance rules (FARs) have been incorporated into a wide variety of existing environmental protection laws and regulations, including aboard some vessels. Essentially, a FAR is a requirement that a party wishing to engage in risky behavior demonstrate its ability to pay for any damages that might result. This can be done in a variety of ways, including posting a surety bond, obtaining a letter of credit, or purchasing adequate liability insurance. The use of FARs may be beneficial under any single regulatory program for one or more of a variety of reasons:[131]

- *Liability and cost internalization*
  Regulators do not impose financial damages until the environment has been damaged. As a result, defendants can avoid liability for past pollution (i.e., externalize the cost of pollution) by declaring bankruptcy, dissolving, or sheltering their assets. Effective FARs, on the other hand, ensure that polluters internalize at least part of the costs of compensating the public for damages they cause.[132]

- *Performance bonding*
  In some contexts, companies are required to undertake an expensive future action, such as removing an oil platform or remediating a mine site. FARs may be useful to ensure that companies set aside sufficient funds to undertake future actions.

- *Reduced litigation and administrative costs*
  Under FAR systems, the public can be compensated rapidly and at low cost relative to other systems that require a judicial determination of liability before funds are released. Rapid access to funding enables swift responses that may reduce the damages resulting from a particular pollution event. In addition, FARs may shift the burden of proof from the government to the responsible party, encouraging active responses.

- *Incentives for environmentally sound practices*
  Regulated entities must often purchase financial assurance from third parties. These assurance providers are generally financially responsible for future liabilities, so they have strong incentives to ensure that the regulated party engages in environmentally sound practices. The cost of assurance thus differs – in some cases significantly – based on environmental practices. Regulated parties can therefore achieve cost savings under FARs by improving their practices.

Several of the justifications for implementing a FAR system are directly relevant to the prevention of biological pollution discharge from vessels in the Great Lakes. First, AIS

have imposed significant costs on Great Lakes states and resource users in the region—as mentioned previously, the estimated cost of zebra mussels alone is estimated at $100 million, much of which is a result of clogged water intake pipes.[133] The internalization of these costs by the responsible polluters is a desirable policy outcome. Second, funds are often unavailable to mount immediate rapid response actions, leaving state and federal agencies with no option but to try and seek emergency appropriations before initiating response actions. The speed with which a response action is initiated may determine its success in eradicating invaders, and a FAR could potentially provide a source of instantly-accessible funds for rapid response actions. Finally, FAR systems could promote the rapid implementation and use of ballast water treatment or filtration technologies designed to eliminate the presence of biological materials in ballast water. Carriers that forego installation of such technologies could face significant increases in the price of mandatory assurance products, which would provide significant incentives for the installation and operation of these technologies.

There are a number of different types of FARs, each of which is used for a certain purpose. FARs may either be purchased or non-purchased. Purchased options include third-party insurance, surety obligations, bank letters of credit, and cash accounts and deposit certificates. Non-purchased mechanisms include trust funds, escrow accounts, and self-demonstration of sufficient asset base and bond rating to ensure ability to absorb liability.[134]

Different FAR systems are best suited for different environmental problems and desired results. FARs must be designed to avoid several pitfalls, including long lag times between damage and discovery, potential third party defenses against liability (direct action limits, policy exclusions, and/or cancellation), and accessibility of funds without judicial process. In addition, some level of monitoring is required to ensure compliance with any FAR. Regulators can customize FARs by altering the specific rules that govern each type of FAR in use or by limiting the universe of FARs that regulated entities can use. Four forms of FAR are potentially applicable to the ballast water context and are discussed below:[135]

- *Insurance*
  Insurance requirements generally require regulated parties to purchase insurance from a third party. The cost of insurance is generally based on the risks presented by the firm's practices, and thus promises robust incentives to reduce risk. However, this mechanism can be effective only if coverage requirements are sufficiently extensive and insurers can determine risks effectively. Mandatory insurance systems may also minimize regulatory monitoring burdens by delegating some burdens to insurance companies.

  On the other hand, insurance also raises some dangers. Defenses must be limited to ensure that insurers cannot avoid paying damages when a claim is made. In addition, liability insurance must cover any violation that occurs while

the policy is in effect (an 'occurrence' policy, not a 'claims-made' policy) to ensure that lag times between discharge and discovery do not foreclose damage assessments. Retroactive liability is not recommended, however, as it may be inconsistent with the development of a robust insurance market. Finally, termination should not be permitted without prior notice to regulators.[136]

- *Bank letters of credit*
  Letters of credit are purchased and require the bank to pay the government should the purchaser default on a requirement to pay damages. In other words, the purchaser indemnifies the bank, making it liable only for damages that the purchaser itself cannot bear. It is likely to be less expensive than insurance but still provides incentives for the bank to ensure that the purchaser's practices will minimize liability. It also can be structured to enable rapid access to funds when damages are discovered. Letters of credit can be based on an annual contract, which may be beneficial for ongoing shipping; on the other hand, the format may struggle to adapt to damages that occur after a shipping company has ceased operations. In addition, like insurance, effective design of a system reliant on letters of credit should disallow termination without prior notice to regulators.

- *Cash accounts/deposit certificates*
  Cash accounts and certificates of deposit enable cost internalization by placing an interest-bearing security – such as cash – into accounts assigned to or payable to the regulator. If the regulated entity defaults on its regulatory obligations, it forfeits the security, which the regulator can use to remediate damages. Thus, as James Boyd has noted, "[c]ash accounts and certificates of deposit are a particularly iron-clad form of assurance."[137] This FAR thus provides rapid access to funds and limits monitoring requirements. Effective deposit certificate rules require that the regulator is the sole beneficiary, that the accounts are managed by independent institutions, and that the terms of deposit can be changed only with the regulator's prior consent.

- *Trust funds and escrow accounts*
  Trust funds and escrow accounts are not purchased, but can and should be administered by an independent, third-party trustee. They are created by collecting funds that are dedicated to a particular purpose. They are filled up over time, and thus can permit some degree of differential liability based on the amount that a regulatory system is used. This is not an advisable policy response, however, as damages are not necessarily related to the amount that a regulatory system is used and the purpose of FARs is to ensure complete coverage of damages. Moreover, "incompletely funded trusts are relatively common."[138] As a result, a short pay-in period is recommended for these systems, which have relatively large monitoring requirements. Furthermore, the regulator should be the sole beneficiary of the fund.

FARs can ensure that vessels use and maintain appropriate ballast water treatment technologies. However, the shipping industry historically has predicted that imposition of new financial assurance products would result in catastrophic damage to the industry. Similar arguments undoubtedly would be presented in the event of a proposal for financial assurance based on biological pollution. In fact, the industry's fears have always proved unfounded due to the development of novel forms of insurance. "All [FARs] allow compliance to be demonstrated via a variety of mechanisms, such as insurance, bonds, and self-insurance, and all have generated concerns regarding the insurability of the costs or risks they cover. The lesson to be learned from [FAR] programs is that financial products will emerge to satisfy the demands of legally mandated financial responsibility."[139] Thus, historical trends indicate that creation of a vessel-discharge FAR would stimulate the creation of appropriate financial mechanisms to provide third-party assurance. In fact, insurance providers have been closely monitoring ballast discharge developments for some time with an eye towards providing vessel discharge coverage.[140]

Insurance is already very much a part of the shipping industry. As noted previously, shipping companies have voluntarily established "P&I clubs" that allow the companies to pool their risks. In addition to this voluntary insurance system, mandatory systems have also arisen – most notably in the Oil Pollution Act of 1990 ("OPA") and the Price-Anderson Act of 1957, which governs nuclear facility liability. In both situations, financial assurance is heavily weighted towards (but not limited to) insurance products. In practice, the OPA's mandatory liability insurance is generally not provided by the P&I clubs, but rather is purchased from specialty insurers, contrary to the dire predictions regarding the chilling effects of this liability on the shipping industry made during debate on the OPA. A similar system would likely arise for insurance against biological pollution.

While insurance is the most obvious fit for liability, other forms of FARs may also be effective, especially when used in combination with third-party insurance. Letters of credit in particular may be effective means of providing ready access to funds that can be leveraged for early detection and rapid response. Regardless of the FAR's form, however, self-insurance alternatives should be limited. Third-party assurance mechanisms provide an important check on potential bad actors and are therefore necessary to ensure that pricing reflects underlying environmental practices.[141]

To be an effective policy tool for internalizing costs and providing incentives for vessels to reduce risks, insurance systems must address several challenges. However, mandatory insurance programs avoid adverse selection and moral hazard, two common factors commonly affecting insurance markets. Adverse selection occurs when low-risk parties do not obtain insurance, weighting the insurance pool towards high-risk entities. Moral hazard occurs when insurance encourages insureds to take more risks because they are not liable for damages that may result. Adverse selection is not a problem in

mandatory insurance systems, because low-risk parties are required to stay in the market. Similarly, moral hazard can be avoided:

> [I]nsurers can, and do, charge premiums as a function of the technologies being insured . . . and the claims history of the insured. Insurers can also cancel coverage as long as they give adequate advance notice. The possibility of cancellation can act as an important deterrent to lack of precaution by the insured. Coverage cancellation would force the insured to go back to the insurance market and purchase coverage from another firm, which would presumably be aware of the reasons for the original coverage cancellation. Failure to acquire coverage results in the closure or cessation of operations.[142]

Mandatory liability insurance in the biological pollution context would likely result in disparate premiums resulting from environmental practices, a prerequisite to achieving price differentials based on the riskiness of a given carrier's environmental practices. Premiums naturally depend on both the amount of liability coverage desired and the insurer's ability to effectively determine risk. Determination of proper coverage amounts is a key weakness of mandatory liability coverage systems. In many cases, liability coverage is required to the extent of liability under statute. No appropriate statutory liability amounts are available to use as a minimum coverage level for ballast water-related liability – CWA liability, amounts, for example, would drastically under-represent the potential damages that an AIS discharge could produce. As a result, development of adequate minimum coverage is an area where additional research is needed to ensure adequate coverage for potential damage and risk-based differential pricing.

Determination of the risks presented by particular vessels is likely to be surprisingly simple. Historical examples suggest that differential premiums develop rapidly; in the oil pollution context, "[p]remiums . . . are largely determined by the reinsurance market and are a function of the vessel's volume (the basis of the coverage requirement), age, and technical characteristics (such as single or double hull) and the cargo it carries."[143] Insurance providers would use different characteristics to determine premiums in the ballast water context, but effective mechanisms are available to determine risk. For example, reporting of vessel practices is currently available and the data can be expected to increase in coming years under enhanced ballast water treatment laws at the federal and state levels, some of which require biological monitoring and reporting. Moreover, insurance providers are already evaluating the effectiveness of treatment technologies, and data are widely available on ballast tank size and flow rates, transit times, and vessel origins. Such information should provide ample information on which to base the price of premiums for each vessel.

Existing Financial Responsibility Programs

So far, we have considered FRMs only individually. In practice, however, FRMs commonly are utilized in conjunction to produce desired policy outcomes. In this section, we describe how financial responsibility policies have been implemented in a variety of real-world regulatory frameworks. The programs discussed here are not intended to cover all FRM programs, and indeed only provide superficial discussion of a small subset of existing programs. As even this limited discussion indicates, however, natural resource damage claims are most likely to be enforced effectively when the regulatory agency is supported by a fee structure, and financial assurance rules may not work effectively without the support of natural resource damage provisions. Appropriate FRMs for vessel discharge are unlikely to precisely mirror the policy choices developed for these model cases, but are likely to echo their blending of policy mechanisms for optimal impact.

Oil Spill Regulation

In 1989, the Exxon *Valdez* spilled vast amounts of crude oil into Alaskan waters. The federal government responded in part by enacting the Oil Pollution Act of 1990 (OPA). The OPA requires all oil tanker vessels to provide certification of $100 million in liability protection. Despite initial resistance by the shipping industry, the imposition of this FAR statute has proven workable but under-protective, as most oil spills result in more than $100 million in damages. As a result, California subsequently strengthened the federal requirements.

Less than a year after the *Valdez* spill, the *American Trader* spilled 300,000 gallons of crude off Huntington Beach, California. California responded quickly, enacting the Lempert-Keene-Seastrand Oil Spill Prevention and Response Act (LKS Act) in 1990.[144] The Act was designed to prevent future oil spills by comprehensively regulating oil shipping and created an administrative structure to govern oil spill prevention and response. The LKS Act is a notable model for ballast water regulation primarily because of its financial assurance and funding provisions, but it also contains other provisions regarding vessel design,[145] oil spill contingency planning,[146] mitigation of damage to wildlife and the environment,[147] and other matters.

California requires carriers to provide adequate assurance that they can pay for damage from spills.[148] Before their vessels enter California waters, carriers must obtain a certificate from the state demonstrating financial responsibility.[149] Carriers can satisfy the financial responsibility provision through almost any type of policy tool, including "insurance, surety bond[s], letter[s] of credit, qualifications as a self-insurer, or any combination thereof or other evidence of financial responsibility."[150] The amount of financial assurance required differs by vessel size; for large tankers, the certificate requires $1 billion in liability protection.[151] Marine facilities also must obtain liability insurance.[152] Any vessel carrying oil as cargo must provide a copy of its certificate to the

state 24 hours before entering state waters, along with a statement by the carrier authorizing use of its certificate for the vessel in question. This provision ensures that the responsible company acknowledges its responsibility for each of its vessels, avoiding potential future attempts to evade responsibility in the event of a spill. Marine facilities also administer the financial assurance program on the water by validating the certificate of any vessel loading, unloading, or transferring oil.[153]

The LKS Act's second important innovation is the creation of a fund for oil spill preparation, response, and habitat restoration. As in the invasive species detection and rapid response context, pre-spill funding for oil spill response is difficult to source. The LKS Act provides funding by charging fees for each barrel of oil that is received from a vessel by a marine terminal. As for financial assurance, the marine terminals are responsible for collecting the fees.[154] While the fund is not intended to have a deterrent effect and does not differ based on the particular risks of spillage presented by individual vessels, the fund nonetheless represents a model for the mechanics of operating a funding mechanism to prepare for rapid response actions.

Finally, the LKS Act authorizes robust penalties to ensure compliance with its provisions. Violators are subject to both civil and criminal penalties.[155] For example, knowing discharge of oil or knowing failure to clean up oil may result in both imprisonment and substantial fines. Some specific violations of the LKS Act may also result in civil penalties up to $100,000. If a spill occurs, the responsible party is liable up to $10 per gallon spilled, reduced by the number of gallons recovered. If the responsible party was grossly negligent, however, the maximum fine increases up to $30 per gallon spilled.[156] Parties who discharge oil are also required to reimburse the state for its expenses incurred in cleaning up the spill.[157]

The LKS Act penalty structure is notable for several reasons. First, the penalty amounts to individuals involved in spills may be significant, and are tailored to the magnitude of the spill, which offers interesting parallels for potential invasive species penalty structures. Second, the LKS Act liberalized the standards for imposing penalties on violators. Carriers are strictly liable for violations of the LKS Act; as a result, the state need not show that a carrier acted negligently before imposing a violation; instead, the mere discharge of oil that damages state or private property is sufficient to support a penalty.[158] However, operators that do operate negligently are likely to receive heightened penalties; as a result, the Act's penalty structure retains incentives for carriers to engage in responsible practices.

Mine Reclamation

The federal Surface Mining Control and Reclamation Act (SMCRA) offers a useful example of the implementation of a combined fee-assurance FRM. Enacted in 1977, the statute created an Abandoned Mine Reclamation Fund (AMRF) into which all coal mining companies are required to contribute.[159] In 1983, the Department of Interior

Office of Surface Mining Reclamation and Enforcement promulgated regulations further requiring surface coal mining operations to post a bond ensuring their "faithful performance" of the Act's requirements, mining program, permit obligations, and reclamation plan.[160] Similar requirements apply to hard-rock mining on federal lands, pursuant to the Federal Land Policy and Management Act.[161]

The AMRF mandates payment of fees based on yield from each mine. All coal mining operations are required to pay $0.315 per ton of surface coal mined and the lesser of $0.135 per ton or 10% of the total value of underground coal mined.[162] The SMCRA fee amounts were slightly decreased, but were extended through 2021, by a 2006 amendment.[163] The AMRF is used to reclaim and clean-up lands harmed by pre-SMCRA and/or emergency mining, and to fund grants to the states to further SMCRA's objectives.[164] According to the Department of Interior, the AMRF has devoted $1.736 billion to coal-related public health and safety problems, $339 million to coal-related environmental problems, and $298 million to noncoal-related problems. West Virginia, Pennsylvania, and Kentucky were the subjects of approximately 60% of these reclamation efforts.[165]

The form, duration, and amount of the bond requirement are determined by the regulatory authority depending on the particular circumstances of the mining operation. The operator can post a surety, collateral, or combination bond, and in some instances can self-bond. The liability period extends for the duration of the mining itself, for any revegetation period required under other sections of the act, and until all reclamation requirements have been achieved. The size of the bond varies by operator and operation, but should never be set below $10,000. Finally, in the event that all or part of the bond is forfeited, but the costs of reclamation exceed the amount received, the regulatory authority has the right to pursue reimbursement for the excess costs from the responsible party.[166]

In practice, commentators have noted that the operation of the bonding requirement, while an improvement from the prior, state-directed bonding system, the SMCRA bonding system has been ineffective, due to systematic underestimation of appropriate bonding amounts and resultant inability to remediate mine sites and insufficient funding of trusts over time.[167] As a result, SMCRA is a useful example of how financial responsibility mechanisms can be implemented in tandem to create a more comprehensive framework, as well as the pitfalls that attend the creation and implementation of an effective assurance system. In the case of surface coal mining, a mining operator must pay a per-ton fee that is contributed to a reclamation fund dedicated to restoring sites degraded before SMCRA was enacted, then post a bond to ensure his compliance with statutory and regulatory requirements in the future. This combination is well structured to creatively address both past and future degradation, even though its implementation has been less effective than desired.

Nuclear Liability

In 1957, Congress responded to the potential dangers associated with nuclear development by enacting the Price-Anderson Act. In brief, the Price-Anderson Act (PAA) mandated that nuclear facilities insure themselves so that they are able to compensate anyone harmed in event of a nuclear accident. In addition to the PAA liability requirements, the Atomic Energy Act requires assurance for decommissioning nuclear facilities,[168] closure of radioactive waste facilities,[169] and closure of uranium and thorium mill sites.[170] Plant decommissioning bonding amounts exceed $100 million.

The PAA requires nuclear facilities licensed by the Nuclear Regulatory Commission (NRC) to obtain primary insurance covering up to $300 million in damages, and to enter a secondary insurance pool that will cover any further damages.[171] Liability is limited based on the amount of liability insurance required.[172] There are over 100 operating commercial nuclear power plants in the United States, and every one of them obtains its primary insurance coverage from one provider, American Nuclear Insurers.[173] The secondary insurance pool currently insures up to $10 billion in damages.[174] Coverage for Department of Energy facilities is slightly different, in that the government itself insures their activities.[175] The Energy Policy Act of 2005 extended the PAA through 2025.

Although the likelihood of a nuclear accident is extremely low, the cost of obtaining insurance is very high, due to the probability that should liability be incurred it will be quite extensive. In addition, nuclear accidents – like discharges of biological pollution – yield uncertain liability and may result in significant time lags between the initial accident and ultimate liability. The famed Three Mile Island Accident, which occurred in March,1979, offers an example of these considerations. The resulting personal injury cases have been resolved extremely slowly due to extreme difficulties handling issues of causation and evidentiary requirements.[176] While some cases settled in 1986, many others were still pending in the courts over two decades later.

Wetlands Mitigation

The EPA and U.S. Army Corps of Engineers (USACE) have implemented financial assurance to ensure the meeting of wetlands compensatory mitigation requirements. Section 404 of the Clean Water Act provides for the protection of wetlands and mandates that a party obtain a permit before they can discharge dredged or fill material into U.S. navigable waters. Responsibility for wetlands protection is divided between EPA and USACE. In general, USACE is responsible for the operation of the section 404 permit program. Each year, about 47,000 acres of wetlands mitigation is required under section 404 to compensate for the loss of 21,000 acres of wetlands.[177]

According to EPA and USACE regulations, section 404 permits require applicants to demonstrate that they attempted to avoid and minimize any impacts their activities

might have on wetlands and that they will provide compensation for unavoidable impacts. Intricate banking operations, including a financial assurance requirement, have arisen to track these compensatory mitigation actions.[178] USACE and EPA regulations require that "[t]he district engineer shall require sufficient financial assurances to ensure a high level of confidence that the compensatory mitigation project will be successfully completed, in accordance with applicable performance standards."[179] The district engineer determines the necessary amount of financial assurance required, depending on the project parameters; it may take the form of a performance bond, escrow account, casualty insurance, letter of credit, legislative appropriations for government sponsored projects, or other as approved by the district engineer.

Section 404 provides for permit noncompliance penalties of up to $10,000 per day; willful or negligently violations trigger penalties of between $2,500 and $25,000 per day, and/or imprisonment for up to one year, with the penalties (both monetary and penal) doubled for repeat convictions. In the alternative, the Secretary can seek an injunction against violations of compliance orders already issued.[180] However, the CWA does not provide for enhanced natural resources damages based on the loss or degradation of environmental services or other economic costs; as a result, the financial assurance aspects of wetlands mitigation are limited to the bonding requirements.[181]

Wetlands mitigation bonding represents a compromise between environmental protection and development: section 404 permits some loss of wetlands if such damage is unavoidable and if the responsible party pays for or itself carries out compensation projects. The success of these compensation projects requires long-term stewardship and monitoring, however, so assurance is necessary to ensure that mitigation is fiscally sound and that projects are not abandoned after the original wetlands are lost. Despite the large market for wetlands compensation projects, however, few studies of the on-the-ground effectiveness are available. The few available studies on compensation projects indicate, however, that wetland mitigation is not an effective tool. As one meta-analysis concluded, "[a]lthough wetland mitigation accounts for a significant annual investment in habitat restoration and protection, it has not, to date, proven to be a reliable conservation tool. . . . [T]he federal compensatory mitigation program may currently lead to a net loss in wetlands acres and functions."[182]

Hazardous Waste

Enacted in 1976, the Resource Conservation and Recovery Act (RCRA) governs the management of hazardous and non-hazardous waste from cradle to grave. RCRA implements a number of financial assurance mechanisms to ensure that human health and the environment are protected during the generation, transportation, treatment, and disposal of waste. As part of the management process, RCRA imposes financial assurance requirements to guarantee completion of several requirements. Hazardous and nonhazardous solid waste treatment, storage, and disposal facilities must meet closure, post-closure, and corrective action financial assurance requirements.

Hazardous waste facilities must also provide sudden and nonsudden accidental occurrence assurance. Petroleum underground storage tanks must demonstrate corrective action and accidental occurrence assurance.[183]

For solid and hazardous waste facilities, closure, post-closure, and for solid waste even corrective assurance can be demonstrated by a trust fund, surety bond guaranteeing payment into a trust fund or performance, letter of credit, insurance, financial test and corporate guarantee, or combination thereof.[184] For hazardous waste facilities, sudden and nonsudden accidental occurrence liability for bodily injury and property damage to third parties requires liability insurance, a financial test for guarantee, a letter of credit, a surety bond, a trust fund, or a combination of the above. Sudden occurrences must be covered for $1 million per accident, with a minimum of $2 million aggregate coverage, while nonsudden occurrences require $3 million per accident and $6 million aggregate.[185] Corrective action for hazardous waste was deemed "necessary to protect human health and the environment for all releases . . . regardless of the time at which waste was placed in such unit." As such an operating permit must contain adequate assurance for the completion of correction activities.[186]

Petroleum underground storage tanks require a slightly different framework. RCRA regulations state that the corrective action and accidental release liability assurance necessary depends on the size of the operation. A facility handling up to 10,000 gallons of petroleum monthly must have insurance covering up to $1 million per occurrence, while all other facilities must be insured up to $500,000 per occurrence. In the aggregate, if a facility has 1–100 barrels it must demonstrate $1 million in aggregate coverage, while any more triggers a requirement of $2 million.[187]

In addition to the federal statutory requirements, some states have implemented additional administrative regulations in their individual solid waste management programs. For instance, several states have shifted the burden of proof from the government to the potentially responsible party. Pennsylvania, for example, statutorily created a strict liability structure for groundwater contamination, wherein the storage, treatment, or disposal of hazardous waste creates a rebuttable presumption of responsibility for damages, contamination, or pollution that occurs within 2,500 feet.[188] The penalties must be paid immediately, and it is the defendant's responsibility to prove that they should be returned. This provision prevents the state from having to bear the brunt of the upfront costs while penalties are delayed in continuing appeals. Although their statutes are not as explicit, Louisiana and Florida have implemented similar measures.[189]

Financial Responsibility for Vessel Discharge

The implementation of financial responsibility requirements to address environmental issues in other contexts is instructive in showing how a financial responsibility system might operate for vessel discharge. This section reflects on lessons from existing

programs to consider potential structures for an effective ballast FRM program. We note, however, that the development of recommendations for the creation and implementation of specific mechanisms is beyond the scope of this paper. These general conclusions are therefore limited to the potential utility of different policy types in the ballast water context.

At the outset, it is important to recognize that some jurisdictions recognize the potential importance of financial responsibility mechanisms and other incentive programs. For example, the Michigan Department of Environmental Quality recently recommended that it should develop industrial best practices to prevent AIS introductions, and that "economic requirements and incentives should be investigated to encourage commitment and successful implementation of these agreements and best practices (e.g., bonds or insurance)."[190] In light of such statements and the wide acceptance of financial responsibility mechanisms in other contexts, we view the development of FRM programs in the ballast water context to be a foregone conclusion. As a result, the debate should focus on ensuring that the eventual requirements that are adopted successfully accomplish their intended aims.

In implementing an FRM for ballast water discharge, regulators can apply a variety of policy tools, including one or a combination of enhanced penalty provisions, fees, and assurance tools. It is likely that an effective system will incorporate more than one tool, and potentially all three, in the form of incorporation of natural resource damages, vessel fees, and mandatory assurance requirements. In this respect, none of the above models is a precise fit (oil pollution liability, for example, may be limited to the bond amount).

With respect to expansion of penalties, current daily federal penalties for CWA violations are less than the costs to transit the Saint Lawrence Seaway. If no other penalties were available, vessels could potentially treat CWA penalties as a cost of doing business rather than take meaningful action to comply with legal requirements. The availability of other penalties would address this behavior. For example, where natural resource damages are available, vessel liability would not be sharply limited, and compliance would be economically rational behavior. Limitations or preemption of tort law to eliminate natural resource damages therefore likely would be counterproductive for encouraging compliance and could undermine the operation of other elements of an FRM program.

Second, we have noted that fees or taxes are already used to address biological pollution in several states, and may effectively reduce discharge frequency at low cost. As applied in California, such fees would respond to a consistent problem in detecting and responding to invasions by providing a stable source of funding for monitoring and enforcement of existing laws. Fees thus offer a simple, cost-effective, and easily administered mechanism for enforcing new ballast treatment requirements against vessels. Fees could take other forms as well, however, and through variation based on

risk could encourage vessels to retain ballast. By varying fee assessment based on the use of ballast treatment technologies, regulators can give vessels incentives to reduce their risk; the resultant savings would be reflected in the price of shipping, allowing shippers to determine which vessels present lower risks of liability. However, fees will never fully internalize the full cost of discharge and on their own would be of limited utility as a financial responsibility mechanism. As a result, they are most likely to be effective as components of larger systems of penalty assessment or financial assurance.

Finally, regulators can impose financial assurance requirements on vessels, requiring them to provide proof of their ability to pay for damages their actions may cause. Such policies – including mandatory liability insurance, bonding, and letters of credit – only require regulators to determine the minimum amount of liability insurance, administer the program, and enforce the laws, while third-party assurance providers determine how to price different practices based on risk. Using the free market to set rates will likely result in premiums that reflect risk and minimize market inefficiencies. Variable, accurate pricing of financial assurance products by third parties would be the most effective way for vessels to signal to shippers and ports that they are operated in a safe and responsible manner. In addition, the use of mandatory minimum assurance amounts would prevent unscrupulous carriers from skirting regulations and simply paying fees while doing the bare minimum – or less – to protect the states they serve. They could also act to indemnify downstream users of the shipping system, such as ports and shippers of goods, against potential liability.

In summary, each form of financial responsibility policy could act on the shipping market to significantly reduce negative social outcomes resulting from the discharge of ballast water. Existing programs can be potential models for creation of an FRM system for vessel discharges, but must be tailored to address the specifics of the Great Lakes shipping market and the damages caused by biological pollution.

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[125] BOYD, FINANCIAL ASSURANCE RULES, *supra* note 28, at 21–22.

[126] *See, e.g.*, Jenkins, supra note 21; GENERAL ACCOUNTING OFFICE, INVASIVE SPECIES—OBSTACLES HINDER FEDERAL RAPID RESPONSE TO GROWING THREAT (2001) ("Officials from USDA, Interior, Commerce, and Defense have reported that many rapid response needs have not been and are not being adequately met. Many unmet needs stem from inadequate resources or attention to the problem."); PEW OCEANS COMMISSION, INTRODUCED SPECIES IN U.S. COASTAL WATERS (2001) ("Congress should establish a national bioinvasions reparation fee, which will significantly help to recoup federal-funding costs for management, research, and development programs.").

[127] Jenkins, *supra* note 21, at 69.

[128] Pimentel et al., *supra* note 11.

[129] NBIC, *supra* note 10. The NBIC is a joint venture of the U.S. Coast Guard and the Smithsonian Environmental Research Center. Vessels are required to report their discharges to NBIC, and it has been estimated that upwards of 80% of vessels comply.

[130] *Id.*

[131] *See* BOYD, FINANCIAL ASSURANCE RULES, *supra* note 28, at 1 (internal citation omitted).

[132] FARs may impose significant costs on regulated industries because they force regulated entities to fully pay for costs that were previously imposed on the public as a whole. The financial impact of these cost increases are not increased costs to society, but rather reflect a reallocation of existing costs. The only

new costs are those that result from the purchase of financial assurance from third parties and administrative costs related to the program.

[133] *See supra* text accompanying note 128.

[134] *See generally* BOYD, FULFILLING PROMISE, *supra* note 25

[135] Surety bonds and self-demonstration are not applicable. Because ballast discharge is not a future obligation, the use of sureties is less applicable than the use of insurance. While self-assurance could be used, past experience shows that it is unlikely to be successful. In addition, these systems require extensive government monitoring, imposing a significant burden on the regulators. BOYD, FINANCIAL ASSURANCE RULES, *supra* note 28, at 27 ("[T]hese instruments are less desirable [than purchased products] from a regulatory standpoint. They require more administrative oversight than insurance and sureties, and they provide less of a guarantee that costs will be recoverable in the future.").

[136] For further information on general environmental insurance structuring options, see generally Benjamin J. Richardson, *Mandating Environmental Liability Insurance*, 12 DUKE ENVTL. L. & POL'Y F. 293, 324–27 (2002).

[137] *Id.* at 25 (citation omitted).

[138] *Id.* at 44.

[139] *Id.* at 39.

[140] For example, Lloyd's Register has begun to offer ballast water consultancy and evaluates the status of treatment technology. *See* LLOYD'S REGISTER, *supra* note 123.

[141] In other words, mandatory use of third-party assurance avoids adverse selection problems. Similarly, moral hazard is not an issue in the mandatory insurance context. Richardson, *supra* note 136, at 38.

[142] BOYD, FINANCIAL ASSURANCE RULES, *supra* note 28, at 38. Regulatory liability (e.g., criminal) and elimination of liability limits also limit moral hazard.

[143] *Id.* at 35.

[144] 1990 Cal. Stat. 1248, CAL. GOV'T CODE § 8670.1 et seq. *See generally* James E. Beaver, et al., *Stormy Seas? Analysis of New Oil Pollution Laws in the West Coast States*, 34 SANTA CLARA L. REV. 791, 795–96 (1994).

[145] § 8670.16–27.

[146] §8670.28–37.5, 70–73.

[147] §8670.61.5–62.

[148] §8670.37.51–58. The LKS Act applies to any "responsible party." A "responsible party" is defined as the owner of oil, transporter of oil, person accepting responsibility for oil, vessel owner, or vessel operator. § 8670.3(w). As with all applicable federal and state law, compliance with these financial assurance requirements is mandatory before entering California's waters. 1990 Cal. Stat. 1248 § 19, CAL. PUB. RES. CODE § 8752.

[149] An owner or operator with more than one vessel is only required to carry one certificate of financial responsibility for all owned vessels. Certificates are valid for up to two years, but the administrator can suspend a carrier's certificate based on excessive liabilities incurred by the fleet, even those outside the state's jurisdiction. § 8670.37.55(a); § 8670.37.56; § 8670.37.57.

[150] § 8670.37.54(a); 14 Cal. Code. Reg. § 795 (providing more detailed requirements for each type of funding).

[151] § 8670.37.51(a), 53(a)–(b).

[152] § 8670.37.51(d), 53(c)(1); 14 Cal. Code. Reg. § 791.7(e)(2)(B)(1) (requiring marine facilities insurance to exceed the "product derived by multiplying the maximum per barrel clean-up and damage cost of spilled oil ($12,500) times the reasonable worst case spill volume, as measured in barrels, calculated in the certificant's oil spill contingency plan").

[153] § 8670.37.51(b)–(c).

[154] § 8670.38–53. Pipelines are also subject to fees but are beyond the scope of this study.

[155] § 8670. *See also* Beaver, *supra* note 144, at 802, 835.

[156] § 8670.67.5.

[157] § 8670.62.

[158] §§ 8670.56.5, 8670.67.5.
[159] 30 U.S.C. § 1232(a).
[160] 40 C.F.R. 800.11.
[161] 43 U.S.C. § 1732(b)
[162] 30 U.S.C. § 1232(a).
[163] Tax Relief and Health Care Act of 2006, Surface Mining Control and Reclamation Act Amendments of 2006, P.L. 109-432 § (signed Dec. 20, 2006). Previously, the fees were $0.35 and $0.15, respectively, and expired in 2004. Lignite coal has always been an exception, with its own fee of the lesser of 2% of the value of coal mined or $0.10 per ton; the amendments decreased the latter to $0.09. 30 U.S.C. § 1232(a).
[164] *SMCRA Amendments of 2006*, § 402(a).
[165] U.S. Dep't of Interior, Office of Surface Mining and Reclamation and Enforcement, Abandoned Mine Land Program, Accomplishments, http://www.osmre.gov/aml/accomp/zp12acin.htm (last visited Oct. 14, 2008).
[166] 30 C.F.R. 800.11, 800.12, 800.13, 800.14, 800.50.
[167] *See* JAMES MCELFISH, ENVIRONMENTAL REGULATION OF COAL MINING: SMCRA'S SECOND DECADE 85 (Environmental Law Institute 1990) ("Bond amounts are often set based on faulty assumptions or under systems that have not accurately projected the need for reclamation funds."); BOYD, FULFILLING PROMISE, *supra* note 25.
[168] 10 C.F.R. 50.33(k), 50.75
[169] 10 C.F.R. 61.62.
[170] 10 C.F.R. Part 40, Appendix A.
[171] U.S. Nuclear Regulatory Commission, *Office of Public Affairs, Fact Sheet—Nuclear Insurance and Disaster Relief Funds* (Feb. 2008), *available at* http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/funds-fs.pdf.
[172] 42 U.S.C. § 2210
[173] GAO, Report to Congressional Requesters, No. 04-654, Nuclear Regulation—NRC's Liability Insurance Requirements for Nuclear Power Plants Owned by Limited Liability Companies (May 2004), available at http://www.gao.gov/new.items/d04654.pdf.
[174] NRC, Fact Sheet, *supra* note 171.
[175] David S. Ziegler, Report on the Price-Anderson Act and its Potential Effects on Eureka County, Nevada, at 8–9 (Mar. 10, 2003).
[176] *Id.* at 14–19.
[177] Rebecca L. Kihslinger, *Success of Wetland Mitigation Projects*, NAT'L WETLANDS NEWSLETTER 30(2), at 14 (Mar.-Apr. 2008).
[178] *See generally*, ENVIRONMENTAL LAW INSTITUTE, BANKS AND FEES: THE STATUS OF OFF-SITE WETLAND MITIGATION IN THE UNITED STATES (2002).
[179] 33 CFR 332.3(n) (USACE regulation); 40 CFR 230.93(n) (identical EPA regulation).
[180] Clean Water Act, §404(s), 33 U.S.C. § 1344(s).
[181] For an overview and evaluation of wetland mitigation enforcement, *see generally* GENERAL ACCOUNTING OFFICE, WETLANDS PROTECTION: CORPS OF ENGINEERS DOES NOT HAVE AN EFFECTIVE OVERSIGHT APPROACH TO ENSURE THAT COMPENSATORY MITIGATION IS OCCURRING (2005).
[182] Kihslinger, *supra* note 177, at 16.
[183] 40 C.F.R. 264–5, 258, 280.
[184] 40 C.F.R. 264.13(a)–(i), 264.15(a)–(i).
[185] 40 C.F.R. 264.147(a)–(b).
[186] 40 C.F.R. 264.101(a)–(b).
[187] 40 C.F.R. 280.93.
[188] PA. STAT. ANN. § 6018.611 (2008) ("It shall be presumed as a rebuttable presumption of law that a person or municipality which stores, treats, or disposes of hazardous waste shall be liable, without proof of fault, negligence, or causation, for all damages, contamination or pollution within 2,500 feet of the perimeter of the area where hazardous waste activities have been carried out. Such presumption may be

overcome by clear and convincing evidence that the person or municipality so charged did not contribute to the damage, contamination, or pollution.").

[189] La. Rev. Stat. § 30:1147.1(B); FLA. STAT. § 403.727(3)(a) (2008) ("In any action by the department against a small hazardous waste generator for the improper disposal of hazardous wastes, a rebuttable presumption of improper disposal shall be created if the generator was notified pursuant to s. 403.7234; the generator shall then have the burden of proving that the disposal was proper. If the generator was not so notified, the burden of proving improper disposal shall be placed upon the department.").

[190] Michigan Department of Environmental Quality—Office of the Great Lakes, MICHIGAN GREAT LAKES PLAN: OUR PATH TO PROTECT AND RESTORE MICHIGAN'S NATURAL TREASURES 9 (draft revised and posted for public comment Oct. 2008), *available at* http://www.michigan.gov/documents/deq/Draft_MI_Great_Lakes_Plan_251564_7.pdf.

VI. Conclusion

Aquatic invasive species receive a great deal of attention in the Great Lakes, which is one of the most invaded ecosystems known. To date, attention has focused on the creation of regulatory systems to control the discharge of ballast water without treatment. However, the discharge of biological pollution in ballast has long been prohibited under a variety of state laws. More recently, every Great Lakes state has adopted explicit limitations on discharge. Thus far, however, regulations have proven insufficient to control the spread of AIS due to inadequate enforcement and the difficulty in determining the causation of particular biological invasions. In addition to new enforcement tools, such as mandatory monitoring requirements, causation bars are currently eroding in the face of technological innovation in treatment for and sensing of biological activity in ballast water discharge. As a result, liability for biological pollution is likely to accrue to increasing numbers of specific vessels. In addition, downstream users – whether ports, other terminals, contractors, of even municipalities, may become liable for AIS introduction if they fail to consider the foreseeable consequences of their actions in doing business with specific vessels. These potential liabilities are likely to support new forms of vessel insurance, but that market will be insufficient, alone, to protect society against pollution from undercapitalized and underinsured vessels.

Financial responsibility mechanisms are a potential tool for ensuring that biological polluters internalize the costs of their actions. FRMs have successfully been implemented in a plethora of environmental and public health damages situations, including oil pollution, mine reclamation, waste disposal, and nuclear accidents. States have taken initial steps toward implementation of these mechanisms in some cases, but financial assurance has not yet been required. With implementation of a tailored FRM framework, states and the federal government can protect both the economy and environment in the Great Lakes.

When designing financial assurance policies for the Great Lakes, policymakers should consider three questions: which vessels should be regulated; what type(s) of financial responsibility mechanisms should be adopted; and which agency(s) should adopt them. While this paper suggests answers to each of these questions, further study is required before concrete recommendations are possible.