Golden Gate University Law Review

Volume 30
Issue 4 *The American Coast: Law on the Edge*

Article 3

January 2000

The Regulation of Biological Pollution: Preventing Exotic Species Invasions from Ballast Water Discharged into California Coastal Waters

Andrew N. Cohen

Brent Foster

ARTICLE

THE REGULATION OF BIOLOGICAL POLLUTION: PREVENTING EXOTIC SPECIES INVASIONS FROM BALLAST WATER DISCHARGED INTO CALIFORNIA COASTAL WATERS

BY ANDREW N. COHEN* AND BRENT FOSTER**

INTRODUCTION

Toward the end of the film *Apollo 13*, which portrays a stricken spacecraft rescued from disaster by American pluck and ingenuity, the returning astronauts are told at the last possible moment that if they don't immediately load more ballast into the re-entry vehicle they'll be bounced back out of the atmosphere to drift through space forever. "Ballast?" ask the

---

* Environmental Scientist, San Francisco Estuary Institute, Richmond, California; PhD, Energy and Resources, University of California, Berkeley. The authors thank Michael Bean (Environmental Defense Fund), Leora Elazar and Jon Smith (San Francisco Bay Conservation and Development Commission), Tami Grove (California Coastal Commission), Russell Harding (Oregon Department of Environmental Quality), John Lien and Michael Meier (California State Lands Commission), Michael Lozeau (Earthlaw), Steve Moore (San Francisco Bay Regional Water Quality Control Board), Dennis Nixon (University of Rhode Island), Alison Rieser (University of Maine School of Law), Linda Sheehan (Center for Marine Conservation) and Jody Zaitlin (Port of Oakland) for providing information and/or reviewing the manuscript. The Rose Foundation and a Switzer Environmental Leadership Grant, through the San Francisco Foundation, provided support to Mr. Cohen.

** Mr. Foster is a public-interest environmental attorney in Portland, Oregon; J.D., Northwestern School of Law, Lewis and Clark College; B.S. (Ecology) and B.A. (Environmental Science), University of California (Santa Barbara). Mr. Foster thanks Craig Johnston (Pacific Environmental Advocacy Center) and the numerous biologists who improved his understanding of the effects of exotic species.

incredulous astronauts, who then frantically transfer excess equipment, empty containers and anything else that's not nailed down into the re-entry module to increase its weight.[1]

Thus, the practice of adjusting a vessel's weight and trim by loading ballast (which is later ejected into the surrounding environment when it is no longer needed) has persisted from the days of sailing ships into the era of starships. Ballast dumping came under regulatory control during the 19th century, as harbor masters barred ships from dumping rock, sand, mud and miscellaneous debris carried as ballast into harbors and channels, to prevent shoaling. In many areas, ballast dumping was banned by statute, both to protect channel depths and, in some cases, to prevent the fouling of waters.[2] "Ballast grounds" were set up where ballast could be legally disposed of, and professional "ballast haulers" and guilds of "ballast heavers" serviced the merchant shipping industry.[3] Even on America's wild frontier, laws and regulations prohibited the dumping of ballast into harbors, although as Richard Henry Dana reported in *Two Years Before the Mast*, ships on the California coast frequently violated them.[4]

Both a physical and socio-economic infrastructure and a regulatory framework were thus created to control ballast dumping. All of that changed, however, toward the end of the

---

[1] APOLLO 13 (Universal Pictures 1995).

[2] *See* United States v. Standard Oil Co., 384 U.S. 224, 226-227 (1966) (discussing a number of statutes relating to restricting ballast discharges dating back to 1886). Such laws remain on the books in Oregon, Washington and Alaska. *See e.g.*, OR. REV. STAT. § 783.600 (1995); WASH. REV. CODE § 88.28.060 (1996) ("Discharging Ballast, When Prohibited"); ALASKA STAT. § 30.50.020 (1996) ("Discharging Ballast in Navigable Waters").

[3] *See* James T. Carlton, History, Biogeography, and Ecology of the Introduced Marine and Estuarine Invertebrate of the Pacific Coast of North America 63-65 (1979) (unpublished Ph. D. thesis, University of California (Davis)) (on file with the University of California (Davis) Library).

[4] Dana describes the usual practice for disposing of ballast at Ballast Point in San Diego in 1836 as follows: "[W]e were turned-to, heaving out ballast. A regulation of the port forbids any ballast to be thrown overboard; accordingly, our long-boat was [used]...but where one tub-full went into the boat, twenty went overboard. This is done by every vessel [.]" RICHARD HENRY DANA, TWO YEARS BEFORE THE MAST, ch. 29 (1840).

19th century with the advent of steel-hulled ships and steam-driven (and later, diesel-powered) water pumps. These made water a far more convenient and much cheaper substance to use as ballast than solid materials that had to be hauled into and out of ships by gangs of laborers. The regulatory authorities at the time, operating under the erroneous assumption that the water used to ballast ships was harmless, imposed no restrictions on its discharge.

However, we now know, beyond any doubt, that ballast water discharges are not harmless. Ballast water is recognized as a major mechanism for transporting and introducing exotic species[5] into the world's coastal ecosystems, which may result in severe and irreversible impacts on environmental quality and biological diversity, on economic and recreational activities, and on public health. Thus, as we enter a new century, government regulators are beginning to seek means to rectify the errors made since the beginning of the last one, and to at last bring ballast water discharges under appropriate regulatory control. Although several bouts of limited legislative activity during the 1990s have nibbled at this problem, existing state and federal laws offer numerous, generally unexploited opportunities for managing ballast discharges. Several factors have made California a primary focus of attention and experi-

---

[5] This article uses the terms "exotic species" or "exotic organism" to refer to a species or organism that has been transported into an ecosystem outside of its historic, natural range. This is similar to the federal statutory definition of non-indigenous species (NIS) as "any species or other biological material that enters an ecosystem beyond its historic range, including any such organism transferred from one country into another [.]" 16 U.S.C. § 4702(11) (2000). Related terms, some of which have been used interchangeably, include alien, non-native, foreign, immigrant, adventive, introduced, invasive, colonizing, naturalized, escaped, translocated and transfaunated species. Another frequently used term is aquatic nuisance species (ANS), defined in federal statutes as "a nonindigenous species that threatens the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural or recreational activities dependent on such waters[.]" *Id.* § 4702(1). In slightly different words, California statutes describe "a non-indigenous species that threatens the viability or abundance of a native species, the ecological stability of waters inhabited by those species, or the viability of commercial, agricultural, aquacultural, or recreational activities which depend on those waters[.]" CAL. FISH & GAME CODE § 6431 (West 1994). More-or-less similar terms are injurious, harmful, pest or weed species. *See* D. M. Whalin, *The Control of Aquatic Nuisance Nonindigenous Species*, 5(1) ENVTL. LAW. 68-127 at 70-77 (1998) [hereinafter Whalin, *Nuisance Nonindigenous Species*].

mentation in ballast water regulation, including a spate of recent marine and freshwater invasions, the publication of some key scientific studies, substantial public and media interest in the phenomenon of invasions, aggressive work by a few environmental organizations, and, possibly, a more activist approach by the government agencies responsible for the protection of natural resources. These factors warrant a close examination of the legal authorities for ballast regulation in California.

In Part I of this article, we describe ballast water's use, its contribution to biological invasions, and the technical approaches that could be used to combat the problem. In Part II, we describe opportunities for employing existing laws and regulations to manage ballast discharges in California. We first discuss the limitations of international, federal and state laws that have tried to address ballast discharges of exotic organisms as a shipping issue. We then consider the potential for regulating ballast discharges under federal and state laws aimed at controlling water pollution, protecting wildlife, ensuring the assessment, disclosure and mitigation of environmental impacts, and providing for the planning and management of coastal zone development. While we evaluate these laws in terms of their potential application in California, the federal laws and, in many cases, corresponding state laws could be applied in other coastal regions. We conclude by summarizing how existing regulations may provide a comprehensive overall framework for achieving effective regulation of ballast water discharges.

I. BALLAST WATER DISCHARGES AND BIOLOGICAL INVASIONS

A. THE ROLE OF BALLAST WATER IN SHIPPING

A ship carrying little or no cargo rides high in the water. This may make the ship vulnerable to being knocked over by high waves and winds; increase the potential for "slamming" the bow or stern when riding over waves; or raise the propeller

so that it is insufficiently immersed.[6] At the start of a voyage a ship may take on large quantities of water—of whatever water the ship is floating in, fresh water if in a river port, and salt water if in the sea—in order to lower the ship to a safer and more efficient position in the water. At the end of the voyage the ship will then discharge this ballast water into a new port or coastal region (perhaps thousands of miles from its source) before loading cargo. Ballast water is also loaded or discharged for various other purposes such as adjusting trim, improving maneuverability, increasing propulsion efficiency, reducing hull stress, raising the ship to pass over shallow areas, and lowering it to get under bridges or cranes.[7]

Ballast water enters a ship through intake ports located below the water line. These are typically covered with grates or strainer plates with openings of about half an inch.[8] The function of the strainer plates is to prevent objects from being drawn in that could damage the ship's pumps, although they incidentally serve to prevent the introduction of large organisms into ballast tanks. Depending on the level of the tank relative to the water surface, water may be taken on or discharged either by pumping or by gravitational flow. Ballast

---

[6] *See* James T. Carlton, et al., U. S. COAST GUARD & U. S. DEP'T OF TRANSPORTATION REPORT NO. CG-D-11-95, THE ROLE OF SHIPPING IN THE INTRODUCTION OF NONINDIGENOUS AQUATIC ORGANISMS TO THE COASTAL WATERS OF THE UNITED STATES (OTHER THAN THE GREAT LAKES) & AN ANALYSIS OF CONTROL OPTIONS (1995) [hereinafter Carlton, et al.]. *See also* Andrew N. Cohen, CALFED Bay Delta Program, Ships' Ballast Water and the Introduction of Exotic Organisms into the San Francisco Estuary: Current Status of the Problem and Options for Management (1998) [hereinafter Cohen, CALFED Bay Delta Program].

[7] *See id.*

[8] Sometimes the openings are larger either because they've been enlarged by corrosion or because the strainer plate has fallen off. *See e.g.*, James T. Carlton, *Transoceanic and Interoceanic Dispersal of Coastal Marine Organisms: The Biology of Ballast Water*, 23 OCEANOGR. MAR. BIOL., ANN. REV. 313 (1985); AUSTRALIAN QUARANTINE & INSPECTION SERVICE, BALLAST WATER RESEARCH SERIES REPORT NO. 1, BALLAST WATER TREATMENT FOR THE REMOVAL OF MARINE ORGANISMS 20 (1993) [hereinafter AQIS, *Report No. 1*]; AUSTRALIAN QUARANTINE & INSPECTION SERVICE, BALLAST WATER RESEARCH SERIES REPORT NO. 4, BALLAST WATER MANAGEMENT 25 (1993) [hereinafter AQIS, *Report No. 4*]; Carlton, et al. *supra* note 6; MARINE BOARD COMMITTEE ON SHIPS' BALLAST OPERATIONS, STEMMING THE TIDE: CONTROLLING INTRODUCTIONS OF NONINDIGENOUS SPECIES BY SHIPS' BALLAST WATER (1996) [hereinafter *Stemming the Tide*].

water is generally carried in several different compartments on board ship, often in tanks set aside for that purpose (called "segregated" or "dedicated" ballast tanks), although bulk carriers and tankers may carry ballast water in their cargo holds ("unsegregated tanks"). Some individual ships can carry tens of millions of gallons of ballast water.[9]

Sediment sometimes accumulates in the bottom of ballast tanks or ballasted cargo holds.[10] This sediment may include mud and small debris pumped in with the ballast water, rust and interior coatings that flake off the inside walls of the tank, and residue from previously carried cargo. Sediment is typically removed from ballast tanks every 3-5 years when a ship is in dry-dock, and from ballasted cargo holds on every voyage at the cargo-loading port. Sediment from cargo holds, which may amount to 500 gallons or more per ship,[11] is typically shoveled or hosed out and either dumped into port or coastal waters, or retained and disposed of on land or at sea.[12]

---

[9] *See* James T. Carlton, et al., *Remarkable Invasion of San Francisco Bay (California, USA) by the Asian Clam Potamocorbula amurensis: I. Introduction and Dispersal*, 66 MARINE ECOL. PROG. SER. 81-94 (1990). *See also Stemming The Tide supra* note 8; Cohen, CALFED Bay Delta Program *supra* note 6.

[10] *See generally* G. M. Hallegraeff & C. J. Bolch, *Transport of Diatom and Dinoflagellate Resting Spores in Ships' Ballast Water: Implications for Plankton Biogeography and Aquaculture*, 14(8) J. PLANKTON RES. 1067 (1992). Accumulated sediment may range from negligible to quite substantial amounts. *See e.g.*, POLLUTECH ENVIRONMENTAL, LTD., CANADIAN COAST GUARD, A REVIEW AND EVALUATION OF BALLAST WATER MANAGEMENT AND TREATMENT OPTIONS TO REDUCE THE POTENTIAL FOR THE INTRODUCTION OF NON-NATIVE SPECIES TO THE GREAT LAKES 21(1992) (recording a foot-thick layer of mud in the ballast tanks of one ship) [hereinafter Pollutech Environmental, Ltd.].

[11] *See generally* J. M. Kelly, *Ballast Water and Sediments as Mechanisms for Unwanted Species Introductions into Washington State,* 12(2) J. SHELLFISH RES. 405 (1993).

[12] *See generally* R. J. Williams, et al., *Cargo Vessel Ballast Water as a Vector for the Transport of Non-Indigenous Marine Species*, 26 ESTUAR. COAST. SHELF SCI. 409 (1988). *See also* G. M. Hallegraeff, et al., *Microalgal Spores in Ship's Ballast Water: A Danger to Aquaculture, in* TOXIC MARINE PHYTOPLANKTON 475 (E. Granéli, et al., eds., 1990); AQIS, *Report No. 1 supra* note 8, at 21; J. M. Kelly, *Ballast Water and Sediments as Mechanisms for Unwanted Species Introductions into Washington State,* 12(2) J. SHELLFISH RES. 405-410 (1993). *See also Stemming The Tide supra* note 8.

B. BIOLOGICAL INVASIONS IN AQUATIC ECOSYSTEMS: HISTORY AND IMPACTS

Recent studies have identified over 230 exotic species that have become established in the San Francisco Estuary.[13] At least another 125 organisms in the estuary are considered to be "cryptogenic," meaning there is inadequate evidence to determine whether they are native or exotic.[14] Exotic species dominate many of the estuary's biotic communities, where they may account for forty to 100 percent of the common species, up to ninety-seven percent of the total number of organisms, and up to ninety-nine percent of the biomass.[15] Perhaps even more striking than their abundance is the rapidly increasing rate at which new species are arriving and becoming established. Roughly half of the exotic species identified were first observed in the ecosystem within the last thirty-five years.[16] Overall, the rate of invasions increased from an average of about one new species established every fifty-five weeks between 1851 and 1960, to one new species every fourteen weeks between 1961 and 1995.[17]

These exotic organisms arrived on the West Coast[18] through a variety of mechanisms. Historically, the most important of

---

[13] In this study, the San Francisco Estuary was defined as all waters in the San Francisco Bay watershed within the reach of the tides, including both the salty waters of the Bay and the freshwater inland delta of the Sacramento-San Joaquin rivers. *See* Andrew N. Cohen & James T. Carlton, *Accelerating Invasion Rate in a Highly Invaded Estuary,* 279 SCIENCE 555-558 (1998) [hereinafter Cohen & Carlton, *Accelerating Invasion Rate*].

[14] *See generally* ANDREW N. COHEN & J. T. CARLTON, U. S. FISH & WILDLIFE SERVICE & NATIONAL SEA GRANT COLLEGE PROGRAM, NONINDIGENOUS AQUATIC SPECIES IN A UNITED STATES ESTUARY: A CASE STUDY OF THE BIOLOGICAL INVASIONS OF THE SAN FRANCISCO BAY AND DELTA (1995) [hereinafter Cohen & Carlton, *SF Bay Case Study*]. The concept of cryptogenic species is defined and explored in James T. Carlton, *Biological Invasions and Cryptogenic Species*, 77(6) ECOLOGY 1653-1655 (1996).

[15] *See generally* Cohen & Carlton, *SF Bay Case Study supra* note 14. *See also* Cohen & Carlton, *Accelerating Invasion Rate supra* note 13, at 555-558. Biomass is a measure of the weight of the living organisms present.

[16] *See generally* Cohen & Carlton, *Accelerating Invasion Rate supra* note 13.

[17] *See id.*

[18] In this article "West Coast" and "East Coast" refer to the western and eastern coasts of North America.

these involved organisms that had attached to or bored into the hulls of ships; organisms accidentally transported with oysters from the East Coast or Japan that were planted in the West Coast bays for rearing to market size; and fish imported and stocked to support commercial or recreational fisheries, primarily in fresh water.[19] For the last several decades, however, these mechanisms have either not been operating or have declined in importance, while increasing numbers of organisms have been introduced through the discharge of ships' ballast water.[20] Although a few species may have been introduced by ballast water discharges during the first half of the 20th century,[21] substantial numbers began to appear in the 1960s,[22] and by the 1990s between fifty-three and eighty-eight percent of the exotic species newly found in the San Francisco Estuary had been introduced to the West Coast via ballast water.[23]

Evidence from other aquatic ecosystems also indicates a high degree of invasion, an accelerating rate of invasion, and an increasing contribution to invasions by ballast water. Within California, at least eighty-one exotic marine species have become established in southern California between San Diego and Los Angeles,[24] twenty-seven species in Morro Bay,[25] and thirty-four species in Humboldt Bay.[26] In the freshwater

---

[19] *See generally* James T. Carlton, History, Biogeography, and Ecology of the Introduced Marine and Estuarine Invertebrates of the Pacific Coast of North America (1979) (unpublished Ph. D. thesis, University of California (Davis)) (on file with the University of California (Davis) Library). *See generally* Cohen & Carlton, *SF Bay Case Study supra* note 14.

[20] *See generally* Cohen & Carlton, *SF Bay Case Study supra* note 14. *See also* Andrew N. Cohen, *Invasions Status and Policy on the U. S. West Coast, in* PROC. FIRST NAT'L CONF. ON MARINE BIOINVASIONS (Jan. 24-27, 1999) (forthcoming 2000) [hereinafter Cohen, *Marine Bioinvasions*]. The use of ballast water in the shipping industry is described *infra* Part I.A.

[21] *See* Cohen, CALFED Bay Delta Program *supra* note 6, at app. A.

[22] *See id.* at 12, Figure 1.

[23] *See generally* Cohen, *Marine Bioinvasions supra* note 20.

[24] Unpublished data established by Andrew N. Cohen (on file with authors).

[25] *See id.*

[26] Unpublished data established by James T. Carlton & Andrew N. Cohen (on file with authors).

Great Lakes, 139 exotic organisms had become established by the early 1990s.[27] Nearly one-third of these arrived between 1960 and 1990,[28] coinciding with the opening of the St. Lawrence Seaway in 1959, which resulted in a dramatic increase in the number and size of ocean-going ships entering the Great Lakes and in the volume of ballast water released into the Lakes.[29] Invasions due to ballast water discharges first began to appear in the Lakes the 1930s, increased substantially after 1960, and accounted for eighty-two percent of new invasions in the 1980s.[30]

Biological invasions have the potential to cause substantial damage to ecosystems and to the human activities that depend on them.[31] Several recent invasions resulting from ballast water discharges provide noteworthy examples:

1. Western Atlantic Comb Jelly

The western Atlantic comb jelly,[32] a small, floating organism similar to a jellyfish, was introduced into the Black and Azov Seas by the early 1980s. It became phenomenally abundant and by consuming much of the seas' crustacean zooplankton[33]

---

[27] *See* E. L. Mills, et al., *Exotic Species in the Great Lakes: A History of Biotic Crises and Anthropogenic Introductions,* 19(1) J. GREAT LAKES RES. 1 (1993) [hereinafter Mills].

[28] *See id.* at 1, 39.

[29] *See id.* at 1, 4.

[30] Based on data in Mills *supra* note 27, at Tables 3 and 4.

[31] *See generally* U.S. OFFICE OF TECHNOLOGY ASSESSMENT, REPORT NO. OTA-F-565, HARMFUL NON-INDIGENOUS SPECIES IN THE UNITED STATES (1993) [hereinafter OTA, *Harmful Non-Indigenous Species in U.S.*]. *See also,* Cohen & Carlton, *SF Bay Case Study supra* note 14 (for a discussion of the types of impacts caused by aquatic invasions); Andrew N. Cohen, *The Exotic Species Threat to California's Coastal Resources, in* CALIFORNIA AND THE WORLD OCEAN '97 1418-1426 (1998).

[32] Mnemiopsis leidyi.

[33] Plankton are organisms that drift within the water column, most of which are microscopic or nearly microscopic. Plant and animal plankton are called, respectively, phytoplankton and zooplankton.

contributed to the decline of the region's already-stressed fisheries, affecting fishing fleets in six nations.[34]

2. *European Zebra Mussel*

The European zebra mussel[35] was discovered in the Great Lakes in the late 1980s and rapidly proliferated. It caused massive problems by clogging water-delivery pipes, attaching to boat hulls, marine structures and navigational buoys, and accumulating in nuisance quantities on recreational beaches.[36] Damages through 1995 were reported at up to $1.5 million at one factory, $3.7 million at a water treatment plant, and $6 million at a power plant, with ten-year costs estimated at $3.1 billion for the power industry and $5 billion in all.[37] Zebra mussels have also disrupted food webs, promoted blooms of nuisance algae and threatened native species, although some organisms have benefited from the mussel's presence.[38] The zebra mussel has now spread across much of North America,

---

[34] *See* E. A. Shushkina & E. I. Musayava, *Structure of Planktic Community of the Black Sea Epipelagic Zone and its Variation Caused by Invasion of a New Ctenophore Species,* 30 OCEANOLOGY 225-228 (1990). *See also* J. Travis, *Invader Threatens Black, Azov Seas* 262 SCIENCE 1366-1367 (1993); G. R. Harbison & S. P. Volvik, *The Ctenophore,* Mnemiopsis leidyi, *in the Black Sea: A Holoplanktonic Organism Transported in the Ballast Water of Ships*, *in* NONINDIGENOUS ESTUARINE AND MARINE ORGANISMS (NEMO), PROCEEDINGS OF THE CONFERENCE AND WORKSHOP 25-36 (U. S. DEPT. OF COMMERCE, NOAA, Seattle WA, 1994).

[35] Dreissena polymorpha.

[36] *See* ZEBRA MUSSELS: BIOLOGY, IMPACTS, AND CONTROL (Thomas F. Nalepa & Don W. Schloesser eds., 1993).

[37] *See, e.g.,* OTA, *Harmful Non-Indigenous Species in U.S supra* note 31, at 68 (for reports and estimates of zebra mussel-related costs). *See also* W. L. LePage, *The Impact of* Dreissena polymorpha *On Waterworks Operations at Monroe, Michigan: A Case History, in* ZEBRA MUSSELS: BIOLOGY, IMPACTS, AND CONTROL 333-358 (T. F. Nalepa & D. W. Schloesser eds., 1993); K. Glassner-Shwayder, Biological Invasions, Address Before the Great Lakes Panel on Aquatic Nuisance Species and Great Lakes Commission (1996); C. O'Neill, The Zebra Mussel: Impacts and Control (1997) (unpublished manuscript, on file with Cornell University).

[38] *See* L. Hushak, Zebra Mussel Update (1995) (unpublished manuscript, on file with Ohio State University).

from Canada to New Orleans and from the Hudson River to Oklahoma.[39]

3. *Small Asian Clam*

In 1986, three specimens of a small Asian clam[40] were found in San Francisco Bay by a college biology class.[41] Within a year, it had become the most abundant clam in the northern part of the bay, and soon spread to the rest of the bay. The clam feeds by filtering small organisms out of the water column, and researchers calculated that virtually the entire volume of water over a large portion of the bay was being filtered through these clams between once and twice a day, dramatically altering the food web. The clam also appears to concentrate the metal selenium in its tissues, directing it into the diets of bottom-feeding fish and birds, which are accumulating selenium at levels known to cause reproductive defects in some species.[42]

---

[39] *See* C. O'Neill, The Zebra Mussel: Impacts and Control (1997) (unpublished manuscript, on file with Cornell University).

[40] Potamocorbula amurensis.

[41] *See* James T. Carlton, et al., *Remarkable Invasion of San Francisco Bay (California, USA) by the Asian Clam Potamocorbula amurensis: I. Introduction and Dispersal,* 66 MARINE ECOL. PROG. SER. 81-94 (1990).

[42] *See id. See also* F. H. Nichols, et al., *Remarkable Invasion of San Francisco Bay (California, USA) by the Asian Clam Potamocorbula Amurensis: II. Displacement of a Former Community*, 66 MAR. ECOL. PROG. SER. 95-101 (1990) [hereinafter Nichols, et al., *S.F. Bay Invasion*]; I. Werner & J. T. Hollibaugh, *Potamocorbula amurensis: Comparison of Clearance Rates and Assimilation Efficiencies for Phytoplankton and Bacterioplankton,* 38(5) LIMNOL. OCEANOGR. 949-964 (1993); W. J. Kimmerer, et al., *Predation By An Introduced Clam as the Likely Cause of Substantial Declines in Zooplankton of San Francisco Bay*, 113 MAR. ECOL. PROG. SER. 81-93 (1994); A. E. Alpine & J. E. Cloern, *Trophic Interactions and Direct Physical Effects Control Phytoplankton Biomass and Production in an Estuary*, 37(5) LIMNOL. OCEANOGR. 946-955 (1992); S. N. Luoma & R. Linville, *Selenium Trends in North San Francisco Bay*, 10(2) IEP NEWSLETTER 25, 26 (1997); J. K. Thompson, Impacts of the Asian Clam on San Francisco Bay, Paper Presented at the 127th Annual Meeting of the American Fisheries Society (Aug. 24-28, 1997); Save San Francisco Bay Association, *Intruders in the Estuary*, *in* WATERSHED 1, 8 (Fall 1998) (for a personal description of the extent of this invasion).

4. Dinoflagellates and Red Tides

Dinoflagellates are microscopic organisms[43] that sometimes become so abundant that they color the sea as "red tides." These can kill fish or invertebrates,[44] and some dinoflagellate species produce neurotoxins which, becoming concentrated in mussels or clams, produce a potentially fatal syndrome known as Paralytic Shellfish Poisoning or PSP when consumed by human beings. In recent decades red tides and PSP outbreaks have been reported more frequently around the world and in areas where they were previously unknown.[45] Dinoflagellates are common in ballast water and ballast sediments,[46] and at least some outbreaks (in Australia and Tasmania, and possibly also in New Zealand and Chile)[47] apparently resulted from the introduction of dinoflagellates in ballast discharges.

---

[43] Dinoflagellates are single-celled organisms that exhibit features that have been thought characteristic of both plants (photosynthesis) and animals (motility), and have been variously classified. They are found in both fresh and salt water. *See generally* Harold C. Bold & Michael J. Wynne, INTRODUCTION TO THE ALGAE: STRUCTURE AND REPRODUCTION (2d ed. 1985).

[44] *See, e.g.*, Brian Cole & Andy Cohen, *Red Tide in Berkeley Marina Raises Concern for Toxic Blooms in Central Bay*, *in* INTERAGENCY ECOLOGICAL PROGRAM NEWSLETTER 11(1): 11-13 (1997).

[45] *See* Donald M. Anderson, *Toxic Algal Blooms and Red Tides: A Global Perspective*, *in* RED TIDES: BIOLOGY, ENVIRONMENTAL SCIENCE, AND TOXICOLOGY 11-16 (T. Okaichi, et al., eds., 1989); Theodore J. Smayda, *Novel and Nuisance Phytoplankton Blooms in the Sea: Evidence for a Global Epidemic*, *in* TOXIC MARINE PHYTOPLANKTON 29-40, (E. Granéli, et al., eds., 1990); G. M. Hallegraeff, *A Review of Harmful Algal Blooms and Their Apparent Global Increase*, 32(2) PHYCOLOGIA 79-99 (1993).

[46] *See* G. M. Hallegraeff, et al., *Microalgal Spores in Ship's Ballast Water: A Danger to Aquaculture*, *in* TOXIC MARINE PHYTOPLANKTON 475-480 (E. Granéli, et al., eds., 1990); G. M. Hallegraeff & C. J. Bolch, *Transport of Toxic Dinoflagellate Cysts Via Ships' Ballast Water*, 22(1) MARINE POLLUTION BULLETIN 27-30 (1991); G. M. Hallegraeff & C. J. Bolch, *Transport of Diatom and Dinoflagellate Resting Spores in Ships' Ballast Water: Implications for Plankton Biogeography and Aquaculture*, 14(8) J. PLANKTON RES. 1067-1084 (1992); Cohen, CALFED Bay Delta Program *supra* note 6, at Table 5.

[47] Alexandrium catenella and Alexandrium minutum in Australia and Gymnodinium catenatum in Tasmania. *See, e.g.*, G. M. Hallegraeff, et al., *Three Estuarine Australian Dinoflagellates That Can Produce Paralytic Shellfish Toxins*, 10(3) J. PLANKTON RES. 533-541 (1988); G. M. Hallegraeff & C. J. Bolch, *Transport of Toxic Dinoflagellate Cysts Via Ships' Ballast Water*, 22(1) MARINE POLLUTION BULLETIN 27-30 (1991); G. M. Hallegraeff & C. J. Bolch, *Transport of Diatom and Dinoflagellate Resting Spores in Ships' Ballast Water: Implications for Plankton Biogeography and Aquaculture*,

5. Cholera Strain

During the 1991 South American cholera epidemic, the South American cholera strain was discovered in oysters and fish in Mobile Bay, Alabama. The U. S. Food and Drug Administration subsequently found the same strain in five out of fifteen ships sampled on arrival in the Gulf of Mexico from Latin American ports.[48] Some medical researchers believe that this epidemic strain had originally been transported from Asia to South America in ballast water.[49]

C. ORGANISMS TRANSPORTED IN BALLAST WATER

It has long been recognized that marine and freshwater organisms can be transported in water carried on ships. As early as 1897, biologists showed that marine plankton can pass through pumps into a ship's seawater system and survive, and the first scientific report of a ballast water introduction was in 1908.[50] It was not until the 1970s, however, that scientists began directly sampling the organisms carried in ballast water,[51] with the results of the first substantial studies appearing in

---

14(8) J. PLANKTON RES. 1067-1084 (1992); G. M. Hallegraeff, *A Review of Harmful Algal Blooms and Their Apparent Global Increase*, 32(2) PHYCOLOGIA 79-99 (1993). Gymnodinium breve in New Zealand. *See* P. Smith, et al., *Toxic Phytoplankton and Algal Blooms, Summer 1992/3, in* 1993 MARINE TOXINS AND NEW ZEALAND SHELLFISH 11-17 (J. A. Jasperse ed., 1993). Alexandrium catenella in Chile. Telephone Interview with G. Lembeye (1999).

[48] *See* 56(239) Fed. Reg. 64,381-64,386 (Dec. 12, 1991); 63(69) Fed. Reg. 17782-17791 (Apr. 10, 1998). *See also* S. A. McCarthy, et al., *Toxigenic* Vibrio cholerae *O1 and Cargo Ships Entering Gulf of Mexico*, 339 LANCET 624-625 (1992); S. A. McCarthy & F. M. Khambaty, *International Dissemination of Epidemic* Vibrio Cholerae *by Cargo Ship Ballast and Other Nonpotable Waters*, 60(7) APPL. ENVTL. MICROBIOL. 2597-2601 (1994).

[49] *See* P. R. Epstein, et al., *Marine Ecosystems*, 342 LANCET 1216-19 (1993). *See also* J. Ditchfield, *Cholera, Plankton Blooms, and Ballast Water*, 3(3) GLOBAL BIODIVERSITY 17-18 (1993). The South American cholera epidemic resulted in over one million reported cases and over 10,000 deaths. *See* R. V. Tauxe, *Epidemic Cholera in the New World*, 1 EMERGING INFECTIOUS DISEASE 141-146 (1995).

[50] *See, e.g.,* James T. Carlton, *Transoceanic and Interoceanic Dispersal of Coastal Marine Organisms: The Biology of Ballast Water*, 23 OCEANOGR. MAR. BIOL., ANN. REV. 313-371 (1985).

[51] *See generally id.*

the mid-1980s.[52] Numerous studies since then have shown that ballast tanks typically contain many species of animals, plants, protozoans, bacteria and viruses, sometimes in considerable abundance.[53] Well over a thousand different species have been identified from the water and sediment in ballast tanks.[54] The types of organisms transported in ballast tanks can include organisms that are planktonic for their entire lives, organisms that are planktonic as larvae but settle on the bottom as adults (these include many clams, oysters, mussels, snails, worms, barnacles, crabs, starfish and other common marine organisms), small swimming organisms such as fish or shrimp, parasites of planktonic or swimming organisms, organisms that normally live on the bottom but are stirred up into the water by waves or by ships' propellers, and organisms attached or clinging to bits of wood or other floating debris.[55]

Many planktonic organisms can survive relatively long voyages drifting in the ballast water carried in ships, to be discharged into coastal waters at the end of the voyage.[56] While several studies have reported dramatic declines in the number and diversity of organisms over the course of a voyage,[57] some live organisms have been collected from ballast water or sediments after periods of up to a year.[58] Such long-term survival could be due to the presence of cysts, spores or other resting stages of certain organisms, which may be tolerant of harsh

---

[52] *See id. See also* R. J. Williams, et al., *Cargo Vessel Ballast Water as a Vector for the Transport of Non-Indigenous Marine Species*, 26 ESTUAR. COAST. SHELF SCI. 409-420 (1988); James T. Carlton & J. B. Geller, *Ecological Roulette: The Global Transport of Nonindigenous Marine Organisms*, 261 SCIENCE 78-82 (1993).

[53] *See* COHEN, CALFED Bay-Delta Program *supra* note 6, at Tables 4-6.

[54] *See id.*, at Tables 4-5.

[55] *See generally* Carlton, et al. *supra* note 6. *See also* Cohen, CALFED Bay-Delta Program *supra* note 6.

[56] *See* Cohen, CALFED Bay-Delta Program *supra* note 6, at Tables 4, 5 & 8.

[57] *See id.* at Table 7. *See also* S. Gollasch, et al., *Nonindigenous Organisms Introduced Via Ships Into German Waters, in* BALLAST WATER: ECOLOGICAL AND FISHERIES IMPLICATIONS (James T. Carlton ed., 1998). The declines may be due to changes in temperature or reductions in dissolved oxygen, or to depletion of food resources since there is no light in ballast tanks that would allow phytoplankton to photosynthesize.

[58] *See* Cohen, CALFED Bay-Delta Program *supra* note 6, at Table 8.

environmental conditions and capable of remaining dormant for many weeks or months,[59] or to the long-term persistence of biological communities in ballast tank sediments.[60] However, even with large declines, substantial numbers and considerable variety of living organisms may remain in ballast tanks after typical transoceanic voyages of ten to twenty days. Densities on the order of 0.1-1 relatively large (>0.003 inch) organisms per gallon, and much greater densities of smaller organisms, have been found in ballast water at the conclusion of transoceanic voyages.[61] Given the large capacity of ship's ballast water pumps,[62] a single deballasting ship may thus discharge into the environment millions of exotic phytoplankton and zooplankton per hour, and larger numbers of protists, bacteria and viruses.[63]

D. REDUCING THE INTRODUCTION OF ORGANISMS IN BALLAST WATER

The approaches suggested for reducing or eliminating the introduction of harmful organisms in ballast water generally fall into three categories: (1) adjusting where, when or how ballast water is loaded or discharged ("ballast water microman-

---

[59] *See generally* James T. Carlton, *Transoceanic and Interoceanic Dispersal of Coastal Marine Organisms: The Biology of Ballast Water,* 23 OCEANOGR. MAR. BIOL., ANN. REV. 313 (1985). *See also* R. J. Williams, et al., *Cargo Vessel Ballast Water as a Vector for the Transport of Non-Indigenous Marine Species,* 26 ESTUAR. COAST. SHELF SCI. 409-420 (1988); G. M. Hallegraeff, et al., *Microalgal Spores in Ship's Ballast Water: A Danger to Aquaculture, in* TOXIC MARINE PHYTOPLANKTON 475-480 (E. Granéli, et al., eds., 1990); G. M. Hallegraeff & C. J. Bolch, *Transport of Diatom and Dinoflagellate Resting Spores in Ships' Ballast Water: Implications for Plankton Biogeography and Aquaculture,* 14(8) J. PLANKTON RES. 1067-1084 (1992); B. S. Galil & N. Hülsmann, *Protist Transport Via Ballast Water—Biological Classification of Ballast Tanks by Food Web Interactions,* 33 EUROP. J. PROTISTOL. 244-253 (1997). Notable among the cyst-forming organisms are some toxic species of dinoflagellates, whose viable cysts have been found in ballast sediments in enormous numbers.

[60] *See generally,* L. D. SMITH, ET AL. & U.S. COAST GUARD, REPORT NO. CG-D-02-97, BIOLOGICAL INVASIONS BY NONINDIGENOUS SPECIES IN UNITED STATES WATERS: QUANTIFYING THE ROLE OF BALLAST WATER AND SEDIMENTS, PARTS I AND II (1996).

[61] *See* Cohen, CALFED Bay-Delta Program *supra* note 6, at Table 6.

[62] Typical ships' pumping capacities are 0.3-0.5 million gal/hr for general cargo and container ships, 1.3-2.6 million gal/hr for bulk freighters and ore carriers, and 1.3-5 million gal/hr for tankers. *See generally Stemming The Tide supra* note 8.

[63] *See* Cohen, CALFED Bay Delta Program *supra* note 6, at 11.

agement")[64]; (2) exchanging ballast water at some distance from shore ("ballast water exchange"); or (3) treating ballast water to remove or kill the organisms in it ("ballast water treatment"). In addition, the use of a "risk-based decision support system" has been recommended by the Australian government and some shipping industry representatives.[65] This is not a management action *per se*, but rather a regulatory approach in which regulators would first assess a ship to determine whether its ballast water contained organisms that pose a risk, and then determine what management action would be required.

Due to either intrinsic limitations or practical operational constraints, no approach is likely to be completely effective, and some are most certain to fall short. Combinations of approaches may ultimately be adopted, or different approaches may be used in different areas or by different parts of the industry. For any approach, certain issues must be considered such as the safety of the ship and crew, its effectiveness in destroying potential invading organisms, technical feasibility and compatibility with ships' operations, environmental impacts, the ability of regulatory agencies to monitor implementation, and the cost of implementation.[66]

1. Ballast Water Micromanagement

Various actions have been suggested to reduce the number of harmful organisms taken in when loading ballast, or to avoid the discharge of ballast water in sensitive or vulnerable areas. Measures related to the loading of ballast include not loading in areas that are known to contain harmful organisms or

---

[64] The term "ballast water micromanagement" was used by Carton, et al. *supra* note 6, at 132 to describe types of limitations on where and when ballast water is loaded; as used in this article, the term also includes certain types of limitations on where ballast water is discharged.

[65] *See* AUSTRALIAN QUARANTINE & INSPECTION SERVICE, BALLAST WATER RESEARCH SERIES REPORT NO. 9, BALLAST WATER--TECHNICAL OVERVIEW REPORT 44-45 (1996). *See also* DENIS PATERSON & KATHERINE COLGAN, AUSTRALIAN QUARANTINE & INSPECTION SERVICE, INVASIVE MARINE SPECIES: AN INTERNATIONAL PROBLEM REQUIRING INTERNATIONAL SOLUTIONS 13 (1998).

[66] *See Stemming The Tide supra* note 8, at 47.

phytoplankton blooms, or in areas with local outbreaks of infectious water-borne diseases, or in waters with high sediment loads or where propellers may stir up the sediment, or near dredging operations or in shallow water, or near sewage discharges or in areas with poor tidal flushing.[67] Other measures include not ballasting at seasons when harmful plankton are abundant, or at night when many types of organisms migrate closer to the surface; or ballasting through intakes located high on the ship's hull when in shallow water, to avoid entraining bottom sediments or organisms living near the bottom; or loading fresh water as ballast when expecting to deballast in salt water; and salt water as ballast when expecting to deballast in fresh water.[68] Measures related to the discharge of ballast include not discharging near aquaculture areas, seafood harvesting areas, marine sanctuaries or parks, coral reefs or other sensitive sites.[69]

---

[67] *See International Guidelines for Preventing the Introduction of Unwanted Aquatic Organisms and Pathogens from Ships' Ballast Water and Sediment Discharges*, Marine Environmental Protection Committee Res. (50)31 (July 4, 1991) (adopted by International Maritime Organization, Res. A774(18) (Nov. 4, 1993) (photocopy on file with authors)). *See also* C. J. S. Bolch & G. M. Hallegraeff, *Ballast Water as a Vector for the Dispersal of Toxic Dinoflagellates, in* NONINDIGENOUS ESTUARINE AND MARINE ORGANISMS (NEMO), PROCEEDINGS OF THE CONFERENCE AND WORKSHOP 63-67 (U. S. DEP'T OF COMMERCE & NOAA, Seattle, WA,1994); Carlton, et al. *supra* note 6, at 132-138; K. Weathers & E. Reeves, *The Defense of the Great Lakes Against the Invasion of Nonindigenous Species in Ballast Water*, 33(2) MARINE TECHNOLOGY 92-100 at 98, Table 4 (1996); *Stemming The Tide supra* note 8, at 50; E. REEVES & U.S. COAST GUARD, PROTECTION OF THE GREAT LAKES FROM INFECTION BY EXOTIC ORGANISMS IN BALLAST WATER 14, Table 5 (1998) [hereinafter E. Reeves & U.S. COAST GUARD]; Cohen, CALFED Bay Delta Program *supra* note 6, at 20-21; 64(94) Fed. Reg. 26672, 26683-26684 (May 17, 1999) [33 C.F.R. 151.2305].

[68] *See* JAMES T. CARLTON, ET AL., U. S. COAST GUARD & U. S. DEP'T OF TRANSPORTATION REPORT NO. CG-D-11-95, THE ROLE OF SHIPPING IN THE INTRODUCTION OF NONINDIGENOUS AQUATIC ORGANISMS TO THE COASTAL WATERS OF THE UNITED STATES (OTHER THAN THE GREAT LAKES) AND AN ANALYSIS OF CONTROL OPTIONS 132-138 (1995). *See also* K. Weathers & E. Reeves, *The Defense of the Great Lakes Against the Invasion of Nonindigenous Species in Ballast Water*, 33(2) MARINE TECHNOLOGY 92-100 at 98, Table 4 (1996); *Stemming The Tide supra* note 8, at 50, 56; E. Reeves & U.S. COAST GUARD *supra* note 67, at 14, Table 5; Cohen, CALFED Bay-Delta Program *supra* note 6, at 20-21; 64(94) Fed. Reg. 26672, 26683-26684 (May 17, 1999) [33 C.F.R. 151.2305].

[69] *See* C. J. S. Bolch & G. M. Hallegraeff, *Ballast Water as a Vector for the Dispersal of Toxic Dinoflagellates, in* NONINDIGENOUS ESTUARINE AND MARINE ORGANISMS (NEMO), PROCEEDINGS OF THE CONFERENCE AND WORKSHOP 63-67 (U. S. DEP'T OF COMMERCE & NOAA, Seattle, WA,1994). *See also* Cohen, CALFED Bay-Delta Program

While such micromanagement measures could enhance the effectiveness of ballast water exchange or ballast water treatment approaches, they are not a substitute for such approaches, and will not by themselves adequately resolve the problem of introductions in ballast water.[70] In actual practice, ships will be unable to implement most of these measures much of the time, since the time and place of ballasting will to a large degree be constrained by the ship's itinerary, schedule and operational needs.[71]

2. *Ballast Water Exchange*

Ballast water exchange is often proposed as a measure for ships arriving from overseas ports. In such cases, an exchange would consist of discharging most of the ballast water that had been loaded in overseas coastal waters and replacing it with ocean water taken on when the ship is some distance from shore or in some minimum depth of water. In this article, this process is referred to as an open-ocean exchange.[72] The majority of existing laws, regulations or guidelines specify that open-ocean exchange is to take place at least 200 miles offshore, or in waters that are at least 2,000 meters (6,560 feet) deep, or both.[73]

---

supra note 6, at 20-21; 64(94) Fed. Reg. 26672, 26683-26684 (May 17, 1999) [33 C.F.R. 151.2305].

[70] *See* Carlton, et al., *supra* note 6, at 132. *See also* Cohen, CALFED Bay-Delta Program
supra note 6, at 20.

[71] *See* Cohen, CALFED Bay-Delta Program *supra* note 7 at 20-21. In addition, systematically avoiding sites with unwanted organisms or where blooms of phytoplankton are occurring may be impossible because the system of international sampling programs and notification procedures that would be needed to support such an effort does not exist. Also, avoiding discharging into or near sensitive sites may be of limited value, since exotic species, once established at one site, can sometimes spread rapidly to other sites along the coast. For example, the European green crab, first collected on the West Coast in San Francisco Bay in 1989 or 1990, has since spread northward to Vancouver Island in British Columbia, a distance of about 900 miles.

[72] This procedure has also been called a mid-ocean, high seas, at sea or deep water exchange. *See* Carlton, et al. *supra* note 6, at 154 (for a discussion of these terms).

[73] For most of the U. S. coast, the 2,000 meter depth contour is within 200 miles of shore. *See id.* at 161. The specifications for exchange in the International Maritime Organization guidelines, the Canadian guidelines, and the U. S. federal rule for tank-

The primary purpose of open-ocean exchange is to remove exotic coastal organisms from a ship's ballast tanks, and replace it with water containing only oceanic organisms. On arrival at its destination, the ship would then be discharging only oceanic organisms into coastal waters. These are not expected to survive or thrive in the coastal zone, or to compete effectively with organisms adapted to coastal conditions.[74] There have

---

ers exporting Trans-Alaska Pipeline oil is to conduct the exchange in waters at least 2,000 meters deep. *See International Guidelines for Preventing the Introduction of Unwanted Aquatic Organisms and Pathogens from Ships' Ballast Water and Sediment Discharges*, Marine Environmental Protection Committee Res. (50)31 (July 4, 1991) (adopted by International Maritime Organization, Res. A774(18) (Nov. 4, 1993) (photocopy on file with authors)). *See also* 61(106) Fed. Reg. 27,255-27,258 (May 31, 1996). In federal law, at least 200 miles from shore (NANPCA 1990; NISA 1996). In federal regulations and California law, in waters that are both at least 200 miles from shore and at least 2,000 meters deep. *See* (58(66) Fed. Reg. 18,330-18,334 (Apr. 8, 1993); 64(94) Fed. Reg. 26,672, 26,683-26,684 (May 17, 1999) [33 C.F.R. 151.2035]; CAL. PUB. RES. CODE §§ 71200(e), 71201(b), 71204(a)(1) (West 2000). In Chilean law, at least 12 miles from shore. *See, e.g.,* D. GAUTHIER & D. A. STEEL, CAN. MANUSCR. REP. FISH. AQUAT. SCI., NO. 2380, A SYNOPSIS OF THE SITUATION REGARDING THE INTRODUCTION OF NONINDIGENOUS SPECIES BY SHIP-TRANSPORTING BALLAST WATER IN CANADA AND SELECTED COUNTRIES (1996). In Israeli regulations, beyond the continental shelf. *See generally,* STATE OF ISRAEL, MINISTRY OF TRANSPORT, ADMINISTRATION OF SHIPPING AND PORTS, HAIFA, *Notice to Mariners No. 4/96—Subject: Ballast Water Control* (1996)).

[74] *See* Carlton, et al., *supra* note 6, at 153. *See also* E. REEVES & U.S. COAST GUARD *supra* note 67, at 5. Similarly, coastal organisms are not expected to do well in the middle of the ocean. *See id.* at 153. Coastal waters are characterized by higher turbidity, lower levels of UV radiation, and more variable and generally lower salinities. *See* A. Locke, et al., *Ballast Water Exchange as a Means of Controlling Dispersal of Freshwater Organisms by Ships*, 50 CAN. J. FISH. AQUAT. SCI. 2086-2093 (1993) [hereinafter Locke, et al. 1993]. *See also* Carlton, et al., *supra* this note; E. Reeves & U.S. COAST GUARD *supra* this note, at 5. These conditions are thought to make transplants from either environment into the other likely to fail. Higher concentrations of nutrients in coastal waters, different availability of food resources, and different levels of competition and predation may also play a role. *See* Geoff Rigby & Gustaaf Hallegraeff, *The Transfer and Control of Harmful Marine Organisms in Shipping Ballast Water: Behaviour of Marine Plankton and Ballast Water Exchange Trials on the MV "Iron Whyalla,"* 1 J. MARINE ENVTL. ENGINEERING 91-110 (1994). For many coastal organisms that are planktonic only during their larval stages and must settle on the bottom for the adult stage of their lives, open ocean regions where the bottom is more than 2,000 meters down would provide singularly inhospitable environments. Two other phenomena that are sometimes cited as the rationale for open-ocean exchange may augment the effectiveness of the exchange process, but are not the primary objectives of the process. The first phenomenon is that higher salinity ocean water may act as a biocide, killing organisms adapted to freshwater or to lower salinity coastal water. *See* A. Locke, et al., *Effectiveness of Mid-Ocean Exchange in Controlling Freshwater and Coastal Zooplankton in Ballast Water*, CAN. TECH. REP. FISH. AQUAT. SCI., No. 1822 (1991) [hereinafter Locke, et al. 1991]; POLLUTECH ENVIRONMENTAL LTD. *supra* note 10, at app. B at 12; K. Weathers & E. Reeves, *The Defense of the Great Lakes*

been some suggestions that vessels engaged in coastwise traffic should conduct ballast water exchanges at some lesser distance offshore, but there is no clear consensus on the value of such exchange.

Ballast water exchange may be conducted in two basic ways. In an empty-and-refill exchange,[75] a ballast tank is pumped as empty as possible[76] and then refilled. The second approach is to pump water in through one port and allow it to flow out through another, called a flow-through exchange.[77] An empty-and-refill exchange could potentially make a ship unstable or prone to slamming (by discharging too much ballast for the sea conditions), cause inadequate propeller immersion, or impose unacceptable stresses on the hull (by changing the buoyancy in one section of the vessel relative to another).[78] In general, sta-

---

Against the Invasion of Nonindigenous Species in Ballast Water, 33(2) MARINE TECHNOLOGY 92-100 (1996); Geoff R. Rigby & Alan Taylor, *Ballast Water: Its Impacts Can Be Managed, in* BALLAST WATER: ECOLOGICAL AND FISHERIES IMPLICATIONS (James T. Carlton ed., 1998). However, a variety of freshwater organisms have been found to survive open-ocean exchange. *See generally,* Locke et al. 1991 *supra* this note; Locke et al. 1993 *supra* this note; Carlton, et al. *supra* note 6, at 159-162; E. Reeves & U.S. COAST GUARD *supra* note 67, at 5. The second phenomenon is that on transequatorial voyages, the influx of warmer tropical water may kill off temperate species; and the tropical species loaded during exchange would be less likely to survive or thrive when discharged to temperate coasts. *See* C. HAY, ET AL., CAWTHRON INSTITUTE, CAWTHRON'S BALLAST WATER RESEARCH PROGRAMME: FINAL REPORT 1996-1997 7 (1997). It has also been suggested that exchange will result in fewer organisms being released because lower concentrations or a lower diversity of organisms are found in the open ocean than in coastal waters. *See, e.g.*, POLLUTECH ENVIRONMENTAL, LTD. *supra* note 10, at 8, app. B; C. A. Welch, The National Invasive Species Act of 1996: Response to a Global Concern (1996) (unpublished student paper, University of Washington School of Law) (on file with authors). However, others claim this is not necessarily true. *See* Carlton, et al. *supra* note 6, at 155.

[75] Also called deballast-and-reballast exchange, reballasting, sequential release and replacement, sequential exchange, pumpdown exchange and complete exchange.

[76] A substantial amount of water, typically on the order of tens of thousands of gallons per ship and often containing a high concentration of sediment and possibly organisms, may remain in the bottom of a ship's ballast tanks after the pumps have lost suction. *See* Carlton, et al. *supra* note 6, at 77, app. D & E; Locke, et al. 1991 *supra* note 74. This is known as unpumpable ballast or dead water.

[77] Also called flow-through dilution, flushing, continuous flushing, flush-through exchange, continuous exchange, dilution exchange and overflow exchange.

[78] *See generally* AQIS, *Report No. 4 supra* note 8. *See also* J. B. Woodward, et al., *Ship Operational and Safety Aspects of Ballast Water Exchange at Sea*, 31(4) MARINE TECHNOLOGY 315-326 (1992).

bility problems are likelier for smaller ships, and unsafe hull stresses are likelier for larger ships.[79]

Such problems do not occur with flow-through exchange. Because the ballast tanks are never emptied, stability is never compromised and hull stresses are not significantly altered. However, flow-through exchange can be difficult because there is usually only one pipe available for both filling and draining the tank.[80] Flow-through exchange has been conducted by pumping water in through a pipe at the bottom of the tank and overflowing water onto the decks through hatch covers or air

---

[79] *See* C. HAY, ET AL., CAWTHRON INSTITUTE, CAWTHRON'S BALLAST WATER RESEARCH PROGRAMME: FINAL REPORT 1996-97 8 (1997). A figure that has been repeatedly cited in the ballast exchange literature, but is apparently without data to support it, is that empty-and-refill exchange is unsafe for vessels over 40,000 deadweight tons. *See, e.g.,* Geoff R. Rigby, et al., *The Transfer and Treatment of Shipping Ballast Waters to Reduce the Dispersal of Toxic Marine Dinoflagellates, in* TOXIC PHYTOPLANKTON BLOOMS IN THE SEA, 169-176 (T. J. Smayda & Y. Shimuzu eds., 1993). *See also* C. J. S. Bolch & G. M. Hallegraeff, *Ballast Water as a Vector for the Dispersal of Toxic Dinoflagellates, in* NONINDIGENOUS ESTUARINE AND MARINE ORGANISMS (NEMO), PROCEEDINGS OF THE CONFERENCE AND WORKSHOP 63-67 (U. S. DEP'T OF COMMERCE & NOAA, Seattle, WA,1994); Carlton, et al. *supra* note 6, at 164; E. Reeves & U.S. COAST GUARD *supra* note 67; POLLUTECH ENVIRONMENTAL LTD. *supra* note 10, at 23, app. B (reporting that the limit for safe exchange as ships of up to 30,000 tons of cargo, but without providing any basis or reference for this number). Modeling studies on empty-and-refill exchanges by various ship types and data from strain gauges have provided a more complex picture, with different studies indicating no stability or stress problems on three ship types of 37,700 to 110,000 tons displacement until the seas reached significant wave heights of somewhere between ten and 20 feet (significant wave heights of ten to 20 feet imply occasional waves nearly 40 feet high). *See* J. B. Woodward, et al., *Ship Operational and Safety Aspects of Ballast Water Exchange at Sea*, 31(4) MARINE TECHNOLOGY 315-326 (1992)). *See also* AQIS, *Report No. 4 supra* note 8, at (no stability or stress problems on a bulk carrier of 150,000 deadweight tons when tanks were exchanged in calm sea conditions). *But see* Geoff R. Rigby, et al., *The Transfer and Treatment of Shipping Ballast Waters to Reduce the Dispersal of Toxic Marine Dinoflagellates, in* TOXIC PHYTOPLANKTON BLOOMS IN THE SEA,169-176 (T. J. Smayda & Y. Shimuzu eds., 1993) (unsafe stress conditions for four bulk carriers of 70,000 to 188,000 deadweight tons). *See also* Geoff Rigby & Gustaaf Hallegraeff, *The Transfer and Control of Harmful Marine Organisms, in Shipping Ballast Water: Behaviour of Marine Plankton and Ballast Water Exchange Trials on the MV "Iron Whyalla,"* 1 J. MARINE ENVTL. ENGINEERING 91-110 (1994); K. Weathers & E. Reeves, *The Defense of the Great Lakes Against the Invasion of Nonindigenous Species in Ballast Water*, 33(2) Marine Technology 92-100, at 93, 94 (1996) *citing* A. D. PRIOR, TRANSPORT CANADA, MARINE REGULATORY DIRECTORATE, BALLAST WATER EXCHANGE STUDY: PHASE I (1995).

[80] *See generally* E. Reeves & U.S. COAST GUARD *supra* note 67.

ventilators at the top of the tank.[81] This is generally inefficient, and in some circumstances may be unsafe.[82] Fitting ballast tanks with a second pipe and making some other changes in the tanks could make flow-through exchange safer and easier and somewhat more efficient, even for the largest vessels.[83] Because of its limited effectiveness and potential safety issues, open-ocean ballast water exchange is generally viewed as an interim measure that should be replaced or augmented as soon as possible by more effective and safer ballast treatment approaches.[84]

3. Ballast Water Treatment

Many technologies for treating ballast water could potentially be applied either on-board ship or in on-shore facilities,[85] although a few will be limited to on-shore use due to physical

---

[81] *See* Geoff Rigby & Gustaaf Hallegraeff, *The Transfer and Control of Harmful Marine Organisms in Shipping Ballast Water: Behaviour of Marine Plankton and Ballast Water Exchange Trials on the MV "Iron Whyalla,"* 1 J. MARINE ENVTL. ENGINEERING 91-110 (1994); C. HAY, ET AL., CAWTHRON INSTITUTE, CAWTHRON'S BALLAST WATER RESEARCH PROGRAMME: FINAL REPORT 1996-1997 (1997).

[82] *See* AQIS, *Report No. 4 supra* note 8, at 61; C. Hay, et. al., CAWTHRON INSTITUTE, CAWTHRON'S BALLAST WATER RESEARCH PROGRAMME: FINAL REPORT 1996-1997 (1997).

[83] Retrofit costs for this work have been estimated at £170,400 (•$280,000) to £528,000 (•$860,000) per ship for different ship types and sizes. *See* K. Weathers & E. Reeves, *The Defense of the Great Lakes Against the Invasion of Nonindigenous Species in Ballast Water*, 33(2) MARINE TECHNOLOGY 92-100 (1996); G. Armstrong, *Ballast System Design for Flow-Through Exchange of Ballast Water*, THE INSTITUTE OF MARINE ENGINEERS (1997); E. Reeves & U.S. COAST GUARD, *supra* note 68). Brazilian researchers have developed a cheaper approach involving deck-mounted pipes, called the "dilution method," which performed well in trials. *See* REPORT OF THE WORKING GROUP ON BALLAST WATER 5 (Jan. 5, 1999) (convened during MEPC 42, MEPC 43/4). In addition, a flow-through exchange requires that more water be pumped into a tank than in an empty-and-refill exchange, typically about three tank volumes to achieve a comparable level of exchange. *See* Geoff Rigby & Gustaaf Hallegraeff, *The Transfer and Control of Harmful Marine Organisms in Shipping Ballast Water: Behaviour of Marine Plankton and Ballast Water Exchange Trials on the MV "Iron Whyalla,"* 1 J. MARINE ENVTL. ENGINEERING 91-110 (1994)).

[84] *See Stemming The Tide supra* note 8, at 53.

[85] Some studies consider a category of "port treatment" where ballast water is transferred from cargo ships to a treatment plant on a specially-designed vessel floating in the port. *See generally* AQIS, *Report No. 1 supra* note 8. In this article this is considered to be a type of on-shore treatment.

restrictions or safety concerns.[86] Treatment technologies are generally of two types: technologies designed to removal particles, including both organisms and suspended sediments and technologies designed to kill living organisms, called disinfection. With most technologies, effective treatment will require both an initial particle removal process and a disinfection process, as discussed below.

Most of the studies and experiments conducted to date have targeted on-board application and have primarily looked at filtration, chemical biocides and heat treatment. Other methods that have been proposed include ultraviolet (UV) radiation, ultrasound, microwaves, electric pulse and pulse plasma, magnetic treatment, mechanical agitation, and deoxygenation.[87]

a. Particle Removal

Several studies have considered different types of screens, strainers or membrane filters for on-board treatment of ballast water.[88] In general there are tradeoffs between efficiency, size, complexity and cost. Systems that are capable of removing very small organisms[89] at an acceptable flow rate[90] tend to be large and shrinking the system tends to make it more complex

---

[86] *See* Cohen, CALFED Bay-Delta Program *supra* note 6, at 27.

[87] *See* C. J. S. Bolch & G. M. Hallegraeff, *Ballast Water as a Vector for the Dispersal of Toxic Dinoflagellates, in* NONINDIGENOUS ESTUARINE AND MARINE ORGANISMS (NEMO), PROCEEDINGS OF THE CONFERENCE AND WORKSHOP 63-67 (U. S. Dep't of Commerce & NOAA, Seattle, WA,1994); Carlton, et al. *supra* note 6; *Stemming The Tide supra* note 8; E. Reeves & U.S. COAST GUARD *supra* note 67.

[88] *See* POLLUTECH ENVIRONMENTAL LTD. *supra* note 11; AQIS, *Report No. 1 supra* note 8; Carlton, et al. *supra* note 6; *Stemming The Tide supra* note 8; K. Mulvaney, *Filters Put the Squeeze on Alien Stowaways*, New Scientist, May 10, 1997, at 14; E. Reeves & U.S. COAST GUARD *supra* note 67, at 15.

[89] The size ranges of organisms found in ballast water include invertebrate eggs at 20-100 microns, algal spores and cysts at 5-25 microns, fungi at 1-100 microns, protozoa at 1-80 microns, bacteria at 0.1-100 microns and viruses at 0.01-1 micron. *See, e.g.,* AQIS, *Report No. 1 supra* note 8; E. Reeves & U.S. COAST GUARD *supra* note 68. A research project on the Great Lakes is testing filters in the 25-250 micron range. *See* K. Mulvaney, *Filters Put the Squeeze on Alien Stowaways*, NEW SCIENTIST 14 (May 10, 1997).

[90] Typical ballast pumping rates on commercial vessels are on the order of 1,000-20,000 cubic meters per hour (4,400-88,000 gallons per minute). *See Stemming The Tide supra* note 8, at 37.

and more costly. Generally, the preferred arrangement is to filter the ballast water as it is loaded, so that backwash water and material may be discharged back into the source waters, rather than stored for later treatment and/or disposal.[91] Another technology that has been suggested for on-board use is cyclonic separation, which removes particles by centrifugal action. [92]

While these technologies could be used either on-board or on-shore, there are other, generally cheaper methods for removing organisms and sediment that are only suitable for use on-shore. These include settling tanks and granular filtration. However, requirements for space or still conditions cannot be met on-board.[93] Whatever technology is used for particle removal, whether employed on-board or on-shore, it is unlikely to be effective at removing the smallest organisms present in ballast water or, in the case of cyclonic separation, to remove organisms with a specific gravity near that of the ballast water. Thus, any particle removal technology will probably need to be followed by additional treatment to kill the remaining organisms, such as biocide application or UV disinfection.[94]

---

[91] *See id.* at 77-79, 87. A disadvantage of in-line filtration during loading is that the system must be large enough to handle the ship's maximum ballast pumping rate. *See id.* at 70.

[92] *See* D. Oemcke, *The Treatment of Ships' Ballast Water*, ECOPORTS MONOGRAPH SERIES NO. 18 60 (Ports Corporation of Queensland, Brisbane, Mar. 1999).

[93] One study calculated that a media filtration system (such as is routinely used in water trement on-shore) which was large enough to handle the ballast pumping rates on a small bulk carrier or tanker would need filters that are 200 square meters in area and two meters deep, too large to install on a ship. *See Stemming The Tide supra* note 8, at 78. Another study calculated that granular filtration in pressure filters would require a footprint of at least 100 square meters to treat a flow of 4,000 cubic meters per hour. *See* AQIS, *Report No. 1 supra* note 8, at 33.

[94] *See* POLLUTECH ENVIRONMENTAL, LTD. *supra* note 11; Carlton et al. *supra* note 6, at 140; E. Reeves & U.S. COAST GUARD *supra* note 67, at 2. The need to combine on-board filtration with another on-board treatment system tends to make this a relatively expensive approach. For example, one study estimated that filtration to 50 microns would cost about three to five times as much per gallon as open-ocean exchange, and that filtration with UV would cost about 200 times as much as open-ocean exchange. *See* POLLUTECH ENVIRONMENTAL, LTD. *supra* note 11. *See also* E. Reeves & U.S. COAST GUARD *supra* note 68, at 18 (noting that current cost estimates suggest that on-board filtration will be prohibitively expensive, and that "one filter break-

b. Disinfection

Biocides that could potentially be used to disinfect ballast water include chlorine, ozone, hydrogen peroxide, various metal ions, organic acids and glutaraldehyde. In laboratory tests of various commonly-used biocides, extraordinarily high doses were needed to kill dinoflagellate cysts,[95] which were chosen as test organisms because of their potential harm to shellfisheries and human health, and their resistance to chemical treatment relative to mobile organisms.[96] These high doses would make use of these biocides prohibitively expensive.[97]

---

through or failure to religiously maintain and use the system...throughout the voyages around the world...will contaminate the tank and vitiate the protection to be achieved").

[95] Many types of marine and freshwater organisms can form cysts, spores or other resting life stages, which may be able to survive in environmental conditions that would be harmful to the organism's active life stages. *See* G. M. Hallegraeff & C. J. Bolch, *Transport of Diatom and Dinoflagellate Resting Spores in Ships' Ballast Water: Implications for Plankton Biogeography and Aquaculture*, 14(8) J. PLANKTON RES. 1067-1084 (1992); Carlton et al. *supra* note 6, at 162).

[96] It was felt that biocides capable of killing dinoflagellate cysts would also kill larval zooplankton, copepod eggs and seaweed spores, although possibly not bacterial spores or viral particles. *See, e.g.,* C. J. Bolch, & G. M. Hallegraeff, *Chemical and Physical Treatment Options to Kill Toxic Dinoflagellate Cysts in Ships' Ballast Water*, 1 J. MARINE & ENVTL. ENGINEERING 23-29 (1993). Chlorine and hydrogen peroxide proved to be effective against some dinoflagellate cysts only at doses that were tens or hundreds of times greater than normal water and wastewater treatment doses. *See id. See also* Geoff R. Rigby, et al., *The Transfer and Treatment of Shipping Ballast Waters to Reduce the Dispersal of Toxic Marine Dinoflagellates, in* TOXIC PHYTOPLANKTON BLOOMS IN THE SEA 169-176 (T. J. Smayda and Y. Shimuzu eds., 1993); S. Ichikawa, et al., *Extermination Efficiency of Hydrogen Peroxide Against Cysts of Red Tide and Toxic Dinoflagellates, and its Adaptability to Ballast Water of Cargo Ships*, 58(12) NIPPON SUISAN GAKKASHI 2229-2233 (1992); S. Montani, et al., *Chemical and Physical Treatments for Destruction of Phytoflagellate Cysts*, J. MARINE BIOTECHNOLOGY (1995).

[97] *See* C. J. Bolch & G. M. Hallegraeff, *Chemical and Physical Treatment Options to Kill Toxic Dinoflagellate Cysts in Ships' Ballast Water*, 1 J. MARINE & ENVTL. ENGINEERING 23-29 (1993); C. J. S. Bolch & G. M. Hallegraeff, *Ballast Water as a Vector for the Dispersal of Toxic Dinoflagellates, in* NONINDIGENOUS ESTUARINE AND MARINE ORGANISMS (NEMO), PROCEEDINGS OF THE CONFERENCE AND WORKSHOP 63-67 (U. S. DEP'T OF COMMERCE & NOAA, Seattle, WA,1994); Geoff R. Rigby, et al., *The Transfer and Treatment of Shipping Ballast Waters to Reduce the Dispersal of Toxic Marine Dinoflagellates, in* TOXIC PHYTOPLANKTON BLOOMS IN THE SEA 169-176 (T. J. Smayda and Y. Shimuzu eds., 1993). Some current research efforts in the Great Lakes are investigating the use of glutaraldehyde or organic acids to treat the relatively small amounts of unpumpable ballast remaining in ballast tanks on NOBOB ("no ballast on board") ships, but these chemicals are too expensive for general treatment of ballast water. *See, e.g.,* E. Reeves & U.S. COAST GUARD, PROTECTION OF THE GREAT LAKES FROM INFECTION BY EXOTIC ORGANISMS IN BALLAST WATER 19-20 (1998).

Many biocides may also not be feasible for on-board use because of inadequate storage space on ships, human health hazards, corrosion of ballast tanks or pipes, and concerns about discharging biocides or their residues into the environment.[98] Many biocides are also much less effective in water containing sediment or organic material.[99] A prior particle removal process to remove sediments and cysts would reduce the amount of biocide needed for disinfection and could make the use of biocides more feasible.

UV radiation is effective at killing bacteria and other microorganisms, but may not be as effective for larger organisms, for cysts and spores,[100] or for algae and fungi. Its effectiveness is also greatly reduced in water containing suspended sediment. UV radiation is thus considered to be a feasible treatment for ballast water only after a particle removal stage.[101]

Laboratory tests and field trials indicate that on tropical voyages the cooling water from ship's engines can be used to heat ballast water to temperatures that may be high enough to

---

[98] *See* C. J. Bolch & G. M. Hallegraeff, *Chemical and Physical Treatment Options to Kill Toxic Dinoflagellate Cysts in Ships' Ballast Water*, 1 J. MARINE & ENVTL. ENGINEERING 23-29 (1993); Geoff R. Rigby, et al., *The Transfer and Treatment of Shipping Ballast Waters to Reduce the Dispersal of Toxic Marine Dinoflagellates, in* TOXIC PHYTOPLANKTON BLOOMS IN THE SEA 169-176 (T. J. Smayda & Y. Shimuzu eds., 1993); AQIS, *Report No. 1 supra* note 8, at 38; Carlton, et al. *supra* note 6, at 145-147.

[99] *See* C. J. Bolch & G. M. Hallegraeff, *Chemical and Physical Treatment Options to Kill Toxic Dinoflagellate Cysts in Ships' Ballast Water*, 1 J. MARINE & ENVTL. ENGINEERING 23-29 (1993).

[100] Tests have shown substantial germination of dinoflagellate cysts after two hours exposure to UV radiation. *See* Geoff R. Rigby & Alan Taylor, *Ballast Water: Its Impacts Can Be Managed, in* BALLAST WATER: ECOLOGICAL AND FISHERIES IMPLICATIONS (James T. Carlton ed.,1998) *citing* S. Montani, et al., *Chemical and Physical Treatments for Destruction of Phytoflagellate Cysts*, J. MARINE BIOTECHNOLOGY (1995).

[101] *See* POLLUTECH ENVIRONMENTAL, LTD. *supra* note 11; AQIS, *Report No. 1 supra* note 8, at 36; Carlton, et al. *supra* note 6, at 142; *Stemming The Tide supra* note 8, at 85. The likelihood of effective application on ships is small. *See* E. Reeves & U.S. COAST GUARD, PROTECTION OF THE GREAT LAKES FROM INFECTION BY EXOTIC ORGANISMS IN BALLAST WATER 17 (1998) (stating that "as a matter of practical experience, we have found that many vessel owners forget to conduct the regular monitoring of the UV penetration necessary to guarantee that their marine sanitation devices are actually treating the sewage adequately").

kill dinoflagellates and many other ballast water organisms.[102] Bacteria and viruses may be unaffected, however,[103] and in many ships it would not be possible to heat the water sufficiently on short voyages or voyages through colder waters.[104]

Other suggested technologies are generally considered to be less promising.[105] For example, high intensity ultrasound can kill organisms, but no one frequency is likely to be effective against the range of organisms found in ballast water, the necessary exposure time may be quite long, and the power requirements high.[106] Microwaves appear to be prohibitively expensive and of questionable effectiveness.[107] Electric pulse and pulse plasma technologies, magnetic treatment and mechanical agitation are at experimental or exploratory levels of development, and they may not kill the full range of organisms in ballast water.[108] Ballast water could be deoxygenated by adding certain chemicals, but this would be ineffective against anaerobic bacteria, effectiveness would be compromised by surface reoxygenation, corrosive compounds and hazardous gases would

---

[102] *See* C. J. Bolch & G. M. Hallegraeff, *Chemical and Physical Treatment Options to Kill Toxic Dinoflagellate Cysts in Ships' Ballast Water*, 1 J. MARINE & ENVTL. ENGINEERING 23-29 (1993); C. J. Bolch &G. M. Hallegraeff, *Ballast Water as a Vector for the Dispersal of Toxic Dinoflagellates, in* NONINDIGENOUS ESTUARINE AND MARINE ORGANISMS (NEMO), PROCEEDINGS OF THE CONFERENCE AND WORKSHOP 63-67 (U. S. DEP'T OF COMMERCE & NOAA, Seattle, WA, 1994); GEOFF R. RIGBY, ET AL. & AUSTRALIAN QUARANTINE & INSPECTION SERVICE, BALLAST WATER RESEARCH SERIES REPORT NO. 11, BALLAST WATER HEATING AND SAMPLING TRIALS ON THE BHP SHIP *M.V. IRON WHYALLA* IN PORT KEMBLA AND EN-ROUTE TO PORT HEDLAND (1997) [hereinafter Rigby & AQIS].

[103] *See* Rigby & AQIS *supra* note 102, at 37.

[104] *See id.*

[105] *See* POLLUTECH ENVIRONMENTAL, LTD. *supra* note 11; Carlton, et al. *supra* note 6; *Stemming The Tide supra* note 8.

[106] *See* POLLUTECH ENVIRONMENTAL, LTD. *supra* note 11, at app. B; Carlton, et al. *supra* note 6, at 143-144; *Stemming The Tide supra* note 8, at 85, 130.

[107] *See* Carlton, et al. *supra* note 6, at 150.

[108] *See* POLLUTECH ENVIRONMENTAL, LTD. *supra* note 11, at 6, app. B; Carlton, et al. *supra* note 6, at 141; *Stemming The Tide supra* note 8, at 84-85, 127-130.

be generated, and there could be environmental impacts from discharging anoxic and possibly sulfur-rich water.[109]

c. On-shore vs. On-board Treatment

Although most of the research conducted to date has focused on on-board ballast water treatment systems, it may be possible to develop treatment systems on-shore more quickly and cheaply, using available technologies that are routinely applied to water and wastewater treatment.[110] On-shore treatment approaches have several attractive characteristics. They avoid the ship safety and crew safety issues that arise with some ballast exchanges and on-board treatments.[111] As noted above, on-shore treatment can use some relatively inexpensive particle removal technologies that would be impossible on a ship,[112] and some of the least expensive types of biocides that would be too hazardous on a ship.[113] Economies of scale would likely result from constructing and operating a smaller number of relatively large on-shore treatment plants, rather than constructing and operating a treatment plant on every single ship.[114] In some cases, it may be possible to use existing wastewater treatment facilities.[115] Proper maintenance and operation are more likely

---

[109] *See* POLLUTECH ENVIRONMENTAL, LTD. *supra* note 11, at 81-89, app. B; AQIS, *Report No. 1 supra* note 8, at 44; Carlton, et al. *supra* note 7, at 150.

[110] *See* Cohen, CALFED Bay-Delta Program *supra* note, at 27-28. Feasibility studies conducted for the Canadian and Australian governments estimated on-shore treatment costs that were generally cheaper than on-board approaches. *See e.g.,* POLLUTECH ENVIRONMENTAL, LTD. *supra* note 11 *and* AQIS, *Report No. 1 supra* note 8.

[111] *See* AQIS, *Report No. 1 supra* note 8, at 13.

[112] *See id.* at 31-34.

[113] Such as chlorine gas, probably the most common biocide used in water and wastewater treatment in the United States.

[114] *See* Cohen, CALFED Bay-Delta Program, *supra* note 6, at 27-28. *See also* AQIS, *Report No. 1 supra* note 8, at 86 (noting that "clearly the provision of centralised treatment in port or land-based facilities will be more economic in capital cost terms than provision of treatment facilities on board each ship.")

[115] For example, the volume of wastewater treated in the San Francisco Bay region is several hundred times the amount of overseas ballast water discharged into San Francisco Bay. Thus it may be possible in some cases to mix these relatively small ballast water discharges into the existing large waste streams without unduly altering their physical or chemical characteristics or straining the capacity of the wastewater plants to treat them.

in on-shore than in on-board treatment plants,[116] and it is also likely to be easier to monitor and regulate on-shore than on-board plants.[117] Disadvantages of on-shore treatment include the use of land near shore which may be needed for other purposes, possible delays to ships while off-loading ballast water, and the likelihood that in some regions ships will discharge some ballast water before entering port which will not receive treatment.[118]

4. Risk-based Decision Support System

Various shipping interests and the Australian government have advocated that the required level of ballast management should vary from ship to ship and voyage to voyage based on individual risk assessments. In this approach, the responsible agency would first estimate the level of risk presented by the discharge of a ship's ballast water, and then require a management action appropriate to the level of risk.[119] The apparent

---

[116] "[W]ater treatment equipment would be subject to operation, repair and maintenance by the crew. With the standards of ship maintenance in some cases having slipped badly for both hull and machinery, it may be assumed in these cases that ballast water treatment systems would not be accorded a high priority for maintenance and could be easily by-passed or operated at suboptimal efficiency." AQIS, *Report No. 1 supra* note 8, at 23.

[117] *See id.* at 12.

[118] *See* Cohen, CALFED Bay Delta Program *supra* note 6, at 28. Some ships may need to discharge ballast to lessen their draft before crossing a shallow bar or entering a shallow port. One question that arises with on-shore treatment is who would pay for the construction and operation of treatment facilities, the ships or the ports? If ships were required to treat their ballast water discharges and on-shore treatment was the cheapest approach, either shipping companies, ports or , conceivably, independent entrepreneurs might choose to construct treatment facilities. If ports or independent parties were to do so, they could recover costs and turn a profit by charging ships appropriate fees for receiving and treating their ballast water. A potential advantage to the shipping industry of on-shore treatment is that plant construction costs are more likely to be subsidized by federal or state governments—just as the cost of constructing wastewater treatment plants was subsidized during the implementation of the Clean Water Act—than would the cost of constructing or installing treatment plants on board ships. For example, low-interest or no interest loans are available for the construction of on-shore facilities to treat ballast water in California, through the State Revolving Fund administered by the State Water Resources Control Board, which is a form of subsidy.

[119] *See* AUSTRALIAN QUARANTINE AND INSPECTION SERVICE, BALLAST WATER RESEARCH SERIES REPORT NO. 9, BALLAST WATER - TECHNICAL OVERVIEW REPORT at 44-45 (1996); Keith R. Hayes & Chad L. Hewitt, *Risk Assessment Framework for Ballast*

objective is to release a significant number of ships from an otherwise required action, such as exchange or treatment.[120] Two approaches for estimating risk are "species-specific assessments"[121] (which estimate the probability that one or more species from a list of harmful organisms could be introduced in the ship's ballast water) and "environmental matching" (which compares the regions where ballast is loaded and discharged and assigns a higher estimate of risk if the regions are similar).[122] Thusfar, there are only rough descriptions of how such approaches might be implemented, but anything more ambitious than very conservative environmental matching (which would probably release few ships from management requirements) would likely prove to be unreliable.[123]

Water Introductions, in TECHNICAL REPORT NO. 14 at 5 (1988) [hereinafter Hayes & Hewitt, *Risk Assessment Framework*]. *See also* REPORT OF THE WORKING GROUP ON BALLAST WATER 7 (convened during MEPC 42, MEPC 43/4, Jan. 5, 1999). This strategy was adopted by the Australian government in 1996. *See* DENIS PATERSON & KATHERINE COLGAN, AUSTRALIAN QUARANTINE & INSPECTION SERVICE, INVASIVE MARINE SPECIES: AN INTERNATIONAL PROBLEM REQUIRING INTERNATIONAL SOLUTIONS 11 (1998).

[120] "Based on the "target" organism approach...it is possible that only a relatively small number of ships may need to undertake ballast treatment before discharge, in some areas." Geoff R. Rigby & Alan Taylor, *Ballast Water: Its Impacts Can Be Managed, in* BALLAST WATER: ECOLOGICAL AND FISHERIES IMPLICATIONS (James T. Carlton ed., 1998). *See also* AUSTRALIAN QUARANTINE AND INSPECTION SERVICE, BALLAST WATER RESEARCH SERIES REPORT NO. 9, BALLAST WATER - TECHNICAL OVERVIEW REPORT (1996) at 44-45; Hayes & Hewitt, *Risk Assessment Framework supra* note 119, at 2.

[121] Also called a "target organism approach."

[122] *See* Hayes & Hewitt, *Risk Assessment Framework supra* note 119. This report actually outlines six levels of assessment of increasing complexity from simple environmental matching (Level 0) to a fully-detailed species-specific assessment (Level 5).

[123] Species-specific assessments target a group of organisms identified as harmful, and are thus a kind of "dirty list" approach. Such approaches are thought to be ineffective by most regulators and researchers. *See* discussion and references *infra* Part II.C.2.b). One problem is that we have not tested criteria for predicting which organisms are likely to invade and do harm. For example, Australia currently proposes thirteen "invasive" species as targets for management, whose placement on the list is in large part due to their having become established in areas outside of their native ranges. *See* Hayes & Hewitt, *Risk Assessment Framework supra* note 119, at 65. However, ten of these species were not reported outside of their native ranges until the 1980s or 1990s, so that most of the listed species would not have been selected as management targets even a decade or two ago. This strongly suggests that many of the most harmful invaders of the coming decades would not be included on target lists prepared today. In addition, all but two of the thirteen listed species are already established in Australia—consistent with a common complaint regarding dirty list approaches that species are usually listed only after it is too late to prevent their intro-

II. REGULATING BALLAST WATER DISCHARGES INTO CALIFORNIA WATERS

Despite the large ecological and economic costs resulting from the release of exotic organisms, there has been little effort to regulate ballast water discharges at the international, federal or state level. Although Congress enacted federal laws as early as 1900 to protect the United States from invasion by exotic species, these statutes have not been applied to transfers of

---

duction. *See, e. g.,* M. J. Bean, The Role of the United States Department of the Interior in Nonindigenous Species Issues 45-46 (1991) (report to the OFFICE OF TECHNOLOGY ASSESSMENT, U. S. Congress) (on file with authors) [hereinafter Bean, *Report to OTA*].

The value of environmental matching is limited because the ranges of many marine organisms are very poorly known, because the range of environmental conditions in their native habitats may not be good indicators of the environmental limits in which they can establish, and because some aquatic organisms can tolerate or thrive in an extraordinarily broad range of physical and chemical conditions. *See, e.g.,* Hayes & Hewitt *supra and* CENTRE FOR RESEARCH ON INTRODUCED MARINE PESTS, CSIRO DIVISION OF MARINE RESEARCH, Hobart, Tasmania, Australia 16 (March 1988). Examples of aquatic organisms that successfully invaded waters outside of their presumed physical or chemical limits include two diatom species, originally considered to be strictly marine organisms, which became abundant in the Great Lakes. *See* BIO-ENVIRONMENTAL SERVICES, THE PRESENCE AND IMPLICATION OF FOREIGN ORGANISMS IN SHIP BALLAST WATERS DISCHARGED INTO THE GREAT LAKES 18 (1981) (report to ENVIRONMENTAL PROTECTION SERVICE, ENVIRONMENT CANADA, OTTAWA) (on file with authors). *See also* Janet Raloff, *Rogue Algae*, 154(1) SCI. NEWS 8-10 (July 4, 1998) (discussing the tropical green algae *Caulerpa taxifolia* which invaded the Mediterranean) *and* Telephone Interview with J. T. Carlton (1999) (discussing.the tropical freshwater weed *Hydrilla verticillata* which became abundant in a New England pond that freezes over in the winter). Another problem is that many ballast tanks contain a mixture of water from a variety of ports, making it difficult to know the sources of all the ballast water carried. *See* Carlton, et al. *supra* note 6, at 48; Hayes & Hewitt *supra* at 16.

In commenting on proposed international regulations, the United States noted that risk assessment-based ballast water management could be based on three conditions that theoretically could create a lower risk of invasion: longstanding movement of ballast water along the route in question, absence of target organisms in the ballast water, and different environmental conditions in donor and receiver ports. However, the United States rejected these arguments because many invasions have occurred decades after ballast water movement was begun, because "it is generally impossible to predict which organisms in ballast water will become serious invaders," and because the assumption that organisms introduced from different climate regions will die "is questionable." *Proposed Amendments and Comments on the Draft Regulations for the Control and Management of Ships' Ballast Water and Sediments to Minimize the Transfer of Harmful Aquatic Organisms and Pathogens,* MEPC 43/3, Annex 1, at fn. 8 (*see* discussion *infra* Part III.A.1, note 141) [hereinafter *Proposed Amendments and Comments*].

exotic species in ballast water.[124] Similarly, California laws that prohibit the unauthorized release of exotic species have not been used by California as a method for addressing ballast water-caused invasions.

The few measures that have been taken by California and the federal government to address the discharge of exotic organisms in ballast water have largely treated ballast water releases as a shipping issue. As established exotic species continue to expand their ranges and new invasions threaten ecosystems and economies across the United States, frustration at the slow pace of federal efforts to reform ballast water practices has lead a number of organizations and interest groups affected by invasions of exotic species to explore new strategies for regulating ballast water discharges. At the core of these strategies is the recognition that exotic organisms are biological pollutants. In fact, because these biological pollutants can reproduce, expand their range, and fundamentally alter ecosystem processes and bio-diversity, many exotic organisms can produce long-term impacts that are far more severe than those of many pollutants categorized as hazardous wastes.

These new strategies have looked to federal and state statutes aimed at controlling water pollution, such as the federal Clean Water Act (CWA),[125] Ocean Dumping Act[126] and Rivers and Harbors Act of 1899[127] and California's Porter-Cologne Water Quality Control Act (California's equivalent of the CWA),[128] to regulate ballast water discharges of exotic organisms. Additionally, they have focused attention on how public agencies have failed to assess the indirect effects of ballast water releases associated with the development and operation of shipping facilities and waterways, as is required by the National

---

[124] *See* 16 U.S.C. §§ 3371-3378 (2000).

[125] *See* 33 U.S.C. §§ 1251-1387 (1986).

[126] *See id.* §§ 1401-1445.

[127] *See id.* §§ 401-426

[128] *See* CAL. WATER CODE §§ 13000-13806 (West 1992).

Environmental Policy Act,[129] California Environmental Quality Act,[130] and Section 7 of the Endangered Species Act.[131] In California and elsewhere, groups concerned about the growing environmental and economic effects of exotic organisms are beginning to employ these statutes to hasten reform of ballast water practices.

Applying existing water pollution laws to control ballast water discharges and using existing environmental review statutes to analyze actions that facilitate the release of ballast water (such as port construction or channel deepening projects) provide a framework for regulating ballast water discharges in California and nationwide. Wildlife protection statutes such as the Endangered Species Act [132] and the Lacey Act, [133] and statutes dealing with the management or protection of wetlands, tidelands or coastal lands may provide additional mechanisms for managing ballast discharges. To understand the full framework of potentially applicable regulatory approaches to ballast water, it is important to consider both the inadequacies of current international and domestic efforts that have addressed ballast discharges largely as a shipping issue, as well as the relevance of existing pollution control, environmental review, and other laws to ballast releases of exotic organisms.

A. REGULATING BALLAST WATER DISCHARGE AS A SHIPPING ISSUE

1. International Law

Ballast water discharges were first recognized as an international concern in 1973, when the United Nations Conference on Marine Pollution requested the World Health Organization to investigate the potential spread of epidemic disease in bal-

---

[129] *See* 42 U.S.C. §§ 4331-4370 (1995).

[130] *See* CAL. PUB. RES. CODE §§ 21000-21177 (West 1996).

[131] *See* 16 U.S.C. § 1536(a)(2) (2000).

[132] *See id.* §§ 1536 (a)(2), 1538(a).

[133] *See id.* §§ 3371-3378 *and* 18 U.S.C. § 42 (2000).

last water.[134] As early as 1976, the Tasmania State Government in Australia reportedly required the open-ocean exchange of ballast water for inbound ships,[135] and in 1982 the Canadian Coast Guard, concerned about the potential for introducing toxic dinoflagellates into local mussel farms, prohibited the discharge of unexchanged ballast water in the vicinity of the Iles-de-la-Madelaine in the Gulf of St. Lawrence.[136] Between 1989 and 1993, Canada, Australia, New Zealand and the United Nations' International Maritime Organization (IMO) adopted guidelines on ballast water management.[137] These were in large part spurred by concerns over toxic dinoflagellates, based on studies of their introduction into Australia via ballast discharges.[138]

The IMO Guidelines were adopted by the IMO's Marine Environmental Protection Committee (MEPC) in 1991[139] and by the IMO as a whole in 1993.[140] These guidelines recommend

---

[134] The requested research was apparently never conducted. *See* J. M. Kelly, Transport of Non-native Organisms via Cargo Ship Ballast Water: Characterizing the Science/Policy Interface at 77-78 (1992) (unpublished Masters thesis, University of Washington) (on file with the University of Washington Library); C. A. Welch, The National Invasive Species Act of 1996: Response to a Global Concern (1996) (unpublished student paper, University of Washington School of Law) (on file with authors)).

[135] *See* R. J. Williams, et. al., *Cargo Vessel Ballast Water as a Vector for the Transport of Non-Indigenous Marine Species*, 26 ESTUAR. COAST. SHELF SCI. 409-420 (1988).

[136] *See* D. GAUTHIER & D. A. STEEL, CAN. MANUSCR. REP. FISH. AQUAT. SCI., NO. 2380, A SYNOPSIS OF THE SITUATION REGARDING THE INTRODUCTION OF NONINDIGENOUS SPECIES BY SHIP-TRANSPORTING BALLAST WATER IN CANADA AND SELECTED COUNTRIES 5 (1996).

[137] Locke et al. 1991 *supra* note 74, at App. A. *See also* AQIS, *Report No. 4 supra* note 8, at 114-121. *See, e.g.,* NEW ZEALAND MINISTRY OF FISHERIES, IMPORT HEALTH STANDARD FOR SHIPS' BALLAST WATER FROM ALL COUNTRIES (1998).

[138] See G. M. Hallegraeff, et al., *Microalgal Spores in Ship's Ballast Water: A Danger to Aquaculture, in* TOXIC MARINE PHYTOPLANKTON 475-480 (E. Granéli, et al., eds., 1990); G. M. Hallegraeff & C. J. Bolch, *Transport of Toxic Dinoflagellate Cysts Via Ships' Ballast Water,* 22(1) MARINE POLLUTION BULLETIN 27-30 (1991); G. M. Hallegraeff & C. J. Bolch, *Transport of Diatom and Dinoflagellate Resting Spores in Ships' Ballast Water: Implications for Plankton Biogeography and Aquaculture*, 14(8) J. PLANKTON RES. 1067-1084 (1992); C. J. S. Bolch & G. M. Hallegraeff, *Ballast Water as a Vector for the Dispersal of Toxic Dinoflagellates, in* NONINDIGENOUS ESTUARINE AND MARINE ORGANISMS (NEMO), PROCEEDINGS OF THE CONFERENCE AND WORKSHOP 63-67 (U. S. DEP'T OF COMMERCE & NOAA, Seattle, WA,1994).

[139] *See* MEPC Resolution (50)31, adopted July 4, 1991.

[140] *See* IMO Resolution A.774(18), adopted November 4, 1993.

the exchange of coastal ballast water in water at least 2,000 meters deep, along with various operational procedures related to loading and discharging ballast water and sediment. The Guidelines note that Member States or their Port State Authorities may adopt ballast water or sediment management requirements, or may develop shore reception facilities for disposing of ballast water and ballast sediment and implement fees for their use. The Guidelines themselves, however, are entirely voluntary.

In 1994, MEPC established a Working Group on Ballast Water to consider potential ballast water regulations to be proposed as an annex to the Convention on Pollution from Ships (MARPOL).[141] Even if effective regulations should be included in the proposed annex,[142] it would still take many steps and potentially a very long time before the regulations were adopted and implemented at the national level. First the work on drafting the proposed annex (which has taken five years so far) would need to be completed. Then the MEPC would have to adopt the proposed annex, followed by the IMO as a whole. For the United States, the executive branch of the federal government would decide whether to support the proposed annex at these stages. After adoption by the IMO, the annex would then need to be ratified by IMO member states before it entered into force.[143] Such ratification is often neither prompt nor ulti-

---

[141] Report of the Working Group on Ballast Water convened during MEPC 42, MEPC 43/4 (Jan. 5, 1999) [hereinafter MEPC 43/4]. The Convention, adopted in 1973, along with the Protocol of 1978, are commonly known as MARPOL. MEPC has also considered proposing ballast water regulations as amendments to an existing annex to MARPOL, or as a new Convention (MEPC 43/4).

[142] The current draft of the proposed annex requires open-ocean exchange of ballast water, with treatment of ballast water as an optional alternative. An annex requiring treatment of ballast water appears very unlikely at this time.

[143] The necessary conditions for IMO treaties or annexes to enter into force are set by the Conference convened to adopt the instrument. For example, MARPOL was designed to take effect 12 months after it was ratified by at least 15 member states controlling at least 50% of the world's gross tonnage of merchant shipping. Depending on the treaty, non-ratifying member states may or may not be bound by the treaty provisions. Telephone Interview with Dennis Nixon, Professor of Maritime Law, University of Rhode Island (Nov. 1999). The current draft of the proposed annex also allows a Port State, or multiple Port States through Regional Agreements, to opt out of adopting and implementing the regulations for waters within their jurisdictions. *See,*

mately assured.[144] For the United States, that decision would be made by the Senate.

Once the annex was in force, any elements of the annex that required implementation by Port States would in practice not go into effect until the Port States drafted, adopted and, finally, implemented appropriate statutes and regulations.[145] Thus, although ideally the transport of exotic organisms in ballast water should ultimately be managed through the development and implementation of comprehensive international regulations, the length of time this is likely to take and the urgency of the problem suggest that national, regional or local regulations may be necessary in the interim.

2. *Federal Law*

In the United States concern over ballast water arose with the discovery of zebra mussels in the Great Lakes in 1986, which had apparently been introduced through ballast water discharges.[146] The zebra mussel had long been recognized as a nuisance species in Europe, fouling structures and clogging water systems, and its population exploded in the Great Lakes bringing environmental and economic disruption.[147] In November 1990 the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA)[148] was signed into law. NANPCA set voluntary guidelines, modeled on the IMO Guidelines, for bal-

---

e.g., Proposed Amendments and Comments supra note 123. *See also Regional Agreements* MEPC 43/3 at Annex 2.

[144] For example, the Convention on the Law of the Sea was adopted by the IMO with U. S. support and after considerable U. S. input on the language in the Convention, in 1982, but it has not yet been ratified either by the United States or by a sufficient number of IMO member states. Telephone Interview with Dennis Nixon, Professor of Maritime Law, University of Rhode Island (Nov. 1999).

[145] This too may take several years. For example, work on drafting the National Invasive Species Act (described in the next section) was underway at least by the fall of 1995. The bill was introduced in March 1996 and signed into law in October 1996. The implementing regulations were finally published in May 1999, an elapsed time of over three and a half years.

[146] *See generally* OTA, *Harmful Non-Indigenous Species in U.S supra* note 31.

[147] *See* discussion *supra* Part I.B.

[148] *See* 16 U.S.C. §§ 4701-4751 (2000).

last water management by ships arriving from outside the Exclusive Economic Zone (EEZ)[149] and entering the Great Lakes. The voluntary guidelines were published in March 1991 and became mandatory requirements in May 1993.[150]

These guidelines required ships to exchange their ballast water in the open ocean before discharging it into the Great Lakes, or to conduct alternative treatments that were determined to be as effective.[151] Additional support for these regulations resulted from the discovery in 1991 that a strain of epidemic cholera was being carried in ballast water from South America to the U. S. Gulf Coast, where it was found in oysters and fish.[152] In early 1995, the mandatory ballast water regula-

---

[149] The EEZ extends to 200 miles from the U. S. coast.

[150] Ballast Water Management for Vessels Entering the Great Lakes, 58 Fed. Reg. 18,330-18,334 (Apr. 8, 1993). NANPCA had directed that mandatory regulations be issued within 24 months of enactment of the statute, by November 29, 1992, but they were not published until April 8, 1993 and did not take effect until May 10, 1993. The regulations authorize the Coast Guard to prohibit a vessel's operation on the Great Lakes () or revoke its clearance if it is not in compliance. *See* 33 C.F.R. § 151.1506 (2000) *and* 33 C.F.R. § 151.1508 (2000). Violation of these regulations carries a maximum civil penalty of $25,000 per day or a criminal charge of a class C felony which carries with it a maximum penalty of 12 years in prison and a $250,000 fine for an individual or a $500,000 fine for a company. *See* K. Weathers & E. Reeves, *The Defense of the Great Lakes Against the Invasion of Nonindigenous Species in Ballast Water*, 33(2) MARINE TECHNOLOGY 92, 95 (1996) [hereinafter Weathers & Reeves].

[151] NANPCA allows the use of alternative ballast water management methods if the Secretary of Transportation determines that these methods "are as effective as ballast water exchange in preventing and controlling infestations of aquatic nuisance species." NANPCA § 1101(b)(2)(B)(iii). There have been no such determinations made or requested. However on four occasions the Coast Guard has allowed ships not in compliance with the regulations to conduct one of the following *ad hoc* alternative treatments: adding salt in the form of liquid sodium chloride (not likely to be allowed again, according to the Coast Guard), adding chlorine as liquid chlorine or sodium hypochlorite, and heating the water (a capability that few vessels possess). *See* L. V. Kabler, *Ballast Water Invaders: Breaches in the Bulwark*, 1(3) AQUATIC NUISANCE SPECIES DIGEST 25, 34-35 (1996); Weathers & Reeves *supra* note 150, at 92-100. *See generally* E. Reeves & U.S. COAST GUARD *supra* note 67.

[152] *See* S. A. McCarthy, et al., *Toxigenic* Vibrio cholerae *O1 and Cargo Ships Entering Gulf of Mexico*, 339 LANCET 624-625 (1992); S. A. McCarthy & F. M. Khambaty, *International Dissemination of Epidemic* Vibrio Cholerae *by Cargo Ship Ballast and Other Nonpotable Waters*, 60(7) APPL. ENVI. MICROBIOL, 2597-2601 (1994).

tions were amended to include ships entering the upper Hudson River. [153]

In October 1996, the National Invasive Species Act (NISA)[154] became law. NISA continued the mandatory regulations for the Great Lakes and upper Hudson River, and added similar voluntary guidelines for the rest of the country,[155] along with record-keeping requirements.[156] However, unlike NANPCA, in which the voluntary guidelines for the Great Lakes automatically become mandatory within two years of enactment, under NISA the voluntary guidelines that apply to the rest of the country will remain voluntary unless the Secretary of Transportation determines that they are not being complied with or are ineffective.[157] NISA requires that an initial review and de-

---

[153] *See* 16 U.S.C. 4701-4751. (directs that NANPCA's mandatory requirements be applied to vessels entering the Hudson River north of the George Washington Bridge after January 30, 1995). The objective was to provide further protection to the Great Lakes, since organisms established in the upper Hudson River could enter the Great Lakes via the Erie Canal. *See* Ballast Water Management for Vessels Entering the Hudson River, 59 Fed. Reg. 67,632-67,634 (Dec. 30, 1994).

[154] *See* 16 U.S.C. §§ 4701-4751 (2000).

[155] *See* Implementation of the National Invasive Species Act of 1996, 64 Fed. Reg. 26,672-26,690 (May 17, 1999). These guidelines recommend that ships exchange their ballast water outside the EEZ or in other designated areas, or employ alternative ballast water management methods that are determined to be as effective. Passenger vessels with treatment systems designed to kill aquatic organisms in ballast water, and crude oil tankers engaged in coastwise trade were exempted from the guidelines.

[156] Under NANPCA and NISA, the record-keeping and reporting requirements for ship's ballast water have become more precisely codified over time. In 1991, NANPCA said nothing directly about ships' record-keeping, but ordered the Secretary of Transportation to "provide for sampling procedures to monitor compliance with the requirements of the regulations" which were to be promulgated for vessels bound for the Great Lakes from overseas. Under this authority, in 1993 these vessels (later including vessels bound for the upper Hudson River) were required to provide, on request of the Coast Guard, information including the volume and salinity of ballast water expected to be discharged into U. S. waters and any ballast water exchange conducted. *See* Ballast Water Management for Control of Nonindigenous Species in the Great Lakes and Hudson River, 33 C.F.R. § 151.1516 (2000). In 1996, NISA required vessels bound for all U. S. waters from overseas to maintain ballast water records on board and make them available for inspection on request. In 1999 these vessels were required to provide somewhat more detailed information to the Coast Guard by a specified point or time before entering port (for ships bound for the Great Lakes or upper Hudson River) or before leaving the first port of call (for vessels entering other waters), and a Ballast Water Reporting Form was provided for this information. *See* 33 C.F.R. §§ 151.2040, 151.2045.

[157] *See* Whalin, *Nuisance Nonindigenous Species supra* note 5, at 123-124.

termination regarding compliance and effectiveness be completed within four years of the statute's enactment, but at the current time, three years after enactment, the process is already over a year and a half behind schedule.[158]

Furthermore, it appears that the data being collected by the Coast Guard are not adequate to assess either compliance or effectiveness. These data consist of information provided by the ships on Ballast Water Reporting Forms[159]—in which a ship reports on whether it has conducted an open-ocean exchange—and Coast Guard measurements of the salinity of the ballast water carried by some arriving ships. Although some past reports have based assessments of the rate of compliance on ships' statements about having conducted exchanges, [160] the available evidence indicates that these statements are generally unreliable. For example, an Australian test that checked ships' claims of conducting a full exchange against the ships'

---

[158] Despite Congress' direction that voluntary guidelines were to be issued within one year of enactment (by October 26, 1997), draft guidelines were not published for public comment until April 1998. *See* Implementation of the National Invasive Species Act of 1996, 63 Fed. Reg. 17,782-17,791 (Apr. 10, 1998) (to be codified at 33 C.F.R. pt. 151). The final guidelines were not published until May 1999, 19 months after the date mandated by NISA. *See* 64 Fed. Reg. 26,672-26,690 (May 17, 1999) (to be codified at 33 C.F. R. pt. 151). NISA also directed that criteria for determining the adequacy of compliance with and effectiveness of the guidelines were to be submitted to the Secretary of Transportation within 18 months of enactment, or by April 26, 1998; but the committee created to develop recommendations for criteria is not scheduled to submit these recommendations to the Aquatic Nuisance Species Task Force until May of 2000. *See* AQUATIC NUISANCE SPECIES TASK FORCE, BALLAST WATER PROGRAM EFFECTIVENESS AND ADEQUACY COMMITTEE: REQUIREMENTS AND IMPLEMENTATION CONSIDERATIONS (April 24, 1999). The Task Force will then decide on the criteria and submit them to the Secretary, but no schedule has yet been set for submission. Telephone Interview with Sharon Gross, U.S. Fish & Wildlife Service (Sept. 1999).

NISA directs the Secretary of Transportation to determine the adequacy of compliance and effectiveness, within three years of the issuance of guidelines, and within four years of enactment (that is, by October 26, 2000). However, since the guidelines were not issued until May of 1999 it is unlikely that this determination will be made before May 2002. If the Secretary then determines that either compliance or effectiveness is inadequate, mandatory regulations are to be promulgated promptly.

[159] *See, e.g.*, 33 C.F.R. 151 (2000) Subpart D, Appendix.

[160] *See, e.g.*, A. Locke, et al., *Effectiveness of Mid-Ocean Exchange in Controlling Freshwater and Coastal Zooplankton in Ballast Water*, CAN. TECH. REP. FISH. AQUAT. SCI., No. 1822 (1991); D. GAUTHIER & D. A. STEEL, CAN. MANUSCR. REP. FISH. AQUAT. SCI., NO. 2380, A SYNOPSIS OF THE SITUATION REGARDING THE INTRODUCTION OF NONINDIGENOUS SPECIES BY SHIP-TRANSPORTING BALLAST WATER IN CANADA AND SELECTED COUNTRIES 6, 24, 44 (1996).

electrical records found that 24% of the ships appeared to have done no exchange, another 18% appeared to have done a partial exchange of less than 50%, and only 30% appeared to have done the full exchange that was claimed.[161]

Given the doubtful reliability of ships' statements about ballast exchanges, it is critical that regulators independently test whether exchanges have been conducted. To this end the Coast Guard measures the salinity of ballast water on some arriving ships, but this provides a limited test at best. Open-ocean waters, where ballast exchange is supposed to take place, typically contain about 3.4 to 3.7 percent salt. If a ship arrives in port with ballast water with a substantially different salt content, this would indicate that the ship had not done an adequate ballast exchange. However, this test is most effective when the salinity of the initial ballast water (prior to exchange) is very different from that of the open ocean, and is largely or completely ineffective when the initial salinity is close to that of the open ocean, which will be true for ballast water loaded at many ports. Thus, salinity tests cannot provide a reliable es-

---

[161] Memorandum from Penny Lockwood, Former Manager, Australia Ballast Water Program, to the Pacific Coast Ballast Water Group (July 4, 1999) (summarizing her presentation to the Group's meeting at the Port of Oakland on June 17, 1999) (on file with authors). This method of checking ships' ballast reports against electrical records is called the Newcastle method after the Australian port where it was first tried. While some of the inconsistencies between the ships' statements and their electrical records were apparently due to misunderstandings about what constitutes a full ballast exchange, the large number of discrepancies and the number of ships that apparently conducted no exchange at all is consistent with anecdotal and documentary evidence of ships providing false statements about their activities in order to satisfy regulatory requirements. For example, in 1994 a ship entering the Great Lakes reported to the Coast Guard that it had completed a full ballast exchange at sea; however, on inspection, the Coast Guard found that it carried freshwater ballast, apparently having arrived from the Congo River without any exchange. *See* L. V. Kabler, *Ballast Water Invaders: Breaches in the Bulwark*, 1(3) AQUATIC NUISANCE SPECIES DIGEST 25, 34-35 (1996); K. Weathers & E. Reeves, *The Defense of the Great Lakes Against the Invasion of Nonindigenous Species in Ballast Water*, 33(2) MARINE TECHNOLOGY 92-100 (1996)). In 1996 a ship arriving in San Francisco Bay reported to the Coast Guard that it had treated its ballast water with chlorine to kill the exotic organisms in it, but tests failed to reveal any trace of chlorine in the water. Telephone Interview with U. S. Coast Guard Marine Safety Office–San Francisco Bay (1999). In 1997, 59 ships entered the Great Lakes from overseas and reported to the Coast Guard that they had conducted a ballast water exchange as required by NANPCA, but the ballast salinities for at least 13% of the ships were inconsistent with that claim. *See* E. Reeves & U.S. COAST GUARD *supra* note 67, at 11-12.

timate of the rate of compliance; they can at most provide an estimate of the minimum rate of noncompliance.[162]

With the data now being gathered, the issue of effectiveness will, if anything, be even harder to assess than compliance. Though not defined in the statute, effectiveness presumably refers to the degree to which the voluntary guidelines reduce the release or establishment of exotic species. Since neither the release nor the establishment of these species is being systematically monitored, a direct assessment of effectiveness will be impossible. Theoretically, one could calculate the effectiveness of the guidelines in reducing the rate of release of exotic species by combining data on the effectiveness of individually monitored exchanges with information on the rate of compliance and the volume of shipping—but as noted above, the data needed to assess the rate of compliance are not being gathered.

3. *California Law*

California's recent legislative involvement with the management of ballast water began with a 1990 State Assembly resolution which found that introductions of exotic organisms in ballast water threatened sport and commercial fisheries and which asked the U. S. Coast Guard to prohibit "the dumping of ballast water originating in foreign ports in any west coast

---

[162] While it may be advisable for the Coast Guard to employ the Newcastle method in its monitoring efforts, in the end this also is not an independent test of whether a ship has conducted a ballast water exchange, because a ship's electrical records can be falsified to support such a claim. Thus it is impossible for this method to distinguish between a ship that has conducted an exchange and truthfully reports it, and a ship that falsely claims to have conducted an exchange and consistently falsifies its records in support. Like salinity tests, the Newcastle method can at best provide a minimum estimate of the rate of noncompliance. Independent tests that are based on the analyzing the biota in the ballast water. *See, e.g.,* Christopher Badger, Harbour Master, Port of Vancouver, "Mandatory Ballast Water Exchange—The Vancouver Solution ," Presentation at the Eighth International Zebra Mussel and Aquatic Nuisance Species Conference, Sacramento, CA (March 16-19, 1998); Deborah Tanis, Review and Recommendations of Ballast Water Exchange Verification Technologies and Measurement Techniques (Oct. 1998) (discussing the chemical and physical characteristics of the ballast water) (unpublished manuscript on file with the U.S. Department of Transportation and U. S. Coast Guard). It is not yet clear whether these types of tests will prove to be any more effective than salinity tests.

river, estuary, bay or coastal area."[163] In 1992, California passed a bill[164] that also found that fisheries were threatened by ballast water introductions of exotic organisms and that "the people of the state have a primary interest in the regulation of the dumping of ballast water originating in foreign ports in any river, estuary, bay or coastal area of this state." [165] However, the bill contained no mechanisms for regulating ballast water dumping, and merely adopted the voluntary IMO guidelines and directed that ballast management practices be monitored,[166] although the monitoring was never conducted.[167]

In 1999, California adopted the first state law in the United States to regulate ballast water discharges specifically in order to prevent the introduction of exotic organisms.[168] Initial versions of the bill regulated ballast water discharges through waste discharge permits in accordance with the state's Porter-

---

[163] California Joint Assembly Resolution No. 88—Relative to Ballast Water (filed with the Secretary of State, July 12, 1990). Washington considered, and Alaska adopted, similar resolutions. *See, e.g.,* Washington Senate Joint Memorial 8002—Requesting that the Coast Guard Prohibit Dumping of Ballast Water in United States Waters (1991). *See also* Alaska Legislative Resolve No. 85, Relating to the Discharge of Ballast Water by Vessels Entering the Waters of Alaska (signed by the Governor, June 8, 1992).

[164] *See* CAL. FISH & GAME CODE §§ 6430-6439 (West 1994).

[165] *See id.* § 6430.

[166] It required all operators of vessels carrying ballast water and entering a California port after January 1, 1994 to complete a form describing their ballast water management practices. The Department of Fish & Game was to administer this monitoring program and report of the Legislature on the rate of compliance with the IMO guidelines by January 1, 1995. O'Shea and Cangelosi's description of this statute as *requiring* ballast water exchange was apparently a misreading. *See* S. O'Shea & A. Cangelosi, *Trojan Horses in Our Harbors: Biological Contamination From Ballast Water Discharge*, 27 U. TOL. L. REV. 381, 393, 395 (1996).

[167] The statute was reportedly regarded as an excessive burden on interstate commerce and, therefore, unconstitutional under the Dormant Commerce Clause. *See id.* 393. In fact, this appears not to be the case. *See* discussion *infra* Part II.A.4. Regardless, after five years passed without any monitoring being conducted, the statute was amended in 1997 to instead allow the Department of Fish & Game to obtain information on ballast management practices from the U. S. Coast Guard, which didn't actually begin collecting such information (under NISA) until mid-1999. Senate Bill 1003, *amending* CAL. FISH & GAME CODE §§ 6433, 6434 and 6439, Chapter 490 (Sept. 25, 1997).

[168] *See* CAL. PUB. RES. CODE §§ 71200-71271 (West 2000).

Cologne Water Quality Control Act,[169] and established an interim period during which open-ocean ballast water exchange or alternative treatment would satisfy permit requirements, followed by the imposition of more stringent standards potentially requiring ballast water treatment or involving a standard of zero discharge of exotic organisms.[170] As passed, however, the law makes no reference to waste discharge permits, providing only for an interim period of required ballast exchange or alternative treatments until Jan. 1, 2004.[171]

The California law largely parallels NISA, but with mandatory rather than voluntary ballast exchange. Its main provisions require vessels that are carrying ballast water into the waters of the state after operating outside the EEZ,[172] to retain the water on board, to conduct an open-ocean exchange, or to employ an alternate approved treatment method that is at least as effective as ballast exchange,[173] and to report to the State Lands Commission (SLC) certain information on the ballast water carried and exchanged.[174] As in NISA, there is a safety exemption.[175] The SLC is to monitor compliance[176] and to submit to the Legislature by Sept. 1, 2002 an assessment of the compliance with and the effectiveness of the law, along with recommendations for improvements.[177] In addition, the California Department of Fish and Game (CDFG) is to submit to the Legislature by Dec. 31, 2002 information on "baseline conditions" and on the location and range of exotic organisms in the coastal and estuarine waters of the state, for the purpose,

---

[169] *See* discussion *infra* Part II.B.2.a (Porter –Cologne Act).

[170] Assembly Bill 703 as introduced on Feb. 14, 1999 through amendments made in the Senate on Aug. 17, 1999.

[171] *See* CAL. PUB. RES. CODE §§ 71200-71271.

[172] Certain vessels are exempted. *See id.* § 71202.

[173] *See id.* § 71204.

[174] *See id.* § 71205. This is the same information required to be reported to the Coast Guard under NISA and is submitted on the same form.

[175] *See id.* at § 71203.

[176] *See id.* § 71206.

[177] CAL. PUB. RES. CODE § 71212 (West 2000).

among other things, of determining alternative discharge zones;[178] and the State Water Resources Control Board (SWRCB) is to submit to the Legislature by Dec. 31, 2002 an evaluation of "alternatives for treating and otherwise managing ballast water for the purpose of eliminating the discharge of nonindigenous species into the waters of the state or into waters that impact the waters of the state."[179]

Noncompliance with reporting requirements could incur penalties of up to $500 per day, and knowingly filing false reports with the intent to deceive, or other intentional or negligent violations could incur penalties of up to $5000 per day.[180] It is questionable whether such modest penalties will alter ships' behavior and induce them to exchange or treat their ballast water. Any penalties collected plus fees of up to $1,000 for each voyage involving transit outside the EEZ are to be deposited in an account and used to implement the law.[181]

This law further directs that "unless required by federal law, a state agency, board, commission, or department shall not, prior to January 1, 2004, impose any requirements that are different from those" specified by it.[182] However, the types of studies and reports mandated by this law suggest that more stringent requirements may be imposed by state agencies (including boards, commissions and departments) or by the Legis-

---

[178] *See id.* § 71211. NISA also anticipates the designation of alternative, backup exchange or discharge zones, but more have been designated. *See* 16 U.S.C. § 4712 (2000). The scientific review conducted pursuant to NISA indicates that there is no valid scientific basis for designating such zones within protected waters or within the waters of the state. Letter from Bill Harvey, Chair, Western Regional Panel to Cathleen Short, Assistant Director–Fisheries, U.S. Fish & Wildlife Service, and Sally. J. Yozell, Deputy Assistant Director for Oceans and Atmosphere, NOAA (May 12, 1999) (on file with authors).

[179] *See* CAL. PUB. RES. CODE § 71210.

[180] *See id* § 71216.

[181] *See id.* § 71215. The SLC has proposed fees of $600 per vessel voyage, but shipping industry representatives are protesting these fees, arguing that they should be no more than $400 per vessel voyage. Telephone Interview with Marian Ashe, California Department of Fish & Game (Jan. 2000).

[182] *See id.* § 71207(a).

lature after this interim period.[183] For example, several possible approaches to regulating ballast water discharges under existing state laws are discussed in the following pages. While implementation of these approaches by state agencies prior to Jan. 1, 2004 is prohibited, it would be fully consistent with the directives and objectives of this bill for agencies to investigate and prepare for implementation of those approaches after that date. In addition, implementation of federal law requirements by authorized state agencies is not restricted during the interim period, nor is there any restriction on the ability of California courts to impose penalties or injunctions based on a finding that discharges are inconsistent with either a state or federal law.[184]

---

[183] As noted above, these studies and reports include an assessment by the CDFG of the extent of the exotic species problem in California coastal waters, which could justify more vigorous regulation of ballast discharges; an assessment and recommendations by SLC regarding compliance with and effectiveness of the current measures, which could recommend more aggressive enforcement or a different regulatory approach; an evaluation by SWRCB of ballast water treatment methods and additional research on developing treatment methods to reduce or eliminate the discharge of exotic species, which could demonstrate the feasibility of regulations that required treatment or that set higher standards (such as a zero discharge standard) for exotic organisms in ballast discharges. *See* CAL. PUB. RES. CODE §§ 710-71213 (West 2000). This law thus appears to be an interim measure adopted by the Legislature in order to give the agencies time to determine a more effective approach to be implemented at the end of the interim period.

[184] Other states have also begun to adopt laws that regulate ballast water discharges, inspired in part by the California law, though differing in some important respects. Washington House Bill 2466, signed into law on March 24, 2000, prohibits ships from discharging into state waters any ballast water from outside the coastal region from the Columbia River on Washington's southern border to the north end of the Strait of Georgia in British Columbia, unless the ship has conducted an open-ocean exchange. *See* State of Washington, Substitute House Bill 2466, Sec. 4 [hereinafter WA 2466]). There is a safety exemption, but after July 1, 2002 ships invoking the exemption will be required to treat their ballast water to standards that will be set by the state. WA 2466, Sec. 4(2). Ships will be required to report on their ballast water management, and as in the California law, the information required will likely be the same as that required under NISA and submitted on the same form (though unlike NISA, this reporting will be required of ships traveling to Washington from a U.S. port in Alaska or south of the Columbia River). WA 2466, Sec. 5(1). The Washington law is also generally similar to the California law in providing for sampling and monitoring of ballast water, in requiring certain studies and reports to the legislature, and in providing for the same very modest penalties for violations. *See generally* WA 2466. The Washington law differs in providing no funds to implement the law. *See* WA 2466, Sec. 7. In Michigan, a bill introduced in 2000 would prohibit vessels from operating on state waters if carrying ballast water from outside the state that had not been treated

4. Constitutional Limitations on State Regulation of Ballast Water Discharges

While states generally have significant discretion in adopting legislation to address the spread of exotic organisms, there are two constitutionally derived limitations on that authority. These limitations restrict state regulation that is preempted by federal law, under the Supremacy Clause of the U.S. Constitution,[185] and prohibit a state from excessively burdening interstate commerce, under the dormant commerce clause.[186] Although there are case precedents upholding a state's right to prevent exotic invasions and regulate ships' discharges, a recent Supreme Court decision suggests the need for a close look at the potential limitations on state regulation of ballast discharges.[187]

In deciding *United States v. Locke*, (previously entitled *International Association of Independent Tanker Owners (INTERTANKO) v. Locke*)[188] the Supreme Court found that Washington's oil tanker safety regulations relating to general navigation watch procedures, English language skills, training, and casualty reporting on oil tankers were preempted by Title II of the Ports and Waterways Safety Act of 1972, as amended by the Ports and Tanker Safety Act of 1978 (PWSA).[189] The Court explained that:

> The state laws now in question bear upon national and international maritime commerce, and in this area there is no beginning assumption that concurrent regulation by the State is a valid exercise of its police powers. Rather, we must ask whether the local laws in

---

"to destroy or remove all living biological organisms," and would require a permit for discharging any ballast water into state waters. Michigan SB-955, "A bill to amend the Natural Resources and Environmental Protection Act".

[185] U.S. Const. art. VI, cl. 2.

[186] *See, e.g.,* Newfound/Owatonna, Inc. v. Town of Harrison, 520 U.S. 564, 117 (1997). *See also* Pike v. Bruce Church, Inc., 397 U.S. 137, 142 (1970).

[187] *See* United States v. Locke, 529 U.S. 89 (2000).

[188] INTERTANKO v. Locke, 148 F.3d 1053 (1998).

[189] 46 U.S.C. §§ 3702-3719 (2000).

> question are consistent with the federal statutory structure, which has as one of its objectives a uniformity of regulation for maritime commerce.[190]

PWSA Title II "requires the Coast Guard to issue regulations addressing the design, construction, alteration, repair, maintenance, operation, equipping, personnel qualification and manning" of tanker vessels.[191] Despite this Title's broad reach and the federal objective of uniform regulation of maritime commerce, the Court nevertheless envisioned the possibility of some state role in regulating tanker vessels. While finding that PWSA Title II or other laws preempted four of Washington's regulations, the Court remanded twelve remaining regulations to the lower courts for further consideration.[192]

In a 1984 decision that the Supreme Court declined to review, the Ninth Circuit found that Alaska's requirement that oil tankers discharge oil-tainted ballast water at shore-side treatment plants was consistent with both the Clean Water Act (CWA) and PWSA Title II.[193] In making the latter finding, the Ninth Circuit principally relied on the Supreme Court decision in *Ray v. Atlantic Richfield Co.*, which determined that PWSA Title II had implicitly occupied the field in terms of regulating the design and construction of tanker vessels and therefore states could not require additional or different design or construction.[194] The Ninth Circuit, however, distinguished impermissible design and construction requirements from permissi-

---

[190] United States v. Locke, 120 S.Ct. 1135, 1148.

[191] *See id.* at 1138.

[192] *See id.* at 1150.

[193] *See* Chevron v. Hammond, 726 F.2d 483 (9th Cir. 1984), *cert. denied* 421 U.S. 1140 (1985).

[194] *See* Ray v. Atlantic Richfield Co., 435 U.S. 151, 160-161 (1978). Federal law can pre-empt local or state measures either explicitly or implicitly. Although the PWSA did not explicitly restrict state efforts to regulate the design or construction of tankers, the Supreme Court found that in adopting PWSA Congress implicitly intended to foreclose states from requiring different or more stringent requirements on tankers. *See id.* at 163. At the same time the Supreme Court overturned two determinations of preemption by the District Court, finding instead that state requirements for piloting of vessels engaged in foreign trade and for tug escorts of tanker vessels were not preempted by federal law. *See id.* at 152.

ble operational requirements such as de-ballasting at shoreside treatment plants, and upheld Alaska's effort to control discharges of polluted ballast water.[195] The Supreme Court now appears to have undermined this distinction in PWSA Title II when it rejected the Ninth Circuit's similar reasoning *U.S. v. Locke.*[196]

PWSA Title II, however, applies only to tanker vessels and not to all vessels generally,[197] and mandates regulations for the specific purpose of increasing the protection against hazards to life, property and the marine environment, and providing for navigation and vessel safety, that may be necessary in regard to tanker vessels.[198] PWSA Title II thus seems unlikely to preempt state regulations regarding the release of exotic organisms in ballast discharges by ships in general.

Federal statutes that are more clearly relevant to such state regulation also appear unlikely to impede it. For example, NISA explicitly states that nothing in the statute shall restrict states' authority to control exotic species,[199] and the Coast Guard emphasized this when issuing regulations.[200] Similarly,

---

[195] *See* Chevron v. Hammond, 726 F.2d 483, 487 (1984), *cert. denied.*

[196] United States v. Locke, 529 U.S. 89 (2000).

[197] *See* 46 U.S.C. § 3702 (2000). A "tank vessel" is defined as "a vessel that is constructed or adapted to carry, or that carries, oil or hazardous material in bulk as cargo or cargo residue, and that (A) is a vessel of the United States; (B) operates on the navigable waters of the United States; or (C) transfers oil or hazardous material in a port or place subject to the jurisdiction of the United States." 46 U.S.C. § 2101 (2000).

[198] *See* 46 U.S.C. § 3703(a). These regulations are to apply in addition to regulations prescribed under other laws that may apply to those vessels.

[199] "Nothing in this Title shall affect the authority of any State or political subdivision thereof to adopt or enforce control measures for aquatic nuisance species." 16 U.S.C. § 4725 (Supp. 2000). NISA goes further, and not only does not restrict state action but rather directs federal agencies to cooperate with states to minimize the risk of unintentional introductions, which are defined to include ballast water introductions. *See* NISA §§ 1003(17), 1202(c)(2). NISA also invites states to develop their own management programs for exotic species, including prevention of introductions and authorizes the granting of federal funds to implement the states' programs, up to 75% of the total cost. *See id.* § 1204(a) and (b).

[200] In adopting the current NISA regulations, the Coast Guard stated that "It has long been the Coast Guard's position that consistent standards of universal application, coupled with Federal initiatives to address unique concerns, are the best means of meeting local and national environmental goals with the least disruption to interna-

in adopting the CWA, Congress clearly intended that it serve only as a floor for water quality protection and that states retain the right to require a greater level of protection.[201] The express purpose of these laws was to provide states with significant discretion to adopt standards that are stricter than federal standards without fear that such actions would be preempted.

In considering whether state regulation of ballast discharges would violate the dormant commerce clause, the Supreme Court's decision in *Maine v. Taylor* is likely most relevant.[202] In that case, which addressed state regulations prohibiting the importation of exotic bait fish into the state,[203] the Supreme Court found that Maine had a legitimate interest in protecting its waters against exotic bait fish and restated the District Court opinion that:

> [T]he constitutional principles underlying the commerce clause cannot be read as requiring the State of Maine to sit idly by and wait until potentially irreversible environmental damage has occurred or until the scientific community agrees on what disease organisms are or are not dangerous before it acts to avoid such consequences.[204]

Accordingly, despite the recent Supreme Court decision invalidating certain state laws related to the operation of oil tankers,[205] which recognized the considerable federal interest in

---

tional maritime commerce...[t]he Coast Guard will try to maintain nationwide consistency in methods for control of invasive species...However, this regulation isn't intended to preempt any State, regional, or local efforts that exceed but do not conflict with the standards set forth in this rule." 64 Fed. Reg. 26,672, 26,674 (May 17, 1999) (to be codified at 33 C.F.R. pt. 151).

[201] *See* 33 U.S.C. § 1370 (1986). The relevance of the CWA to the regulation of ballast discharges is discussed in the next section of this article.

[202] Maine v. Taylor, 477 U.S. 131, 148 (1986).

[203] *See id.*

[204] *Id.*

[205] *See* United States v. Locke, 529 U.S. 89 (2000).

uniform regulation of maritime commerce,[206] states nonetheless appear to have significant discretion in adopting measures to control the discharge of exotic organisms in ballast water. Neither the dormant commerce clause nor the Supremacy Clause appear to provide an absolute bar to such measures. In particular the federal statutes that are most clearly relevant to these efforts, NISA and CWA, include strong saving clauses that leave the states substantial discretion to adopt and enforce regulations regarding the release of exotic organisms and pollution standards that are stricter than those adopted by the federal government.

B. REGULATING BALLAST WATER DISCHARGE AS A POLLUTANT DISCHARGE

1. Federal Law

a. The Clean Water Act

In 1972, Congress passed the Clean Water Act (CWA) with the aggressive goal that "the discharge of pollutants into the navigable waters be eliminated by 1985."[207] Although the CWA has hardly eliminated water pollution, it has substantially reduced point source discharges of pollutants into U. S. waters. The CWA is primarily implemented by the U. S. Environmental Protection Agency (EPA), and employs a number of interrelated strategies for restricting water pollution. Several of these are relevant to ballast water discharges of exotic organisms, but have been largely ignored by both federal and state entities.[208]

As in most states, California is authorized by the EPA to issue permits under state water quality laws that satisfy the requirements of the federal CWA. EPA, however, retains author-

---

[206] *See id.* at 1148.

[207] 33 U.S.C. § 1251(a)(1) (1986).

[208] *See* Whalin, *Nuisance Nonindigenous Species supra* note 5, at 89-101 (additional discussion of the application of the CWA to ballast water discharges of exotic organisms).

ity to veto a state-issued permit that it deems inconsistent with the CWA. In California, waste discharge permits are issued by the State Water Resources Control Board (SWRCB) and nine Regional Water Quality Control Boards (RWQCBs),[209] which are responsible for adopting water quality control plans that will achieve requirements under both the state's Porter-Cologne Water Quality Act and the CWA.[210]

i. The Discharge Permit Requirement

At the heart of the CWA is a prohibition against the discharge of any pollutant into the navigable waters of the United States from a point source absent a CWA permit.[211] Several factors indicate that this prohibition applies to the release of exotic organisms in ballast water discharged into either fresh water or nearshore ocean waters. First, the CWA broadly defines "pollutants" as including "biological materials,"[212] which therefore include exotic organisms, a reading supported by substantial case law.[213] Second, vessels are statutorily defined as point sources.[214] Finally, "navigable waters" are broadly de-

---

[209] Seven of the RWQCBs are responsible for coastal or port areas: North Coast RWQCB (Region 1), San Francisco Bay RWQCB (Region 2), Central Coast RWQCB (Region 3), Los Angeles RWQCB (Region 4), Central Valley RWQCB (Region 5), Santa Ana RWQCB (Region 8) and San Diego RWQCB (Region 9).

[210] *See* CAL. WATER CODE § 13142 (West 1992).

[211] *See* 33 U.S.C. § 1362 (12) (1996), *amended by* Pub. L. No. 106-284, 11 Stat. 870 (2000).

[212] *See id.* § 1362(6).

[213] *See* National Wildlife Federation v. Consumers Power, 862 F.2d 580, 585 (6th Cir. 1988) (acknowledging that live fish, if added to a water body, would qualify as pollutants under the CWA); DuBois v. U.S. Dept. of Agriculture, 102 F.3d 1273, 1299(1st Cir. 1996) (finding that the transferring water from one water body to another constituted a discharge of pollutants that required an NPDES permit because the water being transferred had different biological and chemical components that the receiving waters); Marine Environmental Consortium v. State of Washington, 1997 WL 394651 4 (May 27, 1997) (ruling of Washington Pollution Control Hearings Board that Atlantic salmon, were biological pollutants under the meaning of the Clean Water Act when released into the waters of the Pacific Northwest). *See* Whalin, *Nuisance Nonindigenous Species supra* note 5, at 90-94. As noted *infra* in Part II.B.1.a.ii., the states of Oregon and California have explicitly recognized that exotic organisms (including those discharged in ballast water) constitute a pollutant within the meaning of the CWA, by listing such organisms as water quality limiting pollutants under CWA §303(d). However, EPA Region 9, in reviewing the California listing, stated that exotic species are not a pollutant. *See infra* note 241.

[214] *See* 33 U.S.C. § 1362(14).

fined to include both inland water bodies such as rivers, estuaries and lakes as well as ocean waters extending out to three miles from shore.[215]

Congress explicitly recognized that CWA applies to ballast water discharges in 1990 and again in 1996, in language included in NANPCA and NISA.[216] Yet again, Congress made clear its intent that CWA's permit requirements apply to ballast water discharges when it amended the CWA in 1996 to narrowly exempt ballast water discharges from Armed Forces vessels from these requirements, but not ballast water discharges in general.[217]

Although the language of the CWA, case law and legislative history indicate that ballast discharges of exotic organisms require CWA permits, EPA regulations nevertheless purport to exempt ballast discharges from these requirements.[218] However, a group that includes conservationists, water industry associations, Native American tribes, and commercial and sport fishing interests from across the United States has argued that this exemption is illegal in a petition filed under the

---

[215] *See id.* *See also* Definition of Waters of the United States, 33 C.F.R. § 328.3 (2000).

[216] "The regulations issued under this subsection shall....not affect or supersede any requirements or prohibitions pertaining to the discharge of ballast water into the waters of the United States under the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq)." 16 U.S.C. § 4711(b)(2)(C) (2000). *See also* Whalin, *Nuisance Nonindigenous Species supra* note 5, at 92, 100-101.

[217] *See* Marine Sanitation Devices, 33 U.S.C. § 1322(n) (1986); 33 U.S.C. § 1362(6)(A) (1986), *amended by* Pub. L. No. 104-106, § 325(c)(3) (1996). The Senate Report on the bill stated that "[v]essels are sources of pollution under the Clean Water Act. Any discharge from a point source, including a vessel, into the waters of the United States is prohibited unless specifically permitted under section 402 or 404 of the Act." *See* Craig Johnston letter, *infra* note 220 for further discussion.

[218] *See* 40 C.F.R. § 122.3(a) (2000) stating that: "The following discharges do not require NPDES permits...discharge of sewage from vessels, effluent from properly functioning marine engines, laundry, shower, and galley sink wastes, *or any other discharge incidental to the normal operation of a vessel.*" (Emphasis added). The CWA defines "discharge incidental to normal operation of a vessel" to include ballast water. *See* 3 U.S.C. § 1322(a)(12)(A)(i) (1996), *amended by* Pub. L. No. 106-284, 11 Stat. 870 (2000).

Administrative Procedures Act.[219] In reply, EPA acknowledged that CWA permits could be used to control ballast discharges, and promised a decision on whether to remove the exemption by the spring of 2000.[220]

In deciding how to respond to the petition, EPA will have to consider how the courts would likely rule on a challenge to the current exemption. A similar EPA regulation exempting agricultural return flows from the CWA's permit requirements was roundly rejected by the D.C. Circuit Court. The Court found that "[t]he wording of the statute, legislative history, and precedents are clear: the EPA Administrator does not have the authority to exempt categories of point sources from the permit requirements of § 402."[221] There is little reason to believe that the exemption for ballast discharges would fare any better.[222]

---

[219] Letter from Craig N. Johnston, Attorney, Pacific Environmental Advocacy Center to Carol Browner, Administrator, U.S. Environmental Protection Agency (Jan. 13, 1999) (on file with authors).

[220] Letter from J. Charles Fox, Assistant Administrator, U.S. Environmental Protection Agency, to Craig N. Johnston, Attorney, Pacific Environmental Advocacy Center (April 6, 1999) (on file with authors). The letter stated that EPA would prepare a report on the mechanisms available under the CWA to regulate ballast discharges and a plan for eliminating the exemption of ballast discharge from CWA permit requirements. The report was to be released for public comment by Sept. 1, 1999, but as of this writing it had not been released. Interestingly, some ballast water has been regulated through CWA permits and California water quality law to prevent the release of exotic organisms. Since 1997, the San Francisco Bay RWQCB has issued waste discharge permits to dry docks (under both CWA § 402 and California's Porter-Cologne Water Quality Control Act) which prohibit the discharge of ballast water from ships controlled by the dry docks, even before they have entered the dry docks. *See* SAN FRANCISCO BAY RWQCB, WASTE DISCHARGE REQUIREMENT FOR PEGASUS INC., MARE ISLAND, SOLANO COUNTY (ORDER NO. 96-156, NPDES NO. CA0030040) *and* WASTE DISCHARGE REQUIREMENT FOR ASTORIA METAL COMPANY, HUNTERS POINT, SAN FRANCISCO COUNTY (ORDER NO. 98-101, NPDES NO. CA0028282). Ballast water from these ships is pumped directly into sewers and treated at municipal wastewater treatment plants. Telephone Interview with J. Huang, San Francisco Bay RWQCB (1998).

[221] Natural Resources Defense Council v. Costle, 568 F.2d 1369, 1376 (D.C. Cir. 1977). The EPA did not exempt ballast discharges in its initial proposed rule, but did so in the final rule in order to reduce administrative costs, reasoning that "[t]his type of discharge generally causes little pollution." 38(98) Fed. Reg. 13,528-13,530 (May 22, 1973). This exemption was thus adopted more than a quarter-century ago when there was little information available on the harmful effects of ballast discharges, and was based on the erroneous assumption that they are benign. Since there is now substantial scientific evidence of their impacts, and since EPA has concurred that they are the source of a priority pollutant causing impairment of San Francisco Bay, there would

If it is established that ballast water discharges into inland U.S. waters are subject to CWA's permit requirements, then prior to making such discharges shippers would be required to obtain a permit under Section 402 of CWA, the National Pollution Discharge Elimination System (NPDES).[223] In order to get an NPDES permit a discharger must meet several criteria. First, the discharge must be consistent with the protection of water quality standards established by states to protect all designated uses of the water body where the discharge would occur.[224] Second, the CWA's anti-degradation policy restricts discharges that would degrade high quality waters even where those waters would still be able to support designated uses.[225] Third, the discharge must be treated to the level that could be achieved with the best available technology.[226] If the discharges were to be made into ocean waters within three miles from shore, the discharge would also have to comply with Section 403 of the CWA, which basically holds NPDES permits to the requirements of the Ocean Dumping Act.[227] Because of these requirements along with the CWA's significant penalties[228] and citizen suit provision,[229] the CWA could become a powerful tool for addressing ballast water discharges of exotic organisms.

---

appear to be no factual basis for maintaining the exemption, even if it were found to be legal. *See supra* Parts I.B, I.C, and II.B.1.a.i and references therein.

[222] *See* Brent C. Foster, *Pollutants Without Half-lives: The Role of Federal Environmental Laws in Controlling Ballast Water Discharges of Exotic Species*, 30 ENVTL. L. (forthcoming 2000) [hereinafter Foster, *Pollutants Without Half-lives*].

[223] *See* 33 U.S.C. § 1362 (12) (1996), *amended by* Pub. L. No. 106-284, 11 Stat. 870 (2000).

[224] Designated uses are set by states for each water body in the state and include uses such as fish and wildlife propagation, domestic water supply, recreation, or shellfish production, but must at least include all existing uses. *See* 40 C.F.R. § 131.11(h)(1) (2000).

[225] *See* 40 C.F.R § 131.12(a)(1).

[226] *See* 33 U.S.C. § 1311(b)(2)(A) (1986).

[227] *See* discussion *infra* Part II.B.1.b.

[228] *See* 33 U.S.C. § 1319 (c)(2) (providing for civil penalties of up to $25,000 a day, and larger penalties for knowing violations).

[229] *See id.*. § 1365.

Because exotic organisms are capable of reproducing and thereby increasing in abundance and expanding in range, the discharge of even a small number of exotic organisms could be inconsistent with the protection of designated uses. Accordingly, the Clean Water Act may actually prohibit the discharge of exotic organisms into aquatic ecosystems entirely. This conclusion becomes difficult to avoid when faced with the challenge of trying to identify a level of discharge of exotic organisms greater than zero that would be consistent with the CWA. In fact, the only governmental body that has attempted to identify a level of exotic species releases that would be consistent with the protection of water quality standards necessary to support designated and existing uses, the San Francisco Bay Regional Water Quality Control Board (RWQCB), appears ready to conclude that no additional input of exotic organisms can be permitted into San Francisco Bay consistent with the CWA.[230] The requirements in Section 303(d) of the CWA triggered this assessment and are relevant to ballast water-caused biological pollution in a number of respects.

ii. Requirements for Water Quality Limited Water Bodies under Section 303(d)

Section 303(d) of the CWA requires states to identify water bodies that are not meeting water quality standards set by the state and approved by EPA.[231] Water quality standard violations may include a violation of specific numeric criteria established to protect existing uses of the water body or may be caused by the fact that existing uses, such as fish or wildlife reproduction, are being impaired.[232] If, for example, high water temperatures due to industrial discharges were impairing shellfish production in a given water body or simply exceeding a maximum temperature standard set to protect shellfish production then that water body should be listed as water quality limited for temperature.

---

[230] *See EPA Adds S.F. Bay Dioxins and Other Pollutants and Streams to State's Section 303(d) List,* 11(12) CALIFORNIA ENVIRONMENTAL INSIDER (Nov. 17, 1998).

[231] *See* 40 C.F.R. § 130.7(c) (2000).

[232] *See id.* § 130.2(d). *See also* 33 U.S.C. § 1313(c)(2)(A) (1986).

Once a water body is identified as not meeting water quality standards, the state must then establish a total maximum daily load (TMDL) for the given pollutant in that water body,[233] based on the maximum amount that can be released consistent with the protection of designated uses. [234] Once established, any future NPDES permits must be consistent with the TMDL.[235] Although there have been a number of problems in implementing the TMDL program, it does have the potential to reduce the discharge of specific pollutants.

At least two states have listed exotic organisms as water-quality limiting pollutants under Section 303(d). Oregon listed three exotic plant species in 1996 and 1998.[236] California applied Section 303(d) to ballast water discharges in 1998, when the San Francisco Bay RWQCB listed San Francisco Bay as water quality limited for exotic organisms released in ballast water, designating these pollutants as a high priority for the development of TMDLs,[237] which was subsequently approved by the SWRCB.[238] These state boards, used to setting discharge

---

[233] *See* 40 C.F.R. § 130.7(c)(1).

[234] *See id.* § 130.2(i).

[235] *See* 33 U.S.C. § 1311(c)(1)(C) (1986).

[236] Brazilian waterweed (*Elodea densa*), Eurasian watermilfoil (*Myriophyllum spicatum*) and Fanwort (*Cabomba carolina*) from the southeastern United States were each listed as water quality limiting for one of ten lakes, variously interfering with beneficial uses such as boating and swimming and in some cases requiring the application of herbicides. *See* OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY, WATER QUALITY LIMITED STREAMS 303(D) LIST (1994/96 and 1998 lists) (last visited Nov. 12, 2000) <http://waterquality.deq.state.or.us/wq/303dlist/303dpage.htm>.

[237] The RWQCB's proposed list did not at first include exotic species. *See* CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, SAN FRANCISCO BAY REGION, PROPOSED REVISIONS TO SECTION 303(D) LIST AND PRIORITIES FOR DEVELOPMENT OF TOTAL MAXIMUM DAILY LOADS (TMDLS) FOR THE SAN FRANCISCO BAY REGION (Jan. 7, 1998). Exotic species were added in response to comments from the San Francisco BayKeeper. Letter from Michael R. Lozeau, San Francisco BayKeeper to Thomas Mumley, Senior Water Resources Control Engineer, California Regional Water Quality Control Board, San Francisco Bay Region (Feb. 2, 1998). The RWQCB proposed to begin development of a TMDL for exotic species in 1998 and complete it by 2003. *See* CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, SAN FRANCISCO BAY REGION, STAFF SUMMARY REPORT, 1998 WATER QUALITY ASSESSMENT OF IMPAIRED WATER BODIES IN THE SAN FRANCISCO BAY REGION app. A (Feb. 18, 1998).

[238] *See* SAN FRANCISCO REGION WATER QUALITY CONTROL BOARD SECTION, 303(D) LIST OF IMPAIRED WATER BODIES AND PRIORITIES FOR DEVELOPMENT OF TOTAL MAXI-

standards for a range of hazardous pollutants ranging from carcinogens to heavy metals, are now faced with the task of establishing a TMDL for exotic organisms.[239]

Unlike conventional pollutants, however, establishing a TMDL for exotic organisms may be relatively simple given the potential for a discharge of even a small number of organisms to grow into a multi-billion dollar ecological infection. As noted, the San Francisco Bay RWQCB appears poised to set a standard of zero discharge of exotic species into San Francisco Bay.[240] Because designated uses in San Francisco Bay are already severely affected as a result of past invasions and since those effects continue to worsen, it would be difficult to argue that allowing the discharge of additional exotic organisms would be consistent with the CWA's water quality requirements.

iii. Dredge and Fill Permitting Under Section 404

The CWA regulates the discharge of dredged or fill material into U.S. waters under Section 404 instead of through Section 402's NPDES program.[241] Section 404 permits are required

---

MUM DAILY LOADS FOR THE SAN FRANCISCO BAY REGION, FINAL STAFF REPORT (Mar. 9, 1998). *See also EPA Adds S.F. Bay Dioxins and Other Pollutants and Streams to State's Section 303(d), List, 11(12)*, CALIFORNIA ENVIRONMENTAL INSIDER (Nov. 17, 1998).

[239] In reviewing the state's 303(d) list, EPA Region 9 stated that exotic species are not a pollutant and that the CWA therefore does not require that TMDLs be developed for them, although the state may do so if it chooses. *See* DAVID SMITH & JOE KARKOSI, U.S. EPA, REGION 9, STAFF REPORT, REVIEW OF CALIFORNIA'S 1998 SECTION 303(D) LIST (Nov. 3, 1998). However, on January 12, 2000, the San Francisco BayKeeper filed suit to force EPA to develop TMDLs for all pollutants and water bodies listed under 303(d) in California, including exotic species. *See* San Francisco Baykeeper et al. v. Carol Browner et al., No. C-00-0132 (N.D. Cal. filed Jan. 12, 2000). As of January 2000, there were 509 water-quality-limited water bodies and 1471 impairments listed, with the EPA having developed TMDLs for five of these. Telephone Interview with Michael Lozeau, Staff Attorney, Earthlaw, (Jan. 2000).

As noted *supra* Part II.A.3, while recent legislation bars state agencies from imposing additional requirements on ballast water discharge under *state law* before Jan. 1, 2004, state agencies such as the RWQCB and SWRCB are explicitly not barred from imposing federal law requirements. *See* CAL. PUB. RES. CODE § 71207(a) (West 2000).

[240] *See EPA Adds S.F. Bay Dioxins and Other Pollutants and Streams to State's Section 303(d), List, 11(12)*, CALIFORNIA ENVIRONMENTAL INSIDER (Nov. 17, 1998).

[241] *See* 33 U.S.C. § 404 (1986).

when private or public entities engage in a number of different activities associated with shipping such as channel deepening for navigational purposes, wetland fills for port expansions, lock construction and maintenance dredging. In order to issue a permit for these activities under Section 404, the U.S. Army Corps of Engineers must insure that the activity 1) will not "cause or contribute to significant degradation of the waters of the United States,"[242] 2) will not cause or contribute to a violation of water quality standards, and 3) is in the public interest.[243]

In evaluating whether a dredge or fill action will cause or contribute to a significant degradation of U.S. waters the Corps must consider the "secondary effects" of a planned fill.[244] For example, the secondary effect of a shipping-related project requiring a 404 permit may be to increase shipping traffic and thus increase the volume of ballast water and the quantity of exotic organisms being released in a given water body. If the discharges of exotic organisms associated with the proposed activity would have "significantly adverse" effects on fish, shellfish, plankton, wildlife, or on "aquatic ecosystem diversity, productivity, and stability" then the project would constitute a significant degradation of U.S. waters and could not be approved by the Corps.[245] Similarly, if a project's secondary effects would have significantly adverse effects on recreational, aesthetic or economic values this would constitute a significant degradation that could not be permitted.[246] Because of the known effects of ballast water-caused invasions of exotic species on these resources and values, it is unclear how the Corps could justify a dredge or fill permit where a predictable secon-

---

[242] 40 C.F.R. § 230.10(c) (2000).

[243] *See* 33 C.F.R. § 320.4(a) (2000). Additionally, 404 permit requirements include the need to consider practicable alternatives to the planned dredge or fill activity, potential mitigation measures, and whether the action will jeopardize threatened and endangered species. *See id.* §§ 320.10(a), 230.10(b), 320.4(r).

[244] 40 C.F.R § 230.10(c).

[245] *Id.*

[246] *See id.*

dary effect was the release of millions of gallons of untreated ballast.

It would also seem difficult to support a finding that a project that would result in an increased or even a continued release of exotic organisms into a water body would not "cause or contribute to" a water quality violation given the nature of exotic organisms.[247] If an area is already listed under Section 303(d) as water quality limited for exotic organisms, such as San Francisco Bay, then it is unclear how an activity that would facilitate the continued release of exotic organisms would not at the very least "contribute to" if not "cause" a water quality violation.

Finally, in determining what actions are in the "public interest," in some circumstances the economic, ecological and social costs that are associated with invasions of exotic organisms may outweigh the public benefits associated with the development of additional shipping industry infrastructure. However, in reviewing permit applications for dredge or fill projects the Corps has paid little attention to the cost side of this equation. In assessing the effects of proposed projects in San Francisco Bay, the Columbia River and elsewhere, the Corps has largely ignored the potential role of dredge and fill activities in leading to increased discharges of exotic organisms.[248]

These failures could be challenged by a citizen or industry group affected by the release of exotic species. Additionally, Section 401 of the CWA gives states an opportunity to reject an Army Corps-issued 404 permit or to place conditions upon the permit that address the potential threat from exotic species.[249] Section 401, which requires that states certify that a Section 404 permit issued by the Army Corps is consistent with the

---

[247] *Id.* § 230.10(b)(1).

[248] *See* PORTLAND DISTRICT, U.S. ARMY CORPS OF ENGINEERS, DREDGED MATERIAL MANAGEMENT PLAN SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT: COLUMBIA RIVER AND LOWER WILLAMETTE RIVER FEDERAL NAVIGATION CHANNEL (1998). *See also* PORT OF OAKLAND, BERTHS 55-58 PROJECT: DRAFT ENVIRONMENTAL IMPACT REPORT (1999).

[249] *See* 33 U.S.C. § 401 (1986).

protection of state water quality standards, is yet another avenue the CWA provides for addressing the discharge of exotic organisms in ballast water as a pollution control issue.[250]

b. The Ocean Dumping Act

While the CWA regulates discharges within navigable inland waters and out to three miles from shore, the Ocean Dumping Act (ODA) relates to discharges further offshore.[251] The ODA prohibits the "dumping" of "any material transported from outside the United States" into the territorial sea or contiguous zone of the U.S. (between three and twelve miles from shore) without a permit.[252] The ODA defines "dumping" broadly as a "disposition of material."[253] What constitutes a "material" is also broadly defined to include "matter of any kind or description, including but not limited to, dredged material, solid waste, incinerator residue, garbage, sewage[.]"[254] Furthermore, the U.S. Supreme Court, after twice considering the phrase "matter of any kind" in the context of the Rivers and Harbors Act of 1899, strongly supported an expansive reading of its meaning.[255] Because exotic organisms taken on in ballast water outside the U.S. likely qualify as "matter of any kind" and deballasting is clearly a disposing of that matter into the water, it appears that the ODA requires a permit for such discharges. The U.S. EPA has principal responsibility for enforcing the ODA and issuing dumping permits, but has made no effort to apply the ODA to ballast water discharges of exotic organisms.

---

[250] *See id.* States can, however, waive this certification if they so choose. *See* 33 U.S.C. § 1341(a)(1).

[251] *See* 33 U.S.C. § 1411(b) (1986). *See also* Foster, *Pollutants Without Half-lives supra* note 222, at 38 (for a more in depth review of the ODA's relevance to ballast discharges).

[252] 33 U.S.C. § 1411(b).

[253] *Id.* § 1402(f).

[254] *Id.* § 1402(c).

[255] *See, e.g.,* United States v. Pennsylvania Indus. Chem. Corp., 411 U.S. 655, 669 (1973). *See also* United States v. Standard Oil Co., 384 U.S. 224, 226-227 (1966).

To issue an ODA permit, EPA must find that the dumping will not "unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities."[256] EPA is required to consider the need for the proposed dumping and the effect of the dumping on the marine ecosystem (including the effect on everything from plankton to marine mammals).[257] Specifically, EPA must look at how the requested dumping may change the species diversity and productivity of the marine ecosystems or affect species and community population dynamics, and must evaluate the persistence and permanence of the effects of the dumping.[258] EPA must also hold a hearing if any member of the public or an agency requests one[259] and ensure that the dumping will be consistent with relevant water quality standards.[260] Because exotic organisms released many miles from shore can be swept into coastal waters and establish themselves, EPA's analysis of a proposed dumping would have to include consideration of on-shore aquatic impacts.[261] Discharges in violation of the ODA are subject to penalties of up to $50,000, and actions for a violation of the ODA can either be brought by the EPA or filed under the ODA's citizen suit provision.[262]

While statutes such as the National Invasive Species Act and California's AB 703 focus on minimal ballast water operation changes without regard for whether those measures are adequate for the protection of aquatic ecosystems, the ODA's prohibition against dumping that "unreasonably degrades" aquatic resources (like the CWA's restriction of discharges that threaten existing or designated uses) establishes a critical floor of protection against damage to the environment. Due to this substantive bar against unreasonable degradation, it is

---

[256] 33 U.S.C. § 1412(a) (1986).

[257] *See id.* §§ 1412(a)(A), 1412(a)(C).

[258] *See id.* §§ 1412(a)(D), 1412(a)(E).

[259] *See* 33 C.F.R. § 222.4(a) (2000).

[260] *See* 33 U.S.C. § 1412(a).

[261] *See Stemming the Tide supra* note 8, at 17.

[262] *See* 33 U.S.C. § 1415(g).

unlikely that EPA could issue an ODA dumping permit for ballast discharges absent some effective technological treatment to remove exotic organisms. Enforcement of the ODA could therefore serve as an additional mechanism requiring technological treatment of ballast water prior to discharge, and would extend the regulation of ballast water discharges out to twelve miles from shore.

c. The Rivers and Harbors Act of 1899

Another statute that apparently applies to ballast water discharges of exotic organisms is the Rivers and Harbors Act of 1899 (RHA).[263] The RHA states that absent a permit "it shall not be lawful to throw, discharge, or deposit, or cause, suffer, or procure to be thrown, discharged or deposited either from or out of any ship, barge, or other floating craft of any kind...any refuse matter of any kind or description whatever ... into the navigable water of the United States[.]"[264] Since ballast water is obviously "discharged" from ships into the navigable water of the United States, the only question is whether ballast water containing exotic organisms qualifies as "refuse of any kind or description whatever." The U.S. Supreme Court has twice held that the term "refuse" as used in the RHA broadly applies to the release of "all foreign substances and pollutants," which suggests that RHA should apply to ballast discharges.[265] However, as with the CWA and ODA, the RHA has simply not been applied to ballast water discharges.

With the adoption of the CWA, the procedure for permitting a discharge under the RHA has been replaced by the CWA's NPDES permitting program. Because requirements for obtaining an NPDES permit are substantially stricter than the original requirement for an RHA permit, the RHA has primarily one effect: it increases the potential fines that could be levied

---

[263] *See* Foster, *Pollutants Without Half-lives supra* note 222, at 38 (for a more detailed review of the RHA's applicability to ballast water releases).

[264] 33 U.S.C. § 407 (1986).

[265] *See* United States v. Standard Oil Co., 384 U.S. 224, 228 (1966); United States v. Pennsylvania Indus. Chem. Corp., 411 U.S. 655, 669 (1973).

against unpermitted discharges from a ship.[266] In fact a ship that begins discharging ballast water while more than three miles from shore, where the ODA applies, and then continues de-ballasting while traveling into the three mile coastal zone covered by the CWA and RHA faces federal penalties that could exceed $100,000.[267] The Supreme Court may have been correct in referring to the RHA as "almost an insult to the sophisticated wastes of modern technology,"[268] but the failure of the EPA to enforce this 100-year-old statute against discharges of exotic organisms in ballast water highlights the need for agencies to recognize and regulate exotic species as a form of biological pollution.

2. *California Law*

a. *The Porter-Cologne Water Quality Control Act*

California's Porter-Cologne Water Quality Control Act provides an additional basis for regulating ballast water discharges in California.[269] Porter-Cologne's system for regulating pollutant discharges is similar to that of the CWA in that waste discharges must meet water quality standards.[270] Unlike the

---

[266] Penalties for violation of the RHA are up to $25,000 a day and/or up to a year in jail. *See* 33 U.S.C. § 411 (1994). *See also* U.S. v. Lambert, 915 F.Supp 797, 801 (1996) (EPA succeeded in an enforcement action for violations of both the CWA and RHA).

[267] ODA provides penalties of up to $50,000 per violation. *See* 33 U.S.C §§ 1415(a), 1415(b) (1986). CWA provides civil penalties of up to $25,000 per day. *See id.* § 1319(d). In addition, there could be criminal penalties of up to $1,000,000 for knowing endangerment by repeat offenders under CWA. *See id.* § 1319(c)(3)(A). As discussed below, state law penalties may also apply. Besides increasing the potential fines, the RHA may act as a legal backstop to the CWA, by remaining applicable to ballast water discharges within three miles of shore even if the EPA's regulatory exemption for ballast water were found to be legal.

[268] United States v. Pennsylvania Indus. Chem. Corp., 411 U.S. 655, 669 (1973).

[269] *See* CAL. WATER CODE §§ 13000-13999 (West 1992). As noted above in Part II.A.3, recent legislation bars state boards from imposing additional requirements on ballast water discharges under Porter-Cologne or other state laws prior to Jan. 1, 2004. *See* CAL. PUB. RES. CODE § 71207(a) (West 2000). However, the SWRCB and RWQCBs could take steps short of imposing requirements, such as developing, proposing and holding hearings on language for permit requirements that would go into effect on or after that date. In addition, the courts may impose penalties or injunctions if they find that discharges of exotic organisms in ballast water violate Porter-Cologne.

[270] *See* CAL. WATER CODE § 13263.

CWA, however, Porter-Cologne is not restricted to the regulation of point source discharges.[271]

Porter-Cologne uses the term "waste" to describe discharges under its purview, defining waste broadly as "sewage and any or all other waste substances."[272] The full definition neither specifically includes nor specifically excludes ballast discharges, but because ballast water is taken on vessels as a necessary substance for maintaining a ship's stability and then discharged when no longer needed, ballast water is consistent with the common definition of waste.[273] California courts implementing Porter-Cologne have also construed the term "waste" broadly to essentially cover the same types of pollutants covered under the CWA. Specifically, waste has been found to include silt caused by a dam,[274] runoff from mining and logging operations,[275] and agricultural runoff.[276] Additionally, Porter-Cologne adopts the same definitions of "pollutants," "discharge" and "point sources" as are used in the CWA.[277] Thus, there is good support that Porter-Cologne applies to the same substances that would be covered by the CWA, including exotic species discharged in ballast water.[278] While Porter-

---

[271] *See id.*

[272] *See id.* § 1350(d).

[273] *See* Petition from the San Francisco Baykeeper and DeltaKeeper to the Bay Area Regional Water Quality Control Board and the Central Valley Regional Water Quality Control Board, Seeking Control of Ballast Water Discharges in the Bay-Delta Region (May 21, 1997). In considering whether detritus from construction operations dumped or drained into water could be regulated under Porter-Cologne, the California Attorney General turned to "the New Standard Dictionary, which defines waste as follows: 'Something rejected as worthless or not needed; surplus or useless stuff.' " 16 Op. Cal. Att'y Gen. 125, 132 (1950).

[274] *See* Lake Madrone Water Dist. v. State Water Resources Control Bd., 209 Cal.App.3d 163, 169 (1989).

[275] *See* People v. New Penn Mines, Inc., 212 Cal.App.2d 667, 673. *See also* 27 Op. Cal. Att'y Gen. 182 (1956).

[276] *See* 27 Op. Cal. Att'y Gen. 182 (1956).

[277] CAL. WATER CODE § 13373 (West 1992).

[278] California's Secretary for Resources and Secretary for Environmental Protection have concluded that the meaning of "waste water discharges" in Porter-Cologne can include ballast water. *See, e.g.,* DOUGLAS P. WHEELER & PETER M. ROONEY, REPORT OF THE SECRETARY FOR RESOURCES AND SECRETARY FOR ENVIRONMENTAL PRO-

Cologne appears to require regulation of ballast discharges from individual ships, some conservationists have argued that it imposes similar requirements on port facilities where docked vessels commonly release ballast water.[279]

Porter-Cologne provides for civil penalties of up to $25,000 for each day of violation and criminal penalties of up to $50,000 and up to three years in jail.[280] Repeat offenders of Porter-Cologne could face a fine of up to $100,000 and up to six years in jail.[281] The San Francisco Bay RWQCB has made some limited use of Porter-Cologne to regulate ballast water discharges, by prohibiting ballast discharges from ships controlled by dry docks.[282] However, in 1997 the San Francisco BayKeeper petitioned the San Francisco Bay and Central Valley RWQCBs to apply Porter-Cologne to all ballast water discharges in the Bay/Delta system.[283]

b. Fish and Game Code

While Porter-Cologne requires dischargers to apply for a permit before discharging waste, California's Fish & Game Code provides even broader protection. Section 5650 makes it illegal to "deposit in, permit to pass into, or place where it can

---

TECTION TO GOVERNOR PETE WILSON: AN ANALYSIS OF FEDERAL RESPONSIBILITIES RELATED TO OCEAN RESOURCE MANAGEMENT IN CALIFORNIA (June 1998).

[279] *See, e.g.,* Petition of San Francisco BayKeeper and DeltaKeeper to the Bay Area Regional Water Quality Control Board and the Central Valley Regional Water Quality Control Board, Seeking Control of Ballast Water Discharges in the Bay-Delta Region (May 21, 1997) (on file with authors) [hereinafter BayKeeper, *Seeking Control*].

[280] *See* CAL. WATER CODE §§ 13385(b)(1), 13385(c)(1), 13387(b) and (c). Additional Porter-Cologne civil penalties may be levied at the rate of up to $25 per gallon for the volume discharged in excess of 1,000 gallons. *See id.* §§ 13385(b)(2), 13385(c)(2).

[281] *See id.* § 13387(b), (c).

[282] *See supra* note 221 and accompanying text.

[283] *See* BayKeeper, *Seeking Control*. Responding to similar questions, the Washington State Attorney General determined that "there is no doubt that water containing exotic microfauna that is potentially harmful to other aquatic life or to public health meets the definition of pollution" in Washington State law, that "ballast water containing harmful microfauna is pollution" under state law, and that "commercially operated vessels are prohibited from discharging waste material—including unwanted ballast waters—into waters of the state, except in accordance with the provisions of a state waste discharge permit." Washington Attorney General (1993).

pass into the waters of this state... [a]ny substance or material deleterious to fish, plant life, or bird life" unless expressly authorized by a permit issued under Porter-Cologne.[284] Because exotic organisms can clearly be deleterious to fish, plant and bird life, Section 5650 would appear to apply to ballast water releases of exotic organisms. Violations of Section 5650 are punishable by fines of up to $25,000 for each violation and are in addition to penalties for violations of any other law such as Porter-Cologne.[285] The California Department of Fish & Game has the authority to bring an action to enforce the requirements of Section 5650,[286] but has never used this authority to control ballast water discharges of exotic organisms.

To help enforce this provision, Fish & Game Code Section 12015 places cleanup responsibility directly on the party who has contaminated or polluted state waters.[287] Fish & Game Code 12016 more broadly "imposes liability on any person who discharges...any substance deleterious to fish, plant, bird or animal life or their habitats, into state waters."[288] This section further specifies that the discharger is liable to the state for both actual damages to wildlife and habitats as well as reasonable costs the state incurs in the "clean up and abatement of the effects of the discharge" in addition to any other statutory penalties.[289] While it may be difficult to show that an individual shipper had caused a given invasion, this law does provide a potential avenue for funding exotic species control efforts.

---

[284] CAL. FISH & GAME CODE § 5650(a), (b) (West 1998).

[285] *See id.* §§ 5650.1(a), (b).

[286] *See id.* § 5651. As noted *supra* Part II.A.3, recent legislation bars state departments such as CDFG from imposing additional requirements on ballast water discharges under Section 5650 or other state laws prior to Jan. 1, 2004. *See* CAL. PUB. RES. CODE § 71207(a) (West 2000).

[287] *See* CAL. FISH & GAME CODE. § 12015.

[288] *Id.* § 12016.

[289] *Id.*

C. REGULATING BALLAST WATER DISCHARGE AS A WILDLIFE PROTECTION ISSUE

1. International Law

Various current and pending international treaties related to the protection of wildlife or of the natural environment make reference to the prevention and control of exotic species. Although it is possible that these treaties could obligate the signatory nations to take steps to prevent or manage the introduction of exotic species in ballast water, none have yet been used for that purpose.[290]

For example, the United Nations Convention on the Law of the Sea (not yet ratified by the U.S.) directs signatories to "take all measures necessary to prevent, reduce and control...the intentional or accidental introduction of species, alien or new, to any particular part of the marine environment, which may cause significant or harmful changes thereto."[291] It has been argued that this phrase would impose a due diligence standard on the signatories, including a duty to identify the pathways transporting exotic species and "close them off,"[292] and that failure to take such measures could make them liable for any damages caused by such introductions.[293]

The Protocol adopted pursuant to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region directs that "[e]ach Party shall take all appropriate measures to regulate or prohibit intentional or

---

[290] *See* D. J. Bederman, *International Control of Marine "Pollution" by Exotic Species*, 18 ECOL. LAW QUART. 677, 696-707 (1991) [hereinafter Bederman, *Control of Marine "Pollution"*] *and* OTA, *Harmful Non-Indigenous Species in U.S supra* note 31, at 294-298 (for a fuller discussion of the relevance of international treaties to the management of exotic species, both on land and in the sea).

[291] Bederman, *Control of Marine "Pollution" supra* note 290, at 700-707; C. de Klemm, *The Introduction of Exotic Species and the Law, in* INTRODUCED SPECIES IN EUROPEAN COASTAL WATERS 85-92 (C. F. Boudeouresque, et al., eds., 1994) [hereinafter de Klemm, *Exotic Species and the Law*]. The Convention has not yet been ratified by enough countries to take effect, nor been signed by the United States.

[292] *See* Bederman, *Control of Marine "Pollution" supra* note 290, at 702, 707.

[293] *See* de Klemm, *Exotic Species and the Law supra* note 291, at 85-92.

accidental introduction of non-indigenous...species...that may cause harmful impacts to the natural flora, fauna or other features of the Wider Caribbean Region."[294]

The Bonn Convention on the Conservation of Migratory Species of Wild Animals obligates signatories to "the extent feasible and appropriate...[to undertake the task of] strictly controlling the introduction of, or controlling and eliminating, already introduced exotic species" that endanger or are likely to further endanger migratory species, or that are detrimental to migratory species in "unfavorable conservation status."[295]

The Convention Between the United States and Japan on Migratory Birds states that both signatories must attempt to control the importation of organisms that are determined to be hazardous to the birds protected by the treaty, or that could disturb the ecological balance of unique island environments.[296]

The Convention on Biological Diversity requires the signatories, as far as possible and appropriate, to "prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species."[297]

Thus, if the introduction of exotic organisms in ballast water would endanger migratory animals, harm protected migra-

---

[294] The Convention was signed by the United States in 1983, while the Protocol Concerning Specially Protected Areas and Wildlife was opened for signature on Jan. 18, 1990 and is not yet in force. *See* Bederman, *Control of Marine "Pollution" supra* note 290, at 704.

[295] Adopted in 1979. *See* Bederman, *Control of Marine "Pollution" supra* note 290, at 677-717; de Klemm, *Exotic Species and the Law supra* note 291, at 85-92.

[296] *See* R. A. Peoples, Jr., et al., *Introduced Organisms: Policies and Activities of the U. S. Fish and Wildlife Service, in* DISPERSAL OF LIVING ORGANISMS INTO AQUATIC ECOSYSTEMS, 325-351 (A. Rosenfield & R. Mann eds., 1992) (Article VI of the Convention, which was adopted in 1972) [hereinafter Peoples, *Introduced Organisms*]. Other bilateral migratory bird protection treaties, with Canada (signed in 1916), Mexico (signed in 1936) and the USSR (signed in 1976), may have similar implications.

[297] Article 8(h) of the Convention. The Convention was signed by the United States in 1993 but has not yet been ratified by the Senate. *See generally* OTA, *Harmful Non-Indigenous Species in U.S. supra* note 31; de Klemm, *Exotic Species and the Law supra* note 291, 85-92. *See also* OTA, *Harmful Non-Indigenous Species in U.S. supra* note 31, at 296 (describing this provision as "vague and probably unenforceable.")

tory birds, threaten aquatic ecosystems, habitats or species, or cause significant changes to marine or island environments, it is possible that the signatories to these conventions could be obligated to regulate and control ballast discharges.

2. *Federal Law*

a. *The Endangered Species Act*

Exotic species are the second most common threat to imperiled species[298] and endangered fish[299] in the United States, the second most frequent contributing factor to North American fish extinctions,[300] and the dominant threat to imperiled aquatic organisms in the West.[301] Within California, exotic species may have caused the extinction of three native fish and the eradication of another from its native waters through competition, predation or parasitization,[302] and contributed to the decline of the endangered winter-run chinook salmon.[303] The Delta smelt, listed as threatened, may be at risk from an exotic predator of its eggs and larvae.[304] Among ballast water introductions, zebra mussels are thought to pose a serious threat to many freshwater mussels[305] and to chinook salmon if introduced into California.[306] The shimofuri goby, introduced to California from

---

[298] *See* David S. Wilcove, *Quantifying Threats to Imperiled Species In the United States*, 48(8) BIOSCIENCE 607-615 (1998) [hereinafter Wilcove, *Quantifying Threats*]..

[299] *See* A REPORT TO CONGRESS, AQUATIC NUISANCE SPECIES TASK FORCE, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS OF THE INTENTIONAL INTRODUCTIONS POLICY REVIEW app. D (Mar. 1994).

[300] *See* Robert R. Miller, et al., *Extinctions of North American Fishes During the Past Century*, 14(6) FISHERIES 22-38 (1989). In these three studies, habitat alteration, degradation or loss was found to be the most common threat or contributing factor.

[301] *See* Wilcove, *Quantifying Threats supra* note 298, at 612.

[302] *See* Cohen & Carlton, *SF Bay Case Study supra* note 14, at 119-22, 125-27, 129, 131, 133, 187.

[303] *See* NATIONAL MARINE FISHERIES SERVICE, SOUTHWEST REGION, PROPOSED RECOVERY PLAN FOR THE SACRAMENTO RIVER WINTER-RUN CHINOOK SALMON [hereinafter NMFS, *Sacramento Chinook Recovery Plan*].

[304] *See* Cohen & Carlton, *SF Bay Case Study supra* note 14, at 129, 187.

[305] *See* Don W. Schloesser, et al., *Zebra Mussel Infestation of Unionid Bivalves (Unionidae) in North America*, 36 AMERICAN ZOOLOLGIST 300-310 (1996).

[306] *See* NMFS, *Sacramento Chinook Recovery Plan supra* note 303.

Japan in ballast water, could have significant impacts on endangered tidewater gobies by preying on juveniles, competing for food and disturbing mating activities.[307] Endangered and threatened salmon, steelhead and Delta smelt may be impacted by changes in their food supply caused by clams and zooplankton introduced via ballast water. [308]

Several provisions of the federal Endangered Species Act (ESA)[309] are relevant to ballast water discharges of exotic organisms and to federal projects that indirectly result in ballast water discharges of exotic organisms. A recent Presidential Executive Order on invasive species[310] specifically listed the ESA as one source of the federal government's authority to prevent the introduction of invasive species.[311]

For example, Section 7 of the ESA prohibits federal agencies from authorizing, funding or carrying out actions that would jeopardize a listed species or adversely modify the critical habitat of a listed species.[312] If a federal action "may affect" a listed

---

[307] *See* Ramona O. Swenson & Scott A. Matern, Interactions Between Two Estuarine Gobies, the Endangered Tidewater Goby (*Eucyclogobius newberryi*) and a Recent Delta Invader, the Shimofuri Goby (*Tridentiger bifasciatus*), presented at the California-Nevada Chapter Meeting, American Fisheries Society, Napa, CA (1995).

[308] *See* NMFS, *Sacramento Chinook Recovery Plan supra* note 303. *See also* Biological and Conference Opinion for Port of Oakland Berths 55-58 Project, submitted as an attachment to a letter from Rodney R. McInnis, Acting Regional Director, National Marine Fisheries Service, Southwest Region, to Calvin Fong, Chief, Regulatory Section, U. S. Army Corps of Engineers, San Francisco District (Nov. 26, 1999); CALIFORNIA DEPARTMENT OF WATER RESOURCES. *Delta Smelt Investigations*, 12(2) IEP NEWSLETTER 25, 28 (1999).

[309] Since the California Endangered Species Act offers less protection than the federal ESA, it is not analyzed here.

[310] *See* Exec. Order No. 13,112, 64 Fed. Reg. 6183 (Feb. 3, 1999).

[311] Agencies' willingness to use the ESA to regulate ballast water in appropriate circumstance may be encouraged by the order's directives to each federal agency to "use relevant programs and authorities to...prevent the introduction of invasive species" and to "not authorize, fund or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize the risk of harm will be taken in conjunction with the actions." *Id.*

[312] *See* 16 U.S.C. § 1536(a)(2) (2000).

species or its designated critical habitat, the responsible federal agency must initiate consultation with the U.S. Fish & Wildlife Service (USF&W) (for terrestrial and freshwater species) or the National Marine Fisheries Service (NMFS) (for marine and anadromous[313] species).[314] In determining whether a federal action will jeopardize a species or its critical habitat, agencies must consider both direct and indirect effects.[315] Thus, a federal agency that is engaged in, is authorizing or is funding the construction or expansion of a port or the dredging of a waterway that would indirectly result in the release of ballast water containing exotic organisms must consider the potential effect on listed species or their critical habitat.

Section 9 of the ESA prohibits the taking of an endangered species or its habitat,[316] with "take" meaning to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."[317] Under some circumstances, the introduction of exotic organisms can constitute a take under Section 9. For example, the Ninth Circuit, when first affirming that Section 9 protects the habitat of endangered species and not just the species themselves, found that habitat damage caused by the grazing of exotic goats was a take.[318] In addition, NMFS recently adopted a rule specifying that "[r]eleasing non-indigenous or artificially propagated species into a listed species' habitat or where they may access the habitat of listed species" is a type of habitat modifying activity that may qualify as a take.[319] In practice, demonstrating a causal link between a given ballast discharge, the release and establishment of an exotic organism, and resulting habitat degradation constituting a take of a listed species may prove to be

---

[313] Anadromous species, such as salmon, spawn in fresh water and live as adults in salt water.

[314] *See* 16 U.S.C. § 1536 (a)(3).

[315] *See* 50 C.F.R. § 402.14(g)(3) (2000).

[316] *See* 16 U.S.C. § 1538(a)(1).

[317] *Id.* § 1532(19).

[318] *See* Palila v. Hawaii Dep't of Land and Natural Resources, 852 F.2d 1106 (9th Cir. 1988).

[319] 64 Fed. Reg. 60,727 (Nov. 8, 1999) (to be codified at 50 C.F.R. pt. 222).

very difficult. However, when considered in the context of a broader scale challenge to the long-term practice of deballasting exotic species and thereby creating biologically-polluted waters, a Section 9 challenge may be more viable.

In January of 1999, Earthlaw's Environmental Clinic at the Stanford Law School, on behalf of the Center for Marine Conservation and the San Francisco BayKeeper, filed a notice of intent to sue over violations of Section 7 of the ESA in connection with a proposed dredging project at the Port of Oakland.[320] The U.S. Army Corps of Engineers, the federal lead agency for the project, had requested a formal consultation from USF&W in January 1998.[321] The Stanford notice alleged that the Army Corps had failed to comply with its obligations under the ESA in three respects: by preparing an inadequate Biological Assessment that did not address the projects' impacts on endangered and threatened species due to ballast water discharges resulting from the project (violating ESA Section 7(c)), failing to initiate consultation with USF&W and NMFS regarding those impacts (violating Section 7(a)(2)), and by failing to consult with USF&W and NMFS to develop programs for the conservation of endangered and threatened species that are at risk from exotic species invasions in the project area, largely as a result of ballast discharges (violating Section 7(a)(1)).[322] In re-

---

[320] Letter from Deborah A. Sivas, Supervising Attorney, Stanford Environmental Clinic, Stanford Law School, to Lt. Gen. Joe N. Ballard, Chief of Engineers and Commander, U. S. Army Corps of Engineers, San Francisco District and Lt. Col. Peter T. Grass, U. S. Army Corps of Engineers, San Francisco District (January 6, 1999) (on file with authors). While the specific project discussed in this letter is the Oakland Harbor Navigation Improvement (-50 Foot) Project [hereinafter the "dredging project"], any legal challenge is likely to include related projects such as the Berths 55-58 Project referenced below. The environmental review of these projects is discussed in Part II.D.

[321] Letter from Cay C. Goude, Acting Field Supervisor, U.S. Fish & Wildlife Service, Sacramento Field Office, to Peter E. LaCivita, Chief, Environmental Planning Section, U. S. Army Corps of Engineers, San Francisco District (June 29, 1999) (on file with authors). The Army Corps also requested consultation from NMFS on the dredging project on March 5, 1999 and on the berth expansion project on September 27, 1999. *See generally* BIOLOGICAL AND CONFERENCE OPINION FOR PORT OF OAKLAND BERTHS 55-58 PROJECT.

[322] *See* Letter from Deborah A. Sivas to Lt. Gen. Joe N. Ballard and Lt. Col. Peter T. Grass, *supra* note 320.

sponse, the Army Corps confirmed that it was requesting consultation on the exotic species issues raised in the notice.[323]

In a biological opinion on the dredging project and a related berth expansion project, USF&W found that the Port's proposed ballast water exchange regulation and other measures would adequately minimize the impacts of ballast water discharges, and required the Army Corps to ensure that those measures were implemented.[324] NMFS concluded that the dredging project is not likely to adversely affect listed species,[325] but found that the introduction of exotic organisms resulting from the berth expansion project could result in a take of listed salmon or steelhead.[326] Accordingly, NMFS required the Army Corps to condition the Port's permit to require the Port to enter into an agreement with NMFS on monitoring and managing the introduction of exotic species, and further required the Army Corps to retain discretion to re-initiate Section 7 consultation with NMFS if the Port failed to fulfill that agreement or if ballast water discharges exceeded the amounts projected by the Port.[327]

b. The Lacey Act and the Federal Noxious Weed Act

In 1900, Congress passed the Lacey Act with the general purpose of preventing the introduction of animal and bird spe-

---

[323] Telephone Interview with Michael Lozeau, Staff Attorney, Earthlaw (Jan. 2000).

[324] *See* Letter from Cay C. Goude to Peter E. LaCivita, *supra* note 321.

[325] Letter from Rodney R. McInnis, Acting Regional Director, National Marine Fisheries Service, Southwest Region, to Peter E. LaCivita, Chief, Environmental Planning Section, U. S. Army Corps of Engineers, San Francisco District (August 9, 1999) (on file with authors).

[326] In listing the anticipated effects of the project, NMFS wrote: "The introduction of nonindigenous species by ballast water and hull fouling may adversely affect listed salmonids and result in an unknown quantity of take, in the form of mortality, harm, injury, and/or harassing, listed salmonids." Potential impacts include changes in food availability, introduction of pathogens and predators, clogging of fish screens and decreased efficiency of fish salvage facilities, and loss of rearing habitat, which could result in a degradation of a listed species' ability to survive and recover. *See* BIOLOGICAL AND CONFERENCE OPINION FOR PORT OF OAKLAND BERTHS 55-58 PROJECT 20, 22.

[327] *See id.* at 23-24.

cies injurious to agriculture.[328] As amended, the Lacey Act today prohibits the importation[329] or interstate shipment of wild mammals, wild birds, reptiles, amphibians, fishes, mollusks or crustaceans, or their offspring or eggs, that are either listed in the Act or are determined by the Secretary of the Interior "to be injurious to human beings, to the interests of agriculture, horticulture, forestry or to wildlife or the wildlife resources of the United States."[330] The Secretary may only permit the importation of such species for zoological, educational, medicinal or scientific purposes.[331]

---

[328] *See* Act of May 25, 1900, ch. 553, 31 Stat. 187, 188 § 2. Amendments made in 1981 consolidated and partially repealed the 1900 Lacey Act and the 1926 Black Bass Act. *See* Amendments of 1981, Pub. L. No. 97-79, § 9(b)(2), 95 Stat. 1073, 1079 (codified at 16 U.S.C. §§ 3371-3378 (2000) and 18 U.S.C. § 42 (2000)). The Act is generally implemented by the USF&W.

[329] The Act defines import to mean "to land on, bring into, or introduce into, any place subject to the jurisdiction of the United States, whether or not such landing, bringing, or introduction constitutes an importation within the meaning of the customs laws of the United States." 16 U.S.C. § 3371(b) (2000).

[330] 18 U.S.C. § 42(a)(1) (2000). Some have read the Lacey Act as only prohibiting transport between the continental United States and its island states, territories and possessions, rather than all interstate transport. *See, e. g.* Bean, *Report to OTA supra* note 123, at 6. *See also* Peoples, *Introduced Organisms supra* note 296, at 325, 328. This seems to us to require a rather tortured reading of the admittedly somewhat convoluted text. Specifically, the Act prohibits "shipment between the continental United States, the District of Columbia, Hawaii, the Commonwealth of Puerto Rico, or any possession of the United States." 18 U.S.C. § 42(a)(1). The "United States" is defined by applicable regulation to mean "the several States of the United States of America." 50 C.F.R. § 10.12 (2000). This passage is thus most sensibly read as prohibiting shipment between the individual states, the District of Columbia, and so forth. In contrast, the interpretation that this passage only prohibits shipment between the continental United States as a whole and the other listed entities is severely hampered by the inclusion of the District of Columbia in the list—leading (by this interpretation) to the nonsensical situation where transport of harmful organisms between, for example, Bethesda, Maryland and the adjacent District of Columbia would be prohibited, but transport across the continent from Maryland to California would be allowed.

On the other hand, U.S. Fish & Wildlife Service staff have at times read the Lacey Act as even prohibiting the intrastate transport of proscribed species, although that does not seem to be the Service's current interpretation. Email from Denny Lassuy, U. S. Fish & Wildlife Service to J. A. Kopp, Prince William Sound Regional Citizens Advisory Council and posted to the Western Regional Panel listserver (July 12, 1999) (on file with authors).

[331] *See* 18 U.S.C. § 42(a)(3).

Additionally, the Lacey Act makes it a violation of federal law to import, export, transport,[332] sell, receive, acquire or purchase in interstate or foreign commerce, or possess within the maritime and territorial jurisdiction of the United States, any fish, wildlife, or plants taken, possessed, transported or sold in violation of any state law or regulation.[333] The implementing regulations deem that "[a]ny importation or transportation of live wildlife"[334] into the United States is injurious or potentially injurious, and prohibit such importation or interstate transport except as otherwise provided.[335] Further provisions specifically allow for the importing or transporting of fish, mollusks or crustaceans under certain conditions,[336] but prohibit their release into the wild without the written permission of the state wildlife conservation agency with jurisdiction over the release site.[337]

The Federal Noxious Weed Act similarly prohibits, except by permit, importing into the United States or the interstate movement of noxious weeds identified by the Secretary of Agriculture.[338] "Noxious weeds" are defined as any living stage of a plant that "is of foreign origin, is new to or not widely prevalent in the United States, and can directly or indirectly injure crops, or other useful plants, livestock, or poultry or other interests of

---

[332] "Transport" is broadly defined to mean "to move, convey, carry or ship by any means, or to deliver or receive for the purpose of movement, conveyance, carriage, or shipment." 16 U.S.C. § 3371(j).

[333] *See* 16 U.S.C. § 3372(a) (2000).

[334] "Wildife" is defined to include "any wild animal, whether alive or dead, including without limitation any wild mammal, bird, reptile, amphibian, fish, mollusk, crustacean, arthropod, coelenterate, or other invertebrate, whether or not bred, hatched, or born in captivity, and including any part, product, egg, or offspring thereof." 50 C.F.R. § 10.12.

[335] *See id.* § 16.3.

[336] Fish, mollusks or crustaceans other than a few listed species may be imported or transported without a permit if a written declaration has been filed with the Customs Department. *See id.* § 16.13(a).

[337] *See id.* § 16.13(1).

[338] *See* 7 U.S.C. §§ 2803(a) and (b). Noxious weeds identified by the Secretary are listed at 7 C.F.R. § 360.200 (2000). The Act is generally implemented by the Animal and Plant Health Inspection Service (APHIS) in the Department of Agriculture.

agriculture, including irrigation, or navigation or the fish and wildlife resources of the United States or the public health."[339]

Because implementation of the Lacey Act and the Noxious Weed Act are each based on the use of a "dirty list" of prohibited species, the statutes are generally applied only to species that have already demonstrated their invasive nature.[340] This limits the usefulness of these statutes as a pre-emptive mechanism for preventing invasions before they occur, which is one of several reasons for the oft-noted ineffectiveness of these Acts.[341] Various attempts to adopt a "clean list" approach (restricting the import of new species unless it is shown that the species is

---

[339] 7 U.S.C. § 2802(c).

[340] Although the broad language of the Lacey Act's regulations at 50 C.F.R. § 16.3 describes a clean act approach, the regulations have never been implemented in that way.

[341] *See* Bean, *Report to OTA supra* note 123, at 5-7, 44-46, 66-68. *See also* Bederman, *Control of Marine "Pollution" supra* note 290, at 693, 695; Peoples, *Introduced Organisms supra* note 296, at 332-335; OTA, *Harmful Non-Indigenous Species in U.S. supra* note 31, at 21-30, 173; J. L Dentler, *Noah's Farce: The Regulation and Control of Exotic Fish and Wildlife,* 17 U. PUGET SOUND L. REV.191, 210-212 (1993); D. P. Larsen, *Combating the Exotic Species Invasion: The Role of Tort Liability*, 5 DUKE ENVTL. L. & POL'Y F. 21, 27-29 (1995); S. A. Wade, *Stemming the Tide: A Plea for New Exotic Species Legislation*, 10 J. LAND USE & ENVTL. L. 343, 347-348 (1995); Whalin, *Nuisance Nonindigenous Species supra* note 5, at 104-106. The effectiveness of these Acts is also hindered by inadequate funding for monitoring and enforcement, and by generally lax implementation. In a recent revealing incident, 11,800 bur reed plants (*Sparganium erectum*), an exotic aquatic weed on the federal noxious weed list, were imported from Europe and distributed to Home Depot stores in at least 35 states before the Agriculture Department realized the plant was even in the country, although it was correctly identified on its shipping papers. *See Alien Weed Eludes Authorities, Then Turns Up at Home Depot,* WALL ST. J. (Aug. 10, 1999); Robert Weller, *Noxious Weed Introduced in US, Sold as Pond Plant*, SEATTLE DAILY J. OF COM. (Aug. 19, 1999).

not a threat) have failed,[342] despite substantial support for this approach from the scientific and regulatory community.[343]

Although these statutes have generally been interpreted as applying only to intentional acts,[344] nothing in the language of the statutes or regulations restricts them to intentional acts, and only the application of criminal penalties is restricted to knowingly committed acts. [345] The appropriate standard for applying civil penalties appears to be one of due care.[346] Given the known abundance of certain proscribed species in some port areas, ships discharging ballast water from those areas and which is therefore likely to contain those species may not be exercising due care.[347] Given the amount of attention that

---

[342] In 1973 and again in 1975 the USF&W proposed amending the Lacey Act regulations to incorporate a clean list approach. *See* 38 Fed. Reg. 34,970 (Dec. 20, 1973); 40 Fed. Reg. 7935 (Feb. 24, 1975). These proposals were withdrawn under pressure from pet trade, zoo and scientific interests. Roughly 5,500 comments were received, most of them critical. *See, e.g.,* Bean, *Report to OTA supra* note 123, at 45-46, 67-68; Peoples, *Introduced Organisms supra* note 296; OTA, *Harmful Non-Indigenous Species in U.S. supra* note 31, at 111. In 1995 APHIS attempted unsuccessfully to adopt a partial clean list approach to implementing the Noxious Weed Act. 60 Fed. Reg. 5288 (Jan. 26, 1995); 60 Fed. Reg. 31,647 (June 16, 1995); David Whalin, *The Control of Aquatic Nuisance Species,* 5 ENVTL. LAWYER 69, 107-114 (1998).

[343] *See* OTA, *Harmful Non-Indigenous Species in U.S. supra* note 31,at 109; Letter from Andrew N. Cohen and 106 ecologists and research scientists to Interior Secretary Bruce Babbitt (Oct. 19, 1998), app. A *in* Sandra M. Keppner, et al., Caulerpa taxifolia: *A Potential Threat to U. S. Coastal Waters*, A Preliminary Report to the Aquatic Nuisance Species Task Force (Nov. 17, 1998).

[344] *See, e.g.*, S. A. Wade, *Stemming the Tide: A Plea for New Exotic Species Legislation*, 10 J. LAND USE & ENVTL. L. 343, 348 (1995).

[345] *See* 16 U.S.C. § 3373(d) (2000).

[346] *See id.* § 3373(a)(1).

[347] Crabs in the genus *Eriocheir* (mitten crabs) and the zebra mussel *Dreissena polymorpha* are listed as injurious animals under the Lacey Act. 50 C.F.R. § 16.13(a)(2) (2000). Ballast water is thought to be responsible for the introduction of mitten crabs to Europe, for several cases of mitten crab releases into the Great Lakes, New Orleans region and Columbia River, and possibly for their introduction into California. Mitten crabs spawn in estuaries with individual females producing 250,000 to one million eggs, which hatch in the late spring or summer and develop over three to four months as small, floating larvae. Mitten crabs are common or abundant in many port areas in China, Taiwan, Korea, Japan, Portugal, northern Europe and England, and it is thus likely that many ships taking on ballast water in these countries between late spring and early fall carry mitten crabs. *See* Andrew N. Cohen & James T. Carlton, *Transoceanic Transport Mechanisms: The Introduction of the Chinese Mitten Crab,* Eriocheir sinensis, *to California,* 51(1) PACIFIC SCIENCE 1-11 (1997).

the ballast water issue has received in shipping circles in recent years, and the near-certainty that ballast water contains various types of organisms,[348] many ships may be *knowingly* violating the Lacey Act's regulatory prohibitions on importing wildlife without a permit[349] and releasing fish, mollusks or crustaceans into the wild without a permit.[350]

3. *California Law*

California has several statutory requirements that generally restrict the release of exotic organisms in California absent a permit. The Fish and Game Code makes it unlawful to

> place, plant, or cause to be placed or planted, in any of the waters of the State, any live fish, any fresh or salt water animal, or any aquatic plant, whether taken without or within the state, without first submitting it for inspection to, and securing the written permission of, the department [of Fish and Game].[351]

The Fish and Game Code further requires that "[n]o live aquatic plant or animal may be imported into this state without the prior written approval of the department [of Fish and

---

Zebra mussels were apparently introduced in ballast water from Europe into the Great Lakes, then spread throughout much of eastern North America causing substantial economic and environmental damage. *See supra* discussion Part I.B. Zebra mussels spawn from spring to early fall with individual females producing up to one million eggs, and the larvae spend up to 33 days in the plankton. *See* M. Sprung, *The Other Life: An Account of Present Knowledge of the Larval Phase of* Dreissena polymorpha, *in* ZEBRA MUSSELS: BIOLOGY IMPACTS AND CONTROL 39-53 (T. F. Nalepa & D. W. Schloesser eds., 1993). Thus, ships that take on ballast water between spring and fall at freshwater ports in Europe, the Great Lakes, the Saint Lawrence Seaway, the Hudson River or New Orleans are likely to carry zebra mussels.

[348] For example, in one study of ships discharging ballast water from Japan into Coos Bay, Oregon, crustaceans were found in the ballast water from at least 98.6 percent of the ships. *See* James T. Carlton & J. B. Geller, *Ecological Roulette: The Global Transport of Nonindigenous Marine Organisms,* 261 SCIENCE 78-82 (1993).

[349] *See* 50 C.F.R. § 16.3 (2000).

[350] *See id.* § 16.13(1).

[351] CAL. FISH & GAME CODE § 6400 (West 1998).

Game]."[352] Additionally, California Code of Regulations establishes that "[n]o person shall release in to the wild without written permission of the [Fish and Game] Commission any wild animal...which...is not native to California."[353] Pursuant to the above statutes and regulations, California has published two lists of species that may not be imported, transported, possessed or released into the wild without specific authorization, including several that may be found in ballast water.[354] The California Department of Fish and Game additionally has the power to destroy any fish, amphibian, or aquatic plant that it determines is "merely deleterious" to in-state fish, aquatic plants, amphibians or aquatic animal life.[355]

Despite the broad language in these statues and regulations, California agencies have failed to apply them to the most important mechanism importing and releasing exotic organisms into state waters: ballast water discharges. The Legisla-

---

[352] *Id.* § 2271(a).

[353] CAL. CODE REGS. tit. 14, § 671.6 (2000). "Wild animal" is defined to include fish, crayfish and gastropods.

[354] *See* CAL. FISH & GAME CODE § 2118 makes it "unlawful to import, transport, possess, or release alive into this state, except under a revocable, nontransferable permit" any of a list of species that includes various primarily freshwater fish, three common genera of crayfish, and "all species of slugs." "Transport" is broadly defined to include "to move, convey, carry, or ship by any means" CAL. FISH & GAME CODE § 2580(a). CAL. CODE REGS. tit. 14, § 671 (2000) makes it "unlawful to import, transport, or possess alive...except under permit issued by the Department of Fish and Game" a somewhat larger list of species that includes all species in the genus *Eriocheir* (mitten crabs) and all species in the genus *Dreissena* (zebra mussels). Species in the latter two groups are believed to have been introduced via ballast discharges into, respectively, northern Europe and eastern North America, and resulted in substantial economic and environmental damage. *See supra* note 347 and discussion of zebra mussels *supra* Part I.B. Cal. Code Regs. § 236 also prohibits importing any of the listed species "unless specifically authorized" by the California Fish and Game Commission.

[355] CAL. FISH & GAME CODE § 6303. As noted *supra* in Part II.A.3, recent legislation bars state departments such as CDFG from imposing additional requirements on ballast water discharges under these Fish & Game statutes or other state laws prior to Jan. 1, 2004. *See* CAL. PUB. RES. CODE § 71207(a) (West 2000). However, the courts may impose penalties or injunctions if they find that the importing, transporting or releasing into the wild of exotic organisms in ballast water discharges violates these statutes. In addition, the Lacey Act at 16 U.S.C. Section 3372(a) (2000) makes it a federal offense to violate a state law, such as CAL. FISH & GAME CODE Section 2271(a), which prohibits the importing of fish, wildlife or plants. In *Maine v. Taylor*, the U. S. Supreme Court upheld the use of the Lacey Act "for federal enforcement of valid state...wildlife laws." Maine v. Taylor, 477 U.S. 131, 139-40 (1986).

ture intended such statutes to apply to ballast water discharges. This intent was made clear by Assembly Bill 1625, passed by the Legislature and signed into law in 1998, which added to the Fish and Game Code three sections related to violations of Section 6400 "through the use of an aquatic nuisance species."[356] Section 12023 increased the penalties for violations, Section 12024 made violators "liable for all public and private response, treatment, and remediation efforts resulting from the violation," and Section 12026 provided for rewards to persons providing information leading to the arrest and conviction of violators. Ballast water releases were specifically exempted from the increased penalties of Section 12023,[357] but not from the liability or reward provisions, or from Section 6400 itself, or the already established penalties.[358] In adopting a narrow exemption that applies only to certain penalties for violation of Section 6400 by ballast water discharges, the Legislature implicitly recognized the general applicability of Section 6400 and its other penalty provisions to ballast water discharges.

D. REGULATING BALLAST WATER DISCHARGE THROUGH ENVIRONMENTAL REVIEW

Because of the extensive federal role in the development and maintenance of navigational channels and port and harbor facilities, the National Environmental Policy Act (NEPA) provides an important opportunity to assess and potentially avoid the effects of ballast water transfers in the introduction and spread of exotic species. Although NEPA does not contain substantive protections for the environment[359] and applies only to federal actions, it does provide an opportunity for both federal agencies and the public to assess and consider the relationship between ballast water practices, invasions of exotic organisms

---

[356] *See* definition of "exotic species" *supra* note 5.

[357] *See* CAL. FISH & GAME CODE § 12023(d) (West 1994).

[358] These already established penalties are imprisionment for up to a year and /or a fine of up to $5000. *See* CAL. FISH & GAME CODE § 12007. Section 12023 increased the penalties, for non-ballast water releases of aquatic nuisance species, to imprisonment for six months to a year and/or a fine of up to $50,000. *See id.* § 12023.

[359] *See* Vermont Yankee Nuclear Power Corp. v. Natural Resources Defense Ctr., 435 U.S. 519, 558 (1978).

and the resulting ecological, economic and public health impacts. The California Environmental Quality Act (CEQA), which more broadly applies to any discretionary project approved, financed or carried out by a California state agency,[360] provides a similar opportunity for assessing the effects of non-federal actions, but additionally provides a level of substantive protection that NEPA does not.[361]

NEPA, CEQA and their implementing regulations require that decision-makers evaluate the potential direct, indirect and cumulative impacts of a given action prior to project approval.[362] If a given action may have significant impacts then an Environmental Impact Statement under NEPA, and/or an Environmental Impact Report under CEQA must be prepared to assess the project's impacts,[363] analyze potential alternatives,[364] and consider mitigation measures that could reduce significant impacts.[365] A single environmental review document can be used to satisfy the requirements of both NEPA and CEQA.[366] While NEPA does not actually require an agency to adopt any mitigation measures, CEQA mandates that "[a] public agency should not approve a project as proposed if there are feasible alternatives or mitigation measures available that would substantially lessen any significant effects that the project would have on the environment."[367]

At least one court has specifically found that under NEPA, federal agencies must consider how their actions affect the

---

[360] *See* CAL. PUB. RES. CODE §§ 21065, 21063.

[361] *See id.* §§ 21002, 21081(a).

[362] *See, e.g.*, 42 U.S.C. § 4332(2)(C)(i) (1995). *See also* 40 C.F.R. § 1508.8(b) (2000) *and* CAL. PUB RES. CODE § 21002.1(a).

[363] *See* 42 U.S.C. § 4332(2)(C)(i). *See also* CAL. PUB. RES. CODE § 21080(d) (West 2000) *and* CAL. CODE REGS. tit. 14, § 15064 (a)(1) (2000).

[364] *See* 42 U.S.C. § 4332(2)(C)(iii). *See also* CAL. CODE REGS. tit 14, § 15126(d).

[365] *See* NEPA MIT ADD, CAL. PUB. RES. CODE § 15021 (a)(2).

[366] *See* Village Laguna of Laguna Beach v. Bd. of Supervisors of Orange County, 134 Cal. App. 3d 1022 (1982).

[367] CAL. PUB. RES. CODE § 15021(a)(2).

spread and establishment of exotic species.[368] In that case, conservationists successfully challenged an Army Corps environmental review that failed to consider the potential watershed effects of zebra mussel colonization following the construction of a proposed reservoir.[369]

Over the past two years, eight conservation groups submitted a series of comment letters on the NEPA and CEQA documentation for proposed projects at the Port of Oakland, based on impacts related to the discharge of exotic organisms in ballast water. The projects, including a dredging[370] and a berth expansion project,[371] would upgrade and expand the Port's facilities. The conservation groups argue that the projects will lead to an increase in the release or establishment of exotic species transported in ballast water, in other components of ships' seawater systems, or attached to ships' hulls or anchors. They further argue that the potential impacts from such exotic species introductions have not been adequately analyzed, and that feasible mitigations have not been adequately or fairly analyzed or adopted.

Among other issues, the conservation groups claim that the projects may lead to larger numbers of exotic organisms being introduced, to exotic organisms from different source regions being introduced, and to exotic organisms arriving from overseas in better condition after more direct and, therefore, shorter voyages.[372] They also argue that the proposed dredging

---

[368] *See* Hughes River Conservancy v. Glickman, 81 F.3d 437 (4th Cir. 1996).

[369] *See id.*

[370] *See, e.g.,* U. S. ARMY CORPS OF ENGINEERS, ET AL., OAKLAND HARBOR NAVIGATION IMPROVEMENT (-50 FOOT) PROJECT, FINAL ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT, VOLUME II (May 1998) [hereinafter Final EIR, Oakland Harbor].

[371] *See, e.g.,* PORT OF OAKLAND, ET AL., BERTHS 55-58 PROJECT, DRAFT ENVIRONMENTAL IMPACT REPORT, VOLUME 1: MAIN TEXT (Dec. 11, 1998) [hereinafter Port of Oakland, *Berths Project Vol. I*].

[372] *See* Letter from Warner Chabot, Director, Center for Marine Conservation, Pacific Region and seven other organizations to Gail Staba, Environmental Planning Department, Port of Oakland 3 (Mar. 4, 1998) (on file with author). *See also* Letter from Warner Chabot, Director, Center for Marine Conservation, Pacific Region and eight other organizations to Eric Jolliffe, U. S. Army Corps of Engineers, San Francisco

and emplacement of dredged sediments may lead to an increased rate of establishment of exotic species by creating disturbed and defaunated (and therefore vulnerable) habitat adjacent to areas where ballast water is released.[373] They further suggest that the projects may be inconsistent with various statutes, including CWA sections 303(d), 401 and 402, ESA, the Marine Mammal Protection Act, Porter-Cologne, and sections of the California Fish and Game Code.[374] In response, the Port expanded its discussion of the potential impacts from the discharge of exotic organisms in ballast water, [375] and adopted mitigations including a mandatory ballast water exchange ordinance for vessels using its facilities.[376] However, the conser-

---

District 11 (Mar. 30, 1998) (on file with authors). *See* Letter from Warner Chabot, Director, Center for Marine Conservation, Pacific Region, and eight other organizations to Robert McIntyre, Review Manager, U.S. Army Corps of Engineers, Policy Review Branch 2, 5, 11-12 (June 19, 1998) (on file with authors). *See also* Letter from Linda Sheehan, Pollution Program Manager, Center for Marine Conservation, Pacific Region and seven other organizations to Richard Sinkoff, Supervisor, Environmental Planning Department, Port of Oakland 5, 9-10 (Jan. 28, 1999) (on file with authors).

[373] *See* Letter from Warner Chabot to Robert McIntyre, *supra* note 372, at 2, 5, 12. *See also* Letter from Linda Sheehan to Richard Sinkoff, *supra* note 372, at 5, 9. *See* Letter from Linda Sheehan, Pollution Program Manager, Center for Marine Conservation, Pacific Region and seven other organizations to Jon Amdur, Port of Oakland 8 (Oct. 20, 1999) (on file with authors).

[374] *See* Letter from Warner Chabot to Eric Jolliffe, *supra* note 372, at 20-23. Letter from Deborah A. Sivas, Stanford Environmental Law Clinic to Lt. General Joe N. Ballard, Chief of Engineers and Commander, U. S. Army Corps of Engineers and Lt. Colonel Peter T. Grass, U. S. Army Corps of Engineers, San Francisco District (Jan. 6, 1999) (on file with authors). *See* Letter from Linda Sheehan to Richard Sinkoff, *supra* note 372, at 6, 18-19.

[375] *See* Final EIR, Oakland Harbor *supra* note 370, at Appendices N through V, and Appendix X: Responses to Comments. *See also* Port of Oakland, *Berths Project Vol. I supra* note 371, at 3.6-14, 3.6-25 to 3.6-28, and 3.6-31 to 3.6-33. *See* PORT OF OAKLAND, ET AL., BERTHS 55-58 PROJECT, DRAFT ENVIRONMENTAL IMPACT REPORT, VOLUME 2: APPENDICES APP. F1 (Dec. 11, 1998) [hereinafter Port of Oakland, *Berths Project Vol. II*]. PORT OF OAKLAND, BALLAST WATER MANAGEMENT STUDY. BERTHS 55-58 PROJECT, FINAL ENVIRONMENTAL IMPACT REPORT, VOLUME III: RESPONSE TO COMMENTS 3-67-3-78 (Apr. 8, 1999) [hereinafter Port of Oakland, *Berths Project Vol. III*]. PORT OF OAKLAND, OAKLAND HARBOR NAVIGATION IMPROVEMENT (-50 FOOT) PROJECT, REVISIONS TO THE FINAL ENVIRONMENTAL IMPACT REPORT. PORT OF OAKLAND 15-16 (Sept. 1999).

[376] *See* Port of Oakland, *Berths Project Vol. I supra* note 371, at 3.6-31 to 3.6-32. *See also* Port of Oakland, *Berths Project Vol. II supra* note 375, at app. F2. Port of Oakland, *Berths Project Vol. III supra* note 375, at 3-73 to 3-76. Dennis Cuff, *Port Aims to Protect Bay Species*, SAN JOSE MERCURY NEWS, Oct. 6, 1998, at B1.

vation groups do not consider this to be adequate mitigation,[377] and could challenge the projects.

While neither NEPA or CEQA can be expected to bear the brunt of ballast water reform, both can provide a much needed opportunity to consider the effects of ballast water discharges of exotic organisms on everything from shellfish production to endangered species.[378] CEQA's substantive requirement to adopt any feasible alternatives or mitigation measures that would substantially lessen the project's significant environmental impacts, and the potential for delay in project implementation under NEPA or CEQA if environment assessment and documentation has to be redone and recirculated for public comment, may lead project proponents to adopt mitigations such as requirements for ballast water exchange or treatment.[379] Assessing the potentially serious effects of invasions of exotic organisms through the CEQA or NEPA process may also help persuade states or the federal government to require treatment of ballast water—an action that may appear more reasonable when decision makers are forced to balance the eco-

---

[377] *See* Letter from Linda Sheehan to Richard Sinkoff, *supra* note 372, at 2-3, 5-6, and 11-18. *See also* Letter from Linda Sheehan to Jon Amdur, *supra* note 373, at 2 and 9-12. The CEQA documentation for the berth expansion project was certified in April, 1999 and the opportunity to file suit has passed. Telephone interview with Jody Zaitlin, Port of Oakland (Dec. 1999). A challenge to this project's environmental documentation under NEPA, or to the dredging project's documentation under NEPA or CEQA, remain possible. Telephone interview with Michael Lozeau, Staff Attorney, Earthlaw (Jan. 2000).

[378] In Oregon, where the Army Corps has refused to consider the effects of ballast water discharges and the release of exotic organisms that could result from a proposed channel deepening project, NEPA is principally being used to get the Corps to recognize that there is an issue.

[379] As noted *supra* Part II.A.3, recent legislation bars state agencies from imposing additional requirements on ballast water discharges prior to Jan. 1, 2004. *See* CAL. PUB. RES. CODE § 71207(a) (West 2000). However, the analysis and disclosure of environmental impacts resulting from a proposed project, including impacts resulting from changes in ballast water discharges caused by a project, would still be required under CEQA. Furthermore, while *state agencies* might be barred from imposing CEQA's substantive mitigation requirement, in practice CEQA's requirements are frequently invoked through lawsuits filed by individuals, non-governmental organizations or local governments. Such actions would not be restricted, nor would the courts be barred from imposing restraining orders or injunctions on projects whose environmental analyses and documentation or whose mitigations with regard to ballast water discharges fail to satisfy CEQA.

nomic and environmental risks of invasions against the economic incentives to increase shipping and thus, ballast discharges.

E. REGULATING BALLAST WATER DISCHARGE AS A COASTAL ZONE MANAGEMENT ISSUE

In part, California manages activities in the coastal zone by regulating land use and by setting conditions on leases of state-owned tidelands. State statutes and policies direct agencies to manage these uses to support various objectives, including the protection of natural resources, native species, water quality and other public benefits. In some cases, this may require managing the discharge of ballast water associated with those land uses.

1. The California Coastal Zone

Planning and development within the California coastal zone is managed under the authority of the California Coastal Act,[380] (hereinafter "Coastal Act") which requires proposed developments in the coastal zone to obtain a coastal development permit.[381] The Act created the California Coastal Commission (CCC) to oversee the planning and permitting process.[382] In addition, the federal Coastal Zone Management Act (CZMA)[383] requires federal actions to be consistent with the policies of the Coastal Act.

The coastal zone is defined on a set of maps, and generally includes the land and water "extending seaward to the state's outer limit of jurisdiction,[384] including all offshore islands, and extending inland generally 1,000 yards from the mean high tide line of the sea" (exclusive of the jurisdiction of the San Francisco Bay Conservation and Development Commission,

---

[380] *See* CAL. PUB. RES. CODE §§ 30000-30900 (1996).

[381] *See id.* § 30600.

[382] *See id.* §§ 30300-30344.

[383] *See* 16 U.S.C. § 1451 (2000).

[384] Three miles from shore.

which is described in the next section).[385] The coastal zone extends further inland in "significant coastal estuarine, habitat and recreational areas" and less far inland in developed urban areas.[386] Within this zone, permits for developments on "tidelands, submerged lands, and public trust lands" are issued by the CCC.[387] Permits for developments in specified port areas and other land areas may be issued by, the relevant port governing body in conformity with a certified port master plan,[388] or the relevant local government in conformity with a certified local coastal program.[389] Port master plans and local coastal programs are reviewed and certified by the CCC.[390] In the absence of a certified plan or program, coastal development permits are issued by the CCC.[391] The Coastal Act defines developments to include:

> the placement or erection of any solid material or structure; discharge or disposal of any dredged material or of any gaseous, liquid, solid or thermal waste...change in the density or intensity of use of land...change in the intensity of use of water... [and] construction, reconstruction, demolition, or alteration of the size of any structure[.][392]

Development permits are to be issued, and port master plans and local coastal programs certified, only if they are consistent with the policies of the Act.[393]

---

[385] CAL. PUB. RES. CODE § 30103(a).

[386] *Id.*

[387] *Id.* §§ 30519, 30600.

[388] *See id.* §§ 30700-30721. The specified port areas are the Ports of Hueneme, Long Beach, Los Angeles and San Diego.

[389] *See* CAL. PUB. RES. CODE §§ 30500-30504 (West 2000).

[390] *See id.* §§ 30512.1, 30514, 30702, 30714, 30716.

[391] *See id.* §§ 30600, 30715.

[392] *Id.* § 30106.

[393] *See id.* §§ 30200(a), 30512.2, 30714, 30715.5, 30716(c). The policies are described in Chapter 3 of the statute. *See id.* §§ 30200-30265.5.

The Coastal Act's policies state that "[m]arine resources shall be maintained, enhanced, and, where feasible, restored" and that "[u]ses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes."[394] Coastal water quality is also to be maintained or restored to maintain optimum populations of marine organisms and protect human health "through, among other means, minimizing adverse effects of waste water discharges." [395] The policies further state that diking, filling, or dredging for new or expanded port facilities, or to maintain or restore the depth of navigational channels, turning basins, or vessel berthing and mooring areas shall be permitted "where feasible mitigation measures have been provided to minimize adverse environmental effects."[396] Finally, where conflicts arise between different policies in the Act they are to be "resolved in a manner which on balance is the most protective of significant coastal resources."[397]

Although the Coastal Act does not directly apply to federal agencies, under the CZMA any federal agency action (which includes activities directly undertaken by federal agencies, including development projects, as well as federal licensing, permitting or funding of activities conducted by others) that affects natural resources within the coastal zone is to be "carried out in a manner which is consistent to the maximum extent practicable with the enforceable policies" of the Coastal Act.[398] For example, activities undertaken, licensed, permitted or

---

[394] *Id.* § 30230.

[395] CAL. PUB. RES. CODE § 30231 (West 2000).

[396] *Id.* § 30233(a).

[397] *Id.* § 30007.5.

[398] *See* 16 U.S.C. §§ 1456(c), (d) (2000). A federal agency undertaking an activity that affects natural resources within the coastal zone is required to provide the State with a consistency determination at least 90 days before final approval of the activity. In addition, any applicant for a required federal license or permit, or using federal funding, to conduct such an activity is required to provide a certification of compliance with the Coastal Act's policies. *See id.* § 1456(c)(3)(A).

funded by federal agencies in waters outside of the state's jurisdiction but affecting natural resources within the state's jurisdiction are required by the CZMA to be in conformance with the Coastal Act's policies.[399]

Developments resulting in the introduction of exotic organisms into the coastal zone violate the policies of the Coastal Act to the extent that such organisms degrade marine resources, reduce biological productivity, harm populations of marine organisms that are of commercial, recreational, scientific or educational interest, or affect human health. As discussed earlier, exotic organisms introduced in ballast water discharges may have these effects. The CCC has on occasion explicitly recognized that the introduction or persistence of exotic organisms conflicts with the policies of the Act by including conditions in coastal development permits that restrict plantings to native species or require the removal of exotic plants.[400]

The Coastal Act establishes the authority for state permitting of ballast water discharges of exotic organisms in two ways. First, coastal development permits are required for port or terminal projects, channel dredging projects and other types of projects that may affect shipping. To the extent that these projects affect the volumes, sources or condition of ballast water discharges, and may increase the number or diversity of exotic organisms released or established, they would conflict with the Act's policies. Permit conditions for such projects may thus require that measures be taken to control ballast discharges.[401] Second, since ballast water discharges are dis-

---

[399] *See id.* §§ 1456(c), (d). Telephone interview with T. Grove, Deputy Director, California Coastal Commission (1999).

[400] Telephone interview with T. Grove *supra* note 399.

[401] *See* CAL. PUB. RES. CODE §§ 30200(a), 30233(a), 30714, 30715.5 (West 2000). As noted in Part II.A.3, recent legislation bars state commissions such as the CCC from imposing additional requirements on ballast water discharges under the Coastal Act or other state laws prior to Jan. 1, 2004. *See* CAL. PUB. RES. CODE § 71207(a). However, the CCC could take steps short of imposing requirements, such as developing, proposing and holding hearings on language for permit requirements that would go into effect on or after that date. In addition, since the federal CZMA requires that projects permitted, funded or undertaken by federal agencies conform with the policies of the Coastal Act, comment or action by the CCC on these projects would not be barred. Penalties

charges of a liquid waste, they qualify as a development under the Act's definition[402] and require a permit. In addition, under the CZMA's consistency requirements,[403] actions undertaken, licensed, permitted or funded by federal agencies that would increase the exotic organisms released or established via ballast discharges may required amendment or mitigation.

2. San Francisco Bay Region

The San Francisco Bay Conservation and Development Commission (BCDC) was created by California's McAteer-Petris Act[404] and receives its authority from that Act, the Suisun Marsh Preservation Act,[405] and the federal CZMA.[406] BCDC has permitting authority over dredging, filling and substantial changes in use within its jurisdiction,[407] which includes all of San Francisco Bay within reach of the tides.[408] Suisun Marsh also grants BCDC permitting authority over marsh developments as defined within the primary management area, and appeal authority from local government decisions concerning marsh developments within the secondary management area.[409] BCDC's authority applies to both private parties and non-federal agencies.[410] In addition, under the CZMA, any federal agency activity or activity licensed, permitted or funded by a

---

may also be imposed by the superior court for violations of the Coastal Act. *See* CAL. PUB. RES. CODE § 30820.

[402] *See* CAL. PUB. RES. CODE § 30106.

[403] *See* 16 U.S.C. §§ 1456(c), (d).

[404] *See* CAL. GOV'T CODE §§ 66600-66682 (West 1997).

[405] *See* CAL. PUB. RES. CODE §§ 29000-29612.

[406] *See* 16 U.S.C. § 1451 (2000).

[407] *See* CAL. GOV'T CODE § 66632(a) (West 1997).

[408] BCDC's jurisdiction consists of all areas subject to tidal action within San Francisco Bay from the Golden Gate to the Sacramento River plus certain tributary creeks and rivers, including all sloughs, marshlands, tidelands and submerged lands up to five feet above mean sea level; plus salt ponds and managed wetlands diked off from the bay and maintained in use during the three years prior to the 1969 amendment of the McAteer-Petris Act; plus a shoreline band within 100 feet landward of the San Francisco Bay shore. *See id.* § 66610.

[409] *See* CAL. PUB. RES. CODE § 29000-29612 (West 2000).

[410] *See* CAL. GOV'T CODE § 66632(a).

federal agency that affects land or water use or natural resources within BCDC's jurisdiction, and any activity or development project undertaken by a federal agency within BCDC's jurisdiction, must be consistent with BCDC's enforceable policies.[411]

BCDC will not issue permits to projects that do not conform with the provisions and policies of the McAteer-Petris Act and the San Francisco Bay Plan.[412] Permits may be granted subject to "reasonable terms and conditions" to meet the purposes of the Act and the Plan.[413] BCDC may issue cease and desist orders to block unpermitted projects or activities inconsistent with an issued permit, [414] may seek enforcement by injunction, [415] and may seek or impose penalties for violations.[416]

Projects resulting in the introduction of exotic species into the Bay would likely be inconsistent with the Bay Plan. For example, an objective of the plan is to "protect the Bay as a great natural resource for the benefit of present and future generations." [417] If the long-term protection of this resource implies maintaining it in something approximating its natural state, then the establishment or spread of exotic organisms would violate that objective. The Bay Plan's policies state that marshes, mudflats, fish and wildlife benefits, habitats needed to prevent the extinction of any species, and habitats needed to maintain or increase species that provide substantial public

---

[411] *See* 16 U.S.C. §§ 1456(c), (d). Consistency determinations or certifications must be provided for relevant activities undertaken, licensed, permitted or funded by federal agencies.

[412] *See* CAL. GOV'T CODE § 66632(f) and San Francisco Bay Plan 1998 at cover letter. The Bay Plan was adopted in 1968 and is currently undergoing its first comprehensive revision. BCDC staff is considering recommending the inclusion of policies on exotic species. Interview with Leora Elazar, BCDC Coastal Program Analyst (Sept. 1999). Within the shoreline band, BCDC may deny a permit only for failing to provide adequate public access to the bay and its shoreline. *See* CAL. GOV'T CODE § 66632.4.

[413] *See* CAL. GOV'T CODE § 66632(f) (West 1997).

[414] *See id.* §§ 66637, 66638.

[415] *See id.* § 66640.

[416] *See id.* §§ 66641, 66641.5.

[417] San Francisco Bay Plan 1998 at 7.

benefits are to be protected, maintained or restored.[418] As exotic species may have harmful impacts on fish and wildlife and may substantially alter marsh, mudflat and other aquatic and wetland habitats, their introduction would violate these policies.

The Bay Plan's policies also state that water pollution should be avoided, that water quality should be maintained in all parts of the bay, and that BCDC's actions with regard to water quality should be based on the "policies, recommendations, decisions, advice and authority" of the State Water Resources Control Board and San Francisco Bay RWQCB.[419] Since these agencies have listed the Bay as water-quality limited for exotic species discharged in ballast water,[420] a project that increased the release of exotic species in ballast water would clearly violate the Bay Plan.

Thus, if a project that involved dredging, filling or a substantial change in use can be reasonably expected to contribute to the introduction or spread of an exotic species, BCDC could deny a permit to the project or could require mitigation of that impact as a permit condition.[421] These circumstances would arise with a project creating or expanding a marine port or terminal, or dredging a waterway, if the likely result would be an increase in the amount of ballast water discharged into San Francisco Bay, a change in the source of the ballast water, or a decrease in the travel time for the ballast water.[422] Appropriate

---

[418] *See* San Francisco Bay Plan 1998 at 9-10, 12-13.

[419] San Francisco Bay Plan 1998 at 11.

[420] *See supra* Part II.B.1.a.ii.

[421] As noted *supra* Part II.A.3, recent legislation bars state commissions such as BCDC from imposing additional requirements on ballast water discharges under McAteer-Petris or under other state laws prior to Jan. 1, 2004. *See* CAL. PUB. RES. CODE § 71207(a) (West 2000). However, BCDC could take steps short of imposing requirements, such as developing, proposing and holding hearings on language for permit requirements that would go into effect on or after that date. In addition, since the federal CZMA requires that projects permitted, funded or undertaken by federal agencies conform with the policies of state law including McAteer-Petris, comment or action by BCDC on these projects would not be barred.

[422] Since the number and diversity of organisms in a ballast tank generally decreases dramatically over the course of a voyage (*see* discussion *supra* Part I.C), reduc-

mitigation might involve requiring the exchange or treatment of the ballast water that would arrive at the facility or pass through the dredged waterway, or adopting an exotic species response plan, including both strategy and funding for controlling existing or future invasions.

Violations of the Bay Plan's policies could also arise from projects that alter portions of the San Francisco Bay environment so as to encourage the establishment or spread of exotic organisms. This could occur with projects that dredge or deposit sediment in the bay, to the extent that this creates disturbed habitat or habitat with a depauperate biota, since such habitat may be especially vulnerable to the establishment or spread of exotic species.[423] The creation of such readily-invasible habitat may be of particular concern in areas where exotic organisms are regularly released, such as dredging or filling done in or near a port where ballast water is discharged. Appropriate mitigation might involve requiring the exchange or treatment of the ballast water until such time as the disturbed or depauperate habitat has been fully colonized by extant organisms in the bay.

3. State Tidelands Leases and Marine Terminal Regulation

The State Lands Commission (SLC) was established to manage lands owned by the State of California.[424] These lands include tidelands and submerged lands from the mean high-tide line to three miles from shore, swamp and overflow lands,

---

ing the ballast water's travel time would tend to increase the number and diversity and improve the condition of the organisms released in the discharge.

[423] *See* CHARLES S. ELTON, THE ECOLOGY OF INVASIONS BY ANIMALS AND PLANTS 117 (1958). *See generally* Robert A. Leidy & Peggy L. Fiedler, *Human Disturbance and Patterns of Fish Species Diversity in the San Francisco Bay Drainage, California* 33 BIOLOGICAL CONSERVATION 247-267 (1985). *See also* F. H. Nichols, et al., *Remarkable Invasion of San Francisco Bay (California, USA) by the Asian Clam* Potamocorbula Amurensis, II. *Displacement of a Former Community*, 66 MAR. ECOL. PROG. SER. 95, 100 (1990). Essentially, all dredging or filling activities within the Bay would likely leave disturbed and depauperate sediment surfaces vulnerable to colonization by exotic organisms, unless the top surface of the dredged channel or emplaced fill consisted of highly toxic sediments or other material that organisms could not live on.

[424] *See* CAL. PUB. RES. CODE §§ 6001-6465 (West 1977).

and the beds of naturally navigable rivers, streams and lakes.[425] Where ports have been constructed on such lands, the land title has been conveyed to the local government managing the port, but about twenty privately-owned marine terminals are constructed in part on land leased from the SLC.[426] The SLC holds these lands in trust and has an affirmative duty to manage them in accordance with the public trust doctrine, which includes protecting "the people's common heritage of streams, lakes, marshlands and tidelands."[427] The SLC is authorized by statute to include lease terms and conditions that it believes to be in the best interests of the state.[428]

The SLC is also directed by statute to adopt rules, regulations, guidelines and leasing policies addressing "the location, type, character, performance standards, size, and operation of all existing and proposed marine terminals within the state, whether or not on lands leased from the commission [, to] provide the best achievable protection of public health and safety and the environment."[429] Marine terminals are required to prepare and submit, for SLC approval, an operations manual describing the equipment and procedures used to achieve these goals.[430] Vessels docked at the facilities are required to comply with the terms of the manual,[431] and the SLC is empowered to inspect and monitor terminals with respect to these goals.[432]

Thus, when the SLC leases state lands for marine terminals or other navigational improvements, it has the statutory au-

---

[425] *See* STATE LANDS COMMISSION, DELTA-ESTUARY, CALIFORNIA'S INLAND COAST: A PUBLIC TRUST: REPORT 2 151 (1991).

[426] Telephone interview with Mark Meier, Attorney, State Lands Commission (1999).

[427] National Audubon Society v. Superior Court, 33 Cal.3d 419 (1993).

[428] *See* CAL. PUB. RES. CODE § 6501.2.

[429] *Id.* §§ 8755(a), 8756. A marine terminal is defined as "any marine facility used for transferring oil to or from tankers or barges." *Id.* § 8750(h). This includes most shipping terminals in California.

[430] *See id.* § 8758(a).

[431] *See id.* § 8758(g).

[432] *See id.* § 8757(a).

thority and potentially a public trust duty to include terms that protect wildlife and natural resources, and a statutory responsibility to develop leasing policies for marine terminals that protect public health and the environment.[433] In addition, the SLC is responsible for developing and monitoring regulatory requirements for all marine terminals, whether or not on land leased from the SLC, that protect public health and the environment.[434] So, for activities on land leased from the SLC that involve ballast discharges, or for marine terminals whose operations could result in the release of exotic species in ballast discharges that could in turn affect public trust uses, public health or the environment, the SLC has the authority and possibly the legal obligation to write lease terms and adopt regulations that require ballast water management.[435] Inclusion of such terms in marine terminal leases has been considered in a few cases.[436] In addition, existing lease terms prohibiting the

---

[433] *See id.* § 8755(a). In addition, issuing or renewing such leases is a discretionary action on the part of the SLC, and thus triggers an environmental review under CEQA. Interview with John Lien, Environmental Division, State Lands Commission (1999). Lease terms addressing the management of ballast water discharges could thus be used to satisfy CEQA requirements for mitigation of significant impacts. *See* discussion *supra* Part II.D.

[434] *See* CAL. PUB. RES. CODE §§ 8755(a), 8756, 8757(a) (West 2000).

[435] As noted in the discussion *supra* Part II.A.3, recent ballast water legislation bars commissions such as SLC from imposing additional requirements on ballast water discharges prior to January 1, 2004. *See id.* § 71207(a). However, SLC could write leases with a "reopener" clause, or could develop leasing policies, that would allow terms requiring ballast water management to be included after that date; and similarly could develop rules, regulations or guidelines related to ballast water management that it would expect to be incorporated into marine terminal operations manuals after that date. In addition, the above-mentioned legislation may not bar SLC from essentially exercising the right of a property owner by offering protective lease terms and conditions, in contrast to adopting a regulatory requirement. Finally, the SLC would not be barred from taking actions compelled by the public trust doctrine.

[436] The Environmental Impact Report for an oil terminal in San Francisco Bay proposed that the potential impacts from releasing exotic organisms in ballast water could be mitigated by prohibiting tankers using the terminal from discharging ballast water into the bay and requiring instead that all ballast water (segregated as well as unsegregated) be off-loaded to the terminal's on-shore wastewater treatment facility. *See generally* DRAFT ENVIRONMENTAL IMPACT REPORT FOR CONSIDERATION OF A NEW LEASE FOR THE OPERATION OF A CRUDE OIL AND PETROLEUM PRODUCT MARINE TERMINAL ON STATE TIDE AND SUBMERGED LANDS AT UNOCAL'S SAN FRANCISCO REFINERY, OLEUM, CONTRA COSTA COUNTY 4.4-2, 4.4-4 (March 1994) (report prepared for State of California State Lands Commission). This requirement was not included in the terms of the lease, however. In 1997, the environmental review of the lease application for

discharge of pollutants could possibly be applied to ballast discharges of exotic organisms.[437]

CONCLUSION

Until quite recently, policymakers and regulators generally viewed ballast water discharges as harmless. Over the last few decades, however, scientific research and several dramatic ballast water invasions have made it abundantly clear that this view was incorrect. Events have repeatedly demonstrated that ballast water discharges can result in substantial damage to ecosystems, to economic activities, and even to public health. But because of our earlier mistaken view, we approach the close of the twentieth century with virtually no regulation of these potentially harmful discharges. Our review of the facts concerning ballast discharges and the scope of existing laws suggests that the current situation can be summarized as follows.

Despite the very limited amount of research that has been done on treating ballast water to remove or kill exotic species, it is clear that the basic technology to do so exists. Our long experience as a modern society with disinfecting drinking water supplies and wastewater flows has provided us with a plethora of well-developed tools for killing organisms in large volumes of water. More recent technologies may eventually provide us with even more efficient approaches. Even applying only those methods that are being used to treat water and wastewater today, it is well within our ability to substantially reduce, if not eliminate, the discharge of exotic organisms in ballast water.

Chevron's Estero Marine Terminal was assessing the release of exotic species in ballast water for potential impacts and mitigation measures when the lease application was withdrawn. Telephone interview with John Lien, State Lands Commission, Environmental Division (1999).

[437] Telephone interview with Mark Meier, Attorney, State Lands Commission (1999).

With the recent recognition of the damage that can result from the release of exotic species in ballast water discharges, science and common sense dictates a need for prompt regulatory action. There is, however, a long history of inaction to overcome. This includes a few regulatory missteps—a prime example being the EPA's 1973 adoption of a regulation exempting ballast water discharges from the Clean Water Act's permit requirements. This exemption, though illegal on its face, was adopted at the time because the EPA believed that ballast water discharges were harmless. Given what is now known about their impacts, if the EPA were to approach the issue anew, it clearly would have no basis for adopting such an exemption. Neither does there appear to be any legal or scientific rationale for maintaining it.

On the other hand, the shipping industry has been discharging ballast water without oversight or regulation for over a century, and not surprisingly the industry is now rather resistant to the imposition of regulations. The contrast between the past lack of regulations and the current regulatory need is great, and the resulting potential for conflict is substantial. In these circumstances the legislative response, not surprisingly, has been rather timid, marked more by rhetoric than by action. Thus, in 1996 Congress passed a much-publicized national law on ballast water which, when carefully parsed, merely makes it officially voluntary for the shipping industry to do anything about its ballast water discharges.

At the core of the body of relevant law are laws regulating the discharge of pollutants into the nation's and states' waters. Under the usual definitions in these laws, ballast water discharges are waste discharges, and exotic species, which are frequently contained in ballast water, are biological pollutants. These laws generally prohibit such waste discharges without a permit, which set limits on the concentrations or total loads of pollutants that may be discharged. In the case of exotic species, which can reproduce and spread in the environment, the permissible discharge under these laws is likely to be zero.

There are several additional types of laws—pertaining to wildlife protection, the assessment and mitigation of environ-

mental impacts, and coastal zone management—that may in certain circumstances supplement or substitute for the regulation of ballast water by water pollution control statutes. These types of laws usually come into play at the time that proposed projects are adopted, approved or permitted by government agencies, and are applicable to such projects as the development or modification of shipping ports or terminals, navigable waterways, ship locks and navigation aids, harbor improvements, or other projects which may result in changes in the volumes, sources or patterns of ballast water transported and discharged. Challenges are likely to be brought under these laws if adequate and effective regulation of ballast water discharges is not implemented under water pollution or other laws, and in some cases such challenges are likely to result in delays or denials of permits or approvals for projects.

Although not discussed in this article, a potential additional layer of legal redress exists under the common law theories of liability including tort, nuisance and negligence. If government agencies do not use their available authorities to effectively regulate the release of exotic species in ballast water, we are at some point likely to see lawsuits filed against the shipping industry for recovery of the costs of damages caused by these species and recovery of the costs of containment and eradication. As we have seen from recent invasions in aquatic ecosystems, the costs resulting from the introduction of even a single, particularly harmful organism may amount to several billions of dollars. Thus—besides protecting native ecosystems and public health—implementing technologies to prevent the release of exotic organisms in ballast water could prove to be a wise investment for the shipping industry.