
**EXOTIC POLICY
TABLE OF CONTENTS**

§ 1. Introduction: Coming to terms with the issue	1
§ 2. The continuing history of invasions: What they are, the damage they do, and where they come from	6
§ 2.1. <i>Exotic, ANS, NIS, or what?</i>	6
§ 2.2. <i>Bad things in the water</i>	6
<i>The sea lamprey</i>	6
<i>The zebra mussel</i>	7
<i>The ruffe</i>	9
<i>Other invaders</i>	10
§ 2.3. <i>Dollars and damage</i>	11
§ 2.4. <i>Changing pathways for invasion over time</i>	13
<i>Canals</i>	13
<i>Intentional and “Unintentional” and Releases</i>	13
<i>Ballast water</i>	14
§ 2.5. <i>Future invasions</i>	15
§ 3. The shipping industry and ballast water: Metric tonnes, dollars, and things getting through the cracks	18
§ 3.1. <i>The global business of shipping</i>	18
§ 3.2. <i>Ships and the water they carry: A quick taxonomy of ship species</i>	20
<i>Bulkers, tankers, and container ships</i>	20
<i>Ships great and small</i>	20
<i>Ballasting up</i>	21
<i>Typical loads</i>	22
<i>Moving the water around</i>	23
<i>Speeds</i>	23
<i>Counting metric tonnes</i>	24
§ 3.3. <i>The Great Lakes and Seaway System</i>	26
<i>The Erie Canal</i>	26
<i>The St. Lawrence Seaway</i>	26
<i>The Great Lakes and Seaway maritime industry</i>	27
<i>The third party salties</i>	27
<i>The triangle trade</i>	29
<i>Tonnage carried</i>	29
<i>Paying for the Seaway</i>	30
§ 3.4. <i>Buying and renting ships</i>	31
§ 3.5. <i>The threat from ships: The biological island</i>	32
<i>Ballast</i>	33
<i>Hull fouling</i>	35
<i>Marine sanitation devices (MSDs)</i>	35
<i>Environmental benefits from shipping</i>	35

**EXOTIC POLICY
TABLE OF CONTENTS**

§ 3.6. <i>Ballast exchange: Making do and putting ships at risk</i>	36
<i>The exchange requirement</i>	36
<i>Defining “open ocean.”</i>	36
<i>Salinity</i>	37
<i>The logic of exchange</i>	37
<i>Effectiveness of the exchange regime</i>	39
<i>The design of ballast tanks</i>	39
<i>Breaking ships in half</i>	41
<i>The infamous NOBOBs</i>	43
<i>The effectiveness of exchange</i>	43
<i>The bottom line</i>	44
§ 3.7. <i>Technical options for managing ballast water</i>	45
<i>Open ocean exchange</i>	46
<i>Filtering</i>	47
<i>Ultraviolet light (UV)</i>	48
<i>Biocides</i>	49
<i>Heat</i>	49
<i>Ultrasound</i>	50
<i>Shoreside treatment</i>	50
<i>Getting serious about the options</i>	51
§ 4. Aquaculture: Teach them to grow a fish	51
§ 4.1. <i>Profile of the aquaculture industry</i>	54
§ 4.2. <i>Aquaculture technology</i>	55
§ 4.3. <i>The supply and transportation of organisms</i>	56
<i>Aquaculture diseases</i>	56
§ 4.4. <i>Genetic modification</i>	58
§ 5. Baitfish: The little fish that got away	60
§ 6. Aquaria and ornamental ponds: Exotics for sale	62
§ 7. Legal regimes for controlling ballast water: Acting locally and thinking globally	63
§ 7.1. <i>Ten years of activity on ballast water: A quick review of the bidding</i>	65
<i>The Great Lakes and the world</i>	65
<i>Activity in other jurisdictions around the world</i>	67
§ 7.2. <i>California AB 703</i>	69
§ 7.3. <i>US NISA 96</i>	70
<i>Comparing NISA 96 with other US pollution laws</i>	71
<i>A mandate for delay</i>	72
<i>A shell game over “safety.”</i>	73
<i>An 85% solution</i>	80
§ 7.4. <i>Canada Shipping Act</i>	81
§ 7.5. <i>MARPOL</i>	81

**EXOTIC POLICY
TABLE OF CONTENTS**

§ 8. Legal regimes for control of aquaculture, bait, and aquaria: Holes in the dike	83
§ 8.1. <i>State and provincial laws in the Great Lakes</i>	84
<i>Minnesota</i>	87
§ 8.2. <i>US and Canadian federal laws</i>	88
<i>United States</i>	88
<i>Canada</i>	89
§ 9. Binational regional coordination in the Great Lakes	90
§ 10. Political economics: The use and misuse of economics, and the political realities of environmental regulation	91
§ 10.1. <i>The value of fish and steel: Putting down your money and making your choices</i>	93
<i>Putting a price tag on the environment</i>	96
<i>Perception of risk</i>	106
§ 10.2. <i>All the action is on the margins: Some familiar economic fallacies</i>	107
<i>Compensating a failing industry</i>	107
<i>Passing the costs along</i>	108
<i>The lowest common denominator</i>	108
§ 10.3. <i>The policy options: Command, Litigation, Markets, unintended consequences, and real solutions</i>	109
<i>Non-regulatory and quasi-regulatory approaches</i>	109
<i>Regulation through prohibitions, permits, and prescriptions</i>	112
<i>Regulation through private rights and liabilities</i>	119
<i>Regulation through market incentives</i>	121
Appendix: Terms and Acronyms	125