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Banning Felt Soles in Vermont: A Call for State Legislative Response to the Spread of Invasive Didymo

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BANNING FELT SOLES IN VERMONT: A CALL FOR STATE LEGISLATIVE RESPONSE TO THE SPREAD OF INVASIVE *DIDYMO*

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INTRODUCTION	83
I. BACKGROUND	85
II. CURRENT FEDERAL AND STATE REGULATION OF <i>DIDYMO</i>	90
A. Federal Invasive Species Controls and the Need for State Regulation.....	90
B. State-Level Invasive Species Regulation in Vermont.....	93
III. POSSIBLE STATE REGULATORY SOLUTIONS	94
A. Bolstering Regulation Within Vermont's Established Framework.....	94
B. The New Zealand Experience	97
IV. A FELT SOLE BAN IN VERMONT.....	98
A. The Call for and Propriety of a Ban Bill.....	98
B. Potential Allies and The Affirmative Pre-emptive Response of Industry	102
C. Legislative Procedure In the Wake of the Lead Sinker Ban	103
D. A Model Felt Sole Ban Provision	104
CONCLUSION	105

INTRODUCTION

The appearance and rapid spread of invasive aquatic plants in North America over the past two decades have caused irreparable damage to many of our nation's watersheds and riparian ecosystems. Aquatic invasive species (AIS), specifically invasive aquatic plants and algae, pose a particularly difficult problem to address with traditional legal mechanisms since transfer is often largely unintentional.¹ While

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1. Sophie Riley, *Invasive Alien Species and the Protection of Biodiversity: The Role of Quarantine Laws in Resolving Inadequacies in the International Legal Regime*, 17 J. ENVTL. L. 323, 330 (2005).

“command and control” measures enforcing fines and prison sentences may seem heavy-handed, awareness campaigns and current efforts at deterrence have failed to stem the tide of destruction for invasive species like *Didymoplenia geminata* (*Didymo*).² Based on a comparison of Vermont’s current legal efforts to combat *Didymo* with New Zealand’s highly successful campaign against invasives, this article suggests that state legislatures modify their regulatory policies to stop *Didymo*’s infestation of New England’s streams and rivers. Specifically, this article suggests modifying those policies by passing a bill that bans the use of felt soled waders and boots in Vermont.

International trade, travel, and commerce perpetuate the global transfer of goods and people along a nearly infinite number of vectors.³ Invasive species utilize these vectors to “hitch-hike” across international and state lines, often unbeknownst to those transmitting them.⁴ Nonindigenous AIS introduction in the United States is often relatively unknown or seemingly innocuous, but the damaging effects can be startling.⁵ For instance, Zebra mussels have created annual control costs of \$60 million, and one-time nationwide cleanup costs of up to \$800 million for the electric industry alone.⁶ Regulation of invasives has frustrated legislators, regulators, and judges because of the inherent practical difficulties of enforcement, but some countries have implemented more comprehensive programs seemingly better armed to prevent, detect, eradicate, and control AIS.⁷ Lessons from these countries may inform positive change in traditionally ineffective American legal approaches to invasive species at state and federal levels.⁸ Faced with the present dilemma of *Didymo* invasion in many of its rivers and streams, Vermont should follow New Zealand’s approach by codifying a legislative felt sole wader ban in order to prevent the further spread of *Didymo*.

Section I briefly introduces the present dilemma and difficulty of legal efficacy in controlling *Didymo*’s spread. Section II sets forth nationwide problems with invasive species generally, and *Didymo* specifically, as well as problems posed by *Didymo* in greater New

2. See *infra* notes 27–32 (describing recent discoveries of *Didymo* in several New England states).

3. See Alexander Gillespie, *Threatened Areas of International Significance*, 22 N.Z. U. L. REV. 432, 432-43 (2007).

4. Marc L. Miller, *Does the WTO Substantially Limit the Ability of Countries to Regulate Harmful Nonindigenous Species?*, 17 EMORY INT’L. L. REV. 1059, 1067 (2003).

5. See Viki Nadol, *Aquatic Invasive Species in the Coastal West: An Analysis of States Regulation Within a Federal Framework*, 29 ENVTL. L. 339, 340 (1999).

6. David M. Whalin, *The Control of Aquatic Nuisance Nonindigenous Species*, 5 ENVTL. LAW. 65, 78 (1998).

7. See generally New Zealand’s Biosecurity Council, *Statutes, Regulations, and Enforcement Mechanisms*, available at <http://www.biosecurity.govt.nz/regs> (last visited Oct. 26, 2009) (discussing standards and regulations governing the movement of goods to and from New Zealand).

8. See generally Mitsuhiko A. Takahashi, *Are the Kiwis Taking a Leap? – Learning from the Biosecurity Policy of New Zealand*, 24 TEMP. J. SCI. TECH. & ENVTL. L. 461 (2005) (discussing the effectiveness of New Zealand’s biosecurity policies).

England and Vermont. Section III discusses shortcomings in the American legal system's response to AIS at the federal and state levels. Section IV considers possible solutions within the current legal framework and sets forth the regulatory approach that New Zealand has taken to control and reduce the presence of *Didymo*. Section V suggests Vermont increase the efficacy of its regulatory measures to effectively treat *Didymo* by combining educational efforts with a felt sole ban. Finally, Section VI concludes by advocating that the Vermont legislature pass a bill in the current term banning felt soled boots and waders to stop the transfer of *Didymo* between New England watersheds.

I. BACKGROUND

An "invasive" species is "an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health."⁹ Over 4,500 invasive species currently live in the United States, and many threaten biological diversity because they out-compete and displace native species.¹⁰ Though the ability of certain plants to grow in non-native soils undeniably creates some worthy benefits to society, non-indigenous flora also stimulate fires and disrupt fire cycles, deplete water sources, destroy crops and forests, disrupt fisheries, and impede navigation.¹¹ The combined cost of damage by invasive species in the United States is an estimated \$137 billion per year.¹² About a quarter of the United States' agricultural gross national product is lost due to invasive species, and no study has quantified costs associated with pathogen and parasite introduction.¹³ Indirect economic costs and losses in recreational value are incalculable, but the economic concern is significant to individuals and businesses. Indeed, problems and costs associated with invasive species are a serious and rapidly growing concern for farmers, stockowners, and commercial fishermen whose industries are experiencing the harsh effects of increased AIS prevalence at both state and national levels.¹⁴

The invasive plant species *Didymosphenia geminata*, commonly termed "*Didymo*," is an invasive freshwater diatomic algae.¹⁵ AIS are

9. Exec. Order No. 13,112, 64 Fed. Reg. 6183 (Feb. 3, 1999).

10. David Quammen, *Planet of Weeds: Tallying the Losses of Earth's Animals and Plants*, HARPER'S MAGAZINE, Oct. 1998, at 57, 66.

11. INVASIVE ALIEN SPECIES: A NEW SYNTHESIS 4-5 (Harold A. Mooney et al. eds., 2005) (noting that most plant species that contribute significantly to world food supply are grown in non-native soils).

12. Jason A. Boothe, Comment, *Defending the Homeland: A Call to Action in the War Against Aquatic Invasive Species*, 21 TUL. ENVTL. L.J. 407, 410 (2008).

13. INVASIVE ALIEN SPECIES: A TOOLKIT OF BEST PREVENTION AND MANAGEMENT PRACTICES 28 (Rudiger Wittenberg & Mathew I.W. Cock eds., 2001) (referencing a Congressional Office of Technology Assessment 1993 Report).

14. U.S. FISH & WILDLIFE SERV., *Ecosystem Conservation: Invasive Species* (2008), available at <http://www.fws.gov/midwest/EcoSystemConservation/exotic.html> (last visited Oct. 26, 2009).

15. Global Invasive Species Database: *Didymosphenia geminata* (algae), available at <http://www.issg.org/database/species/ecology.asp?si=775&fr=1&sts> (last visited Oct. 26, 2009).

nonnative species that threaten the diversity or plenitude of native marine species, the ecological stability of infested waters, or the ability of infested waters to support agricultural, aquacultural, commercial, or recreational activities.¹⁶ A species' classification as "invasive" portends its degenerative effect on the environment, the economy, and human health.¹⁷ *Didymo*, though technically native to northern Europe and parts of North America, has been considered invasive, even within its range of origin, since it began to take on the damaging characteristics of an AIS when massive algal blooms began in the mid-1980s.¹⁸ Sudden proliferation occurs in well-lit rivers and streams,¹⁹ but unlike many algal species, infrequently in lakes.²⁰ By attaching with a mucilaginous stalk to stones, plants, and other diatoms, the algae form a thick "whitish-brown mat" with the consistency of "wet cotton wool."²¹ Though invisible to the naked eye, a single transported cell can spread *Didymo* to another watershed.²²

Didymo was first discovered in New Zealand in 2004, but the algae had been spreading stateside since the 1980s. By the end of 2005, several states in the southeastern and western United States had confirmed reports of nuisance-level blooms.²³ By July 2006, *Didymo* had spread into Canada²⁴ and around twenty states in the lower 48.²⁵ A local fishing guide discovered "Rock Snot," a colloquial name for *Didymo*, in Vermont on June 25, 2007, in the Connecticut River.²⁶ Environmental departments subsequently discovered *Didymo* in several other streams in Vermont,²⁷ Maryland,²⁸ New Hampshire,²⁹ Pennsylvania,³⁰ and New

16. Aquatic Nuisance Prevention and Control Act, 16 U.S.C. § 4702(2) (1994).

17. Exec. Order No. 13112, *supra* note 9.

18. CATHY KILROY, NAT'L INST. OF WATER & ATMOSPHERIC RESEARCH LTD., A NEW ALIEN DIATOM, DIDYMOSPHENIA GEMINATA (LYNGBYE) SCHMIDT: ITS BIOLOGY, DISTRIBUTION, EFFECTS AND POTENTIAL RISKS FOR NEW ZEALAND FRESH WATERS 6 (2004), available at <http://www.biosecurity.govt.nz/files/pests/didymo/didymo-preliminary-org-ia-nov-04.pdf> (last visited Oct. 26, 2009).

19. *Id.* at 11.

20. *Id.* at 10-11.

21. *Id.* at 1.

22. Global Invasive Species Database: *Didymophenia*, *supra* note 15.

23. OWEN SCHROEDER, TENNESSEE WILDLIFE RESOURCES AGENCY REGION 4, INVASIVE ALGAE 'DIDYMO' FOUND IN TENNESSEE RIVER (Sept. 1, 2005), available at <http://twra4streams.homestead.com/didymo.html> (last visited Oct. 26, 2009).

24. MINISTÈRE DU DÉVELOPPEMENT DURABLE, DE L'ENVIRONNEMENT ET DES PARCS AND MINISTÈRE DES RESSOURCES NATURELLES ET DE LA FAUNE, WHAT IS *DIDYMO* AND HOW CAN WE PREVENT IT FROM SPREADING IN OUR RIVERS? (2007, rev. 2008), available at http://www.mddep.gouv.qc.ca/eau/eco_aqua/didymo/didymo-en.pdf (last visited Oct. 26, 2009); see also Map of North American Distribution of *Didymosphenia Geminata* (July 21, 2008), available at http://www.anr.state.vt.us/dec/waterq/lakes/docs/ans/lp_didnadistmap.pdf (last visited Oct. 26, 2009) (mapping the distribution of *Didymo* in North America).

25. Map of North American Distribution, *supra* note 24 (mapping the distributional spread of *Didymo* across the contiguous United States).

26. Press Release, Vt. Agency of Natural Res., ANR Confirms First Northeastern U.S. Infestation of "Didymo" (July 6, 2007), available at <http://www.anr.state.vt.us/site/cfm/PressRel/Detail.CFM?ID=1189> (last visited Oct. 26, 2009) [hereinafter Vt. Agency of Natural Res. I].

27. See *infra* note 51 (specifying discrete locations of recent outbreaks); see also Map

York.³¹ The biological and physiological characteristics of the algae promote its rapid spread to both proximate and distant water bodies.³² Though animals, birds, and wind can theoretically transfer *Didymo* along nonhuman vectors, recent rapid spread to areas that fisherman and tourists frequent suggests natural distribution is not the culprit for the current outbreak.³³ *Didymo* populations proliferate quickly once introduced in a watershed, and the likelihood of transfer to other watersheds seems particularly high for areas proximate to other water systems with high human traffic. Spread is nearly inevitable if equipment from a contaminated area is not properly cleaned and dried before use in an uncontaminated but receptive watershed.³⁴ The algae “moves from river to river . . . on the clothing and equipment of people who come in contact with even microscopic quantities.”³⁵

The invasive characteristics of *Didymo* that facilitate its survival perform significant harm to aquatic ecosystems by modifying stream flow, reducing algal diversity, and altering the composition of invertebrate communities. Nuisance algal blooms have the potential to cover the entire riverbed for a half-mile or more,³⁶ smothering aquatic plants and destroying fish habitat.³⁷ More specifically, the algae “adversely affect freshwater fish, plant and invertebrate species . . . by reducing the number of suitable habitats and excluding the growth of

of *Didymo* Present in Vermont, available at <http://www.vtwaterquality.org/lakes/docs/ans/lp.didvtdistmap.pdf> (last visited Oct. 26, 2009) (depicting a distribution chart of affected watersheds in Vermont) (last visited Nov. 13, 2008); Press Release, News from the N.H. Dep’t of Env’tl. Serv., Invasive Algae Threatens New Hampshire’s Rivers and Streams: Algae Known as “*Didymo*” or “Rock Snot” Can Devastate Waterbodies (July 11, 2007), available at <http://des.nh.gov/media/pr/documents/070711.pdf> (last visited Oct. 26, 2009); Press Release, Vt. Agency of Natural Res. I, *supra* note 26; Press Release, Vt. Agency of Natural Res., ANR Announces Regional Approach to ‘Rock Snot’ (July 13, 2007), available at <http://www.anr.state.vt.us/site/cfm/PressRel/Detail.CFM?ID=1195> (last visited Oct. 26, 2009) [hereinafter Vt. Agency of Natural Res. II].

28. Press Release, Md. Dep’t of Natural Res., Invasive Algae Found In Maryland: Potentially Destructive *Didymo* Found in Gunpowder Falls (May 6, 2008), available at <http://www.dnr.state.md.us/dnrnews/pressrelease2008/050608c.html> (last visited Oct. 26, 2009).

29. *FAQs about Rock Snot in New Hampshire*, ENVTL. FACT SHEET, (N.H. Dep’t of Env’tl. Servs., Concord, N.H.), 2007, at 1, available at <http://des.nh.gov/organization/commissioner/pip/factsheets/bb/documents/bb-61.pdf> (last visited Oct. 26, 2009).

30. *Id.*

31. *Additional Discoveries of Didymo in Famed NYS Fishing Rivers*, ENV’T DEC (N.Y. State Dep’t of Env’tl. Conservation, Albany, N.Y.), Aug. 2008, available at <http://www.dec.ny.gov/environmentdec/45398.html> (last visited Oct. 26, 2009).

32. See generally New Hampshire Department of Environmental Services, *supra* note 29, at 2; Kilroy, *supra* note 18, at 6.

33. See Kilroy, *supra* note 18, at 22.

34. See generally News from the N.H. Dep’t of Env’tl. Serv., *supra* note 27.

³³ Press Release, Vt. Agency of Natural Res. II, *supra* note 27.

36. Mary Russ, Executive Dir., White River P’ship, Powerpoint Presentation, slide 5 (on file with author).

37. Press Release, Vt. Agency of Natural Res. II, *supra* note 27.

other diatoms.”³⁸ The presence of *Didymo* also deteriorates fishing conditions and inhibits agriculture by blocking and fouling water intakes.³⁹ The diatom thrives in clear, warm, shallow, and nutrient-poor water⁴⁰ with turbid conditions: “Once a colony is established, fast currents are likely to enhance growth by promoting transfer of nutrients to the cells at the mat surface.”⁴¹ Consuming much of the precious oxygen content in nutrient-poor and often slow-flowing riversheds, *Didymo* literally suffocates other aquatic life out of riparian ecosystems.⁴² Dissolved oxygen depletion pairs with spatial limitations to physically crowd competing aquatic vegetation out of the system, an effect consistent with modern niche theory as it pertains to invasive aquatic species.⁴³ Both oxygen deprivation and the resultant decrease in food source abundance may affect flora and fauna reliant upon aquatic life, so that piscine and mammalian members high on the food chain may suffer population decreases or disappear altogether.⁴⁴

The human impact of *Didymo* runs the gamut from purely aesthetic-based concerns to potential human health risks and economic effects. The brown mats create an eyesore in otherwise pristine riverine settings, foul agricultural equipment, and discourage recreation.⁴⁵ *Didymo* has no known direct harmful physical effect on humans, though it is a mild eye irritant.⁴⁶ The notion that *Didymo* does not harm humans, however, is based largely on a lack of information to the contrary, and this may help explain the lack of urgency in legal redress. Aquatic ecosystem decline has a potentially far-reaching effect on economic interests, and invasives have a notoriously adverse economic effect in harmed areas both with regard to tourism and cleanup costs.⁴⁷ For instance, the diatom’s effective disruption of food sources for trout

38. Global Invasive Species Database: Impact Information for *Didymosphenia geminata* (algae), available at http://www.issg.org/database/species/impact_info.asp?si=775&fr=1&sts=sss&lang=EN (last visited Oct. 26, 2009); see also South Dakota Game, Fish and Parks News, *Troublesome Diatom Spreads in Black Hills Streams*, Jul. 14, 2006, available at <http://listserv.state.sd.us/scripts/wa.exe?A2=ind0607&L=gfpnews&O=D&P=218> (last visited Oct. 26, 2009) (citing biologists’ suspicions that *Didymo* is responsible for dramatic declines in trout populations after blooms covered nearly 90% of the stream bed).

39. See Kilroy, *supra* note 18, at 30.

40. *Id.* at 8.

41. *Id.* at 9.

42. See *id.* at 20; see also Global Invasive Species Database: Impact Information, *supra* note 38.

43. See Amy Lagerstedt, *Didymosphenia geminata*: An example of a biosecurity leak in New Zealand, 3-4 (2007) (unpublished M.S. thesis, University of Canterbury).

44. See generally *id.*

45. Global Invasive Species Database, *supra* note 38 (listing physical and aesthetic implications of a nuisance-level *Didymo* bloom).

46. Otago Regional Council, *Didymo in Otago: Surface Water Quality Fact Sheet*, 2008, available at http://www.orc.govt.nz/Documents/ContentDocuments/env_management/pests/Didymo/Didymo%20in%20Otago%20Report%20Card%20final.pdf (last visited Oct. 26, 2009).

47. See *supra* notes 12-14 (detailing economic harms by invasives).

caused major concern in New Zealand over potential effects on fishing and tourism.⁴⁸ Although no study to date has confirmed a direct causal link between *Didymo* blooms and fish kills, anglers and locals have testified to decreased fishing productivity in subsequent years for waters occupied by *Didymo*.⁴⁹ Recent studies showing effects of invasive species on human infectious disease, food-borne illness, and significant economic effects may create greater urgency in promulgation and enforcement of more stringent legal rules.⁵⁰

Regulators and legislatures have four legal strategies when handling invasive species. They are (in order of decreasing preference): prevention, early detection, eradication, and control.⁵¹ The efficacy of prevention is intrinsically difficult to judge, but recent discovery of this diatom in several states suggests the current legal rubric is inadequate to prevent *Didymo*'s introduction.⁵² Likewise, neither federal nor state governments have employed a scientific or legal method to successfully control or eradicate *Didymo* once it infests a water body in the United States. Legal approaches to invasive species in Vermont and across the United States appear inadequate to stop the spread of *Didymo*. The algae continues to spread across northeastern and western states at an alarming rate, seemingly unchecked by the current legal framework.⁵³ Indeed, since the beginning of 2007, New England has seen reports of newly contaminated watersheds with increasing frequency.⁵⁴

Legislatures have been characteristically slow to adopt the only truly preventative legal recourse offered by the American legal system. The difficulty of tracing an introduction, combined with strict adherence

48. Otago Regional Council, *supra* note 46, at 2 (expressing a governmental agency's concerns and fears).

49. Leah C. Elwell, *Dealing with 'Didymo'*, FLYFISHER, Autumn 2006, at 24, 26, available at http://www.dnr.state.md.us/invasives/Didymo_Flyfisher_Article.pdf (last visited Oct. 26, 2009); see also South Dakota Game, Fish and Parks News, *supra* note 38 (citing biologists' suspicions that *Didymo* is responsible for dramatic declines in trout populations after blooms covered nearly 90% of a streambed).

50. Anthony J. McMichael & Menno J. Bouma, *Global Changes, Invasive Species, and Human Health*, INVASIVE SPECIES IN A CHANGING WORLD, 191, 192 (Harold A. Mooney & Richard J. Hobbs eds., 2000).

51. GLOBAL INVASIVE SPECIES PROGRAMME, INVASIVE ALIEN SPECIES: A TOOLKIT OF BEST PREVENTION AND MANAGEMENT PRACTICES 1 (Rüdiger Wittenberg & Matthew J.W. Cock eds., 2001).

52. See *supra* notes 26–31.

53. As of July 2008, *Didymo* was confirmed in the Connecticut River near Bloomfield, VT; the White River downstream of the Stony Brook confluence in Stockbridge, VT and in Locust Creek in Bethel, VT; the Battenkill River in both Vermont and New York; portions of the Delaware River in New York; the Mohawk River in northern New Hampshire; and the Mad River near Warren, VT. Due to the nature of spread, biologists are concerned that any areas downstream of these five rivers could eventually show growing colonies of *Didymo*. White River Partnership, *Didymo* Resources, available at <http://www.whiteriverpartnership.org/index.php/resources/didymo-resources> (last visited Oct. 26, 2009) [hereinafter White River Partnership, *Didymo* Res.]; see also Map of North American Distribution of *Didymosphenia Geminata*, available at http://www.epa.gov/Region8/water/didymosphenia/na_dis.map.pdf (last visited Oct. 26, 2009).

54. See White River Partnership, *Didymo* Res., *supra* note 53.

to *post facto* remedies, seemingly precludes the usefulness of the judiciary in preventing the introduction and spread of *Didymo*. Federal and state laws currently on the books share a common pitfall relating to *Didymo*'s physiological makeup: the practical difficulty of identifying a microscopic diatom during transfer makes enforcement impossible. Administrators and regulators seem content to relegate their efforts to awareness campaigns, which lack the preventative value of firmly enforced laws necessary to control such a destructive invasive species. A brief analysis of the legal framework dedicated to invasive species reveals the flaws in the current approach.

II. CURRENT FEDERAL AND STATE REGULATION OF *DIDYMO*

A. FEDERAL INVASIVE SPECIES CONTROLS AND THE NEED FOR STATE REGULATION

The federal statutory scheme for preventing and handling invasive species could be comprehensive in theory but is absent in practice, at least in terms of efficacy in controlling aquatic invasive species. Only in the last 20 years, during the height of AIS damage and concern, has the legislature promulgated the statutes most readily conducive to combating *Didymo*: the Lacey Act and the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA).⁵⁵ The Lacey Act prohibits importing aquatic species that the Secretary of the Interior deems injurious without a permit.⁵⁶ The fact that *Didymo*'s transference is largely unintentional and is not a target species under the Lacey Act precludes its relevance to a solution for *Didymo*. In 1990, Congress passed NANPCA, a statute specifically targeting AIS.⁵⁷ Later amended by the National Invasive Species Act of 1996 (NISA), NANPCA created a task force to develop and implement a program to control and prevent AIS introduction and dispersal.⁵⁸ Though intended to provide enforcement lacking in previous legislation targeting AIS, this statute has failed to halt the introduction or stop the spread of *Didymo*.⁵⁹ This may be due to inefficient administration or the statute's primary targeting of ballast water, which may or may not be the exclusive, or even primary, vector responsible for introducing *Didymo* to new watersheds.⁶⁰

Also worthy of consideration are the more broad-based federal

55. Boothe, *supra* note 12, at 414.

56. *Id.*

57. *Id.*

58. See generally Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, 16 U.S.C. §§ 4701-4751 (2007) [hereinafter NANPCA] (laying forth the statutory purpose and proposed enforcement mechanism).

59. The National Invasive Species Act (NISA) provides some guidelines for exchanges involving ballast-water, but has no provision for legal enforcement and has left such exchanges unregulated. Sandra B. Zellmer, *The Virtues of "Command and Control" Regulation: Barring Exotic Species from Aquatic Ecosystems*, 2000 U. ILL. L. REV. 1233, 1234 n.2 (2000).

60. Boothe, *supra* note 12, at 409.

environmental statutes Congress has promulgated to foster non-degradation of water and other natural resources. The National Environmental Protection Act of 1969 (NEPA) and Clean Water Act of 1977 (CWA) each contain provisions that arguably could serve to address problems associated with invasive species, but their present applications provide a wholesale loophole for *Didymo*. As currently applied, both NEPA and CWA are ill-equipped to deal head-on with the pressing issue of microscopic invasives.⁶¹ NEPA is procedural in nature and has no real practical use for combating AIS. The CWA has not generally classified AIS as “pollutants,” nor does it count human transference vectors as “point sources” subject to regulation.⁶² Although scholars have suggested potential avenues to combat invasives under the CWA by targeting introductions via ballast water,⁶³ their assumption that ballast water is the exclusive vector for *Didymo* transportation would allow established populations to spread and flourish along more discrete transference pathways. More importantly, jurisprudence has not developed to this effect, and a paradigm shift that would address the rapid current spread seems neither imminent nor probable. Even if courts began to recognize invasives as pollutants subject to National Pollution Discharge Elimination System (NPDES) permits, enforcement would be nearly impossible (due to difficulty identifying the microscopic diatom) and retributively unjust (because transfer is typically unintentional). Since current statutes have failed to adequately regulate, and case-by-case controls would be ineffective for a pollutant of this nature and scale, government bears the onus for developing a viable plan to address *Didymo*.

The administrative role of the United States Environmental Protection Agency (EPA) in regulating *Didymo* has been one of guidance, not enforcement. The EPA has taken a predominantly informational approach to educating states and individuals on how best to identify and contain the spread of *Didymo*.⁶⁴ Only EPA Region 8 in Denver, Colorado has made a concerted effort to raise awareness about *Didymo*, ostensibly because its representative area is economically dependent on the aesthetics and recreational use of its streams by tourists and fishermen. In January 2007, Region 8 cooperated with the Montana chapter of the Federation of Fly Fishers to publish a White Paper, which

61. *But see* Zellmer, *supra* note 59, at 1241-42 (contending that current federal statutory rubric is adequate to regulate AIS).

62. Whalin, *supra* note 6, at 94-99.

63. Zellmer, *supra* note 59, at 1241-42.

64. *See* Environmental Protection Agency Region 8, *Didymosphenia geminata*: A Nuisance and Invasive Freshwater Alga, available at <http://www.epa.gov/region8/water/didymosphenia/International%20fact%20sheet.pdf> (last visited Oct. 26, 2009) (providing an explanation of *Didymo* as well as links to several documents released by the EPA).

contains a veritable manifesto for global control of *Didymo*.⁶⁵ Though it draws much-needed attention and recommends a comprehensive and in-depth study of the origin, condition, and current distribution of *Didymo*, the White Paper provides no direct mandatory action for the EPA to undertake to decrease introduction, eradicate, or prevent future spread of the algae.⁶⁶ Members of the EPA's Denver office have also co-opted with other intergovernmental organizations⁶⁷ and non-profits⁶⁸ to increase awareness of dangers posed by *Didymo* and provide decontamination techniques to prevent its spread. Region 8 has also contributed posters⁶⁹ and identification guides⁷⁰ to increase awareness and encourage early reporting and decontamination procedures to reduce both the introduction and spread of *Didymo*.

Finally, executive presidential orders have not adequately addressed AIS. President Clinton's Executive Order 13112 in 1999 established a National Invasive Species Council (NISC) comprised of the heads of many federal agency departments, with the stated purpose of cooperating to establish a framework to effectively deal with the increasing problem of invasive species.⁷¹ Though goals have been set forth in a National Management Plan, its implementation has been slow and ineffective overall due to a lack of funding, long-term goals, or quantifiable measures of performance.⁷²

The common thread that renders all of the aforementioned federal measures ineffective is their broadly tailored remedial approach, and failure to account for the physical nature of the diatom, which makes *Didymo* unidentifiable without microscopic analysis. Regardless of the cause, aquatic invasives' continued appearance in the United States, and their uninhibited spread across national and state borders, evinces the

65. See generally S.A. Spaulding & L. Elwell, INCREASE IN NUISANCE BLOOMS AND GEOGRAPHIC EXPANSION OF THE FRESHWATER DIATOM *DIDYMOSPHENIA GEMINATA* (2007), available at <http://www.fort.usgs.gov/products/publications/22046/22046.pdf> (last visited Oct. 26, 2009) (comprehensively describing the history, character, problems, and current handling of *Didymo*).

66. *Id.*

67. *Special Session on Didymosphenia geminata Western Division American Fisheries Society Meeting* at 3 (May 15-16, 2006) available at <http://www.epa.gov/Region8/water/didymosphenia/Montana%20Summary.pdf> (last visited Oct. 26, 2009); see, e.g., Aquatic Nuisance Species Taskforce Website, available at <http://www.anstaskforce.gov/default.php> (last visited Oct. 26, 2009).

68. See *Supra* note 67; see also Protect Your Waters Website, available at <http://www.protectyourwaters.net/> (last visited Oct. 26, 2009) (introducing the "Stop Aquatic Hitchhikers" program); Federation of Flyfishers available at <http://www.fedflyfishers.org/Default.aspx?tabid=4347> (last visited Oct. 26, 2009) (encouraging participation by fishermen and outdoor enthusiasts).

69. See, e.g., Environmental Protection Agency Region 8, *Didymo Geminata: A Nuisance and Invasive Freshwater Alga*, *supra* note 64 (advising the public of dangers and cleaning methods).

70. See, e.g., Environmental Protection Agency Region 8, *A Rough Field Guide for Identification of D. geminata*, available at http://www.epa.gov/region8/water/didymosphenia/didymo_field_guide.pdf (last visited Oct. 26, 2009) (explaining how to identify the algae's various stages).

71. Exec. Order No. 13,112, *supra* note 9; see also Boothe, *supra* note 12, at 417.

72. Boothe, *supra* note 12, at 419-20.

inefficacy of the federal statutory scheme.⁷³ Since federal law fails to comprehensively address the problem of AIS, state regulation is key to *Didymo* management.⁷⁴ States are better equipped to effectively respond to AIS and meaningfully change the fight against this type of invasive species. A state can more easily manage and monitor introduction and spread of the species because it has greater first-hand local knowledge of present and past conditions in watersheds.⁷⁵ Combating AIS through a well-monitored state system, functioning within the broader purpose of the federal framework, would offer the regulatory adaptability and responsiveness necessary to prevent the spread of *Didymo*.

B. STATE-LEVEL INVASIVE SPECIES REGULATION IN VERMONT

The Agency of Natural Resources (ANR) administers Vermont's invasive species policies, coordinating responsibility for *Didymo* between the Fish and Wildlife Department (FWD) and the Water Quality Division of the Department of Environmental Conservation (DEC).⁷⁶ The ANR derives its power from the state constitution, which grants the legislature authority to delegate police powers⁷⁷ to protect and regulate fish and wildlife.⁷⁸ The ANR administers regulations under Vermont's statutory Aquatic Nuisance Control Program.⁷⁹ Vermont's governmental AIS regulation is comprised of an ANR attorney working alongside several biologists to coordinate and promote the Program.⁸⁰ The statute directs the Program to "work with municipalities, local interest organizations, and private individuals and agencies of the state" with the goal of "develop[ing] long-range programs regarding aquatic nuisance controls."⁸¹

Though ANR has adopted a regional approach for combating *Didymo*,⁸² meager funding and a lack of legislatively granted authority limit the program's activities to education campaigns that are much like the EPA's: coordinating with non-profit organizations to raise awareness by posting signs⁸³ along waterways,⁸⁴ using stickers⁸⁵ and

73. See *supra* notes 26–31.

74. Nadol, *supra* note 5, at 341.

75. *Id.*

76. Vermont Agency of Natural Resources Home Page, available at <http://www.anr.state.vt.us/> (last visited Oct. 26, 2009).

77. VT. CONST. ch. I, art. 5.

78. VT. CONST. ch. II, § 67.

79. VT. STAT. ANN. tit. 10, § 921(a) (2009).

80. Telephone Interview with Leslie Matthews, Executive Director, White River Partnership, South Royalton, Vermont (Oct. 21, 2008) (on-file with author); see also ENVTL L. INST., HALTING THE INVASION IN THE CHESAPEAKE BAY: PREVENTING AQUATIC INVASIVE SPECIES INTRODUCTION THROUGH REGIONAL COOPERATION 1 (2007), available at http://www.elistore.org/reports_detail.asp?ID=11257 (last visited Oct. 26, 2009) (noting that invasive species programs operate under significant manpower and financial limitations).

81. *Id.* at (b)(2), (3).

82. Vt. Agency of Natural Res. II, *supra* note 27.

83. See VT. AGENCY OF NAT. RESOURCES, STOP ROCK SNOT, available at

electronic media,⁸⁶ and providing an identification guide for the public to report newly infested waterways.⁸⁷ The Agency has made the most of its constrained situation by aggressively promoting the “Check, Clean, Dry” method, which directs felt sole users to check for algae, clean by boiling or bleaching, and then thoroughly dry felt soled boots before use in another watershed.⁸⁸ However, recent breakouts⁸⁹ in Vermont streams prove this strictly educational approach inadequate to prevent further spread of the diatom. Thus, shortcomings in the current state-level regulatory framework demand a new state initiative that provides the state regulatory administration with an enforceable mechanism to prevent further discrete spread of the algae. Several paths to reform are worth considering to determine the best route toward effective state regulatory control of *Didymo*.

III. POSSIBLE STATE REGULATORY SOLUTIONS

A. BOLSTERING REGULATION WITHIN VERMONT’S ESTABLISHED FRAMEWORK

Jurisprudential, regulatory, and logistical considerations suggest several methods to navigate the existing legal infrastructure to prevent *Didymo*’s introduction into new waterways. The most logical initial route would be to increase the ANR’s funding in order to provide more comprehensive enforcement. According to the ANR, funding increases are unlikely and unpredictable because budgets are politically dependent, difficult to dictate, and often rigidly administered.⁹⁰ Even assuming a modest funding increase, enforcement of current statutes

http://www.anr.state.vt.us/dec//waterq/lakes/docs/ans/lp_didposter.pdf (last visited Oct. 26, 2009) (providing a poster explaining to visitors how to prevent the spread of *Didymo*).

84. Telephone Interview with Mary Russ, *supra* note 36 (explaining that the ANR has worked with the White River Partnership to post signs along public access points of infested watershed; permanent signs have been posted at public accesses, but most signs have been informally posted by nonprofits like the WRP since most of riverbanks, river access, and put-ins are privately owned and governmental organizations lack the authority to post without landowners’ consent).

85. See, e.g. Vermont Agency of Natural Resources, *Help Stick-It to Aquatic Invasive Species*, available at http://www.vtwaterquality.org/lakes/hm/ans/lp_sticker.htm (last visited Oct. 26, 2008).

86. See, e.g., Vermont Agency of Natural Resources, available at <http://www.anr.state.vt.us/> (last visited Oct. 26, 2008); Vermont Water Quality Division, available at <http://www.vtwaterquality.org/lakes.htm> (last visited Oct. 26, 2009) (websites providing information on invasive species).

87. See Vermont Water Quality Division, *Didymosphenia geminata* Identification, available at http://www.vtwaterquality.org/lakes/docs/ans/lp_dididguide.pdf (last visited Oct. 26, 2009).

88. Vt. Agency of Natural Res. II, *supra* note 27.

89. *Id.*

90. Telephone Interview with Leslie Matthews, Head of Aquatic Invasive Species section, Vermont Agency of Natural Resources in Waterbury, Vermont (Oct. 21, 2008) (on-file with author); see also ENVTL. L. INST., *supra* note 80, at 1, 4, 15 (noting that federal funding and support to lead efforts to combat the invaders’ are unlikely to materialize).

governing invasives is prohibitively time-consuming and expensive since identification requires microscopic analysis.⁹¹ Increasing the number of game wardens might have an incremental effect on enforcement of statutory measures across Vermont's vast number of public waters, but increasing funding and the number of game wardens to enforce the current statutory rubric seems like throwing money at a lost cause.⁹² At best, the regulatory framework would end up resembling New Hampshire Department of Environmental Services' (NHDES) robustly funded program for dealing with AIS.⁹³ Recent *Didymo* outbreaks in New Hampshire,⁹⁴ however, make aspirations to NHDES's level of control unappealing to regulators serious about stopping *Didymo*'s spread in Vermont. Logistical issues with funding, resources, and numbers of game wardens and officers make enforcement of these type policies difficult at best, and similar issues plague regulatory methods assessing fines.

Additionally, state agencies could proceed within the established regulatory framework by quarantining affected areas or increasing educational measures to further increase awareness. Scholars suggest that quarantine methods, if strictly implemented and closely monitored, could stop the spread of invasive species and protect biodiversity.⁹⁵ Measures of this magnitude, however, would be unprecedented for any regulatory body in Vermont, and it remains altogether unclear that the ANR has the authority, much less the available resources, to implement a full-scale quarantine of affected rivers.⁹⁶ Only Vermont Fish and Wildlife could enact such a measure, and only in the case of a significant health risk,⁹⁷ which is unlikely since *Didymo*'s mild irritant characteristic is the only direct danger it poses to humans.⁹⁸ When experts on AIS and *Didymo* convened at a 2007 Montreal conference, they determined that educational methods provide the greatest per-dollar effect in slowing

91. See ENVTL. L. INST., *supra* note 80, at 1, 4, 10, 15, 20 (noting some difficulties in enforcement).

92. See Telephone Interview with Mary Russ, *supra* note 36; See also Beth Daley, *A Plea to Wipe Away Rock Snot: Officials Try to Halt Slimy-looking Algae's Slide into N.E.*, BOSTON GLOBE, Mar. 29, 2008, at 1B.

93. See generally NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES, EXOTIC SPECIES PROGRAM, available at <http://des.nh.gov/organization/divisions/water/wmb/exoticspecies/index.htm> (last visited Oct. 26, 2009) (outlining this neighboring states' more comprehensive approach to combating introduction and spread of AIS).

94. See generally NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES, ENVIRONMENTAL FACTSHEET: FAQ'S ABOUT ROCK SNOT IN NEW HAMPSHIRE, available at <http://des.nh.gov/organization/commissioner/pip/factsheets/bb/documents/bb-61.pdf> (last visited Oct. 26, 2009) (noting reports of recent sightings in new watersheds in New Hampshire).

95. Riley, *supra* note 1, at 325.

96. See Telephone Interview with Leslie Matthews, *supra* note 90.

97. See *id.*

98. SEA GRANT PENNSYLVANIA, *DIDYMO: DIDYMOSPHEMIA GEMINATA*, available at <http://www.erie.psu.edu/seagrant/publications/fs/didymo.pdf> (last visited Oct. 26, 2009).

Didymo's spread.⁹⁹ Though education and awareness undoubtedly serve a positive role in the overall scheme of *Didymo* control, a unilateral use of education that relies on prevention is inadequate to stem the tide of *Didymo's* spread.¹⁰⁰ Despite awareness across a near-complete segment of the relevant population in 2005, New Zealand experienced continuous spread of the algae across its waters in the years following its education campaign.¹⁰¹ The "Check, Clean, Dry" Campaign has no doubt served a purpose in limiting exposure of new streams to *Didymo*, and should continue in a supplemental capacity in tandem with new regulations that more directly and aggressively target the spread of *Didymo*.

Two novel methods might provide deterrence by levying fines for *Didymo* transference. The first would be to perfect an identification method in order to impose fines according to strict liability. However, in its diatom form, *Didymo* experts must identify it with the aid of a microscope.¹⁰² Though both EPA and ANR make an identification guide available to allow early detection, there is insufficient technology available for the evidentiary standards of law enforcement.¹⁰³ Vermont ANR is working to develop a sampling protocol for effectively identifying *Didymo* and confirming its existence in watersheds.¹⁰⁴ Even if the technology were available and enforceable (without logistical or funding constraints), this approach is theoretically flawed because it would fail to stop harmful introductions before they occur. By imposing a fine after a watershed is exposed to the diatom, strict liability would have only potential deterrent value in preventing future infestations of watersheds. Since no effort to date has successfully eradicated *Didymo* after introduction, imposing *post-facto* fines would do nothing to proactively keep *Didymo* out of new watersheds.

Second, Vermont's ANR could classify *Didymo* as a noxious weed and add it to the targeted invasive species list in order to levy fines against individuals caught transferring the diatom between watersheds within the state. Vermont courts can hold parties liable for both intentional

99. See Telephone Interview with Leslie Matthews, *supra* note 90.

100. See *supra* notes 26–31 (showing that recent outbreaks continue to be reported despite federal and state-level awareness campaigns).

101. See Special Session on *Didymosphenia geminata*, *supra* note 67.

102. See CATHY KILROY, NAT'L INST. OF WATER & ATMOSPHERIC RESEARCH LTD., PROTOCOL FOR MICROSCOPIC ANALYSIS OF SAMPLES FOR THE DETECTION OF *DIDYMOSPHENIA GEMINATA* 1-3 (2007), available at <http://www.biosecurity.govt.nz/files/pests/didymo/didymo-protocol-for-microscopic-analysis-aug-07.pdf> (last visited Oct. 26, 2009) (describing identification methods).

103. See U.S. ENV'T'L PROT. AGENCY, A ROUGH FIELD GUIDE FOR IDENTIFICATION OF *D. GEMINATA*, available at http://www.epa.gov/region8/water/didymosphenia/didymo_field_guide.pdf (last visited Oct. 26, 2009); VT. AGENCY OF NATURAL RES., *DIDYMOSPHENIA GEMINATA* IDENTIFICATION, available at <http://www.vtfishandwildlife.com/library/factsheets/Invasive%20Species/Didymo/DidymoIdentificationGuide.pdf> (last visited Oct. 26, 2009) (pointing out that field identification is difficult and expert analysis with microscopes is necessary to positively identify the diatom).

104. See Telephone Interview with Leslie Matthews, *supra* note 90.

and unintentional transfers of species listed on the targeted invasive species list.¹⁰⁵ However, fundamental physiological differences between zebra mussels and the microscopic *Didymo* diatom preclude this method's relevance in halting *Didymo*'s spread. It is unclear whether *Didymo* would be eligible for listing under the statute because, despite uncharacteristic nuisance-level blooms in the last two years, it is presumed native to Northern Europe and Canada,¹⁰⁶ and may thus be indigenous to Vermont as well.¹⁰⁷ Furthermore, inadequate resources and identification would make this regulation difficult to implement. While fines might substantively add enforcement potential for *Didymo* beyond that afforded by federal and state statutes currently on the books, there is an inherent lack of deterrent value and fairness issues associated with levying fines against private individuals for unintentional transfer.

B. THE NEW ZEALAND EXPERIENCE

New Zealand maintains a stringent and comprehensive approach to *Didymo* because of historical large-scale economic and environmental difficulties caused by invasive species.¹⁰⁸ Led by its federal Biosecurity Council, New Zealand's environmental policies are some of the "most integrated approaches to the management of natural resources in the world."¹⁰⁹ In 1993, the country's legislature promulgated the Biosecurity Act, a "comprehensive, integrated, model statute for the management of biological pollution."¹¹⁰ Administered by its amply funded Fish and Game Department, the Biosecurity Act adopts a precautionary approach that serves as a model for other countries.¹¹¹ Though it levies \$10,000 fines for knowing transfers of AISs between watersheds, the Biosecurity Act has not stopped *Didymo* from spreading to most of the major watersheds on South Island.¹¹² There are no reported cases of positive identification of carriers resulting in fines,

105. *Id.*; VT. DEPT. OF ENV'T'L CONSERVATION, WATER QUALITY DIV., ILLEGAL AQUATIC PLANT SPECIES IN VERMONT, available at http://www.anr.state.vt.us/dec//waterq/lakes/docs/ans/lp_ansprohibitedlist.pdf (last visited Oct. 26, 2009) (listing of illegal aquatic invasive species in Vermont).

106. VT. DEPT OF ENV'TL. CONSERVATION, WATER QUALITY DIV., *DIDYMO* OR ROCK SNOT (*DIDYMOSPHEA GEMINATA*) IN VERMONT AND THE NORTHEAST, available at http://www.vtwaterquality.org/lakes/htm/ans/lp_didymo.htm (last visited Oct. 26, 2009).

107. Vermont legislators have not followed the federal executive's lead in defining "invasives" according to effect; however, pending legislation may change the direction taken by the legislature. See Act of May 28, 2009, ch. 50, 2009-46 Vt. Adv. Legis. Serv. 1, (LexisNexis) (defining aquatic nuisances and creating a generally comprehensive approach to invasive species).

108. Takahashi, *supra* note 8, at 476.

109. Ton Bürhs & Robert V. Bartlett, ENVIRONMENTAL POLICY IN NEW ZEALAND, THE POLICY OF CLEAN AND GREEN? 156 (1993).

110. See Takahashi, *supra* note 8, at 469.

111. *Id.* at 476.

112. See Emails from Robert Sowman, Policy & Planning Manager, New Zealand Council, Fish & Game New Zealand (October 22, 2008; November 24, 2008; Feb. 8, 2009) (on file with author) (explaining that *Didymo* has not been reported on North Island).

probably due to the same difficulties with identification that regulators in the United States have experienced.

Thus, New Zealand's Biosecurity agency took affirmative measures last year in the fight against *Didymo*. After years of educational efforts that failed to stop the spread of *Didymo* to new watersheds, New Zealand has finally embraced a proactive legislative solution to regulation. On September 2, 2008, New Zealand "Conservation Minister Steve Chadwick . . . agreed to the New Zealand Fish and Game Council recommendation to restrict the use of footwear with felt soles by fishing license holders."¹¹³ As part of the reason for his decision, Mr. Chadwick noted that "felt-soled waders, and similar footwear, are very difficult to clean using the 'Check Clean Dry' approach."¹¹⁴ Common sense also suggests that the average river enthusiast may not always make the effort to complete the steps of this time-intensive process after each outing. Thus, on October 1, 2008, New Zealand Fish and Game implemented new fishing regulations for the 2008-2009 fishing season that ban the use of felt soled wading boots.¹¹⁵ Biosecurity New Zealand's website provides a vast number of resources, including methods for preventing the introduction and spread of AIS,¹¹⁶ stakeholder updates and member contacts,¹¹⁷ a page specifically addressing concerns with the felt sole wader ban,¹¹⁸ and even radio broadcasts by *Didymo* experts.¹¹⁹ The current regulatory framework in New Zealand appears to be an optimal marriage of awareness and action postured to succeed in preventing and treating problems associated with *Didymo*, and every indication suggests its efficacy in preventing further spread.¹²⁰

IV. A FELT SOLE BAN IN VERMONT

A. THE CALL FOR AND PROPRIETY OF A BAN BILL

History has proven that education alone is insufficient to thwart *Didymo*'s spread to new watersheds. Though the Montreal Conference

113. Press Release, Fish and Game N.Z., New Steps to Protect Sports Fisheries from Rock Snot (Sept. 2, 2008), available at http://www.fishandgame.org.nz/Site/Features/Features_Media020908.aspx (last visited Oct. 26, 2009).

114. *Id.*

115. *Id.*

116. BIOSECURITY N. Z., PESTS AND DISEASES: DIDYMO, available at <http://www.biosecurity.govt.nz/pests/didymo> (last visited Oct. 26, 2009) (giving a general protocol for *Didymo*'s characteristics and potential remedies).

117. BIOSECURITY N.Z., DIDYMO STAKEHOLDER UPDATE - OCT. 31. 2008, available at <http://www.biosecurity.govt.nz/pests/didymo/update-31-10-08> (last visited Oct. 26, 2009) (exemplifying New Zealand's AIS stakeholder notifications).

118. FISH AND GAME N.Z., FELT-SOLED WADER RESTRICTIONS - QUESTIONS AND ANSWERS, available at <http://www.fishandgame.org.nz/Site/Features/FeltsoledFAQ.aspx> (last visited Oct. 26, 2009) (describing and addressing concerns with the wader ban).

119. *See Id.* (providing a link to the radio broadcasts).

120. *See* Emails from Robert Sowman, *supra* note 112.

determined that education is the most cost-effective response to *Didymo*,¹²¹ the problem is serious enough to warrant regulation beyond mere awareness of dangers posed by its presence. Though over 95% of water users on New Zealand's South Island knew about *Didymo* in 2005,¹²² the diatom nonetheless continued to spread to new streams, infiltrating a tremendous number of streams in subsequent years up to the present.¹²³ This should not discourage attempts to educate the public (awareness can only benefit future efforts), but it should clearly indicate that education must be supplemented by legislation that provides an element of enforcement to require decontamination practices. The practical reality of informational efforts is that many people who serve as potential vectors for transfer are unaware of, or potentially adverse to, the published methods. Even following the EPA or ANR guidelines for the "Check, Clean, Dry" method, it is very hard to disinfect felt soled boots to a degree that is adequate to ensure *Didymo* mortality. The process requires boiling at extremely hot temperatures (or bleaching) and thorough drying that the average person is unlikely to achieve. Furthermore, felt dries very slowly, and *Didymo* can harbor for extremely long periods in even slightly damp material, remaining viable for transfer.¹²⁴

The Vermont Agency of Natural Resources does not have the authority to ban the use of felt without a legislative grant, so the current session should pass a bill allowing ANR to require discontinuation of the use of felt soled wading boots, as well as waders that incorporate felt soled boots. Doing so would not only give the ANR authority to regulate, but also the ability to promote and guide proper enforcement.¹²⁵ Most of the onus for compliance would fall on individual license holders, while game wardens could serve as a regulatory safety net to encourage observation of and ensure compliance with the rules. Enforcement would require no greater funding or number of officers than current requirements for conducting basic enforcement measures like license checks: an officer would simply check to ensure that a fisherman's boots are in compliance with the felt ban while conducting standard check-ins along Vermont's waterways. Passing a bill would gain media attention that would raise awareness of both the *Didymo* problem and potential solutions, while laying down concrete regulations with appropriate fines for intentional and unintentional violators. A substantial but fair fine seems more appropriate than a command and control statute assessing criminal violations, exorbitant fines, or prison time.

A ban on felt soles is a justified measure to combat *Didymo*. First, the method is effective and enforceable. There would be no need for

121. See Telephone Interview with Leslie Matthews, *supra* note 90.

122. See Special Session on *Didymosphenia geminata*, *supra* note 67.

123. See Emails from Robert Sowman, *supra* note 112.

124. See BIOSECURITY N.Z., *DIDYMO*, CLEANING METHODS FOR SPECIFIC ACTIVITIES, available at <http://www.biosecurity.govt.nz/pests/didymo/cleaning-specific> (last visited Oct. 26, 2009).

125. See Telephone Interview with Leslie Matthews, *supra* note 90.

identification of a microscopic diatom—a game warden would only need to be able to differentiate between felt soled and rubber-bottomed boots. Second, a ban is superior to traditional command and control techniques in terms of retributive justice because it strictly targets intentional or negligently unaware violators.¹²⁶ Third, a ban distributes the burden fairly on those who stand to gain the most from its implementation. By placing the regulations and onus of compliance on fishermen, the proposed legislation would allow those with a future stake in the well-being of watersheds to directly control and maintain accountability to ensure the future of their sport. Anglers are arguably at least partially responsible for *Didymo's* spread, evidenced by a correlation between recently reported contaminated waterways and superb trout habitat heavily frequented by fishermen.¹²⁷ The fact that good trout habitat conditions are also optimal for cultivating *Didymo* could explain this correlation; however, *Didymo's* distribution and spread across international fishing destinations suggest at least some level of connection.¹²⁸

New Zealand's ban espouses this viewpoint and approach,¹²⁹ and Fish and Game New Zealand's wader ban announcement notes the intentional placement of the regulatory burden on those who stand to benefit most.¹³⁰ Fishermen, hunters, conservationists, and preservationists who willingly bear the economic brunt of such regulation have met similar past bans in Vermont and other states with wide support.¹³¹ A state can ostensibly avoid any potential backlash by providing adequate notice of regulatory changes to give commercial,

126. See generally VT. STAT. ANN. tit. 10, § 4502 (2009); VT. STAT. ANN. tit. 10, § 4517 (2009) (providing an example of how this standard would be consistent with Vermont's current regulatory provisions, which do not recognize ignorance as a valid defense to contravention of published regulations).

127. Morgan Lyle, *Fly-Fishing: Despite Preventive Measures, Didymo Spreading*, THE DAILY GAZETTE (NY), May 7, 2009, available at <http://www.tu.org/press-room/tu-in-the-news-archive/miscellaneous/fly-fishing-despite-preventive-measures-didymo-sprea> (last visited Oct. 26, 2009).

128. Compare ROBERT F. RALEIGH, U.S. FISH & WILDLIFE SERV., HABITAT SUITABILITY INDEX MODELS: BROOK TROUT 3 (1982), available at <http://www.nwrc.usgs.gov/wdb/pub/hsi/hsi-024.pdf> (last visited Oct. 26, 2009) (explaining that optimal trout habitat is clear, cold, oligotrophic water with rocky substrate), with CATHY KILROY, *supra* note 18, at 7-9, 16 (explaining that *Didymo's* preferred habitat is cold, oligotrophic water with rock substrate and that the spread of *Didymo* in the U.S. and New Zealand was likely caused by human vectors such as fishing equipment).

129. See Press Release, Fish and Game N.Z., *supra* 113 (suggesting a connection between *Didymo's* presence and trout fishery decline).

130. *Id.* ("The New Zealand Fish and Game Council has recommended that people who hold a license to fish for trout, and other sports fish, should contribute to the national campaign to halt the spread of didymo by not using felt-soled waders when fishing.").

131. See Field & Stream, *Discussion Topic: Should Lead Sinkers Be Banned?*, available at http://fieldandstream.blogs.com/news/2007/01/discussion_topi_4.html (follow "All Comments" link) (last visited Oct. 26, 2009).

industrial, and private interests time to adjust production and supply.¹³² The burden on fishermen is minimal, merely requiring replacement of felt-bottomed boots (which survive only a season or two with heavy use) with rubber soled boots that outlast felt. Fisherman with safety concerns regarding rubber bottomed boots can install, or opt for models that include, studded or sticky rubber soles for increased traction on slick rocks and vegetation.

A felt sole ban is the most effective way to fight *Didymo* for several reasons. The direct and cooperative nature of a ban makes it preferable to other methods that attempt to indirectly remedy the problem by adding money to license fees to fund better enforcement of existing measures. The ban on felt soles would also have commensurate benefits for the battle against other invasive species and fish-killing viruses. Studies suggest felt soles may also provide a viable environment for *Myxobolus cerebralis*¹³³ (commonly termed “whirling disease”) and viral hemorrhagic septicemia¹³⁴ (a deadly fish disease). These viruses, however, cannot survive for extended periods in a dry environment because they lack the stability of the *Didymo* diatom, therefore rubber-bottomed boots do not provide conditions that would support their long-term transference and survival.¹³⁵ Although a felt sole ban is not the most direct way to combat this virus—as other vectors have a higher likelihood of transfer by larger water movements like boats, bilging water from other water bodies, dumping bait buckets, or introducing fish—a felt ban would prevent transmission along this particular vector and would serve to decrease overall transference.¹³⁶ Vermont serves as an excellent candidate for this legislation due to its

132. See generally Kylie Wilson, *Fishermen Upset with Footwear Ban*, OTAGO DAILY TIMES ONLINE, Aug. 21, 2008, available at <http://www.odt.co.nz/print/18781> (last visited Oct. 26, 2009) (noting the displeasure of some fisherman with the late notice of having to replace footwear before opening day of fishing season).

133. See Kiza K. Gates, Christopher S. Guy & Alexander V. Zale, *Adherence of Myxobolus cerebralis Myxospores to Waders: Implications for Disease Dissemination*, 28 N. AM. J. FISHERIES MGMT. 1453, 1453, 1457 (2008), available at http://www.montana.edu/mtcfr/Guy/Publication%20pdf/gates_waders.pdf (last visited Oct. 26) (explaining transference vectors of this deadly fish disease).

134. Compare UTAH DIV. OF WILDLIFE RESOURCES, UTAH FISHING GUIDEBOOK, 10-11 (2008), available at http://wildlife.utah.gov/guidebooks/2008_fishing/2008_fishing.pdf (last visited Oct. 26, 2009) (explaining how fishermen can inadvertently transport aquatic nuisance species via fishing equipment such as felt-soled boots), and Rebekah M. KIPP & ANTHONY RICCIARDI, NAT’L OCEANIC & ATMOSPHERIC ADMIN., NAT’L CTR. FOR RESEARCH ON AQUATIC INVASIVE SPECIES, *NOVIRHABDOVIRUS SP. (VIRAL HEMORRHAGIC SEPTICEMIA - VHS) FACTSHEET 2* (2006), available at <http://www.glerl.noaa.gov/res/Programs/ncrais/docs/factsheets/novirhabdovirus.pdf> (last visited Oct. 26, 2009) (explaining that desiccation inactivates viral hemorrhagic septicemia), with E. Leyla Arsan & Jerri L. Bartholomew, *Potential Dispersal of the Non-Native Parasite Myxobolus cerebralis in the Willamette River Basin, Oregon: A Qualitative Analysis of Risk*, 17 REVS. FISHERIES SCI. 360, 364 (2009), available at <http://www.informaworld.com/smpp/content~content=a910859240~db=all~jumptype=rss> (follow “View Article PDF” link) (last visited Oct. 26, 2009) (explaining that felt soles prevent the desiccation of another ANS, *Myxobolus cerebralis*, thereby allowing it to remain viable longer and facilitating transportation).

135. Arsan, *supra* note 134, at 364.

136. See UTAH DIVISION OF WILDLIFE, *supra* note 134, at 11.

role as a nationwide environmental trendsetter, which makes the Green State an optimal laboratory for a measure of this progressive environmental character. In the last year, Alaska's state Board of Fisheries decided to ban felt soles beginning January 1, 2011¹³⁷ and New Mexico's Department of Game and Fish is evaluating a proposal to ban felt soles beginning April 1, 2011.¹³⁸ Overall, a felt sole wader ban in Vermont seems a reasonable response to a serious and growing concern.

B. POTENTIAL ALLIES AND THE AFFIRMATIVE PRE-EMPTIVE RESPONSE OF INDUSTRY

Nonprofit organizations (NPOs) provide a foundational partner for the government to support a felt sole wader ban. NPOs have historically served an important role in raising awareness of causes affecting public resources like the streams and rivers at stake in the *Didymo* discussion, and several organizations have already stated a strong commitment to this particular cause.¹³⁹ Indeed, Trout Unlimited has asked industry and retailers to stop selling and making felt soles in the interest of trout populations that suffer from *Didymo's* presence.¹⁴⁰ The Federation of Fly Fishers, led by Conservation Coordinator Leah Elwell, has also taken a firm stance, undertaking awareness efforts to engage fishermen in conservation and promote non-transference tactics to reduce *Didymo's* introduction to new waterways.¹⁴¹ In Vermont, White River Partnership has made a valiant effort to get the word out on *Didymo* and state-specific problems associated with its spread by maintaining a website¹⁴² and hosting conferences and symposia about *Didymo*.¹⁴³ The combined efforts of these various NPOs have undoubtedly had a profound, albeit unquantifiable, effect in slowing *Didymo's* spread across the state and

137. Trout Unlimited, *Southeast Alaska Will Ban Felt Sole Waders in 2011*, <http://www.tu.org/press-room/tu-newsletter-archives/june-2009/southeast-alaska-will-ban-felt-sole-waders-in-2011> (last visited Nov. 25, 2009).

138. *Department of Game and Fish, Commission consider changes to fishing rules*, CARLSBAD CURRENT-ARGUS (NM), Nov. 11, 2009, available at http://www.currentargus.com/carlsbad-community/ci_13767493?source=rss (last visited Nov. 25, 2009).

139. See, e.g., White River Partnership, *supra* note 53. See generally White River Partnership, *About White River Partnership*, <http://www.whiteriverpartnership.org/index.php/about> (explaining that White River Partnership is a nonprofit organization) (last viewed Oct. 26, 2009).

140. See Marshall Cutchin, *This Is Last Year For Felt Soles At Simms*, Sept. 17, 2008, available at <http://www.midcurrent.com/news/2008/09/this-is-last-year-for-felt-sol.html> (last visited Oct. 26, 2009) (explaining an industry leader's discontinuation of its felt-soled wading boot line).

141. Federation of Fly Fishers, *Didymosphenia geminata*, available at <http://www.fedflyfishers.org/Default.aspx?tabid=4381> (last visited Oct. 26, 2009) (informing generally about the problems and character of this AIS) (last visited Oct. 26, 2009).

142. White River Partnership, *supra* note 53.

143. White River Partnership, *Our Programs*, available at <http://www.whiteriverpartnership.org/index.php/programs> (last visited Oct. 26, 2009).

nation.

The nontraditional posture of industry on the felt sole issue suggests that commonalities may forge strong alliances between strange bedfellows—state governmental agencies, nonprofit organizations in favor of the ban, and manufacturers. Many industry-leading producers of wading boots have recognized the potential dangers of their products and preemptively protected their business by altering their marketing strategies far in advance of governmental regulation. These forward-thinking industrial leaders have designed, and are now promoting, new lines of boots utilizing new technology that incorporates various rubber materials that claim to be superior to traditional felt soles.¹⁴⁴ These new “sticky rubber” soles adhere to rock surfaces and afford anglers comparable or superior traction and safety to the felt bottomed boots of the past.¹⁴⁵

Some manufacturers, genuinely concerned with the dangers inherent to *Didymo* and its effect on a sport that provides both their livelihood and recreation, have affirmatively committed to discontinuing felt sole boot production beyond 2010, despite a complete lack of governmental prompting.¹⁴⁶ This forward-minded approach to business will decrease the spread of *Didymo* and is encouraging as an indicator of the future direction of sustainable and responsible business practices. The role of manufacturers in the fight against *Didymo* invasion should serve an important, albeit supplemental, role in preventing future introduction of felt soles into the marketplace. Legislative action directed at creating enforceable regulatory policy stopping *Didymo* transference to new waterways is still vitally necessary because of the rate of current spread. If the government relied on manufacturers to allow individuals to eventually phase out their felt soled equipment, the ubiquitous use of felt soles would doubtless continue for many years to come and contribute to the detriment of many of Vermont’s most valued watersheds.

C. LEGISLATIVE PROCEDURE IN THE WAKE OF THE LEAD SINKER BAN

The Vermont Legislature should follow New Zealand’s example of banning felt soled waders by using the same procedural course of action it employed in 2004 when Vermont banned lead split shot and sinkers. In 2004, the Vermont Legislature passed H.516, An Act Relating to a Prohibition Against the Use and Sale of Lead Sinkers.¹⁴⁷ The passage of the Act resulted in the promulgation of two separate statutes in the

144. See Emails from Korkers, Simms, Patagonia, L.L. Bean, and Orvis (describing new lines of felt-free waders and wading boots that will not harbor *Didymo* for transference) (on file with author). Admittedly, these companies stand to profit from marketing new product lines. For the most part, however, companies are minimizing stitch counts and habitable boot surfaces to reduce the potential of *Didymo* transference.

145. Marshall, Editorial, *Felt Soles vs. Aquastealth Sticky Rubber*, FLY FISHING COLO., Aug. 9, 2008, available at <http://www.fly-fishing-colorado.com/wordpress/felt-soles-vs-aquastealth-sticky-rubber/> (last visited Oct. 26, 2009).

146. See Cutchin, *supra* note 140.

147. H.B. 516, 2004 Gen. Assem., 1st Sess. (Vt. 2004).

Vermont Code pertaining to lead sinkers.¹⁴⁸ Section 4606, as amended, prohibits the “use a lead sinker for taking of fish in any state waters,”¹⁴⁹ and Section 4615 makes it “unlawful to sell or offer for sale a lead sinker in the state of Vermont.”¹⁵⁰ By publishing this effective ban in the annual fishing and hunting regulations, which are available to every license purchaser in the state, the legislature created a stringent but reasonable regulation to the section of the population with the greatest interest and ability to remedy the problem. The lead sinker ban has been an undeniable success both in terms of enforcement feasibility and efficacy in preserving loon populations.¹⁵¹

D. A MODEL FELT SOLE BAN PROVISION

Adapted from the statute codified after the 2004 Vermont state legislature passed the lead sinker ban bill, the felt sole ban provision might resemble the following:

10 VSA §[. . .]:

(a) A person shall not enter any state waters wearing felt soled wading boots or waders with a felt bottom or otherwise containing any felt substance. In this section, “felt” means any material which is difficult to dry in a reasonable period of time or otherwise provides aquatic nuisance invasive species an environment in which they can survive for a period sufficient to facilitate inter-watershed transfer. This ban does not include other felt fishing-related items such as clothing, fly drying devices, or flies containing felt materials.

A progressive legislature might extend the protection of watersheds from *Didymo* by adding a provision barring the sale of felt soled waders in the state of Vermont, which might read:

(b) It shall further be unlawful to sell or offer for sale footwear containing felt soles or other components made of materials incorporating felt in the state of Vermont. In this section, “felt” means any material which is difficult to dry in a reasonable period of time or otherwise provides aquatic nuisance invasive species an environment in which they can survive for a period sufficient to facilitate inter-watershed transfer. This ban does not include other felt fishing-related items such as clothing, fly drying devices, or flies containing felt materials.

148. VT. STAT. ANN. tit. 10, § 4606 (g) (2009); VT. STAT. ANN. tit. 10, § 4615 (2009).

149. *Id.* § 4606(g).

150. *Id.* § 4615.

151. Compare DAVID C. EVERS, U.S. FISH & WILDLIFE SERVICE, STATUS ASSESSMENT AND CONSERVATION PLAN FOR THE COMMON LOON (*GAVIA IMMER*) IN NORTH AMERICA 44-45 (2004), available at http://alaska.fws.gov/mbsp/mbm/loons/pdf/Common_Loon_Status_Assessment.pdf (last visited Oct. 26, 2009) (describing the threat that lead poses to loons), with Gretel H. Schueller, *Loons on the Line*, DEFENDERS MAG. (2008), available at http://www.defenders.org/newsroom/defenders_magazine/spring_2008/loons_on_the_line.php (last visited Oct. 26, 2009) (describing the state of loon populations in 2008, four years after the lead sinker ban was implemented).

CONCLUSION

In the upcoming term, Vermont's legislature should respond to the continuing spread of *Didymo* across its state's waterways by passing a bill banning felt soled waders and boots. A bill that would spurn enforceable statute and appurtenant regulations is the best way to ensure that these blooms, which have become characteristic of this destructive invasive algae, do not choke out the aquatic life and destroy the fragile aquatic ecosystems characteristic of many of the state's waterways. Though no entity has succeeded in eradicating *Didymo* from an infiltrated water body, containment is feasible and achievable if Vermont follows the proactive approach New Zealand has taken to confront this serious problem head-on. By legislatively enacting a felt soled wading boot ban, publishing pertinent provisions in the 2009 fishing regulations, and enforcing the provisions strictly along Vermont's waterways, the State can make the best possible effort to stem the tide of invasive *Didymo* invasion and prevent future introductions that risk significant harm to aquatic ecosystems.

