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Will eat any tank-mate that can fit in its mouth.[1]

If we can't beat them, let's eat them![2]

I've never seen any fish colonize so quickly over such a vast geographic range.[3]

I. INTRODUCTION

A symposium titled *Solving Global Problems* is, by its very nature, an ambitious undertaking.[4] The grandly expansive title stakes a claim to human agency and suggests a confidence that law is capable of ensuring "the dignity of men and women in an increasingly universal public order."[5] In the realm of international law discourse, a commitment to solving global problems means taking a very definite position in an ongoing debate over the efficacy of international law as a tool for the progressive realization of human rights and other worthwhile social goals. Such a title invokes optimism about the role of international law in shaping a better world[6]—an increasingly rare sentiment in the climate change context.

If environmentalists in general are gloomy about our future prospects, none are more so than climatologists.[7] As such, this symposium is not without risk for its participants—expectations created by the symposium's title place significant pressure on participants to offer meaningful solutions. To appreciate this pressure, contrast the expectations an audience might bring to a symposium titled *Worrying About Global Problems* or even *Identifying Global Problems*. Having agreed to participate, I tried to infuse myself with the optimistic belief in human capacity captured in the phrase "solving global problems," and to think creatively about contextual, problem-oriented, and multidisciplinary solutions.[8]

To create some kind of template for what it might mean to "solve global problems," this essay uses one very narrow global problem as an exemplar: the explosion of

1. *Black Volitan Lionfish*, Petco, http://www.petco.com/product/101757/Black-Volitan-Lionfish.aspx (last visited Mar. 18, 2014).

2. *Filleting the Lion*, Nat'l Oceanic & Atmospheric Admin., http://oceanservice.noaa.gov/news/weeklynews/june10/eatlionfish.html (last visited Mar. 18, 2014).

3. Anika Gupta, *Invasion of the Lionfish*, Smithsonian (May 8, 2009), http://www.smithsonianmag.com/science-nature/Invasion-of-the-Lionfish.html?c=y&story=fullstory (quoting National Oceanic and Atmospheric Administration fisheries biologist Paula Whitefield).

4. This essay was written in connection with the *New York Law School Law Review* symposium *Solving Global Problems: Perspectives from International Law and Policy*, held at New York Law School on April 12, 2013. Video recordings of the symposium are available at http://www.nylslawreview.com/global-problems-program/.

5. Myres S. McDougal, Studies in World Public Order, at ix (1960).

6. *Id.*

7. *See Climate Change: Consensus*, Nat'l Aeronautics & Space Admin., http://climate.nasa.gov/scientific-consensus (last visited Mar. 18, 2014) ("Ninety-seven percent of climate scientists agree that climate-warming trends over the past century are very likely due to human activities.").

8. Myres S. McDougal et al., *Theories About International Law: Prologue to a Configurative Jurisprudence*, 8 Va. J. Int'l L. 188, 196 (1968).

invasive species[9]—specifically, the lionfish—as climate change alters habitats around the world. By shrinking the scale of inquiry, this essay takes to heart Walt Whitman's assertion that there is "no object too soft to be a hub for the wheeled universe."[10] Through this narrowed focus, it becomes possible to see how the choices made on an individual, local, national, regional, and global scale combine forces to construct global problems.

University of Minnesota Law School professor Hari Osofsky offers an admirable model of the efficacy of this approach with her work on suburbs.[11] While her work starts with the seemingly global problem of climate change and proceeds to question the label "global," my project peers through the opposite end of the telescope. Rather than starting with a problem typically articulated as a global one and documenting its local nature, this essay instead begins with a seemingly small, local problem and unearths its global roots. Starting with a single invasive species—the lionfish—we pretty rapidly get to the ways that global forces, including climate change, globalized trade, and the retreat of the state, have contributed to this seemingly local problem. Despite the difference in methodological starting point, both Professor Osofsky and I are tracing the multiscalar, polycentric efforts[12] necessary for any attempt to "solve" the complex socioeconomic drivers of environmental problems. It remains to be seen

9. *See, e.g.*, David Pimentel et al., *Update on the Environmental and Economic Costs Associated with Alien Invasive Species in the United States*, 52 Ecological Econ. 273, 273–88 (2005) (estimating the environmental and economic damage attributed to invasive species to be $120 billion annually in the United States alone); David M. Lodge, Economic Impact of Ballast-Mediated Invasive Species in the Great Lakes (2008), *available at* http://www.iisgcp.org/research/reports/Lodge_shipping_final.pdf (finding that ship-borne invasive species caused at least $200 million of lost economic benefits in 2006 in the Great Lakes region alone); U.S. Fish & Wildlife Serv., The Cost of Invasive Species (2012), *available at* http://www.fws.gov/home/feature/2012/pdfs/costofinvasivesfactsheet.pdf (finding that in 2011 the U.S. Department of the Interior alone spent $100 million on invasive species prevention). For an explanation of the environmental, economic, and human health impacts of invasive species, see *Frequently Asked Questions About Invasive Species*, U.S. Fish & Wildlife Serv., http://www.fws.gov/invasives/faq.html#q2 (last visited Mar. 18, 2014).

10. Walt Whitman, *Song of Myself*, *in* Leaves of Grass 29, 76 (1855).

11. Hari M. Osofsky, *The Geography of Solving Global Environmental Problems: Reflections on Polycentric Efforts to Address Climate Change*, 58 N.Y.L. Sch. L. Rev. 777 (2013–2014).

12. Until her death in 2012, Elinor Ostrom was the leading voice for polycentric approaches to climate change. Polycentric governance involves multiple decision centers that are formally independent, but have the ability to function interdependently through a system of relationships when they choose. *See* Elinor Ostrom, *A Polycentric Approach for Coping with Climate Change* 33 (World Bank Policy Research, Working Paper No. 5095, 2009), *available at* http://www.iadb.org/intal/intalcdi/pe/2009/04268.pdf. With regard to climate change, a polycentric approach is based on the insight that "'[g]lobal solutions,' negotiated at a global level—if not backed up by a variety of efforts at national, regional, and local levels—are not guaranteed to work effectively. To the contrary they are virtually doomed to fail." Daniel H. Cole, *From Global to Polycentric Climate Governance* 396 (Eur. Univ. Inst., Working Paper No. 2011/30, 2011) (footnote omitted) (quoting Elinor Ostrom), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1858852. Thus, instead of rigid governance hierarchies, polycentric governance recognizes that the interplay between different levels and units of government might fruitfully be harnessed to promote experimentation and learning. This approach stands as a marked contrast with, and a supplement to, the top-down global climate regime represented by the U.N. Framework Convention on Climate Change. *See infra* note 110 and accompanying text.

whether we can successfully tease out how actions on those multiple scales might contribute to solving those problems.

I chose lionfish as my metaphor for the broader challenges of "solving global problems" not only because they are beautiful (which they are), and not only because of the serious socioecological problems they create, but because they also come wrapped in a set of globally rooted drivers that are inherent to most, if not all, of the global problems this symposium might aspire to "solve."

The lionfish problem exists as an unintended consequence of a series of choices that are themselves rooted in a globalized economy—in this case, the exotic fish trade. These fish are emblematic of the consequences that flow from inadequate international, national, and subnational regulation of a global trade regime that has commodified living organisms. They demonstrate, in a very physical sense, how a laissez-faire regulatory regime, which defines priorities based on individual consumer preferences and behavioral choices, systematically disregards systemic risks, including risks to the health of our ecosystem. Finally, lionfish force us to confront the vulnerabilities inherent in relying on individual preferences to make decisions by juxtaposing individual choices with their cumulative impacts, and situating those impacts in the context of fundamental bio-geophysical forces over which humans do not exert control.

Lionfish force us to confront basic questions about the very nature, power, and function of law itself. Their presence in the Western Atlantic is a testament to unintended consequences—highlighting how important public goods erode when economic actors are not forced to consider the environmental impact of their behavior. As such, lionfish call attention to the environmental inadequacies of global trade agreements. As an invasive species, lionfish underscore the threats to global biodiversity associated with climate change. They shine a bright light on how overfishing and coastal overdevelopment jeopardize the stability of marine ecosystems. Lionfish also accentuate the inherent challenges to state-based regulation in an increasingly globalized world, as well as the more fundamental question about the capacity of states to respond to these problems at all when the primary actors are transnational corporations, juridical entities initially created under state law that are increasingly able to elude the regulatory grasp of states. Finally, the growing lionfish problem forces us to confront key aspects of climate change—most notably, the loss of resilience that accompanies the warming and acidifying of the world's oceans.

These are hard, complex problems. But, as Professor Osofsky points out, "[I]f we are going to have a meaningful conversation about solving global problems, we cannot avoid really hard problems."[13] This essay is an attempt to take up her challenge. Part II of this essay provides background on the lionfish problem and describes its impact on coastal communities and ecosystems. Part III identifies the relevant legal regimes that have been deployed in response, emphasizing the multiple governance mechanisms that have been called into action. Part IV highlights the intractable and multiscalar threats that invasive species, like lionfish, pose to our collective ability to realize cherished principles of international law. It situates the lionfish problem

13. Osofsky, *supra* note 11, at 779.

firmly in the context of its multiple drivers, illustrating the complex and reflexive nature of global environmental problems. This Part underscores how the lionfish problem raises profoundly difficult questions about the nature and meaning of international law itself. Finally, Part V begins the process of "solving global problems" by identifying points of fruitful legal and policy intervention, and possible collaborative governance efforts that offer at least a glimmer of hope, if not the full-blown solution promised by this symposium. In doing so, this essay draws on New Haven School[14] ideas about authoritative decisionmaking.[15] More than anything else, this essay underscores that responding to global problems in a fashion we might dare to label "solving" requires textured interventions from multiple authoritative decisionmakers, exercising power at multiple layers of governance.

II. LIONFISH REPRESENT A MULTIPLICITY OF GLOBAL PROBLEMS

In order to appreciate what it means to say that lionfish are emblematic of a certain kind of "global problem," it is first important to know something about lionfish. This Part provides a general introduction to lionfish and to their role as an invasive species in the Western Atlantic and the Caribbean.

A. Lionfish: An Introduction

Lionfish are a variety of carnivorous fish native to the Indian and Pacific Oceans. Flamboyant and beautiful, lionfish are famous for their gracefully flowing fins and dramatically striped colorations. Their seemingly fragile beauty makes them a popular fish for saltwater aquarium enthusiasts. The most common variety, *Pterois volitans*,[16]

14. The New Haven School is the name given to the work product that emerged out of the collaboration between sociologist Harold D. Lasswell and law professor Myres S. McDougal. Together with many prominent associates, including W. Michael Reisman, they devised "a contextual, policy-oriented jurisprudence" to examine how law can promote human dignity in an increasingly global world. McDougal, *supra* note 5, at ix. Embracing interdisciplinarity, these New Haven School thinkers developed an elaborate system of legal analysis intended to flesh out the values at the core of international law, and the processes necessary to translate those values into theories of legal decisionmaking. Their process-oriented, or configurative, jurisprudence produced an impressive body of scholarship, and it remains one of the few legal theories that examines law in both domestic and international arenas. Among the works I found useful in writing this essay are: Harold. D. Lasswell & Myres S. McDougal, Jurisprudence for a Free Society: Studies in Law, Science and Policy (1992); Myres S. McDougal & W. Michael Reisman, International Law in Contemporary Perspective: Public Order of the World Community (1981); Myres S. McDougal, Harold D. Lasswell & Lung-chu Chen, Human Rights and World Public Order: The Basic Policies of an International Law of Human Dignity (1980); Myres S. McDougal, *The Impact of International Law on National Law: A Policy-Oriented Perspective*, 4 S.D. L. Rev. 25 (1959).

15. "Authoritative Decision" is a central concept in New Haven School theories. It represents the synthesis of effective control with legitimate process that comports with the "shared expectations of the members of a community about how decisions should be taken." McDougal et al., *supra* note 8, at 194. When I use the terms "authoritative decisionmaking" or "authoritative decisionmaker," I do so with this definition in mind.

16. Invasive lionfish represent two morphologically similar species, *Pterois volitans* (Linnaeus, 1758) and *Pterois miles* (Bennett, 1828). In this essay, the term "lionfish" refers collectively to both species.

sell for around thirty dollars each,[17] with larger specimens or more unusual varieties selling for sixty dollars or more.[18] These fish are readily available for purchase on the Internet, and are frequently found at local fish stores. It is an extremely lucrative business—imports of lionfish generated revenues in excess of $3 million per month in 2006 alone.[19]

Lionfish were brought into the Western Hemisphere to cater to the tastes of the saltwater aquarium trade—a rarified and expensive hobby. With start-up costs ranging in the neighborhood of $17,000, the hobby is the preserve of those with a measure of material wealth and a hankering for beautiful, exotic fish.[20] There are an estimated 700,000 saltwater aquariums in the United States.[21]

Lionfish are a popular choice for home aquariums, indeed they are considered "icons of the marine aquarium hobby."[22] As a result, lionfish imports rank twenty-ninth among the 1,310 known imported species (with 63,284 individual fish imported in 2005 alone).[23] In captivity, lionfish reputedly prefer live prey and grow to approximately seven inches.[24] Known as voracious predators, online aquarium advice columns warn about adding a lionfish to any tank with smaller fish or crabs—a lionfish "will eat any tank-mate that can fit in its mouth."[25]

Lionfish are just one small part of the multibillion-dollar global industry trading in live tropical reef organisms.[26] Worldwide, this industry is growing at the astonishing

17. Petco, *supra* note 1.

18. *Id.*; *see also Lionfish*, ThePetStop.com, http://www.thepetstop.com/fish-shop/lion-fish-for-sale.html (last visited Mar. 18, 2014); *Lionfish*, LiveAquaria.com, http://www.liveaquaria.com/product/aquarium-fish-supplies.cfm?c=15+36 (last visited Mar. 18, 2014).

19. Cristina M. Balboa, *The Consumption of Marine Ornamental Fish in the United States: A Description from the U.S. Import Data*, *in* Marine Ornamental Species 65–76 (James C. Cato & Christopher L. Brown eds., 2008).

20. *The Real Cost of a Saltwater Aquarium*, Bloomberg (Aug. 22, 2012, 12:10 PM ET), http://www.bloomberg.com/consumer-spending/2012-08-20/the-real-cost-of-a-saltwater-aquarium.html#slide17. It is worth noting that the above-cited article displays a lionfish to represent the world of saltwater aquariums. Undoubtedly, many people set up tanks for less, but even more parsimonious estimates still range into the thousands of dollars, not including the fish. Melev, *What Does it Cost to Set Up a Saltwater Reef Tank?*, ReefAddicts.com (May 12, 2010, 12:14 AM), http://www.reefaddicts.com/content.php/167-What-does-it-cost-to-set-up-a-saltwater-reef-tank.

21. Henry Fountain, *Are Aquariums Getting Too Lifelike?*, N.Y. Times (Mar. 23, 2010), http://nyti.ms/1fUxOJ9.

22. Scott W. Michael, *Lionfish: Risky but Rewarding*, FishChannel.com, http://www.fishchannel.com/saltwater-aquariums/species-info/lionfish/lionfish-rewards.aspx (last visited Mar. 18, 2014).

23. Andrew L. Rhyne et al., *Revealing the Appetite of the Marine Aquarium Fish Trade: The Volume and Biodiversity of Fish Imported into the United States*, Pub. Libr. of Sci. (May 21, 2012), http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0035808.

24. For a description of the machinations tank owners go through to convince lionfish to eat prepared foods, see Frank Marini, *The Lionfish Info Sheet: Captive Care and Home Husbandry*, Reefkeeping.com, http://www.reefkeeping.com/issues/2002-11/fm/feature/ (last visited Mar. 18, 2014).

25. Petco, *supra* note 1; *see also* Marini, *supra* note 24.

26. *See* Lauretta Burke & James Maidens, Reefs at Risk in the Caribbean 53 (2004).

pace of 14% annually.[27] The reasons for this explosive growth are not hard to find—on a per-pound basis, the value of ornamental fish collected for the aquarium trade far outstrips the value of fish harvested for food.[28] Indeed, the Food and Agriculture Organization of the United Nations has begun promoting ornamental fish harvesting as a path to environmentally sustainable development.[29]

Year after year, millions of marine organisms are captured from coral reef ecosystems and "inserted into a pipeline that empties into more than two million homes and public aquariums worldwide."[30] The overwhelming majority of the organisms sold through the global aquarium trade (98%) are captured from their natural habitats—primarily coral reefs.[31] More than half of these organisms find their way to the United States,[32] with the rest destined for Europe, Japan, and a handful of other countries.[33] In 2005 alone, more than eleven million fish were imported into the United States,[34] along with an untold number of marine invertebrates and corals. While forty-five countries participate in the global aquarium trade, 85% of the marine organisms traded globally for ornamental purposes come from Indonesia and the Philippines.[35] The aquarium fish trade is clearly an economic boon for these countries,[36] providing employment for thousands of people with few livelihood alternatives.[37] However, as the demand increases, unsustainable harvesting practices, like the use of cyanide, are becoming a serious problem.[38] Overcollection

27. Dianna K. Padilla & Susan L. Williams, *Beyond Ballast Water: Aquarium and Ornamental Trades as Sources of Invasive Species in Aquatic Ecosystems*, 2 Frontiers in Ecology & the Env't 131, 131 (2004), *available at* http://life.bio.sunysb.edu/ee/padillalab/pdfs/Padilla%20%26%20Williams%20%28Front%20Ecol%29%202004.pdf.

28. Paul Holthus, *Reducing Poverty and Eliminating the Ecological Footprint of Netherlands Consumers Through a Certified Trade in Marine Ornamentals*, Earthmind.net (May 5, 2003), http://earthmind.net/fish/docs/eco-footprint-nl-marine-ornamemtals.pdf.

29. *See Ornamental Fish*, U.N. Food & Agric. Org., http://www.fao.org/fishery/topic/13611/en (last visited Mar. 18, 2014).

30. Katherine F. Smith et al., *U.S. Drowning in Unidentified Fishes: Scope, Implications, and Regulation of Live Fish Import*, 1 Conservation Letters 103, 103 (2008).

31. *See, e g.*, ForTheFishes.org, http://www.forthefishes.org/ (last visited Mar. 18, 2014).

32. *Marine Aquarium Fish Trade Study Reveals Fewer Fish, More Species Imported Than Previously Estimated*, Sci. Daily (May 22, 2012), http://www.sciencedaily.com/releases/2012/05/120522110301.htm [hereinafter *Fewer Fish, More Species*].

33. Rhyne et al., *supra* note 23.

34. *Id.*

35. Marine Aquarium Council et al., Report on Roving Collectors: Case Studies from Indonesia and the Philippines, at v (2006), *available at* http://www.aquariumcouncil.org/materials/Roving-Collectors-Report-Final.pdf.

36. *Fewer Fish, More Species*, *supra* note 32.

37. Marine Aquarium Council et al., *supra* note 35, at 1.

38. Peter J. Rubec & Ferdinand P. Cruz, *Monitoring the Chain of Custody to Reduce Delayed Mortality of Net-Caught Fish in the Aquarium Trade*, 13 SPC Live Reef Fish Info. Bull. 13, 13–14, (2005); Sarah Simpson,

and environmentally destructive fishing practices can lead to loss of biodiversity.[39] In Florida, for example, harvesting of reef invertebrates has increased tenfold in the past twenty years, raising concerns about a potential ecological collapse.[40]

B. How Lionfish Wound Up in the Western Atlantic

Aside from damage that occurs to reef ecosystems in source countries when exotic species are collected for the aquarium trade, another major concern is the risks these animals pose in the importing countries. All too often, unwanted fish and animals are released into the wild by owners who believe that is the "humane" choice. However, this unregulated introduction of non-native species into importing country ecosystems raises the possibility that, under appropriate conditions, the introduced animals can become invasive.[41]

Unfortunately, the warming waters of the Western Atlantic offer those "appropriate conditions" to lionfish, the first non-native marine fishes to establish themselves in the Western North Atlantic and Caribbean regions.[42] Although the precise means and date by which lionfish arrived in these waters are uncertain, most people believe that Hurricane Andrew, in 1992, played a significant part.[43] In Belize and the Bahamas, dive masters readily regale listeners with stories about an irresponsible aquarium owner who dumped his aquarium before evacuating for Andrew.[44] Although almost certainly apocryphal, the story contains at least a grain of truth. Aquarium releases have consistently been found to be among the top sources for the introduction of non-native aquatic species.[45] Fully a third of the aquatic

Fishy Business, Sci. Am., July 2001, at 83–84, *available at* http://faculty.bennington.edu/~sherman/coral%20papers/fishkilling%20in%20reefs.pdf.

39. *See* Simpson, *supra* note 38, at 84.

40. Andrew Rhyne et al., *Crawling to Collapse: Ecologically Unsound Ornamental Vertebrate Fisheries*, Pub. Libr. of Sci. (Dec. 22, 2009), http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0008413.

41. Pamela J. Schofield, *Update on Geographic Spread of Invasive Lionfishes (*Pterois Volitans *[Linnaeus, 1758] and* P. Miles *[Bennett, 1828]) in the Western North Atlantic Ocean, Caribbean Sea and Gulf of Mexico*, 5 Aquatic Invasions S117, S122 (2010); Burke & Maidens, *supra* note 26, at 12–14.

42. Schofield, *supra* note 41, at S117.

43. Anika Gupta, *Invasion of the Lionfish*, Smithsonian (May 8, 2009), http://www.smithsonianmag.com/science-nature/Invasion-of-the-Lionfish.html.

44. *Lionfish Fact Sheet*, Nat'l Oceanic & Atmospheric Admin., http://www.habitat.noaa.gov/pdf/best_management_practices/fact_sheets/Lionfish%20Factsheet.pdf (last visited Mar. 18, 2014). The U.S. Geological Survey (USGS) generally rejects this theory. *Non-Indigenous Aquatic Species:* Pterois Volitans/Miles, U.S. Geological Survey, http://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=963 (last visited Mar. 18, 2013). The first published account of this theory was by fisheries biologist Walter Courtenay in the *American Fisheries Society Newsletter.* Walter Courtenay, *Marine Fish Introductions in Southeastern Florida*, 14 Am. Fisheries Soc'y, Introduced Fish Section Newsletter 2–3 (1995). Courtenay now rejects this theory as well. Virginia Morell, *Mystery of the Lionfish: Don't Blame Hurricane Andrew*, Sci. Insider (Apr. 29, 2010, 4:28 PM), http://news.sciencemag.org/scienceinsider/2010/04/mystery-of-the-lionfish-dont-bla.html.

45. Padilla & Williams, *supra* note 27, at 131.

species listed by the International Union for the Conservation of Nature (IUCN) Invasive Species Specialist Group as the one hundred worst invasive species entered their new environments through aquarium or ornamental releases.[46] The most probable explanation for the arrival of lionfish in the Atlantic Ocean is via the aquarium trade.[47]

The earliest reported lionfish sighting in the Atlantic Ocean was near Florida in 1985. Given that Florida is the point of entry for a significant percentage of the lionfish imported into the United States,[48] it is not surprising that the fish would be found there first. What was surprising was the speed with which the fish multiplied and spread. By the early 2000s, lionfish populations were well established along the Florida coast, where fishermen now report catching lionfish in commercial quantities.[49] In 2004, a National Oceanic and Atmospheric Administration researcher found lionfish in thirteen of seventeen survey sites from Florida to North Carolina, with the lionfish sometimes outnumbering native fish.[50] A 2006 study estimated that lionfish were present in the Western Atlantic at densities of twenty-one lionfish per hectare.[51] Two years later, studies found that average lionfish densities were in the range of 150 to 350 lionfish per hectare,[52] densities that exceed lionfish densities in their native habitat by orders of magnitude.[53]

Lionfish have spread throughout the Western North Atlantic and the Caribbean Sea at a remarkable pace.[54] They are now endemic throughout the Caribbean and the

46. *See generally* S. Lowe et al., 100 of the World's Worst Invasive Alien Species: A Selection from the Global Invasive Species Database (2004), *available at* http://calendar.k-state.edu/withlab/consbiol/IUCN_invaders.pdf.

47. *See* Paula E. Whitfield et al., *Biological Invasion of the Indo-Pacific Lionfish* Pterois Volitans *Along the Atlantic Coast of North America*, 235 Marine Ecology Progress Series 289, 291 (2002), *available at* http://www.int-res.com/articles/meps2002/235/m235p289.pdf; Ramon Ruiz-Carus et al., *The Western Pacific Red Lionfish,* Pterois Volitans *(*Scorpaenidae*), in Florida: Evidence for Reproduction and Parasitism in the First Exotic Marine Fish Established in State Waters*, 128 Biological Conservation 384 (2006); *Non-Indigenous Aquatic Species:* Pterois Volitans/Miles, *supra* note 44.

48. Balboa, *supra* note 19.

49. Philippe Cousteau & Matthew Knight, *Taming the Lionfish: Florida Fights Back Against Invasive Species*, CNN (Apr. 26, 2012, 7:14 AM EDT), http://www.cnn.com/2012/04/24/us/lionfish/index.html?_s=PM:US.

50. Paula E. Whitfield et al., *Abundance Estimates of the Indo-Pacific Lionfish* Pterois Volitans/Miles *Complex in the Western North Atlantic*, 9 Biological Invasions 53, 53 (2006); Ruiz-Carus et al., *supra* note 47.

51. Whitfield et al., *supra* note 50.

52. Stephanie J. Green & Isabelle M. Côté, *Record Densities of Indo-Pacific Lionfish on Bahamian Coral Reefs*, 28 Coral Reefs 107 (2009) (reporting densities greater than 390 lionfish per hectare in the Bahamas).

53. Michel Kulbicki et al., *Distributions of Indo-Pacific Lionfishes* Pterois *Spp. in Their Native Ranges: Implications for the Atlantic Invasion*, 446 Marine Ecology Progress Series 189, 200 (2012).

54. Benjamin I. Ruttenberg et al., *Rapid Invasion of Indo-Pacific Lionfishes (*Pterois Volitans *and* Pterois Miles*) in the Florida Keys, USA: Evidence from Multiple Pre- and Post-Invasion Data Sets*, 88 Bull. Marine Sci. 1051, 1051 (2012); John Alexander Brightman Claydon et al., *The Red Lionfish Invasion of South Caicos, Turks & Caicos Islands*, 61 Gulf & Caribbean Fisheries Inst. 400 (2008), *available at* http://www.gcfi.org/Lionfish/Papers/2009/ClaydonGCFI61_Paper.pdf.

Gulf of Mexico,[55] as well as along the southeastern United States coast from Florida to North Carolina.[56] Juvenile lionfish have been collected as far north as Long Island, New York and as far west as Bermuda.[57] The range of these fish is only likely to increase because climate change is warming the ocean waters,[58] which, in turn, alters the geographic range available to many marine species.[59]

As a result, lionfish have become one of the top predators in many coral reef environments of the Atlantic and Caribbean. Once they entered the warming waters of the acidifying Western Atlantic, lionfish went about doing what they do best—eating. Lionfish are voracious carnivores with no known native predators in the Western Hemisphere.[60] As they exploded in population, lionfish have decimated native species, quickly becoming the poster species for the havoc that invasive species can wreak on vulnerable ecosystems. Lionfish are known to consume over fifty species of fish, including the juveniles of some economically and ecologically important species like grouper, snapper, grunts, and crustaceans.[61] In their native Indo-Pacific habitat, adult lionfish grow up to fifteen inches and can live for up to fifteen years.[62] In the Atlantic, however, significantly bigger lionfish have been reported.[63] Lionfish also reproduce rapidly; a single female can spawn more than two million eggs in a single year.[64] This combination of fecundity, long life, and voracious appetite means

55. Pamela J. Schofield, *Geographic Extent and Chronology of the Invasion of Non-Native Lionfish (*Pterois Volitans *[Linnaeus 1758] and* P. Miles *[Bennett 1828]) in the Western North Atlantic and Caribbean Sea*, 4 Aquatic Invasions 473, 475 (2009).

56. James A. Morris, Jr. & Paula E. Whitfield, Biology, Ecology, Control and Management of the Invasive Indo-Pacific Lionfish: An Updated Integrated Assessment 9–10 (2009), *available at* http://www.ccfhr.noaa.gov/docs/lionfish_%20ia2009.pdf; *see also* Mark A. Albins & Mark A. Hixon, *Worst Case Scenario: Potential Long-Term Effects of Invasive Predatory Lionfish (*Pterois Volitans*) on Atlantic and Caribbean Coral-Reef Communities*, 96 Env't Biology of Fishes 1151, 1151–57 (2013).

57. *Non-Indigenous Aquatic Species:* Pterois Volitans/Miles, *supra* note 44.

58. *See, e.g.*, *Ecosystem Advisory for the Northeast Shelf Large Marine Ecosystem*, Nat'l Oceanic & Atmospheric Admin., http://www.nefsc.noaa.gov/ecosys/advisory/current/advisory.html (last visited Mar. 18, 2014) (documenting water temperature increases in the Atlantic).

59. William W.L. Cheung et al., *Signature of Ocean Warming in Global Fisheries Catch*, 497 Nature 365, 365–68 (2013) (documenting climate change-related shifts in the range of fish species on a global scale).

60. *Lionfish Research Program*, REEF.org, http://www.reef.org/lionfish (last visited Mar. 18, 2014).

61. *Id.*; *The Indo-Pacific Lionfish Invasion*, Nat'l Oceanic & Atmospheric Admin. Coral Reef Info. Sys., http://www.coris.noaa.gov/exchanges/lionfish/ (last updated June 2013); *Atlantic and Caribbean: Lionfish Invasion Threatens Reefs*, World Res. Inst., http://www.wri.org/atlantic-and-caribbean-lionfish-invasion-threatens-reefs (last visited Mar. 18, 2014)

62. *Lionfish*, Nat'l Geographic, http://animals.nationalgeographic.com/animals/fish/lionfish/ (last visited Mar. 18, 2014).

63. Personal observation of the author; *see* Emily S. Darling et al., *Indo-Pacific Lionfish Are Larger and More Abundant on Invaded Reefs: A Comparison of Kenyan and Bahamian Lionfish Populations*, 12 Biological Invasions 2045 (2011).

64. *Lionfish Expansion from 1985 to 2013*, Ocean Support Found., http://www.oceansupport.org/lionfish-information (last visited Mar. 18, 2014).

that the lionfish invasion has the potential to further destabilize already-stressed coral reef ecosystems throughout the Western Atlantic and Caribbean.[65]

Belize is particularly hard hit by this constellation of problems. A small, still-developing country, Belize has a population of roughly 350,000[66] and a territory that includes approximately 280 kilometers of coral reef. Belize has the second-longest unbroken expanse of coral reef in the world, and the longest in the Western Hemisphere. According to Belize's 2010 census, over 40% of the Belizean population lives and works in the coastal zone, and more than 800,000 tourists visit the region each year.[67] Between fisheries and tourism, the reef is responsible for nearly 15% of Belize's annual gross domestic product.[68] Closely affiliated coastal mangrove ecosystems[69] contribute another 12%.[70] Together, the direct and indirect economic benefits associated with Belize's reef total roughly 27% of the nation's gross domestic product.[71] The reef itself was designated a UNESCO World Heritage Site in 1996[72]—an international stamp of approval that features prominently in Belizean tourism promotion.[73] The entire Mesoamerican reef[74] in Belize is protected under domestic law,[75] with much of it designated as "marine protected areas" in which

65. *Atlantic and Caribbean: Lionfish Invasion Threatens Reefs*, *supra* note 61; Marinebioblog, *Dangerous Beauty—The Ongoing Threat of Invasive Lionfish Along the East Coast*, That Fish Blog (Feb. 26, 2013), http://blogs.thatpetplace.com/thatfishblog/2013/02/26/dangerous-beauty-the-ongoing-threat-of-invasive-lionfish-along-the-east-coast/#.UxM0gc63uAY.

66. *Belize*, CIA World Factbook, https://www.cia.gov/library/publications/the-world-factbook/geos/bh.html (last visited Mar. 18, 2014).

67. Coastal Zone Mgmt. Auth. & Inst., Belize Integrated Coastal Zone Management Plan 2 (2013), *available at* http://www.coastalzonebelize.org/wp-content/uploads/2013/06/DRAFT%20BELIZE%20Integrated%20Coastal%20Zone%20Management%20Plan%20_MAY%2020.pdf.

68. Emily Cooper et al., Coastal Capital Belize: The Economic Contributions of Belize's Coral Reefs and Mangroves 1 (2009) (unpublished manuscript), *available at* http://pdf.wri.org/coastal_capital_belize_wp.pdf. This study acknowledges that because it focuses solely on tourism, fisheries, and shoreline protection, it undervalues the actual, total value of the reef as a resource. *Id.* at 5.

69. Peter J. Mumby, *Connectivity of Reef Fish Between Mangroves and Coral Reefs: Algorithms for the Design of Marine Reserves at Seascape Scales*, 128 Biological Conservation 215, 216–18 (2006) (explaining the profound influence that healthy mangrove stands have over nearby coral reef fish populations).

70. Cooper et al., *supra* note 68, at 6–7.

71. *Id.*

72. *Belize Barrier Reef System*, U.N. Educ., Sci. & Cultural Org. (UNESCO), http://whc.unesco.org/en/list/764 (last visited Mar. 18, 2014). In 2009, the Belizean reef was added to the UNESCO's List of World Heritage Sites in Danger. *List of World Heritage Sites in Danger*, UNESCO, http://whc.unesco.org/en/danger/ (last visited Mar. 18, 2014).

73. *See Dive in the Reserve*, Travel Belize, https://www.travelbelize.org/destinations/belize-reef/glovers-reef-atoll (last visited Mar. 18, 2014).

74. The Mesoamerican reef is a marine region in the Carribbean that extends along the coast of four countries: Mexico, Belize, Guatemala, and Honduras. *Mesoamerican Reef*, World Wildlife Fund, http://worldwildlife.org/places/mesoamerican-reef (last visited Mar. 18, 2014).

75. Coastal Zone Management Act, ch. 329 (Belize, 2010), *available at* http://faolex.fao.org/docs/pdf/blz13962.pdf.

fishing is strictly regulated.[76] Belizeans themselves view the reef as a priceless national treasure.

In 2008, lionfish had yet to be spotted in Belize.[77] By 2010, they were everywhere, and by 2012, they were the number one threat identified in the Healthy Reef Report Card.[78] The proliferation of lionfish undermines many of the Belizean government's measures aimed at preserving and protecting the reef.[79] By destabilizing a complex marine ecosystem, lionfish jeopardize the integrity of the reef system, threatening the survival of traditional Mayan and Guarafina cultures.

C. How Lionfish Interact with Broader Threats to Coral Reefs

Coral reefs, the "rain forests of the sea,"[80] are among the most biologically rich and productive ecosystems on earth. They also provide valuable benefits to millions of coastal people as important sources of food and income. They serve as nurseries for commercial fish species, attract divers and snorkelers from around the world, generate the sand on tourist beaches, and protect shorelines from the ravages of storms.[81] Coral reefs do not conform to national boundaries. As a consequence, no single state is in a position to fully protect its coral reef through its own unitary actions. Instead, protecting and restoring coral reefs demands collaboration on multiple scales—within states, between states, and with nonstate entities, including private actors.

To fully appreciate this point about the necessity of multiscalar cooperation, one need look no further than the fact that coral reefs face multiple threats stemming from global, regional, national, and local human activities.[82] More than 60% of the world's coral reefs are under immediate and direct threat from local unsustainable activities like coastal overdevelopment and overfishing, a number that jumps to 75% when local and global threats are considered together.[83] On the most global of scales, anthropogenic climate change jeopardizes the very survival of coral reefs. The year 2013 was one of the warmest on record, following a decade that was itself the

76. Coastal Zone Mgmt. Auth. & Inst., National Integrated Coastal Zone Management Strategy for Belize 31 (2010), *available at* http://www.coastalzonebelize.org/wp-content/uploads/2010/04/czmai_strategy.pdf.

77. Healthy Reefs for Healthy People, Report Card for the Mesoamerican Reef 4 (2012), *available at* http://www.healthyreefs.org/cms/wp-content/uploads/2012/12/2012-Report-Card.pdf

78. *Id.*

79. *See infra* Part IV.

80. Coral Reefs: Rainforests of the Sea (Oceanic Research Grp. 1997), *available at* http://www.oceanicresearch.org/education/films/crrain_qt.htm.

81. Lauretta Burke et al., Reefs at Risk: Revisited, at v (2011), *available at* http://pdf.wri.org/reefs_at_risk_revisited.pdf.

82. *Id.* at 3.

83. *Id.*

warmest on record.[84] The ocean is warming along with the planet.[85] Warmer oceans lead to coral bleaching, a phenomenon in which coral reefs lose their colorful symbiotic algae, exposing their white skeletons.[86] Climate-induced coral bleaching, which is increasingly frequent around the globe, leaves reefs, fish, and the communities depending on these resources at great risk.[87] Carbon emissions also promote ocean acidification, which reduces coral reef growth rates and threatens their physical integrity.[88] Unless current carbon trends change drastically, more than 90% of all coral reefs will be threatened by 2030.[89]

Along with these global-scale threats facing the planet's oceans, the Mesoamerican barrier reef system, which stretches from the Yucatán through Belize and Honduras, also faces a suite of more local threats, including coastal overdevelopment, overfishing, destructive fishing practices, and pollution.[90] This combination of local and global threats leaves reefs increasingly susceptible to damage from storms, infestations, and diseases.[91] The cumulative effect of these multiple stressors undermines the social and economic security of the communities that rely on the reef. The extent and severity of the threats to coral reefs, in combination with the critically important ecosystem services they provide, point to an urgent need for action.

In the Caribbean and Western Atlantic, more than 75% of the coral reefs are degraded or threatened.[92] Overfishing has historically been the most pervasive threat to Caribbean coral reefs, decimating many large predator populations.[93] Indeed, the opening of this formerly occupied ecological niche may have facilitated the lionfish invasion. On many reefs, herbivorous fish populations have also been fished out, with

84. John M. Broder, *Past Decade Warmest on Record, NASA Data Shows*, N.Y. Times (Jan. 21, 2014), http://nyti.ms/1kkazYe ("Average global temperatures have risen by about 1.5 degrees Fahrenheit (0.8 degrees Celsius) since 1880."); Justin Gillis, *2013 Listed as One of the Warmest Years on Record*, N.Y. Times (Jan. 21, 2014), http://nyti.ms/1cT8ADI.

85. Magdalena A. Balmaseda et al., *Distinctive Climate Signals in Reanalysis of Global Ocean Heat Content*, 40 Geophysical Res. Letters 1754 (2013).

86. *Global Warming and Coral Reefs*, Nat'l Wildlife Fed'n, http://www.nwf.org/Wildlife/Threats-to-Wildlife/Global-Warming/Effects-on-Wildlife-and-Habitat/Coral-Reefs.aspx (last visited Mar. 18, 2014).

87. *Id.*

88. *Id.*

89. Burke et al., *supra* note 81, at 6.

90. *Id.* at 1.

91. *Id.*

92. *Id.* at 3, 64 (indicating a marked decline in Caribbean reefs over the past decade); *see also* Burke & Maidens, *supra* note 26, at 11 (reporting that one-third of Caribbean coral reefs were degraded or threatened in 2004).

93. Christopher D. Stallings, *Fishery-Independent Data Reveal Negative Effect of Human Population Density on Caribbean Predatory Fish Communities*, Pub. Libr. of Sci. (May 6, 2009), http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0005333.

overall negative impacts for the health and resilience of coral reef ecosystems.[94] Warming, acidifying ocean waters add to the pressure on these vital ecosystems, with climate change responsible for increasing the occurrence and intensity of hurricanes as well as disease and bleaching events.[95] In addition to climate change and overfishing, the coral reefs of the Caribbean and Western Atlantic are further compromised by pollution and coastal development.[96]

All of these pressures pose long-term threats to reef stability. It is no wonder that these overstressed reefs have little resilience left to weather the lionfish invasion. As a result, in just a few short years, the lionfish invasion has become a major additional threat[97] that not only overlays and intensifies pressure from these preexisting issues, but also poses an independent, immediate threat to the core stability of coral reefs. National Public Radio has analogized the lionfish invasion to a "living oil spill."[98]

The problems flowing from the lionfish invasion reach well beyond concerns about ecological integrity. The Mesoamerican reef system is central to the two key industries for many Caribbean nations: tourism and fishing—both of which represent the entry point for many of these small, developing states into the global economy.[99] In a region where more than forty-two million people depend on coral reefs for food and income,[100] the lionfish invasion has very serious socioeconomic implications. This problem is the unintended, but in retrospect fully predictable, consequence of a set of private consumption patterns facilitated by global trade elsewhere. The beneficiaries of that global trade are on the other side of the world (source states) or in the United States (a consumer state). Belize and the other Caribbean states are innocent bystanders, suffering the consequences of the lionfish invasion without sharing in any of the benefits of the trade that generated the problem in the first

94. Jeremy B.C. Jackson, *What Was Natural in the Coastal Oceans*, 98 Proc. Nat'l Acad. Sci. 5411, 5412 (2001); *Human Impact on the Great Barrier Reef*, U. Mich., http://sitemaker.umich.edu/gc2sec7labgroup3/over-fishing (last visited Mar. 18, 2014).

95. Leonard A. Nurse, *The Implications of Global Climate Change for Fisheries Management in the Caribbean*, 3 Climate & Dev. 228, 232 (2011).

96. In 2004, when the lionfish were first being found in the Caribbean and Western Atlantic, a chronology of the threats facing the Caribbean's coral reefs focused on coastal overdevelopment; sediment and pollutants from inland development; oil spills, ship discharge, and other marine-based threats; overfishing; disease; and rising ocean temperatures. Burke & Maidens, *supra* note 26, at 24–40.

97. Healthy Reefs, Report Card for the Mesoamerican Reef: An Evaluation of Ecosystem Health 5 (2010), *available at* http://www.healthyreefs.org/cms/wp-content/uploads/2012/12/2010-Report-Card.pdf.

98. Elizabeth Shogren, *Lionfish Attacking Atlantic Ocean Like a Living Oil Spill*, Nat'l Pub. Radio (Apr. 17, 2013, 2:56 AM), http://www.npr.org/2013/04/17/177359109/lionfish-attack-the-gulf-of-mexico-like-a-living-oil-spill.

99. *See* World Travel & Tourism Council, Travel and Tourism Economic Impact 2013: Caribbean 11–12 (2013), *available at* http://www.wttc.org/site_media/uploads/downloads/caribbean2013_1.pdf; Milton O. Haughton, Fisheries Subsidies and the Role of Regional Fisheries Management Organizations: The Caribbean Experience 2–4 (unpublished manuscript), *available at* http://www.unep.ch/etu/Fisheries%20Meeting/submittedPapers/MiltonHaughton.pdf.

100. Burke et al., *supra* note 81, at 63.

place. Lionfish are more than a nuisance—they are a profound threat to development in countries that have yet to reap much of the touted dividends of free trade.

III. THE LEGAL TOOLS AND THEIR LIMITATIONS

To use the language of international law to discuss the problem, these fish care nothing about inter- or intragenerational equity. Lionfish will eat everything in their path—shrimp, angelfish, sea bass, parrotfish, octopus, crustaceans, grouper, starfish, and lizards have all been found in their gut.[101] On the intergenerational level, this means that lionfish jeopardize the continued existence of the coral reef ecosystem. Their predation behaviors may leave too few fish to guarantee successful breeding, calling the very existence of future fish generations into question. On the intragenerational level, lionfish have shown a propensity to outcompete their less ruthless or less advantaged copredators, many of which have already been decimated by overfishing. Their presence spells doom for the rest of the reef—there is no balance between lionfish and other marine species.

Unfortunately, the legal tools available for responding to this threat are extremely limited. Because coral reefs span national jurisdictions, there are often no clear lines of authority for responding to the threats posed by lionfish. Neither authoritative decisionmakers nor appropriate processes are obvious. Lionfish pose a multijurisdictional problem, one necessitating a multijurisdictional response. Despite a wide array of potentially relevant global and regional agreements, structural gaps and institutional weaknesses render these agreements less useful than they appear.

This Part provides a brief overview of the relevant global and regional agreements. Part III.A highlights the major international agreements potentially relevant to the lionfish situation by identifying the relevant provisions and their limitations. This discussion demonstrates that problems like the lionfish invasion are largely invisible to international law, even though the problem itself originates from global trade and other international activities promoted by international law. Part III.B identifies the major regional agreements potentially relevant to the lionfish situation. Unlike the pessimism about the effectiveness and relevance of international legal agreements expressed in Part III.A, Part III.B highlights some promising regional initiatives and emphasizes how regional legal agreements have created conditions ripe for potentially successful cooperation and coordination in responding to the lionfish invasion.

A. Global Tools and Treaties

There are few global or international legal tools available for confronting the lionfish invasion. The dominant multilateral regime is the Convention on International Trade in Endangered Species (CITES)[102]—a treaty regime focused on protecting wild species and their habitats. But CITES is predominantly a trade agreement. Its focus on limiting trade in endangered species offers little useful leverage for this kind of problem.

101. *The Hungry Little Lionfish*, Wall St. J. (Nov. 14, 2010, 5:21 PM), http://on.wsj.com/KV6SdX.

102. Convention on International Trade in Endangered Species of Wild Fauna and Flora, *opened for signature* Mar. 3, 1973, 27 U.S.T. 1087, 993 U.N.T.S. 243 (entered into force July 1, 1975).

While grouper (one of the fish species potentially jeopardized by the lionfish invasion) are listed as "critically endangered" on the International Union for the Conservation of Nature (IUCN) Red List,[103] lionfish, the source of the problem, are not on any kind of CITES list. Indeed, CITES has no list to address this kind of situation.

Even though lionfish may further jeopardize grouper, nothing in CITES requires or facilitates action by states with endangered grouper populations to address this invasive species. Indeed, CITES requires no positive steps, unrelated to international trade, in order to promote survival of a listed species. Nor does any CITES provision limit or ban trade in nonendangered species (like lionfish) that might further jeopardize listed species. This situation is simply beyond the scope of CITES. Thus, CITES offers no tools for limiting international trade in lionfish. Even if CITES could entertain the possibility of imposing a trade ban based on the threat that lionfish pose to grouper and other listed marine animals, this remedy would be of the "too little too late" variety. It is only because lionfish have become established in the Western Atlantic and the Caribbean that they pose a threat to grouper and other endangered species. But because lionfish have already established themselves as a self-reproducing population in the Western Atlantic and the Caribbean, a ban on further international trade in lionfish will do little to address the current problem.

Lionfish are beyond the reach of a trade-based agreement. They are living organisms, capable of self-replication.[104] The problem is well beyond the point where a trade prohibition could be an effective remedy. Were a trade remedy to have any chance of being effective, it would have had to be in place *before* the problem occurred, based on the probability of a problem occurring. Yet before an actual problem existed, a trade ban would likely be deemed a violation of other international obligations, most notably the General Agreement on Tariffs and Trade (GATT).[105]

This limitation as to trade-based remedies renders the World Trade Agreements, particularly the GATT, of little use. While the Chapeau to Article XX of the GATT[106] might conceivably allow a state to prohibit lionfish imports on environmental

103. Epinephelus Itajara, IUCN Red List of Threatened Species, http://www.iucnredlist.org/details/195409/0 (last visited Mar. 18, 2014). The IUCN Red List is generally considered the most comprehensive evaluation of the status of individual plant and animal species. Species are listed in a range of categories ranging from "least concern" through various levels of endangerment up to extinction. *See generally* IUCN Species Survival Comm'n, IUCN Red List Categories and Criteria (2012), *available at* https://portals.iucn.org/library/efiles/edocs/RL-2001-001-2nd.pdf. For a detailed explanation of the processes used by the IUCN to manage and update this list, see *Red List Overview*, IUCN Red List of Threatened Species, http://www.iucnredlist.org/about/red-list-overview (last visited Mar. 18, 2014). For an argument that a species-by-species listing is too limited and what is instead necessary is an ecosystem red list, see David A. Keith et al., *Scientific Foundations for an IUCN Red List of Ecosystems*, Pub. Libr. of Sci. (May 8, 2013), http://www.plosone.org/article/info:doi/10.1371/journal.pone.0062111.

104. It is precisely this concern about unintended consequences of international trade in living organisms that has given rise to the fierce debate over international trade in genetically modified organisms.

105. General Agreement on Tariffs and Trade, *opened for signature* Oct. 30, 1947, 61 Stat. A-11, 55 U.N.T.S. 187 (entered into force Jan. 1, 1948).

106. *Id.* art. XX ("Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be

grounds, that ship, too, has already sailed. Past unregulated trade and ill-considered personal consumption choices have already combined to create this problem. A current or prospective trade ban will not undo the effects of past trade or eliminate the invasive species problem. Moreover, even though lionfish pose a demonstrable immediate threat to the Mesoamerican barrier reef, it is not at all clear that a ban on trade in lionfish, or indeed any similarly situated species, would be permissible under the GATT. Most instances of state invocation of Article XX have been fraught,[107] with dispute resolution panels generally unsympathetic to state environmental concerns.[108]

Another route that international law might take is to alter the background conditions that made the lionfish invasion possible, specifically climate change and the attendant changes in ocean conditions. Carbon emissions are certainly a threat to coral reefs, and changing ocean conditions associated with climate change have exacerbated the lionfish problem by weakening the resilience of competitor species.[109] It is thus worth considering the international legal regime most directly responsive to climate change, the U.N. Framework Convention on Climate Change (UNFCCC) and its related protocols.[110]

If the UNFCCC succeeded in reducing carbon emissions, that might allow the Mesoamerican barrier reef to develop resilience to the lionfish invasion. However, the UNFCCC and its associated agreements contain little in the way of binding state obligations, and none that offer much hope of success in the near future. Thus, the UNFCCC offers little that is relevant to the lionfish situation, which is exacerbated by, but not primarily caused by, climate change. To date, the UNFCCC regime has focused much more on climate mitigation than climate adaptation, and managing the lionfish invasion in a warming, acidifying ocean is definitely an adaptation question.

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construed to prevent the adoption or enforcement by any Member of measures . . . (b) necessary to protect human, animal, or plant life or health; . . . [or] (g) relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption . . . .").

107. Sanford Gaines, *The WTO's Reading of the GATT Article XX Chapeau: A Disguised Restriction on Environmental Measures*, 22 U. Pa. J. Int'l Econ. L. 739 (2001); *see also* Daniel C. Esty, Greening the GATT: Trade, Environment and the Future (1994); Elizabeth Trujillo, *Mission Possible: Reciprocal Deference Between Domestic Regulatory Structures and the WTO*, 40 Cornell Int'l L.J. 201, 212–18 (2007) (making the point, in the context of Article III, that there are important domestic regulatory issues the GATT is not equipped to resolve).

108. *See Environmental Disputes in GATT/WTO*, World Trade Org., http://www.wto.org/english/tratop_e/envir_e/edis00_e.htm (last visited Mar. 18, 2014).

109. *See generally* Stanley W. Burgiel & Adrianna A. Muir, Invasive Species, Climate Change and Ecosystem-Based Adaptation: Addressing Multiple Drivers of Global Change (2010), *available at* http://data.iucn.org/dbtw-wpd/edocs/2010-054.pdf; Burke et al., *supra* note 81, at 2–3.

110. U.N. Framework Convention on Climate Change (UNFCCC), *opened for signature* June 4, 1992, S. Treaty Doc. No. 102–38, 1771 U.N.T.S. 107 (entered into force Mar. 21 1994). Professor Osofsky provides an able description of the mechanics of the UNFCCC and its strengths and weaknesses in her essay. *See generally* Osofsky, *supra* note 11.

The U.N. Convention on the Law of the Sea[111] (UNCLOS) offers a bit more hope. Part XII of UNCLOS deals with environmental protection. Article 192 imposes a general duty on states to protect and preserve the marine environment.[112] Article 194 imposes a duty on states, either individually, or jointly when appropriate, to take "all measures necessary to prevent, reduce and control pollution of the marine environment from any source" and to harmonize their environmental policies in this regard.[113] To the extent that an invasive species can be considered a form of pollution, Article 194 lays out an expectation for affirmative state action. However, it is not yet clear whether this provision applies to managing the living resources of the marine environment—Article 194 provides a nonexhaustive list of pollution activities within its scope that does not bear much relationship to an invasive species.[114] Moreover, even if UNCLOS does obligate states to regulate in this context, a direction "to cooperate" and "to harmonize policies" provides little guidance for what states might do and the kinds of policies that might be needed.

What UNCLOS, or rather its 2005 Supplemental Agreement, the Straddling Fish Stocks Agreement,[115] does offer is a directive for states to create regional fishery management organizations.[116] This emphasis on regional planning and cooperation has been embraced wholeheartedly as states attempt to respond to the lionfish problem.

Despite an impressive array of potentially relevant international agreements, it is clear that the lionfish problem does not fit neatly under any of the various governance regimes those agreements create. Indeed, it is difficult to see how this problem fits into the traditional international law model of solving global problems at all—lionfish and other invasive species are not problems readily amenable to treaties or other formal agreements between nation-states.

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111. U.N. Convention on the Law of the Sea (UNCLOS), *opened for signature* Dec. 10, 1982, 1833 U.N.T.S. 397 (entered into force Nov. 16, 1994).

112. *Id.* art. 192 ("States have the obligation to protect and preserve the marine environment.").

113. *Id.* art. 194(1) ("States shall take, individually or jointly as appropriate, all measures consistent with [UNCLOS] that are necessary to prevent, reduce and control pollution of the marine environment from any source, using for this purpose the best practicable means at their disposal and in accordance with their capabilities, and they shall endeavour to harmonize their policies in this connection.").

114. *Id.* art. 194(3) ("The measures taken pursuant to this Part shall deal with all sources of pollution of the marine environment. These measures shall include, *inter alia*, those designed to minimize to the fullest possible extent: (a) the release of toxic, harmful or noxious substances, especially those which are persistent, from land-based sources, from or through the atmosphere or by dumping; (b) pollution from vessels . . .; (c) pollution from installations and devices used in exploration or exploitation of the natural resources of the seabed and subsoil . . .; (d) pollution from other installations and devices operating in the marine environment . . . .").

115. U.N. Agreement for the Implementation of the Provisions of the U.N. Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, *opened for signature* Dec. 4, 1995, T.I.A.S. 13115, 2167 U.N.T.S. 3 (entered into force Dec. 11, 2001).

116. *Id.* Part IV.

B. Regional Tools and Treaties

When we shift our gaze from the international to the regional level of governance, however, the picture is perhaps not quite as bleak. A set of traditional Westphalian legal agreements—legal regimes arising from the consent of sovereign and equal states—as well as a panoply of more innovative soft law initiatives offer a host of potentially authoritative decisionmakers in the Western Atlantic and Caribbean an array of possible tools. Indeed, regional decisionmakers have already undertaken a range of coordinated, multiscalar actions, some spearheaded by individual governments, others by governments acting in concert through regional or international organizations.

In the mid-1980s, the Caribbean states negotiated the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (the "Cartagena Convention").[117] The Cartagena Convention was negotiated under the auspices of the U.N. Environment Programme's Regional Seas Programme, whose mission is to promote "regional co-operation for the protection and [sustainable] development of the marine environment of the Wider Caribbean Region."[118] Supplemented by protocols addressing oil spills, wildlife protection, and land-based sources of marine programs, the Cartagena Convention is a traditional multilateral agreement with the power to bind states to obligations that international law recognizes. It constitutes a legal commitment by the participating governments to protect, develop, and manage their coastal and marine resources, both individually and collectively. Ratified by twenty-five countries,[119] the Cartagena Convention includes virtually every Caribbean state and governs the marine environment of the Gulf of Mexico, the Caribbean Sea, and key areas of the Western Atlantic.[120] As such, the Cartagena Convention has the potential to be a primary transnational governance tool for responding to the lionfish invasion.

In particular, the Cartagena Convention's associated Protocol Concerning Specially Protected Areas and Wildlife (the "SPAW Protocol") offers some interesting possibilities for authoritative decisionmaking.[121] Adopted in 1990, and entered into force a decade later, the SPAW Protocol represents an early embrace of the ecosystem approach to conservation and resource management. To that end, the SPAW Protocol commits states to "progressively take such measures as are necessary and practicable to

117. Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, *opened for signature* Mar. 24, 1983, T.I.A.S. 11085, 1506 U.N.T.S. 159 (entered into force Oct. 11, 1986).

118. U.N. Env't Programme, http://www.cep.unep.org/ (last visited Mar. 18, 2014).

119. *About the Cartagena Convention*, U.N. Env't Programme, http://www.cep.unep.org/cartagena-convention/ (last visited Mar. 18, 2014).

120. The three states remaining outside the Convention are Haiti, Suriname, and Honduras. *Id.*

121. Protocol Concerning Specially Protected Areas and Wildlife to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, *opened for signature* Jan. 18, 1990, S. Treaty Doc. No. 103–5 (entered into force June 18, 2000) [hereinafter SPAW Protocol].

achieve the objectives for which the protected area was established."[122] These measures include "the regulation or prohibition of the introduction of non-indigenous species [and] . . . any other measure aimed at conserving, protecting or restoring natural processes, ecosystems or populations."[123] There is also an independent obligation for member states to take measures to prevent the introduction of nonindigenous species with the potential to become invasive species.[124] Most importantly, the SPAW Protocol created an infrastructure for cooperation,[125] and established a Scientific and Technical Advisory Committee.[126] Thus, when the scale of the lionfish problem became clear in the mid-2000s, there was already an infrastructure for facilitating a regional response.

Scientists were already collaborating under the SPAW Protocol as part of the International Coral Reef Initiative.[127] Working under the auspices of these preexisting regional cooperative arrangements, scientists were able to produce a "Guide to Control and Management" of lionfish in relatively short order.[128] The Guide details best practices for lionfish control and management, emphasizing eradication measures, outreach, education, research, monitoring, legal considerations, and ideas for securing resources and partnerships.[129] The Guide is meant to help managers coordinate on a regional basis while taking action to reduce the local impacts associated with lionfish.

In 2003, seventeen Caribbean states came together to establish the Caribbean Regional Fisheries Mechanism,[130] an intergovernmental organization with a mission "to promote and facilitate the responsible utilization of the region's fisheries and other aquatic resources for the economic and social benefits of the current and future population of the region."[131] Establishing a regional strategy for controlling lionfish is one of the major priorities of this intergovernmental organization.[132]

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122. *Id.* art. 5.

123. *Id.* art. 5(2)(f), (m).

124. *Id.* art. 12.

125. *Id.* arts. 17–18.

126. *Id.* art. 20.

127. The International Coral Reef Initiative (ICRI) is an informal partnership between nations and organizations that promotes best practices in sustainable management of coral reefs and related ecosystems. Int'l Coral Reef Initiative, http://www.icriforum.org/ (last visited Mar. 18, 2014).

128. Gulf & Caribbean Fisheries Inst., Invasive Lionfish: A Guide to Control and Management (James A. Morris ed., 2012), *available at* http://lionfish.gcfi.org/manual/ [hereinafter Guide to Control and Management].

129. *See generally id.*

130. Agreement Establishing the Caribbean Regional Fisheries Mechanism, *opened for signature* Feb. 4, 2002, *available at* http://www.caricom.org/jsp/secretariat/legal_instruments/agreement_crfm.jsp.

131. *About CRFM*, Caribbean Regional Fisheries Mechanism, http://www.crfm.net/index.php/about-crfm.html (last visited Mar. 18, 2014).

132. Maren Headley, *A Regional Lionfish Strategy*, CRFM News (Caribbean Reg'l Fisheries Mechanism, Belize), Mar. 2013, at 2, *available at* http://www.caricom-fisheries.com/portals/0/CRFM%20Files/documents/Newsletters/crfmnews/CRFM_News_Issue_current.pdf.

These high-level regional responses have been buttressed by actions taken by subnational and nonstate actors. Yet, it is not clear that coordinated actions can do much to resolve the lionfish epidemic. This particular human-created environmental problem may have fundamentally changed a vital ecosystem (namely, coral reefs) in a way that is beyond the capacity of any human agency to remedy. Furthermore, little is known about the risks of various possible interventions, or even the long-term effects of this immediate problem. We are swimming through uncharted waters, and uncertainties abound.

IV. BEYOND INTERNATIONAL LAW?

Current international law has few tools to respond to the lionfish invasion. The tools available under international law are focused on the wrong actors and the wrong actions. Individual states do not fare much better as authoritative decisionmakers with power to effect results.[133] National self-help initiatives in Belize, the Bahamas, Jamaica, and the United States cannot solve this problem. No single actor, private individual, corporation, or state can solve this problem on its own. Indeed, it is not at all clear that even all of those actors working in concert can solve this problem, bringing us to another key principle: the possibility that lionfish have irreversibly changed these marine ecosystems. Resilience theory teaches that ecological systems can exist in multiple steady states rather than a single equilibrium.[134] Thus, in response to a perturbation like the lionfish invasion, these marine ecosystems might shift to an alternative steady state rather than return to the prior equilibrium.

The New Haven School's insistence that law and policy must begin from a global concept of community "premised on the interdependence of the entire earth-space arena in which people interact"[135] offers an instructive starting point for mustering a multidimensional response to the lionfish problem. Too often, legal scholars tend to divide responsibility based on the perceived competences of different actors. In regard to a situation like the lionfish problem, this tendency might prompt the conclusion that international law should have the primary responsibility for problem definition and problem prevention because those decisions need to occur on a relatively universal level.

133. However, this is not to suggest that states have exhausted their potential for authoritative decisionmaking in this context. For example, in 1999 President Clinton issued Executive Order 13112, which authorized all federal agencies to use relevant existing authority and programs to prevent, detect, and respond to invasive species. Exec. Order No. 13122, 3 C.F.R. 13112 (1999), *available at* http://www.gpo.gov/fdsys/pkg/FR-1999-02-08/pdf/99-3184.pdf. While the Executive Order has facilitated interagency cooperation and coordination, there is much more that could be done if more funding were made available. *See* Nat'l Invasive Species Council, Five-Year Review of Executive Order 13122 on Invasive Species (2005), *available at* http://www.invasivespecies.gov/home_documents/Five-Year%20Review-FINAL%20PRINT%20VERSION.pdf.

134. For an explanation of the theory of multiple domains of attraction, see Donald Ludwig et al., *Models and Metaphors of Sustainability, Stability and Resilience*, *in* Resilience and the Behavior of Large Scale Systems 21, 22–30 (Lance H. Gunderson & Lowell Pritchard Jr. eds., 2002).

135. W. Michael Reisman, *Myres S. McDougal: Architect of a Jurisprudence for a Free Society*, 66 Miss. L.J. 15, 19–20 (1997).

Under such a framing, states and regional actors would have responsibility for mitigation and response once a problem occurs. However, the lionfish problem shows how artificial this division of labor has become. Mitigation and response, to the extent such a thing is even possible in the case of lionfish, will also require the ability to make authoritative decisions on scales beyond that of the individual state. To the extent that the justification for the international legal system rests on the need for decisional capacity that transcends the state, mitigation is just as much the province of international law as is prevention.

Nevertheless, actions on the subnational and regional levels are also vital. It is increasingly clear that polycentric problems, like the lionfish invasion, simply cannot be solved solely by negotiating better agreements between nation-state parties or by states standing alone in their Westphalian splendor. New international agreements, or at least new interpretations of existing agreements, may well be necessary to prevent future iterations of the problem. But the unfolding response to lionfish shows that informal local and regional actions are essential to any kind of coordinated response once the condition exists. Two promising ways to move forward are discussed below: global governance initiatives and localized responses. These are "beyond" international law either because they are not actually law or because they involve subnational entities that are generally not considered actors under international law.

A. Global Governance Initiatives

In January 2010, the International Coral Reef Initiative (ICRI) established an ad hoc committee (now known as the Regional Lionfish Committee) charged with developing a strategic plan for controlling lionfish in the Western Caribbean. Although ICRI bills itself as "an informal partnership," it functions largely as an international organization.[136] What makes ICRI unique is that it goes well beyond the traditional intergovernmental activities normally associated with international organizations—its membership is not limited to states but also includes intergovernmental organizations and nongovernmental organizations.[137] ICRI's mandate is to preserve coral reef ecosystems through implementation of Chapter 17 of Agenda 21.[138] ICRI is certainly far from what would traditionally be considered an actor under international law, and its self-adopted mandate is to implement a soft law international agreement. Yet, ICRI draws legitimacy for its Regional Lionfish Committee by directing attention to Article 8(h) of the Convention on Biological Diversity, which directs states to "prevent the

136. *About Us*, Int'l Coral Reef Initiative, http://icriforum.org/about-icri (last visited Mar. 18, 2014).

137. *Current Members*, Int'l Coral Reef Initiative, http://icriforum.org/members/icri-members (last visited Mar. 18, 2014).

138. Negotiated at the 1992 U.N. Rio Convention on the Environment and Development, Agenda 21 lays out the globally agreed-upon action plan for implementing sustainable development. U.N. Conference on Sustainable Development, Rio de Janeiro, Braz., June 3–14, 1992, *Agenda 21*, ¶¶ 17.1–17.136, *available at* http://sustainabledevelopment.un.org/content/documents/Agenda21.pdf. At the 2012 U.N. Rio Conference on Sustainable Development, the gathered nations reaffirmed their commitment to implement Agenda 21. U.N. Conference on Sustainable Development, Rio de Janeiro, Braz., June 20–22, 2012, *The Future We Want*, ¶ 16, *available at* http://www.uncsd2012.org/futurewewant.html.

introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species,"[139] and to Article 12 of the SPAW Protocol.[140]

As an informal collective, ICRI was well positioned to be nimble in its response to new problems. In 2010, it facilitated the Caribbean Regional Lionfish Workshop, a key organizing event that shaped a regional response to this problem.[141] Through its Regional Lionfish Committee, ICRI now leads efforts to coordinate a regional response to the lionfish invasion, including sharing best management practices among coral reef managers, facilitating collaboration between national governments, and partnering with industry, civil society, and academic research institutions.[142]

While this is a positive development, any attempt to solve problems like the one posed by the lionfish must include both upstream, or prevention, methods, as well as downstream, or remedial, efforts. To date, there has been little attention paid to prevention. Existing efforts focus mostly on finding less environmentally harmful ways to extract aquarium fish from their native habitats rather than reducing the demand for lionfish and other invasive species in consumer countries.[143]

The Marine Aquarium Market Transformation Initiative[144] illustrates the limitations of this approach. Funded in the mid-2000s by the Global Environment Facility,[145] the Initiative targeted the ecological and economic sustainability of the marine aquarium trade.[146] The main partners were the Marine Aquarium Council, the Reef Check Foundation, and the Conservation and Community Investment Forum.[147] The Initiative was intended to promote conservation management to rehabilitate coral reef ecosystems by involving fisherfolk in the development of reef exploitation plans aimed at poverty alleviation and food security.[148] As part of this process, the Initiative developed a private certification system intended to allow consumers to identify sustainably harvested marine aquarium specimens.[149] The certification was to be awarded by the Marine Aquarium Council, a private trade

139. Convention on Biological Diversity art. 8(h), *opened for signature* June 5, 1992, S. Treaty Doc. No. 103–20, 1760 U.N.T.S. 79 (entered into force Dec. 29, 1993).

140. SPAW Protocol, *supra* note 121, art. 12.

141. *ICRI Regional Lionfish Workshop*, Int'l Coral Reef Initiative, http://www.icriforum.org/icri-meetings/icri-regional-lionfish-workshop (last visited Mar. 18, 2014).

142. *Regional Lionfish Committee*, Int'l Coral Reef Initiative, http://www.icriforum.org/groups/our-committees/regional-lionfish-committee (last visited Mar. 18, 2014).

143. *See infra* note 144.

144. Jean-Joseph Bellamy & Malcolm Winsby, Mid-Term Review of the IFC/GEF Project "Marine Aquarium Market Transformation Initiative (MAMTI)" (2008), *available at* http://www.aquariumcouncil.org/pdf/MAMTI%20MTR.pdf.

145. *Id.* at v; *see also* Global Env't Facility, http://www.thegef.org/gef/home (last visited Mar. 18, 2014).

146. Bellamy & Winsby, *supra* note 144, at v.

147. *Id.*

148. *Id.*

149. *Id.* at 1.

organization with a mission of "conserv[ing] marine ecosystems through the promotion of a responsible aquarium trade."[150]

As such, this project offers a window into yet another global dynamic limiting our ability to "solve" global environmental problems. The trade in ornamental marine species develops as a result of consumer demand in wealthy countries. To meet this demand, marine organisms are extracted from their environment in response to signals generated by global markets, based on the consumption preferences of consumers dissociated from the externalized costs of that extraction. Damaging fishing techniques, including blast and poison fishing, used in this extraction process contribute to the degradation of coral reefs and marine biodiversity more generally.[151] Striking a theme repeated across a host of extractive industries, the producer states lack the capacity or the political will to meaningfully respond to the problem. Private organizations, like the Marine Aquarium Council, seek to fill this gap through a private certification process. In industry after industry, similar certification schemes are touted as the way forward—transforming extractive industries and contributing to poverty alleviation, sustainable livelihoods, and food security.

The Marine Aquarium Council purports to be a nonstate, market-driven form of networked environmental governance.[152] Its board of directors does not include any government officials[153] and the Council itself has no official status. There is no question that the Council differs vastly from any traditional exercise of authoritative power by the state—it has no political status and wields no power to impose civil or criminal sanctions for failure to comply with its precepts. Indeed, whether the Council possesses the power of authoritative decision is wholly contingent. Its authority is defined and circumscribed by the willingness of consumers and producers to participate in its certification scheme—producers by abiding by Council-approved practices, and consumers by letting certification guide their purchasing behaviors.

When such schemes work, they have the potential to transform industrial practices. Networked governance of this type leverages the power of consumer choice in order to modify unsustainable production practices. By creating nonhierarchical interactions between private companies, civil society organizations, and ultimate consumers, networked governance efforts claim to be able to use collaborative decisionmaking to voluntarily change unsustainable practices.[154] This move toward private certification

150. *About Us*, Marine Aquarium Council, http://www.aquariumcouncil.org/Contact_us.aspx?tab=MissionID (last visited Mar. 18, 2014).

151. Marea E. Hatziolos, *Objectives of the Conference*, *in* Coral Reefs: Challenges and Opportunities for Sustainable Management 8 (Marea E. Hatziolos et al. eds., 1998).

152. *See generally* Benjamin Cashore, *Legitimacy and the Privatization of Environmental Governance: How Non-State Market-Driven (NSMD) Governance Systems Gain Rule-Making Authority*, 15 Governance 503, 503–29 (2002).

153. *See* Marine Aquarium Council, *supra* note 150. None of the Marine Aquarium Council Board members come from producer countries. *See id.*

154. *See* Karin Bäckstrand, *Accountability of Networked Climate Governance: The Rise of Transnational Climate Partnerships*, Global Envtl. Pol., Aug. 2008, at 74, 75–77, *available at* http://www.aspeninstitute.org/sites/default/files/content/docs/ee/arctic1109/arctic1109-backstrand-excerpt.pdf.

schemes as a governance tool mirrors a broader shift in our conception of authoritative decision. Thus, its role as a standards arbiter is a precarious one, far more contingent than those conventionally considered to be authoritative decisionmakers in even the broadest conception of law. Yet in industry after industry, we see a proliferation of these private standard-setting organizations aspiring to the mantle of authoritative decisionmakers. Their actual ability to deliver on sustainability promises varies widely. Some, like the Forest Stewardship Council's sustainable forest certification,[155] the World Wildlife Fund-sponsored Aquaculture Stewardship Council,[156] or the Marine Stewardship Council's fishery certification program,[157] have a global reach and a relatively good reputation among consumers and civil society watchdogs alike. Others, like the Roundtable on Sustainable Palm,[158] are industry-dominated efforts that amount to little more than a marketing ploy, or "greenwashing."[159]

While a certification scheme may have the potential to promote sustainability in the marine aquarium industry, and might even build local and national support for biodiversity conservation, reef management, and protected areas, this particular scheme highlights the limitations of using certification as a conservation tool. These efforts to develop an environmentally friendly harvest industry completely ignore the threat non-native species pose when they are introduced or escape into new habitats.[160]

Like so many other top-down international conservation efforts, this particular certification scheme has been hampered by the institutional structure that prioritizes the needs and voices of consumer states, most notably the United States.[161] For example,

155. *What We Do*, Forest Stewardship Council, https://us.fsc.org/what-we-do.186.htm (last visited Mar. 18, 2014); *see also* William Ascher, *Expanding the "Geography" of Policy Options to Reduce Greenhouse Gas Emissions: A Commentary on Hari Osofsky's* The Geography of Solving Global Environmental Problems, 58 N.Y.L. Sch. L. Rev. 859, 864–65 (2013–2014) (discussing the impact of the Forest Stewardship Council's certification standards).

156. *About the ASC*, Aquaculture Stewardship Council, http://www.asc-aqua.org/index.cfm?act=tekst.item&iid=2&lng=1 (last visited Mar. 18, 2014). The Aquaculture Stewardship Council was formed in 2010 by the World Wildlife Fund and the Dutch Sustainable Trade Initiative. *Id.* It grew out of the bottom-up Aquaculture Dialogues process, which developed a set of standards and best practices for sustainable aquaculture. *Id.*; *Aquaculture Dialogues*, World Wildlife Fund, http://wwf.panda.org/what_we_do/footprint/agriculture/shrimp/aquaculture_dialogues_/ (last visited Mar. 18, 2014).

157. *See Get Certified!*, Marine Stewardship Council, http://www.msc.org/get-certified (last visited Mar. 18, 2014).

158. *See Who Is RSPO*, Roundtable on Sustainable Palm Oil, http://www.rspo.org (last visited Mar. 18, 2014).

159. "Greenwashing" refers to the practice of a business or other organization spending "more time and money claiming to be 'green' through advertising and marketing than [it spends] actually implementing business practices that minimize environmental impact." *What Is Greenwashing? It's Whitewashing, but with a Green Brush*, Greenwashing Index, http://www.greenwashingindex.com/about-greenwashing/#what (last visited Mar. 18, 2014).

160. *See* Bruce Bunting & Marshall Meyers, *Healthy Reefs and Fish, Healthy Business and Hobby: A Sustainable Future for the Marine Ornamentals Trade*, Ornamental Fish Int'l, http://www.ornamental-fish-int.org/data-area/conservation/untitled2/-healthy-reefs-and-fish-healthy-business-and-hobby (last visited Mar. 18, 2014).

161. Bellamy & Winsby, *supra* note 144, at v.

no local institutions are involved in the certification process for sustainably captured marine aquarium organisms. As a result, there is limited "ownership" of the initiative in the "producing" countries where the behavioral changes are targeted. And behavioral changes are directed at making production more sustainable, while leaving unsustainable consumption behaviors unaltered. Those consumption behaviors produce their own environmental problems—as the lionfish invasion plainly demonstrates—yet consumption behaviors are rarely viewed as an integral part of the overall global environmental challenge associated with the extractive industry as a whole.

B. Local Level Responses

There is no question that local control efforts are a critical part of the effort to mitigate the impact that lionfish have on key marine habitats.[162] Indeed, many affected states have already developed a series of local responses. In Belize, for example, local tour guides have organized themselves through their tour guide associations (quasi-governmental entities) to kill lionfish and feed them to sharks and eels. Tourists are treated to lionfish sushi and lionfish ceviche (which reportedly tastes like hogfish).[163] The various local tour guide initiatives offer a microlevel response. In the tourist town of San Pedro, Belize, these concerted efforts have managed to clean lionfish from the more popular dive sites.[164] That is authoritative action in itself.

Yet nobody thinks the lionfish are gone from San Pedro—human predation is simply keeping their numbers in check in a few selected sites. A highly localized response is controlling a localized population and tempering, for at least a short time, the negative economic impact from this regional and global problem. As an additional bonus, rumors that grouper may eat lionfish[165] have galvanized popular support for ongoing efforts to protect grouper spawning grounds in Belize.[166] Grouper are listed as endangered on the IUCN Red List.[167] Because there are more than eleven grouper spawning sites in Belizean waters, this additional support for protecting those sites may make a real difference in species recovery. Local efforts to control the localized manifestations of what is clearly a regional problem, which emerged as an unintended consequence of the global trade in lionfish, may wind up advancing the species

162. James A. Morris, Jr., *The Lionfish Invasion: Past, Present, and Future*, *in* Guide to Control and Management, *supra* note 128, at 2.

163. *Divers to Target Lionfish in Nov. 13 Florida Keys Derby; Tastes Like Hogfish*, Underwater Times (Oct. 5, 2010, 22:03 EST), http://www.underwatertimes.com/news.php?article_id=57062841310.

164. Personal observation by the author.

165. *See* Aleksandra Maljković et al., *Predation on the Invasive Red Lionfish,* Pterois Volitans *(Pisces: Scorpaenidae), by Native Groupers in the Bahamas*, 27 Coral Reefs 501, 501–05 (2008).

166. *Belize National Spawning Aggregation Working Group*, Wildlife Conservation Soc'y, http://collaborations.wcs.org/Default.aspx?alias=collaborations.wcs.org/spag (last visited Mar. 18, 2014).

167. Epinephelus Striatus, IUCN Red List of Threatened Species, http://www.iucnredlist.org/details/7862/0 (last visited Mar. 18, 2014).

conservation goals identified in CITES. Thus, local actions, motivated by local concerns, may accomplish goals laid out in an international environmental treaty.

Similar eradication efforts are underway across the Caribbean and Western Atlantic. Hatchet Caye Resort in Belize advertises lionfish eradication as a tourist attraction.[168] For the past few years, places like Green Turtle Cay, Bahamas and Palm Beach County, Florida have held Lionfish Derbies, during which teams compete to kill the most lionfish with cash prizes awarded to the winners.[169] During a 2012 Palm Beach event, participants killed over 1,000 lionfish in a single derby, with the winning team single-handedly killing 232. In 2012, REEF, an organization of divers and other marine enthusiasts that promotes conservation, ran a monthly contest, open to both businesses and individuals, awarding prizes to those who caught the most lionfish.[170] Seeking to encourage lionfish harvesting, the Florida Fish and Wildlife Conservation Commission recently exempted lionfish from many of the state's fishing license laws and removed recreational and commercial catch limits.[171] In the United States, the National Oceanic and Atmospheric Administration has also joined the fight with a targeted campaign to encourage people to eat lionfish. The agency's "If we can't beat them, let's eat them!" slogan[172] has been taken up by restaurants like the Fish House Encore in Key Largo, Norman's Cay in New York City,[173] and many other restaurants across the Western Atlantic and Caribbean.[174]

While localized action is critical, actions on this scale cannot begin to address the magnitude of the actual problem. The ocean is vast—the coral reef stretches for hundreds of kilometers. Efforts to kill lionfish, by contrast, are concentrated mostly in a few tourist spots. Moreover, these local initiatives present a conundrum for international law. The actions themselves have no formal international legal significance under traditional notions of international law, and the local governmental and private actors would not be considered subjects of international law. They are initiatives among subnational actors taking private or coordinated public actions to respond to a problem with global roots and regional ramifications. Yet, such initiatives highlight the critical importance of the New Haven School's insistence that we look

168. *Hunting Lions at Hatchet Caye Resort, Belize*, Hatchet Caye, http://hatchetcaye.com/belize-resort-blog/hunting-lions-at-hatchet-caye-resort-belize/ (last visited Mar. 18, 2014).

169. *See* Lionfish Derby, http://www.lionfishderby.com/events.html (last visited Mar. 18, 2014). In 2012, the winner of the Palm Beach Lionfish Derby, Team Sea Cat, won $1,000 for killing 232 lionfish. *Results*, Lionfish Derby, http://www.lionfishderby.com/results.html (last visited Mar. 18, 2014). There were also prizes for the biggest lionfish caught (387 millimeters caught by Team Chip's Ahoy) and the smallest lionfish brought in alive. In total, event participants killed over 1,000 lionfish. *Id.*

170. *REEF's Monthly Lionfish Contest*, REEF.org (Mar.6, 2012), http://www.reef.org/node/4722.

171. Fla. Admin. Code Ann. r. 68B-5.006 (2013).

172. Nat'l Oceanic & Atmospheric Admin., *supra* note 2.

173. James Mulcahy, *Zagat: Norman's Cay Cooking Up Exotic Lionfish for a Good Cause*, Time Warner Cable News (Nov. 11, 2013, 6:30 AM), http://manhattan.ny1.com/content/lifestyles/zagat/198466/zagat--norman-s-cay-cooking-up-exotic-lionfish-for-a-good-cause.

174. *Restaurants Serving Lionfish*, World Lionfish Hunters Ass'n, http://lionfish.co/eat-lionfish-here/ (last updated Mar. 15, 2014).

beyond treaties and courts and recognize authoritative decisions as decisions about which international law should be concerned.

V. A WAY FORWARD—LESSONS FROM THE NEW HAVEN SCHOOL

So what does this have to do with New Haven? The waters of New England are probably still too cold to support lionfish, which is good because the fisheries there are so depleted that they probably could not withstand yet another stressor.[175] It is not the physical New Haven to which I look, but the intellectual New Haven—the analytical practices of the New Haven School. In his keynote address at the *Solving Global Problems* symposium, Yale Law School professor W. Michael Reisman stated that "[t]he essence of the New Haven School is to empower people, particularly those engaged in law or politics, to more efficiently identify common interests and the ways to implement them."[176] Examining the proliferation of local actors and governance networks responding to the lionfish invasion shows just how important New Haven School ideas are for both describing and promoting the kind of cooperative empowerment Professor Reisman references.

We are already seeing faint inklings of how that might happen. The U.N. Convention on the Law of the Sea, and more specifically the Straddling Fish Stocks Agreement, puts the focus of global fisheries initiatives on cooperative international institution-building. Regional fisheries agreements and regional fisheries management organizations proliferated. These intergovernmental organizations are tasked with developing sound science and promoting sustainable fishery management practices. Yet, it is also true that the many beautiful tools of global administrative law—fish size limits, total allocated catches, fishing ground closures, marine protected areas, and adaptive management—offer little help against a self-replicating invasive species like the lionfish.[177]

These governance mechanisms offer the most that international law can provide—the possibility that Westphalian states will come together in their mutual interest and control (or at least diminish) profound human threats to marine biodiversity and coral reefs. Yet, even with the most sound management techniques, and even with total compliance, this international edifice offers only the possibility that it will contribute to enough of an improvement in the survival of juvenile fish

175. *See, e.g.*, Jenna Russel, *Last of Their Kind*, Bos. Globe (June 16, 2013), http://www.bostonglobe.com/magazine/2013/06/15/this-end-new-england-fisherman/XDE93VGrorgaz5iwui7s3L/story.html.

176. W. Michael Reisman, Professor of Law, Yale Law School, Remarks at the New York Law School Law Review Symposium: Solving Global Problems: Perspectives from International Law and Policy (Apr. 12, 2013), *available at* http://youtu.be/z1eFgbDm2ig?t=1m2s.

177. Of course these tools are also vastly contentious, pitting coastal states against distant water fishing states in pitched battles over fishing limits as the world's fish stocks decline because of overfishing. Let us not forget that Canada and Spain nearly went to war over fishing in the mid-1990s. *See Court Backs Canada's Seizure of Trawler During 'Turbot Wars'*, CBC News (July 27, 2005, 10:44 AM ET), http://www.cbc.ca/news/canada/story/2005/07/27/Turbot-Estai-050727.html; *see also* Derrick M. Kedziora, *Gunboat Diplomacy in the Northwest Atlantic: The 1995 Canada-EU Fishing Dispute and the United Nations Agreement on Straddling and High Migratory Fish Stocks*, 17 Nw. J. Int'l L. & Bus. 1132 (1996–1997).

that those species can outpace the lionfish's insatiable appetite. While CITES-listed species are threatened, lionfish are not covered by the treaty, and the actions that created the problem did not necessarily violate any legal regime.

Among the most important insights that the New Haven School thinkers offer in this circumstance is the recognition that there are many legal decisionmakers besides judges and legislatures, and that truly understanding the scope and scale of a problem means being able to identify those actors with both the power and authority to respond. Taking that insight to heart means acknowledging the limits of international law. Indeed, one clear lesson from the lionfish situation is that legal regimes are at best imperfect tools.

At its best, the New Haven School offers a "prescriptive framework for the performance of optimally rational decision-making"[178]—a way to creatively reconfigure approaches to problem solving to confront new challenges. That kind of creativity is precisely what is needed to face the unique challenges posed by the lionfish invasion. Lionfish present an externality that is truly external—as self-replicating, living animals, they are beyond the control of even the most empowered fisheries managers. Simply put, the lionfish are here to stay. The most that affected states and localities can hope to do is to work together to find new ways to ameliorate the consequences of the lionfish invasion. When the variables involve living organisms and their interaction with complex ecosystems, even the most fully formed and nuanced legal systems only rarely manage to offer much in the way of guidance for behavior a priori, let alone for remedies post hoc.

Taking New Haven School ideas to heart also means building new institutions that offer a forum for discussion and a path forward to generate cooperative, mutually agreed upon management plans. By building new kinds of governance networks and empowering new actors, authoritative decisionmakers can create the conditions that might ward off the next lionfish invasion by making consumers and producers internalize the environmental costs of pursuing their individual interests. Doing so will mean recognizing the localities, states, and regional actors that have used the lionfish as a catalyst for collaboration and for building sustainable institutions as authoritative decisionmakers. Together, the local users (fisherfolk and dive guides), the bureaucrats, and the fish scientists can be authoritative decisionmakers, making choices that have powerful real world effects. The possibility of managing the lionfish is in their hands.

178. Frederick Samson Tipson, *The Lasswell-McDougal Enterprise: Toward a World Public Order of Human Dignity*, 14 Va. J. Int'l L. 535 (1973–1974); *see also* McDougal et al., *supra* note 8, at 208.