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CLIMATE CHANGE, REGULATORY FRAGMENTATION, AND WATER TRIAGE

ROBIN KUNDIS CRAIG*

Viewed from a watershed perspective, we are unconsciously sacrificing many marine ecosystems because upstream fresh water is a regulatorily fragmented resource. That is, water is subject to multiple assertions of regulatory authority and to multiple types of use-right claims that those authorities regulate. As freshwater supplies become increasingly unequal to the task of meeting the multiple demands for both consumptive and in situ use, and as consumptive and in situ uses of water come increasingly into irreconcilable conflict, the various regulatory schemes governing water use have also increasingly come into legal conflict. These courtroom battles have revealed many tensions, overlaps, and gaps in the overall governance of water as a natural resource. The ecological effects of this regulatory fragmentation are also becoming obvious, particularly when downstream marine ecosystems are considered.

Such conflicts in water management are only likely to increase as climate change alters the expected availability of water in many areas of the country. In particular, in those regions where climate change reduces water supplies, competition for water resources in general, and conflicts between consumptive and in situ users in particular, will increase. As such, climate change is likely to underscore two significant weaknesses of the current regulatory fragmentation of water resources that the nation should address: (1) the lack of any comprehensive public debate that acknowledges and

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weighs the cross-jurisdictional tradeoffs among water uses that insufficient supply makes necessary; and (2) the general failure of freshwater regulation, particularly consumptive use regulation, to acknowledge watersheds' "end of the line"—the oceans.

This Article focuses primarily on the second weakness of current water resource management. Specifically, it argues that marine ecosystems have often been the largely unnoticed casualties of water's regulatory fragmentation but that these ecosystems are nevertheless too valuable to continue to be left unconsidered in freshwater regulation. This Article also argues that considering marine ecosystems could provide output-focused, ecosystem-based regulatory goals and a basis for coordinating and, when necessary because of water shortage, prioritizing regulatory choices for fresh water. Moreover, by adding weight to existing arguments for leaving water in situ and highlighting less obvious sensitivities to water pollution, marine ecosystem output goals could suggest both regulatory adjustments to inputs and more comprehensive structural reforms that would better protect the entire watershed—including the human health that depends upon the health of that watershed.

INTRODUCTION

When the Colorado River reaches its final destination, the Gulf of California in Mexico, it delivers a much-reduced flow of highly polluted water to the estuaries there—if it delivers any water at all.[1] As a result, the Gulf of California ecosystems are dying. Originally almost two million acres in size, the Colorado River delta wetland system now occupies only 150,000 acres.[2] At sea, the totoaba fish and the vaquita porpoise have become endangered species, and shrimp harvests in the Sea of Cortez have plummeted.[3]

Water that manages to travel the entire course of the Colorado River basin from the river's origins in Wyoming, Colorado, and New Mexico to its terminus in the Gulf of California will be subject to a multitude of regulatory entities along the way. These regulatory authorities include two countries; at least

1. ROBERT W. ADLER, RESTORING COLORADO RIVER ECOSYSTEMS: A TROUBLED SENSE OF IMMENSITY 34 (2007).

2. *Id.* at 41.

3. *Id.* at 208–10.

four other states besides the state of origin, and their water allocation authorities, water quality authorities, and fish and game authorities; the National Park Service; the U.S. Environmental Protection Agency (EPA); the U.S. Army Corps of Engineers; the U.S. Bureau of Reclamation; the U.S. Forest Service; and several Native American tribes. Moreover, each of these regulatory entities will have different priorities for the water while it passes through that entity's regulatory jurisdiction.

At the end of this chain of regulatory actors, the Gulf of California provides a particularly acute example of the fact that, from a marine perspective, upstream water resource managers' decisionmaking is destructive, with respect to both water withdrawals and water pollution. Management of interstate water supplies is uncoordinated, largely non-prioritized, overly localized in focus, and, as a result, often irrational in overall effect, particularly when the usually forgotten oceans are factored into the evaluation.

This Article will focus on an important weakness of current water resource management: the general failure of freshwater regulation, particularly consumptive use regulation, to acknowledge watersheds' "end of the line"—the oceans. The health of marine ecosystems depends intimately on both the quality and the quantity of fresh water arriving from the relevant watersheds. While upstream pollution problems have been acknowledged in some coastal ecosystems—Chesapeake Bay pollution issues[4] and the hypoxia problem in the Gulf of Mexico[5] are notable examples—upstream states and the EPA still rarely set water quality standards and discharge limitations with the ocean in mind, particularly when the ocean is several states away. Even less marine-focused regulatory attention is paid to water flow, but reduced quantities of fresh water both cause independent problems for marine ecosystems and compound pollution problems.[6]

4. *See infra* notes 346–54 and accompanying text.

5. *See infra* notes 340–45 and accompanying text.

6. Moreover, as the U.S. Supreme Court has acknowledged, the distinction between water quality and water quantity "is an artificial distinction. In many cases, water quantity is closely related to water quality; a sufficient lowering of the water quantity in a body of water could destroy all of its designated uses, be it for drinking water, recreation, navigation, or . . . a fishery." PUD No. 1 of Jefferson County v. Wash. Dep't of Ecology, 511 U.S. 700, 719 (1994).

Indeed, while the Gulf of California/Sea of Cortez may be a particularly dramatic example of aquatic regulatory neglect, it is by no means an isolated one. For example:

> The mighty Rio Grande River that historically sent a steady torrent of freshwater into the Gulf of Mexico now peters out before it reaches the sea. The San Joaquin River no longer flows into San Francisco Bay but rather disappears into a giant plumbing system where it is doled out for agricultural irrigation and drinking water for California's unstoppable growth.[7]

Both the Chesapeake Bay and the Gulf of Mexico suffer from upstream pollution, leading to a crash in the Bay's commercially and ecologically valuable oyster populations[8] and the recurring formation of a large hypoxic zone ("Dead Zone") in the Gulf.[9] Northern Florida is battling Georgia to keep water in the Apalachicola River, both to properly dilute industrial and municipal wastewater discharges and, more importantly, to maintain Florida's oyster industry in downstream Apalachicola Bay.[10] In southern Florida and many other places around the United States, mercury pollution bioaccumulates in aquatic animals until marine fish become too toxic to eat.[11]

These problems are caused, at least in part, by regulatory fragmentation—the division of regulatory authority over water among many laws and jurisdictions. Unlike air, which is only rarely usefully captured and reduced to private possession and hence tends to be regulated as an unownable medium,[12] water is both a capturable natural resource and an environmental

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7. CYNTHIA BARNETT, MIRAGE: FLORIDA AND THE VANISHING WATER OF THE EASTERN U.S. 3 (2007).

8. *See infra* notes 346–54 and accompanying text.

9. *See infra* notes 340–45 and accompanying text.

10. *See infra* notes 330–33 and accompanying text.

11. *See infra* notes 172–79, 304–305 and accompanying text.

12. *See generally* Clean Air Act, 42 U.S.C. §§ 7401–7671q (2000) (regulating emissions into the air on a nationwide basis); Mary Christina Wood, *Nature's Trust: A Legal, Political, and Moral Frame for Global Warming*, 34 B.C. ENVTL. AFF. L. REV. 577, 593–94 (2007) ("EPA is the only federal agency charged by Congress to control air pollution . . . . Viewed through the frame that EPA has presented to the American public, the air is simply an object of regulation, a nebulous commons . . . ." (footnote omitted)); Jonathan C. Thomas, *Spatialis Liberum*, 7 FLA. COASTAL L. REV. 579, 595 (2006) (quoting HUGO GROTIUS, THE FREEDOM OF THE SEAS: OR THE RIGHT WHICH BELONGS TO THE DUTCH TO TAKE PART IN THE EAST INDIAN TRADE 28 (The Law Book Exchange transl., Raulph Van Deman Magoffin ed., 2001) (1633)).

medium that supports ecological processes. Partially as a result of this dual nature, and also as a result of its status as a regulatory commons, water is a regulatorily fragmented resource—that is, water is subject to multiple assertions of regulatory authority and to multiple types of use-right claims that those governmental authorities regulate. For example, there is a general understanding in water law that states control the freshwater resources within their borders. However, waters that are navigable-in-fact are also subject to the Army Corps' authority to protect navigation,[13] while waters deemed "navigable" under the Clean Water Act are also subject to the EPA's regulatory authority to protect water quality.[14] Both the state and federal governments further subdivide their regulatory interests in waters among multiple agencies to address particular sources of problems (for example, polluters, hydropower facilities, and obstructions to navigation) and/or particular uses of the waters (for example, public recreation, consumptive withdrawals, and habitat and biodiversity).[15] Thus, most waterways of any size are subject to multiple regulatory authorities, both state and federal.

Conflict over fresh water tends to derive from the fact that many users consume it, while many other users depend on water remaining in the same source. For example, farmers need water for crops, a consumptive use of water that might clash with recreational fishing taking place in the source of the farmers' irrigation water. Of course, not all out-of-stream appropriations are consumptive, nor, even, are all consumptive appropriations 100% consumptive. Appropriations for irrigation, for example, are generally characterized by significant (if often polluted) return flows to the river.[16] Nevertheless, as numer-

13. Utah v. United States, 403 U.S. 9, 10 (1971) (quoting The Daniel Ball, 77 U.S. (10 Wall.) 557, 563 (1870)); *see also* RICHARD J. LAZARUS, THE MAKING OF ENVIRONMENTAL LAW 32–33 (2004) (describing federal/state fragmentation in environmental lawmaking in general).

14. 33 U.S.C. §§ 1311(a), 1342(a), 1362(14) (2000); ROBIN KUNDIS CRAIG, THE CLEAN WATER ACT AND THE CONSTITUTION: LEGAL STRUCTURE AND THE PUBLIC'S RIGHT TO A CLEAN AND HEALTHY ENVIRONMENT 9–27 (2004).

15. *See infra* Part I.A; *see also* LAZARUS, *supra* note 13, at 33–35 (describing lawmaking and regulatory fragmentation within the federal government).

16. EDWIN D. ONGLEY, FOOD & AGRICULTURAL ORGANIZATION OF THE UNITED NATIONS, CONTROL OF WATER POLLUTION FROM AGRICULTURE ch. 1 (1996), *available at* http://www.fao.org/docrep/W2598E/w2598e04.htm#chapter_1:_introduction_to_agricultural_water_pollution.

ous unnaturally dry rivers in the West attest, consumptive uses are often at odds with *in situ* uses, especially when *in situ* uses require relatively constant and/or relatively significant in-stream flows.

As freshwater supplies become increasingly unequal to the task of meeting the multiple and growing demands for both consumptive and *in situ* use, and as consumptive and *in situ* uses of water come increasingly into irreconcilable conflict, the various regulatory schemes governing water have also increasingly come into legal conflict.[17] These courtroom battles have revealed many tensions, overlaps, and gaps in the overall governance of water as a natural resource. In addition, viewed from watershed and marine perspectives, the undesirable ecological effects of this regulatory fragmentation have also become obvious.

Tensions and conflicts in water management are only likely to increase as climate change alters the expected availability of water in many areas of the country. In particular, in those regions where climate change reduces water supplies, competition for water resources in general, and conflicts between consumptive and *in situ* users in particular, will increase. As such, climate change is likely to underscore two significant weaknesses of the current regulatory fragmentation of water resources that the nation should address—preferably *before* competition and conflict lead to additional unintended and undebated damage to aquatic resources, marine ecosystems, and human health.

The first of these weaknesses is the lack of any comprehensive public debate that acknowledges and weighs the cross-jurisdictional tradeoffs among water uses that insufficient supply makes necessary, let alone any public process that openly, consciously, and explicitly chooses among or prioritizes those competing uses in particular watersheds. As Richard Lazarus has noted, two of the most important trends in environmental and natural resources law have been the development of requirements for information analysis and disclosure, and for public participation.[18] The absence of a comprehensive freshwater management regime means that these features largely do not exist at the watershed level, especially in the absence of

17. *See* discussion *infra* Part II.B.

18. LAZARUS, *supra* note 13, at 185–91.

federal action and the consequent inapplicability of the National Environmental Policy Act's ("NEPA's") requirement that federal agencies complete environmental impact statements.[19]

This lack of comprehensive oversight and of decision making has led, and will continue to lead, to unconscious *de facto* tradeoffs "in the cracks" of regulatory authorities and agency missions. Thus, as noted, in the West rivers are often sucked dry long before they reach their natural destinations, at the expense of potential recreational and biodiversity goals in the waterway and marine ecosystem health at the end of the line, as a result of the *de facto* prioritization of state-authorized consumptive appropriations.[20] As another example, the lack of any comprehensive oversight and the existence of regulatory fragmentation have led to pollution standards established on the basis of immediate human health concerns, at the expense of more protective standards that would both better protect human health and simultaneously safeguard downstream species and ecosystem health.[21] Such *de facto* tradeoffs result not just from regulatory fragmentation but also from the input focus of most regulatory regimes, rather than an output focus that can comprehend the watershed and its ecosystems as a whole.

The second weakness, as noted above, is the failure to incorporate oceans into water resource regulation and management. This Article argues that marine ecosystems have often been the largely unnoticed casualties of water's regulatory fragmentation but that these ecosystems are nevertheless too valuable to continue to be left unconsidered in freshwater regulation. It also argues that considering marine ecosystems could provide output-based ecosystem regulatory goals and a basis for coordinating and, when necessary because of water shortage, prioritizing regulatory choices for fresh water. By adding weight to existing arguments for leaving water *in situ* and hig-

19. 42 U.S.C. § 4332(2)(C) (2000).

20. *See, e.g.*, ADLER, *supra* note 1, at 23, 206–36 (noting in connection with the Colorado River that "[b]ecause water is fundamental to all economic growth in the arid West, the basin states will resist any restoration efforts that jeopardize the fundamental 'deal' struck in the Colorado River Compact"—a deal that leaves Mexico and the Gulf of California with far too little water).

21. *See infra* Part I.B.2.; *see also* Robert W. Adler, *The Two Lost Books in the Water Quality Trilogy: The Elusive Objectives of Physical and Biological Integrity*, 33 ENVTL. L. 29, 50–53 (2003) (discussing the failure to implement the Clean Water Act's goals of physical and biological integrity).

hlighting additional sensitivities to water pollution, marine ecosystem output goals could also suggest regulatory adjustments to inputs that would better protect the entire watershed—including the human health that depends upon the health of the watershed.

Part I of this Article outlines the existing regulatory fragmentation that dominates the management of fresh water, using the specific example of atmospheric deposition of mercury. The problem of mercury deposition into water demonstrates not only how multiple regulatory agencies and regimes might become involved in a single environmental problem but also how certain environmental outputs are elided from regulatory attention. Positing that water's regulatory fragmentation reflects an input-focused or source-based management philosophy that is out of step with the increasing interest in ecosystem-based management and, specifically, the renewed regulatory interest in watersheds, Part I concludes by arguing that output-based management could provide one means of directing all of the water management regimes to a more common overall regulatory goal.

In Part II, this Article suggests why such increased harmonization is legally and ecologically desirable. It outlines the increasing number of legal conflicts regarding the use and regulation of water, suggesting that these conflicts are driven in large part by systemic states of water shortage. In particular, the increasing number of lawsuits to resolve conflicts between water law and endangered species underscores the fundamental conflict that exists between consumptive use of water and users who need water *in situ*—a conflict that climate change is likely to exacerbate for many parts of the United States. Part II concludes by providing examples of watersheds and ecosystems where regulatory fragmentation has impeded the attainment of ecosystem-based restoration goals.

Part III discusses the most important regulatory orphan of water's regulatory fragmentation: the oceans. It begins by providing an overview of the value of healthy marine ecosystems to the United States, and then emphasizes the fact that two oceans commissions have identified regulatory fragmentation as the most important impediment to rational and sustainable regulation of marine resources. This part concludes by arguing that such regulatory fragmentation is explained, at least in part, by William Buzbee's theory of the regulatory commons.

In Part IV, this Article outlines some of the regulatory reforms that an output-based focus incorporating marine ecosystems might suggest. These reforms fall into two categories: (1) relatively limited amendments to existing regulatory regimes, such as the Clean Water Act and Endangered Species Act; and (2) more comprehensive structural changes to water resources management. What the suggested reforms share is an expansion of the federal role in water resource management—logically, the most appropriate level of regulatory authority to oversee and rationalize interjurisdictional water resource management.

In addition, Part IV argues that, given the existing and more-or-less permanent states of water shortage in many parts of the country and the likelihood of climate change-induced increased water stress, the nation needs to consider the possibility of watershed-based water triage. As in medicine, water triage would acknowledge that some systems need little intervention, some are doomed (or, to move from the human to the ecological, sacrificeable), and some are worth the cost of intervention to save and restore. To make water triage a truly valuable tool, however, marine ecosystems must be part of the discussion.

I. WATER'S REGULATORY FRAGMENTATION AND THE EVOLUTION TO ECOSYSTEM-BASED REGULATION

Regulatory fragmentation of water is pervasive, as this Part will outline. Such divisions reflect the numerous values of water both to humans and to aquatic ecosystems. The multiplicity of human uses has prompted an input-based—that is, a source- or user-based—approach to water resources management that divides regulatory authority among a myriad of use-focused federal and state agencies. The following sections note some of the more important uses of water resources, discuss how input-focused regulation leads to regulatory fragmentation, and posit that this input-focused regulatory fragmentation is at odds with environmental law's progression to an ecosystem approach, as typified by recurring interest in watershed-based management of aquatic resources.

A. A Typology of Water Uses and an Overview of the Laws That Govern Them

Numerous uses of water have been discussed and compared in a variety of contexts. For purposes of this Article, however, these specific uses of water are less important than the basic dichotomy noted in the Introduction: water is valuable both as a good and as a medium. Moreover, as a medium, water is valuable both directly to humans and less directly as a result of its support of biodiversity. As a result, this section discusses water and its legal regimes as a three-part typology: (1) water as a commodity; (2) water as a human service provider; and (3) water as habitat and ecosystem. From this typology, moreover, the plethora of regulatory authorities involved in water resource management becomes clear.

1. Water as Commodity: State Water Law and Federal Water Projects

One of the most basic regulatory aspects of water—and arguably, the aspect with the most ability to influence downstream ecological outputs, particularly in areas experiencing freshwater shortages—is the law governing who has the right to remove fresh water from its natural watercourse and to use that water for some consumptive purpose, such as irrigation, drinking water, or industrial manufacturing. From this perspective, freshwater resources, both surface water and groundwater, are generally considered the states' regulatory domain, and state water law dominates in regulating the removal and use of fresh water.[22] As a result, regulatory authority over water diversions in interstate watersheds is necessarily fragmented among the relevant states.

Nor do the states agree in their regulatory priorities. Indeed, the exact principles and requirements governing the withdrawal and consumptive use of water can vary considerably from location to location. However, in broad brush strokes, the eastern states inherited from England the doctrine of ripar-

22. GEORGE A. GOULD ET AL., WATER LAW 23 (7th ed. 2005); Reed D. Benson, *Deflating the Deference Myth: National Interests vs. State Authority under Federal Laws Affecting Water Use*, 2006 UTAH L. REV. 241, 242 (2006); Charlton H. Bonham, *Perspectives from the Field: A Review of Western Instream Flow Issues and Recommendations for a New Water Future*, 36 ENVTL. L. 1205, 1208 (2006).

ianism, which ties the right to use water to ownership of the land adjoining the water source—i.e., the riparian landowners.[23] Common law riparian doctrine emphasizes domestic use,[24] water sharing,[25] correlative and adjustable rights to water,[26] and a limit on withdrawals from the natural watercourse.[27] Riparianism works adequately in areas with plenty of water,[28] and it is fairly supportive of aquatic ecosystems.[29] However, the legal connection of consumptive use rights to riparian land ownership limits non-riparian development,[30] and most eastern states have transitioned to "regulated riparianism" and administrative permitting,[31] which allow for increased consumptive and off-site use of water and concomitant adverse effects on aquatic ecosystems.

In contrast, the perpetually water-limited and drought-threatened western states generally rejected riparianism in favor of the prior appropriation doctrine.[32] Prior appropriation operates on a principle of "first in time, first in right"—the first user to apply water to a beneficial use, without waste or abandonment, acquires a continued right to a water supply superior

23. Benson, *supra* note 22, at 250–52; George A. Gould, *Water Rights Systems, in* WATER RIGHTS OF THE EASTERN UNITED STATES 8–9 (Kenneth R. Wright ed., 1998).

24. Mich. Citizens for Water Conservation v. Nestle Waters N. Am., Inc., 709 N.W.2d 174, 194–95 (Mich. Ct. App. 2005), *aff'd in part, rev'd in part*, 737 N.W.2d 447 (Mich. 2007); Commonwealth Dep't of Envtl. Res. v. Phila. Suburban Water Co., 581 A.2d 984, 986 (Pa. Commw. Ct. 1990); Cummins v. Travis County Water Control & Improvement Dist. No. 17, 175 S.W.3d 34, 46–47 (Tex. App. 2005).

25. Ace Equip. Sales, Inc. v. Buccino, 848 A.2d 474, 480 (Conn. App. Ct. 2004), *rev'd*, 869 A.2d 626 (Conn. 2005).

26. United States v. State Water Res. Control Bd., 227 Cal. Rptr. 161, 170–71 (Cal. Ct. App. 1986); Robinson v. Ariyoshi, 658 P.2d 287, 295 (Haw. 1982); Pine Knoll Ass'n, Inc. v. Cardon, 484 S.E.2d 446, 449 (N.C. Ct. App. 1997).

27. *Mich. Citizens for Water Conservation*, 709 N.W.2d at 194–96; Portage City Bd. of Comm'rs v. Akron, 808 N.E.2d 444, 462 (Ohio Ct. App. 2004), *aff'd in part, rev'd in part*, 846 N.E.2d 478 (Ohio 2006); White's Mill Colony, Inc. v. Williams, 609 S.E.2d 811, 817–18 (S.C. Ct. App. 2005).

28. Gould, *supra* note 23, at 8.

29. Muench v. Pub. Serv. Comm'n, 53 N.W.2d 514, 517–19 (Wis. 1952).

30. Richard F. Ricci et al., *Battles over Eastern Water*, 21 NAT. RESOURCES & ENVT. 38, 38 (2006).

31. *Id.*; Jeremy Nathan Jungreis, *"Permit" Me Another Drink: A Proposal for Safeguarding the Water Rights of Federal Lands in the Regulated Riparian East*, 29 HARV. ENVTL. L. REV. 369, 371 (2005) ("Twenty eastern states now impose some form of regulated riparianism . . . .").

32. Benson, *supra* note 22, at 250–52; Gould, *supra* note 23, at 7; Ricci et al., *supra* note 30, at 38.

to that of later users drawing water from the same source.[33] Moreover, given its origin in western mining on federal public lands,[34] prior appropriation doctrine has never linked water use to riparian land ownership,[35] removing legal obstacles to transporting water from its source to distant farms or other uses. However, the prior appropriation doctrine has also traditionally lacked any impetus to leave water *in situ*, promoting (especially in conjunction with natural conditions where drought is already common) far more destruction of and stress upon aquatic ecosystems than eastern riparianism.[36] Legal mechanisms that allow for the protection of ecological values, such as the recognition of instream rights,[37] expansion of the state public trust doctrine,[38] and incorporation of public interest review into permitting regimes,[39] are relatively recent innovations in prior appropriation states.

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33. W. Maricopa Combine, Inc. v. Ariz. Dep't of Water Res., 26 P.3d 1171, 1180 (Ariz. Ct. App. 2001); Archuleta v. Gomez, 140 P.3d 281, 284 (Colo. App. 2006); Hawley v. Kan. Dep't of Agric., 132 P.3d 870, 879 (Kan. 2006); State *ex rel.* Office of State Engineer v. Lewis, 150 P.3d 375, 383 (N.M. Ct. App. 2006).

34. Irwin v. Phillips, 5 Cal. 140, 145–47 (Cal. 1855); John D. McGowen, *The Development of Political Institutions on the Public Domain*, 11 WYO. L.J. 1, 8–14 (1956).

35. Lux v. Haggin, 10 P. 674, 697–705 (Cal. 1886).

36. Andrew K. Jacoby, *Water Pressure: The Eightieth Texas Legislature Attempts to Protect Instream Flows of Rivers and Streams, and Freshwater Inflows to Bays and Estuaries*, 20 TULANE ENVTL. L.J. 381, 389 (2007); Ruth Mathews, *Instream Flow Protection and Restoration: Setting a New Compass Point*, 36 ENVTL. L. 1311, 1315–16 (2006); *see* Courtney Watts, Introduction to Symposium, *Western Instream Flows: Fifty Years of Progress and Setbacks*, 36 ENVTL. L. 1113, 1113 (2006).

37. Reed D. Benson, *"Adequate Progress," or Rivers Left Behind? Developments in Colorado and Wyoming Instream Flow Laws Since 2000*, 36 ENVTL. L. 1283, 1292–99 (2006); Bonham, *supra* note 22, at 1214–20; Mathews, *supra* note 36, at 1312–14.

38. Nat'l Audubon Soc'y v. Super. Ct., 658 P.2d 709, 718–29 (Cal. 1983); Fort Trumbull Conservancy, LLC v. City of New London, 925 A.2d 292, 301–02 (Conn. 2007) (relying on the Connecticut Environmental Policy Act, CONN. GEN. STAT. § 22a-16 (2006)); Kelly v. 1250 Oceanside Partners, 140 P.3d 985, 1005–06 (Haw. 2006) (imposing a public trust duty on the state to protect coastal waters from pollution); McQueen v. S.C. Coastal Council, 580 S.E.2d 116, 120 (S.C. 2003) (extending the public trust doctrine to marine life); Wash. State Geoduck Harvest Ass'n v. Wash. Dep't of Natural Res., 101 P.3d 891, 895–97 (Wash. Ct. App. 2004) (performing a public trust analysis of shellfish regulation).

39. Cent. & W. Basin Water Replenishment Dist. v. S. Cal. Water Co., 135 Cal. Rptr. 2d 486, 494 (Cal. Ct. App. 2003); *In re* Waiola O Molokai, Inc., 83 P.3d 664, 701–02 (Haw. 2004); Chisholm v. Idaho Dep't of Water Res., 125 P.3d 515, 519–21 (Idaho 2005); Town of Gorton v. Agency of Natural Res., 772 A.2d 1103, 1105–06 (Vt. 2001).

In addition to these variations within state law, three federal law doctrines are relevant to the implementation of state water law, especially when viewing water in a large ecosystem context.[40] As a result, federal agencies and courts also play a role in assigning water rights, further fragmenting authority over water diversions.

First, the federal common law doctrine of equitable apportionment controls—absent interstate compact[41] or direct congressional action[42]—the division of interstate water resources among the relevant states.[43] As applied by the U.S. Supreme Court, equitable apportionment generally follows the legal regime of the relevant states (prior appropriation in the West, riparianism in the East) and strives to preserve existing uses.[44] As such, states with interstate waterways have strong incentives to develop that water quickly and extensively.[45] Indeed, fears about downstream California's rapid development helped to drive interstate and congressional apportionment of the Colorado River.[46]

Second, the federal public trust doctrine limits the states' ability to abdicate title to and especially regulatory authority over the beds and banks of waters that are navigable-in-fact or influenced by the tides.[47] This doctrine seeks to preserve the public's right to use these waters for, at minimum, navigation, commerce, and fishing[48] and hence provides some impetus for leaving water in its natural location.

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40. Benson, *supra* note 22, at 252–54.

41. GOULD ET AL., *supra* note 22, at 486–94.

42. *Id.* at 494–508.

43. *See, e.g.*, New Jersey v. New York, 283 U.S. 336, 342–48 (1931) (apportioning the Delaware River between New Jersey and New York); Wyoming v. Colorado, 259 U.S. 419, 458–59, 467–71 (1922) (apportioning the Laramie River between Colorado and Wyoming), *vacated*, 353 U.S. 953 (1957); Kansas v. Colorado, 206 U.S. 46, 85–89, 97–105 (1907) (establishing the Supreme Court's jurisdiction to hear interstate equitable apportionment cases). *See generally* A. Dan Tarlock, *The Law of Equitable Apportionment Revised, Updated, and Restated*, 56 U. COLO. L. REV. 381 (1985).

44. Nebraska v. Wyoming, 325 U.S. 589, 618 (1945).

45. ADLER, *supra* note 1, at 21; *see also* J.B. Ruhl, *Equitable Apportionment of Ecosystem Services: New Water Law for a New Water Age*, 19 J. LAND USE & ENVTL. L. 47, 51 (2003).

46. ADLER, *supra* note 1, at 21.

47. Shively v. Bowlby, 152 U.S. 1, 11–14, 26 (1894); Ill. Cent. R. Co. v. Illinois, 146 U.S. 387, 435–37 (1892); The Volant, 59 U.S. 71, 74–75 (1855); Martin v. Waddell's Lessee, 41 U.S. 367, 383–88 (1842).

48. *Ill. Cent. R. Co.*, 146 U.S. at 453–56; *The Volant*, 59 U.S. at 74–75; *Martin*, 41 U.S. at 383–88.

Finally, and most importantly in the western states, the doctrine of federal reserved rights recognizes that, in some circumstances, the federal government will be deemed to have reserved water rights for federal purposes that trump state water rights.[49] Federal reserved rights are particularly important for tribes and federal parks,[50] involving those tribes and the relevant federal agencies in water diversions and management. While many such reserved rights have yet to be fully litigated,[51] when these rights are finally acknowledged in prior appropriation states they tend to have early priority dates and hence can significantly alter the implementation of other water rights.[52] In addition, the federal presence is often dominant in the variety of federal reclamation and irrigation projects that exist in the United States, especially in the West.[53]

2. Water as Human Service Provider

While states generally regulate the withdrawal and consumption of fresh water, water *in situ* also provides a number of human services. These services are often protected by federal law and regulated by a variety of federal agencies, further dividing regulatory authority over water resources.

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49. Cappaert v. United States, 426 U.S. 128, 138–41 (1976) (upholding a reservation for water for Devil's Hole); Winters v. United States, 207 U.S. 564, 576–77 (1908) (enjoining a diversion of the Milk River in Montana because of an 1888 reservation for the Fort Belknap Reservation for irrigation).

50. *E.g.*, Idaho v. United States, 533 U.S. 262, 274–79 (2001) (holding that the United States intended to reserve Coeur d'Alene Lake and the St. Joe River for the Coeur d'Alene Tribe, defeating Idaho's claims); Arizona v. California, 530 U.S. 392, 418–19 (2000) (awarding rights to Colorado River water to the Colorado River Indian Reservation); *Cappaert*, 426 U.S. at 138–41 (1976) (upholding a reservation for water for Devil's Hole); *Winters*, 207 U.S. at 576–77 (enjoining a diversion of the Milk River in Montana because of an 1888 reservation for the Fort Belknap Reservation for irrigation).

51. Thomas H. Pacheo, *How Big Is Big? The Scope of Water Rights Suits After the McCarran Amendment*, 15 ECOLOGY L.Q. 627, 627–28, 630–31 (1988); John E. Thorson et al., *Dividing Western Waters: A Century of Adjudicating Rivers and Streams, Part II*, 9 U. DENV. WATER L. REV 299, 357–58 (2006); Janice L. Weis, *Federal Reserved Rights in Wilderness Areas: A Progress Report on a Western Water Fight*, 15 HASTINGS CONST. L.Q. 125, 139–40 (1987).

52. *See, e.g.*, Arizona v. California, 530 U.S. 392, 408–09, 418–19 (2000) (upholding tribal claims to Colorado River water despite an interstate compact allocating that water).

53. *See, e.g.*, U.S. Dep't of the Interior Bureau of Reclamation, Water Operations within the Bureau of Reclamation, http://www.usbr.gov/main/water (listing the Bureau's water projects) (last visited Feb. 15, 2008).

a. Navigation and Commerce

Perhaps most obviously, large waterways in the United States have long been important to navigation and commerce. Relying on the federal government's constitutional authority over interstate commerce,[54] in the 19th century the U.S. Supreme Court lodged final authority over navigation upon the navigable-in-fact waters in Congress.[55] Congress exercised this authority primarily through the various Rivers and Harbors Acts, culminating in the Rivers and Harbors Act of 1899 ("RHA").[56]

The RHA prohibits the construction of actual obstructions in the navigable waters without Congress's explicit consent.[57] The building of lesser structures in the navigable waters requires a permit from the U.S. Army Corps of Engineers,[58] as does excavation in and filling of these waters.[59] Finally, the RHA also prohibits the disposal of refuse in the navigable waters and their tributaries.[60]

Read on its face, the RHA would seem to preserve the more-or-less natural state of navigable waters, and it certainly has been implemented so as to preserve actual navigability.[61] However, the history of the U.S. Army Corps is a history of altering aquatic features, and the RHA has been instrumental in expanding the Army Corps' regulatory presence in navigable waters. Indeed, in its navigation regulatory capacity, the Army Corps now "maintains more than 12,000 miles (19,200 km) of

54. U.S. CONST. art. I, § 8, cl. 3.

55. Gibbons v. Ogden, 22 U.S. (9 Wheat.) 1, 3, 9–12, 22–28 (1824) (holding that the power to regulate commerce includes the power to regulate navigation and the navigable waters).

56. 33 U.S.C. §§ 401–07 (2000 & Supp. V 2005).

57. *Id.* § 401; *see also id.* § 403 ("The creation of any obstruction not affirmatively authorized by Congress, to the navigable capacity of any of the waters of the United States is prohibited . . . .").

58. 33 U.S.C. § 403.

59. *Id.*

60. 33 U.S.C. § 407.

61. United States v. San Juan Bay Marina, 239 F.3d 400, 404, 409 (1st Cir. 2001) (upholding an RHA order to remove piers from San Juan Harbor); United States v. Members of Estate of Boothby, 16 F.3d 19, 20–21 (1st Cir. 1994) (upholding an ejection of houseboats under the RHA); United States v. Nassau Marine Corp., 778 F.2d 1111, 1115 (5th Cir. 1985) (holding that the RHA compels removal of a sunken barge that was an obstacle to navigation).

inland waterways and operates 235 locks"; it also maintains 300 commercial harbors and over 600 smaller harbors.[62]

b. Hydropower

In addition to supporting navigation, large river systems also supply the nation with hydropower. The building and operation of hydroelectric dams fall within the jurisdiction of yet another federal agency, the Federal Energy Regulatory Commission ("FERC"), pursuant to the Federal Power Act of 1935.[63] Under this Act, FERC licenses private entities, states, or municipalities to construct and operate hydroelectric dams in the navigable waters.[64]

In exercising its licensing authority, FERC must consider whether a project is "best adapted to a comprehensive plan for improving or developing a waterway," taking account of other uses, such as recreation and environmental values.[65] While FERC and its predecessor, the Federal Power Commission ("FPC"), have denied hydropower licenses on environmental grounds,[66] "application denials have been the exception rather than the rule."[67] Amendments in the Electric Consumers Protection Act of 1986[68] required FERC to give "equal consideration" to "energy conservation, . . . fish and wildlife, . . . recreational opportunities, and the preservation of other aspects of environmental quality" as well as to "power and development purposes."[69] These amendments have increased respect for environmental values in hydropower licensing.[70]

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62. U.S. Army Corps of Engineers, Missions: Navigation, http://www.usace.army.mil/missions/water.html (last visited Feb. 15, 2008).

63. 16 U.S.C. §§ 792–825r (2000).

64. *Id.* § 797(e).

65. *Id.* § 803(a)(1).

66. *See, e.g.*, *In re* Namekagon Hydro Co., 12 F.P.C. 203 (1953), *aff'd*, 216 F.2d 509 (7th Cir. 1954).

67. FRED BOSSELMAN ET AL., ENERGY, ECONOMICS AND THE ENVIRONMENT: CASES AND MATERIALS 180 (2d ed. 2006).

68. Pub. L. No. 99-495, 100 Stat. 1243 (1986) (codified in scattered sections of 16 U.S.C. (2000)).

69. 16 U.S.C. § 797(e) (2000).

70. *See* Lea Kosnik, Balancing Environmental Protection and Energy Production in the Federal Hydropower Licensing Process 4–5 (July 2007) (unpublished manuscript, on file with author). Also, in November 2005, the Departments of Interior, Commerce, and Agriculture issued new regulations pursuant to the Energy Policy Act of 2005 to ensure that hydropower licensing "protect[ed] threatened and endangered species, water quality, and federal and tribal resources." Joint

Other federal agencies play more specific roles in regulating hydropower. For example, in the Columbia River in the Pacific Northwest, the Bonneville Power Administration ("BPA") allocates the power, including entering into contracts, from the hydroelectric dams in the Columbia River;[71] however, the Army Corps has operational control over the dams themselves.[72] In parts of the southeastern United States, the Tennessee Valley Authority ("TVA") has authority to provide affordable electricity to local residents.[73] Under this authority, the TVA operates twenty-nine hydroelectric dams.[74]

c. *Waste Disposal and Assimilation*

Another service that aquatic media provide is waste disposal and assimilation. Industries and municipalities have long exploited waterways' capacities to dilute, disperse, and in some cases, to treat effectively industrial and municipal wastes and sewage. [75] Other aquatic ecosystems, such as wetlands, are particularly good at filtering and containing toxics and other pollutants.[76] Undisturbed river and lake sediments can also sequester toxic pollutants from the water column.[77]

Press Release, U.S. Dep't of the Interior, U.S. Dep't of Agric., & U.S. Dep't of Commerce Nat'l Oceanic & Atmospheric Admin., Federal Agencies Announce New Hydropower Rules to Ensure Consideration of Environmental and Economic Values (Nov. 16, 2005), *available at* http://www.doi.gov/news/05_News_Releases/051116.htm.

71. Bonneville Project Act, 16 U.S.C. §§ 832a–832m, 838a (2000).

72. 16 U.S.C. § 832 (2000).

73. *See* Tennessee Valley Authority Act of 1933, 16 U.S.C. § 831n–4(h) (2000). *See generally* 16 U.S.C. §§ 831–831ee (2000).

74. Tennessee Valley Authority v. Whitman, 336 F.3d 1236, 1243 & n.10 (11th Cir. 2003).

75. *See* CRAIG, *supra* note 14, at 10–18, 56–62.

76. Rapanos v. United States, ___ U.S. ___, 126 S. Ct. 2208, 2239, 2245, 2247, 2251 (2006) (Kennedy, J., concurring). *Accord id.* at 2259, 2264 (Stevens, J., dissenting); Tahoe-Sierra Preservation Council, Inc. v. Tahoe Reg'l Planning Agency, 535 U.S. 302, 308 (2002); United States v. Riverside Bayview Homes, Inc., 474 U.S. 121, 134 (1985); San Francisco Baykeeper v. Cargill Salt Div., 481 F.3d 700, 707 (9th Cir. 2007); Bid Meadows Grazing Ass'n v. United States *ex rel.* Venemon, 344 F.3d 940, 941 n.1 (9th Cir. 2003); United States v. Wilson, 133 F.3d 251, 268 (4th Cir. 1997); United States v. Cundriff, 480 F. Supp. 2d 940, 944–45 (W.D. Ky. 2007); United States v. Banks, 873 F. Supp. 650, 659 (S.D. Fla. 1995).

77. *See* United States Envtl. Prot. Agency, *Hudson River PCBs*, http://www.epa.gov/hudson (chronicling the controversy over dredging the polychlorinated biphenyl (PCB)-contaminated Hudson River) (last updated Feb. 14, 2008) [hereinafter *Hudson River PCBs*]; Nw. Envtl. Advocates v. Nat'l Marine Fi-

Nevertheless, abuse of these ecosystem services led to excessively polluted waterways and the enactment of the federal Clean Water Act.[78] The Clean Water Act divides regulatory authority over water quality among two federal agencies, the U.S. Environmental Protection Agency ("EPA")[79] and the Army Corps,[80] and the states and territories. The federal agencies oversee implementation of the Act, engage in permitting,[81] and set water quality requirements when the states fail to do so.[82] However, the states retain primary authority over water quality requirements[83] and exclusive authority over nonpoint source regulation.[84] The Act also encourages states to take over permitting within their respective borders.[85]

The Act makes "the discharge of any pollutant by any person" unlawful,[86] meaning that it is illegal for any person[87] to add pollutants (broadly defined in the statute)[88] to "the waters of the United States" or the oceans[89] from "point sources," defined as "any discernible, confined, and discrete conveyance,"[90] without a permit.[91] In addition, the Act establishes national goals that "the discharge of pollutants into the navigable waters be eliminated"[92] and, in the interim and where attainable,

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sheries Serv., 460 F.3d 1125, 1141–42 (9th Cir. 2006) (discussing the need to evaluate, pursuant to NEPA, the toxicity from dredging the Columbia River).

78. *See* Clean Water Act of 1977, Pub. L. No. 95-217, 91 Stat. 1566 (codified as amended at 33 U.S.C. §§ 1251–1387 (2000 & Supp. V 2005)).

79. 33 U.S.C. § 1251(d) (2000) (designating the Administrator of the EPA responsible for administering the stated objectives of the chapter).

80. *Id.* § 1344(d) (declaring the Secretary of the Army, acting through the Chief of Engineers, responsible for issuing permits for dredged or fill material).

81. *Id.* §§ 1342(a), 1344(a).

82. *Id.* § 1313(c)–(d).

83. *Id.*

84. 33 U.S.C. § 1329 (2000 & Supp. V 2005).

85. 33 U.S.C §§ 1342(b) (2000), 1344(g) (2000); *see also* 33 U.S.C. § 1251(g) (2000) (describing policy of state and federal cooperation in managing water resources).

86. 33 U.S.C. § 1311(a) (2000).

87. *Id.* § 1362(5) (defining "person").

88. *Id.* § 1362(6) (defining "pollutant" as "dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal and agricultural waste discharged into water").

89. *Id.* § 1362(10) (defining "ocean").

90. *Id.* § 1362(14) (defining "point source").

91. *See id.* §1342 (describing the permitting process of the national pollutant discharge elimination system).

92. *Id.* § 1251(a)(1).

that "water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved . . . ."[93] Thus, the Act pursues larger ecosystem goals as well as pure water quality goals, although how thoroughly its water quality regulation promotes ecosystem health generally depends on how states set the specific water quality standards for each waterbody within their respective borders.[94] Specifically, states often set their water quality standards to reflect local needs, such as drinking water, fish production, or sewage and industrial waste dilution.[95]

Thus, water quality regulation under the Clean Water Act divides regulatory authority between the federal government and the states, between the EPA and the Army Corps, and among the states and territories. In addition to these divisions of regulatory authority, in many states different agencies regulate water rights and water quality.[96]

d. Fishing and Hunting

Most aquatic ecosystems, including coastal ecosystems, support some form of fishing, whether recreational or commercial. Many also support hunting, such as hunting for waterfowl. A variety of regulatory authorities, both state and federal, oversee these uses. For example, the presence of fisheries and game birds generally triggers the regulatory authority of the relevant state fish and game agencies.[97] In addition, the

93. *Id.* § 1251(a)(2).

94. *See id.* § 1313(c) (describing state water quality standard authority).

95. *See, e.g.*, COMM. ON THE CLEAN WATER ACT & THE MISSISSIPPI RIVER, NAT'L RESEARCH COUNCIL, MISSISSIPPI RIVER WATER QUALITY AND THE CLEAN WATER ACT: PROGRESS, CHALLENGES, AND OPPORTUNITIES 104 (2008) (noting that "[s]tate water quality standards authority is analogous to zoning, because the setting of these standards involves determination of whether a particular segment of a stream should be usable, for example, for human contact recreation or as a cold water fishery") [hereinafter NRC MISSISSIPPI RIVER REPORT]; *id.* at 106–08 (table showing the differences among the Mississippi River states' water quality criteria for the River); *id.* at 109 (figure showing the differences among the Mississippi River states' designated uses for the River).

96. *See, e.g.*, discussion *infra* Part II.A.4 (discussing the relationship between state water law and the Clean Water Act).

97. *E.g.*, ARK. CONST. of 1874, amend. 35 (1945) (establishing Arkansas State Game and Fish Commission); IDAHO CODE ANN. § 36-103 (2002); MICH. COMP. LAWS ANN. §§ 324.47301, 324.48702 (West 1999); OR. REV. STAT. ANN. §§ 498.002, 508.725 (West 2007); S.C. CODE ANN. § 50-1-10 (2008); S.D. CODIFIED LAWS §§ 41-1-2, 41-11-1 (2003 & Supp. 2007); UTAH CODE ANN. § 23-13-3 (2007).

presence of certain species, such as migratory birds or endangered species, may also give the United States Fish and Wildlife Service ("USFWS") a say in how the waterway is managed.[98] In turn, the presence of anadromous fish—fish such as salmon and sturgeon that spend part of their life cycles in fresh water and part at sea[99]—will trigger the regulatory authority of the National Oceanic and Atmospheric Administration ("NOAA"), acting through the National Marine Fisheries Service ("NMFS").[100]

At the coast and out to sea, the federal Magnuson-Stevens Fishery Conservation and Management Act becomes relevant.[101] NOAA and NMFS have oversight authority over federally managed commercial marine fisheries under the Act,[102] although the eight regional Fishery Management Councils ("FMCs") most directly manage these fisheries and regulate the fishers.[103] Within the first three miles of marine waters, however, state fishery agencies also play a large role in fishery regulation,[104] although the federal FMCs and agencies can supersede state regulation if state regulation conflicts with federal Fishery Management Plans.[105]

98. *See, e.g.*, Migratory Bird Treaty Act, 16 U.S.C. §§ 703–712 (2000). In particular, the Secretary of the Interior, acting through the USFWS, must consider "breeding habits" when it promulgates migratory bird regulations. 16 U.S.C. § 704(a) (2000); *see also* Consejo de Desarrollo Economico de Mexicali, A.C. v. United States, 482 F.3d 1157, 1162–63, 1166 (9th Cir. 2007) (challenging the United States' decision to line with concrete the All-American Canal pursuant to the Migratory Bird Treaty Act).

99. 16 U.S.C. § 1802(1) (2000) (defining "anadromous species").

100. 16 U.S.C. § 756 (2000) (imposing a duty on the Secretary of Commerce, acting through NOAA, to conserve salmon and other migratory fish in the Columbia River); *see also* 16 U.S.C. §§ 1801(a)(1), (b)(1) (2000 & Supp. V 2005) (declaring the purpose of Congress to conserve and manage fishery resources, migratory and anadromous species of fish); 16 U.S.C. § 1811(b)(1) (2000) (authorizing the United States to exercise authority over all anadromous species within a specific migratory range); 16 U.S.C. § 1855(b)(3)(B) (2000); 16 U.S.C. § 1857(2)(B) (2000) (giving salmon and other anadromous species special attention under the Magnuson-Stevens Fishery Conservation and Management Act).

101. *See* Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. §§ 1801–1884 (2000 & Supp. V 2005).

102. *See id.* § 1851.

103. *Id.* § 1852.

104. *See id.* § 1856(a) (setting forth state jurisdiction).

105. *Id.* § 1856(b).

e. Recreation

Aquatic ecosystems produce recreational opportunities in the form of recreational fishing, kayaking, canoeing, birdwatching, ecotourism, and swimming. The state agencies that implement the Clean Water Act have some role to play in addressing these recreational uses, because the Act's general goal of restoring and maintaining waters that are fishable and swimmable promotes preservation of aquatic recreation.[106]

Thus, state water quality agencies can protect recreational uses through their water quality standards designations under the Clean Water Act.[107] Other state agencies, such as state recreational and parks commissions, can more directly protect recreational uses through "Wild and Scenic River Designation,"[108] state public trust doctrines[109] or other state laws.[110]

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106. *See* 33 U.S.C. § 1251(a)(2) (2000).

107. 33 U.S.C. § 1313(c)(2)(A) (2000) (requiring states to consider "recreational purposes" when setting water quality standards).

108. *See* Wild and Scenic Rivers Act, 16 U.S.C. §§ 1271–1287 (2000 & Supp. V 2005). The federal Wild and Scenic Rivers Act immediately put several rivers into a protective conservation system. *Id.* § 1274. The Act then allowed states to nominate additional rivers for protection. *Id.* § 1276. The Act encourages the creation of recreational river areas. *See* 16 U.S.C. § 1273(b)(3) (2000). It also places restrictions on water resources projects in designated rivers. *Id.* § 1278 (2000).

Some states have enacted their own Wild and Scenic Rivers programs. Most dramatic is California, which has adopted a state statutory program. CAL. PUB. RES. CODE §§ 5093.50–5093.70 (West 2007). California's Constitution also declares that no waters are appropriable from Wild and Scenic Rivers. CAL. CONST. art. X A, §3. *See also* 20 ILL. COMP. STAT. ANN. §§ 855/0-01–855/2 (West 2001); MINN STAT. ANN. §§ 103F.301–103F.345 (West 2007); N.J. STAT. ANN. §§ 13:8-45–13:8-63 (West 2003).

109. *E.g.*, Santa Teresa Citizen Action Group v. City of San Jose, 7 Cal. Rptr. 3d. 868, 884–85 (Cal. Ct. App. 6th 2003); Kootenai Envtl. Alliance, Inc. v. Panhandle Yacht Club, Inc., 671 P.2d 1085. 1092–93 (Idaho 1983); Friends of Hatteras Island Nat'l Historic Maritime Forest Land Trust for Pres., Inc. v. Coastal Res. Comm'n, 452 S.E.2d 337, 348–49 (N.C. Ct. App. 1995); Raleigh Ave. Beach Ass'n v. Atlantis Beach Club, Inc., 851 A.2d 19, 29–30 (N.J. Super. Ct. 2004); Oregon Shores Conservation Coalition v. Or. Fish & Wildlife Comm'n, 662 P.2d 356, 364 (Or. App. 1983); Citizens for Responsible Wildlife Mgmt. v. State, 103 P.3d 203, 205–06 (Wash. App. 2004); Wisconsin's Envtl. Decade, Inc. v. Dep't of Natural Res., 271 N.W.2d 69, 72–76 (Wis. 1978).

110. *E.g.*, ALASKA STAT. §§ 41.21.455, 41.21.475 (2006) (establishing state recreation areas in Narcy Lake and Chena River); ALASKA STAT. §§ 41.23.400–41.23.510 (2006) (establishing six recreation rivers); COLO. REV. STAT. §§ 33-12.5-101 to 33-12.5-105 (2007) (creating Arkansas River Recreation Act); IDAHO CODE ANN. §§ 36.1601–1604 (2002) (governing recreational streams); LA. REV. STAT. ANN. §§ 38:2601–38:2612 (2005) (establishing the Cypress-Black Bayou Recreation and Water Conservation District); MD. CODE ANN. Natural Resources §§ 5-215 to 5-215.1 (LexisNexis 2007) (laying out the Deep Creek recreation plan);

The presence of federal parks along waterways involves the National Park Service in water resource and recreation management. Other federal public lands such as National Forests, managed by the U.S. Forest Service, and rangelands, managed by the Bureau of Land Management ("BLM"), or other kinds of state lands, managed by state lands agencies, can similarly multiply the number of agencies regulating the recreational use of water.

3. Water as Habitat and Ecosystem

Finally, aquatic ecosystems are just that—ecosystems that provide habitat and life support to numerous species. Nevertheless, no single federal or state statute addresses all of the considerations relevant to water's status as habitat, especially not at the ecosystem level. Instead, a variety of laws confers partial regulatory authority on a variety of entities.

The Clean Water Act encourages states, the EPA, and the Army Corps to think about water's status as habitat. As noted, one of the Act's overall goals is to restore and maintain the fishability of rivers.[111] The EPA must establish guidance water quality criteria that reflect "the latest scientific knowledge" regarding "plankton, fish, shellfish, wildlife, plant life, shorelines, beaches, esthetics, and recreation" and regarding "the effects of pollutants on biological community diversity, productivity, and stability . . . ."[112] States, in turn, use these criteria in setting their water quality standards,[113] subject to EPA approval.[114] States must also consider their waters' uses for "propagation of fish and wildlife" when establishing the water quality standards.[115] Permit standards for discharges into the oceans must consider the effects of the pollutants on "plankton, fish, shellfish, wildlife, shorelines, and beaches"[116] and on marine life generally, including "changes in marine ecosystem diversity, productivity, and stability" and "species and community popu-

N.M. STAT. §§ 16-4-4 to 16-4-16 (2007) (establishing the El Rio Chama Scenic and Pastoral River and Rio Grande Valley State Park).

111. 33 U.S.C. § 1251(a)(2) (2000).
112. *Id.* § 1314(a)(1).
113. *Id.* § 1313(c)(2)(B).
114. *Id.* §§ 1313(c)(3), (c)(4).
115. *Id.* § 1313(c)(2)(A).
116. *Id.* § 1313(c)(1)(A).

lation changes."[117] Similar considerations govern when the Army Corps issues permits for discharges of dredged or fill material.[118] In addition, the USFWS must be given the opportunity to comment on all such "dredge and fill" permits.[119] Thus, three federal agencies and fifty state water quality agencies, as well as agencies in U.S. territories, are all partially empowered to regulate water as an ecosystem.

Nevertheless, the Clean Water Act's regulatory focus remains pollution prevention and mitigation, not habitat preservation *per se*. Direct considerations of aquatic habitat impairments are far more likely to come about as a result of the federal Endangered Species Act of 1973 ("ESA")[120] or similar requirements of state law.[121]

The USFWS implements the federal ESA for terrestrial species, including most freshwater species, while NMFS implements the Act for marine and anadromous species.[122] The ESA states explicitly that one of its purposes is "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved,"[123] and "the present or threatened destruction, modification, or curtailment of [a species'] habitat or range" is the first reason given for listing a species for protection.[124]

Once the appropriate agency lists a species, it is supposed to both designate critical habitat for the species[125] and develop and implement a recovery plan.[126] "Critical habitat" is habitat that a listed species needs for its survival and recovery.[127] Once a species is listed and its critical habitat determined, all federal agencies must "insure that any action authorized, funded, or carried out by such agency . . . is not likely to . . . result in the destruction or adverse modification of" critical habi-

117. *Id.* § 1343(c)(1)(B).
118. *Id.* § 1344(b); *see also* 40 C.F.R. § 230.10 (2006).
119. 33 U.S.C. § 1344(m) (2000).
120. Endangered Species Act of 1973, Pub. L. No. 93-205, 81 Stat. 884 (codified as amended at 16 U.S.C. §§ 1531–1544 (2000)).
121. *E.g.*, ALASKA STAT. §§ 16.20.180 to 16.20.210 (2006); CAL. FISH & GAME CODE §§ 2050–7710.5 (West 1998); CONN. GEN. STAT. ANN. §§ 26-303 to 26-316 (West 1999).
122. 16 U.S.C. § 1532(15) (2000); 50 C.F.R. § 402.02 (2002).
123. 16 U.S.C. § 1531(b) (2000).
124. *Id.* § 1533(a)(1)(A).
125. 16 U.S.C. § 1533(a)(3)(A) (2000 & Supp. V 2005)
126. 16 U.S.C. § 1533(f) (2000).
127. *Id.* § 1532(5)(A).

tat,[128] and individuals wishing to "take" listed species incidental to otherwise lawful activities must complete a habitat conservation plan for the species.[129] Moreover, under the agencies' regulations, habitat destruction can constitute a prohibited "take" of the species.[130]

Finally, state endangered species protections and state water permitting requirements can serve to acknowledge and to protect aquatic ecosystems and the habitat they provide. State endangered species protections vary, but many states protect species not already protected under the federal ESA.[131] In addition, many states have incorporated ecosystem and habitat considerations into their water law and consumptive use permitting.[132] Most often, these considerations are incorporated into permitting decisions through a public interest review. For example, under Oregon statutes, the state Water Resources Department may deny a reservoir owner's water right permit application if the reservoir "[w]ould pose a significant detrimental impact to existing fishery resources."[133] Other states have found other ways to incorporate such considerations. California and Hawaii, for example, use their public trust doctrines to harmonize water law and species protections.[134]

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128. *Id.* § 1536(a)(2).

129. *Id.* § 1539(a)(2) (2000).

130. 50 C.F.R. § 17.3 (2002) (defining "harm" in the definition of "take" for purposes of 16 U.S.C. § 1538(a)(1) to "include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering"); Babbitt v. Sweet Home Chapter of Cmtys. for a Great Oregon, 515 U.S. 687, 696–703 (1995) (upholding the definition of "take" as promulgated in the Agency regulations).

131. *E.g.*, COLO. REV. STAT. § 33-2-102 (2007); LA. REV. STAT. ANN. § 56:1901 (2005); S.C. CODE ANN. § 50-15-10 (2008).

132. *See, e.g.*, ALASKA CONST. art. VIII, § 13 (protecting reservations of water for fish and wildlife uses); ARIZ. REV. STAT. ANN. § 45-151(A) (2003) (allowing appropriations for fish and wildlife uses); NEV. REV. STAT. ANN. § 533.023 (LexisNexis 2006) (defining "wildlife purposes" for the state's water law); People v. Murrison, 124 Cal. Rptr. 2d 68, 75–76 (Cal. Ct. App. 2002) (holding that protecting fish under the California Water Code is in the public interest); Shokal v. Dunn, 707 P.2d 441, 448–49 (Idaho 1985) (concluding that the "local public interest" in water permitting included considerations of fish and wildlife habitat); Cent. Platte Natural Res. Dist. v. Wyoming, 513 N.W.2d 847, 855, 862 (Neb. 1994) (upholding the reservation of water rights in order to maintain habitats for migratory birds).

133. OR. REV. STAT. § 537.409(5)(b) (2007).

134. Nat'l Audubon Soc'y v. Superior Court of Alpine City, 658 P.2d 709, 725–26 (Cal. 1983); Kelly v. 1250 Oceanside Partners, 140 P.3d 985, 1003 (Haw. 2006); Morimoto v. Bd. of Land & Natural Res., 113 P.3d 172, 184 (Haw. 2005).

4. Summary: The Multitude of Use-Based Regulatory Authorities

As this discussion illustrates, multiple regulatory authorities are likely to have some kind of jurisdiction over water-related activities in any large watershed, based on the kinds of uses that occur there. At minimum, the water in any interstate watershed will be subject to the regulatory claims of multiple state water quality agencies, multiple state water rights or allocation agencies, multiple state fish and wildlife agencies, the EPA,[135] one or more divisions and regional offices of the Army Corps,[136] and the USFWS.[137] Interstate cooperation un-

135. The EPA will be involved in regulating any interstate watershed based on its Clean Water Act authority. *See* 33 U.S.C. §§ 1251, 1342(a), 1344(b) (2000) (setting forth the role of the EPA Administrator in regulating the discharge of pollutants into waters of the U.S.). The EPA may also be involved through other of its regulatory programs, such as in connection with the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"). 42 U.S.C. §§ 9601–9675 (2000). The recent debate over dredging of the Hudson River to clean up toxic PCBs provides one example of CERCLA's application in freshwater ecosystems. *See Hudson River PCBs*, *supra* note 77.

In addition, more than one EPA regional authority may have authority over the same watershed. *See* U.S. Envtl. Prot. Agency, *About EPA*, http://www.epa.gov/epahome/aboutepa.htm (last updated Jan. 25, 2008) [hereinafter *About EPA*]. For example, EPA Regions 4, 5, 6, and 7 have jurisdiction over the main stem Mississippi River. *See* U.S. Envtl. Prot. Agency, *Laws, Regulations, Guidance and Dockets: Where You Live*, http://www.epa.gov/lawsregs/where/index.html (last updated Jan. 25, 2008). Similarly, two EPA Regions have jurisdiction over the Colorado River, Regions 8 and 9, with Region 6 encompassing New Mexico. *Id.*

136. The Army Corps will be involved as a result of its Clean Water Act jurisdiction over the dredging and filling of waters of the United States. *See* 33 U.S.C. § 1344(a) (2000 & Supp. V 2005). To the extent that the aquatic watershed also involves a navigable-in-fact waterway, as most interstate watersheds do, the Army Corps's regulatory authority under the Rivers & Harbors Act of 1899 will also be relevant. *See* 33 U.S.C. §§ 401, 403, 406 (2000 & Supp. V 2005). Furthermore, the Army Corps has eight Civil Engineer Divisions with overlapping jurisdiction over watersheds. *See* U.S. Army Corps of Eng'rs, *Where We Are: Map of USACE Civil Engineer Divisions and Districts*, http://www.usace.army.mil/howdoi/civilmap.htm (last visited Feb. 22, 2008). Thus, for example, three divisions govern the Mississippi River, namely, the Mississippi Valley Division, the Great Lakes and Ohio River Division, and the South Atlantic Division. *Id.* Conversely, the South Pacific Division has authority for the entire Colorado River. *Id.* The Army Corps also has forty-one district offices, whose regulatory jurisdictions do not match state boundaries. *See* U.S. Army Corps of Eng'rs, *Who We Are: Divisions and Districts*, http://www.usace.army.mil/who/#Organized (last visited Feb. 11, 2008).

137. Under the Clean Water Act of 1977, the USFWS has the right to comment on any Army Corps permit. 33 U.S.C. § 1344(m) (2000). Moreover, any non-anadromous freshwater species listed for protection under the ESA that are pre-

der the Clean Water Act may add an interstate regulatory authority such as the Tahoe Regional Planning Agency[138] or the Ohio River Valley Water Sanitation Commission ("ORSANCO").[139] The presence of hydropower projects involves FERC and, depending on congressional authorization, potentially other entities such as the TVA or the Bonneville Power Administration.[140] Reclamation and irrigation projects can add any number of regulatory entities, including the federal Bureau of Reclamation ("BOR"),[141] the federal BLM,[142] and more state-specific entities such as those associated with the Central Valley Project ("CVP") in California.[143] The pres-

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sent in the watershed—and almost all watersheds have at least one—will fall under the USFWS's ESA jurisdiction. *See, e.g.*, 16 U.S.C. § 1532(15) (2000); Reorg. Plan No. 4 of 1970, 35 Fed. Reg. 15,627 (Oct. 3, 1970), *incorporated at* 84 Stat. 2090 (dividing authority between NMFS and the USFWS); U.S. Fish & Wildlife Serv., *USFWS Threatened and Endangered Species System (TESS)*, http://ecos.fws.gov/tess_public/SpeciesReport.do?groups=E&listingType=L&mapstatus=1 (listing all fishes receiving the ESA's protections and their locations in the United States) (last visited Mar. 27, 2008). Other Fish & Wildlife Service programs, such as the migratory bird programs, may also be relevant. 16 U.S.C. §§ 701, 712 (2000) (assigning conservation and regulatory authority for migratory birds to the Department of the Interior); U.S. Fish & Wildlife Serv., Div. of Migratory Bird Mgmt., http://www.fws.gov/migratorybirds (describing USFWS's implementation of this authority) (last visited Mar. 13, 2008).

138. *See* Tahoe Regional Planning Agency Home Page, http://www.trpa.org/ (last visited Feb. 11, 2008).

139. *See* Ohio River Valley Water Sanitation Commission, Home Page, http://www.orsanco.org (last visited Feb. 11, 2008).

140. *See supra* notes 71–74 and accompanying text.

141. *See* Pac. Coast Fed'n of Fishermen's Ass'ns v. Bureau of Reclamation, No. 06-16296, 2007 WL 901580, at *1 (9th Cir. Mar. 26, 2007) (involving the BOR's operation of the Klamath Reclamation Project); Consejo de Desarrollo Economico de Mexicali, A.C. v. United States, 482 F.3d 1157, 1162 (9th Cir. 2007) (noting that the All-American Canal lining is a BOR project); Cent. Delta Water Agency v. Bureau of Reclamation, 452 F.3d 1021, 1024 (9th Cir. 2006) (challenging the BOR's operation of the Central Valley Project); Rio Grande Silvery Minnow v. Keys, 333 F.3d 1109, 1117–18 (10th Cir. 2003) (noting that the BOR is in charge of several federal water projects in the Middle Rio Grande); Concerned Irrigators v. Belle Fourche Irrigation Dist., 235 F.3d 1139, 1141 (8th Cir. 2001) (noting that the BOR constructed the Belle Fourche Irrigation Project in South Dakota).

142. W. Watersheds Project v. Matjeko, 456 F.3d 922, 925 (9th Cir. 2006) (challenging BLM's allowance of diversions on public lands in the Upper Salmon River basin).

143. The 9th Circuit has described the CVP:

> The CVP is the largest federal water management project in the country. It includes two of California's major rivers, the Sacramento and the San Joaquin, which meet at the Sacramento-San Joaquin Delta. The rivers mix at the delta and then flow into San Francisco Bay and ultimately out to the Pacific Ocean. *Cent. Delta Water Agency*, 452 F.3d at 1023. While the Bureau of Reclamation operates the project, the Central Delta Water

ence of anadromous species like salmon and sturgeon involves NMFS,[144] particularly if those species are listed under the ESA.[145] If Native American tribes are present in the watershed, they and the federal Bureau of Indian Affairs potentially become additional regulatory presences,[146] and the tribes may assert claims to reserved water rights, as well as fishing rights that again may both undermine watershed health and provide additional impetus for protecting aquatic habitat.[147] Other federal lands within the watershed may confer regulatory authority or water rights on the BLM,[148] the National Park Service,[149] and/or the U.S. Forest Service.[150] State parks and rec-

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Agency, South Delta Water Agency, and California Water Resources Control Board also play significant roles.

Id. at 1023–24.

144. *See* Nw. Reg'l Office, NOAA's National Marine Fisheries Serv., *Salmon Fishery Management*, http://www.nwr.noaa.gov/Salmon-Harvest-Hatcheries/ Salmon-Fishery-Management/Index.cfm (last updated Dec. 13, 2006); Pac. Fishery Mgmt. Council, *Fishery Management: Background: Salmon*, http://www.pcouncil.org/salmon/salback.html#management (last visited Feb. 11, 2008).

145. Pursuant to the Endangered Species Act, NOAA has listed the following anadromous fish for protection: Atlantic salmon (one distinct population segment ("DPS")); Chinook salmon (nine evolutionary significant units (ESUs)); chum salmon (two ESUs); coho salmon (three ESUs); green sturgeon (one DPS); Gulf sturgeon; shortnose sturgeon; sockeye salmon (two ESUs); and steelhead trout (eleven DPSs). NOAA Fisheries' Office of Protected Res., *Marine/Anadromous Fish Species Under the Endangered Species Act (ESA)*, http://www.nmfs.noaa.gov/pr/species/esa/fish.htm (last visited Feb. 18, 2008).

146. Under the Clean Water Act, Tribes can qualify for Treatment-as-State ("TAS") status. *See* 33 U.S.C. § 1377(e) (2000). Tribes with TAS status can establish their own water quality standards, certify federal activities that could affect their water quality, and issue Clean Water Act permits. *Id.*; *see, e.g.*, Wisconsin v. EPA, 266 F.3d 741, 748–49 (7th Cir. 2001); Montana v. EPA, 137 F.3d 1135, 1140–42 (9th Cir. 1998); City of Albuquerque v. Browner, 97 F.3d 415, 420–24 (9th Cir. 1996).

147. *See, e.g.*, Arizona v. California, 460 U.S. 605, 609–12 (1982); Colorado River Conservation Dist. v. United States, 424 U.S. 800, 804–06 (1976).

148. *See* W. Watersheds Project v. Matjeko, 456 F.3d 922, 925 (9th Cir. 2006).

149. Cappaert v. United States, 426 U.S. 128, 142 (1976) (involving the NPS's claims to reserved water rights for Devil's Hole in Death Valley National Monument); Friends of Yosemite Valley v. Norton, 348 F.3d 789, 792 (9th Cir. 2003) (involving the NPS's management of the Merced River under the Wild & Scenic Rivers Act); Sokol v. Kennedy, 210 F.3d 876, 877 (8th Cir. 2000) (involving the NPS's management of the Niobara Scenic River); United States v. Armstrong, 186 F.3d 1055, 1059 (8th Cir. 1999) (holding that Minnesota had ceded the waters in Voyageurs National Park to the United States).

150. *See, e.g.*, Organized Vill. of Kake v. Egan, 369 U.S. 60, 61–64 (1962) (involving the USFS's role in salmon fish traps on Kupreanof Island, Alaska); Or. Natural Desert Ass'n v. U.S. Forest Serv., 465 F.3d 977, 979–81 (9th Cir. 2006) (involving USFS grazing permits that allowed grazing near Wild and Scenic Riv-

reation areas within the watershed may confer regulatory authority over water on state parks or state lands agencies.[151] At the end of the line, when the fresh water flows into the ocean, additional regulatory authorities become relevant: the state coastal management authorities[152] (which may or may not be the same as any of the other relevant state agencies);[153] NOAA and NMFS; and the relevant regional Fishery Management Council under the Magnuson-Stevens Act.[154]

If this list of regulatory authorities seems absurdly long, it is. Nevertheless, it is an accurate description of the regulatory fragmentation likely to occur in any large watershed. For example, in 1993 the Office of Technology Assessment pointed out that "the Delaware River Basin is divided among four states . . . . Responsibility for water resources alone in this basin is divided among at least 10 agencies in each of the four States and among more than 20 Federal agencies."[155] It also concluded that "[t]he result of this jurisdictional fragmentation is often

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ers in Malheur National Forest); Trout Unlimited v. U.S. Dep't of Agric., 441 F.3d 1214, 1216–17 (10th Cir. 2006) (involving water storage on USFS lands); Friends of Boundary Waters Wilderness v. Bosworth, 437 F.3d 815, 818 (8th Cir. 2006) (involving USFS's management of the Boundary Waters Canoe Area Wilderness); Goodrich v. United States, 434 F.3d 1329, 1331–32 (Fed. Cir. 2006) (involving the USFS's authorization of water use in the Lewis & Clark National Forest); Ctr. for Biological Diversity v. Lueckel, 417 F.3d 532, 534 (6th Cir. 2005) (involving the USFS's compliance with the Wild and Scenic Rivers Act in various Michigan waterways).

151. *E.g.*, ALA. CODE § 9-2-3 (2007); ARIZ. REV. STAT. ANN. § 41-511.05 (2007).

152. State coastal zone management agencies become involved through the federal Coastal Zone Management Act, 16 U.S.C. §§ 1451–1465 (2000), which encouraged coastal states to enact Coastal Zone Management Plans. *Id.* §§ 1454, 1455. At the federal level, the EPA and NOAA jointly administer the Act. *Id.* §§ 1453(16), 1455b(i) (defining "Administrator" to be "the Administrator of the EPA" and "Secretary" to be "the Secretary of Commerce"); NOAA, U.S. Dep't of Commerce, *Ocean and Coastal Resource Management*, http://coastalmanagement.noaa.gov (lodging the Secretary of Commerce's CZMA authority in NOAA's Office of Ocean and Coastal Resource Management).

153. In California, for example, the California Coastal Commission implements the CZMA, CAL. PUB. RES. CODE §§ 30008, 30105, 30300, 30330 (West 2007), while the California Water Resources Board implements both the Clean Water Act and water rights permitting, CAL. PUB. RES. CODE §§ 13191.3, 30412 (West 2007); CAL. GOV'T. CODE § 12812 (West 2007).

154. 16 U.S.C. § 1852 (2000).

155. OFFICE OF TECH. ASSESSMENT, U.S. CONGRESS, PREPARING FOR AN UNCERTAIN CLIMATE, Vol. I, OTA-0-567, 23 (Oct. 1993), *available at* http://www.princeton.edu/~ota/disk1/1993/9338/9338.pdf [hereinafter PREPARING FOR AN UNCERTAIN CLIMATE].

seen in conflicting efforts, high management costs, and foregone opportunities to provide better overall service."[156]

B. Input-Based Regulation and Regulatory Fragmentation

As Section A demonstrates, a number of state and federal agencies can simultaneously exercise jurisdiction over the same water body, each focusing on a particular use of that stream, river, or lake. This Section, in turn, discusses how use-based regulation, a form of input-based regulation, promotes regulatory fragmentation, impeding any government's ability to deal effectively with certain emerging *uber*-problems in water resources management.

1. Input-Based Regulation and the History of Environmental and Natural Resources Law

Richard Lazarus has observed that, "[b]roadly stated, environmental law regulates human activity in order to limit ecological impacts that threaten public health and biodiversity."[157] As such, "[e]nvironmental law must necessarily be responsive to the types of problems it seeks to address, including the physical causes and effects of environmental degradation."[158]

These statements suggest that environmental and natural resources law could adopt at least two approaches to regulation. First, law could focus on input-based regulation, setting standards to limit contributions to environmental problems from designated human activities. These input-based standards are generally based on the controls actually available to those activities, such as technologies to reduce emissions or management practices to minimize pollution creation. Alternatively, law could focus on output-based regulation, setting regulatory standards based on desired measures of environmental quality.

Of course, these categories are not perfectly divided. Output-based regulation in particular will still have to connect its environmental standards to individual sources and inputs to be effective. Nevertheless, as a practical matter, the two approaches embody significant differences in regulatory philoso-

156. *Id.* at 25.
157. LAZARUS, *supra* note 13, at 1.
158. *Id.* at 5.

phy. Input-based regulation is usually pragmatic, relying on cost-efficient and readily available means to reduce environmental harms. Economically feasible, technology-based pollution control standards are a quintessential example of input-based regulation.[159]

In contrast, output-based regulation often signals that environmental goals are the top regulatory priority, with the result that regulatory requirements are often characterized as overzealous[160] or "technology-forcing."[161] The Clean Air Act's health-based National Ambient Air Quality Standards ("NAAQS") are an example of this kind of output-based regulation, and even courts and the EPA have suggested that immediate compliance had "draconian" consequences for the economy.[162] Similarly, standards and civil penalties to reduce discharges of toxic water pollutants have also been viewed as overzealously "draconian."[163]

In other words, the difference between input-based and output-based approaches often reflects the level of true commitment to an environmental goal. Indeed, this difference in approach often underscores the difference between regulating to promote what can be done relatively comfortably and without significantly disrupting business as usual, and regulating

159. *See, e.g.*, 33 U.S.C. § 1311(b) (2000) (establishing the technology-based effluent limitations for the Clean Water Act and the timetable for their implementation).

160. Eidson Elec. Inst. v. EPA, 996 F.2d 326, 335 (D.C. Cir. 1993) (describing the "land ban" in the Resource Conservation and Recovery Act as "draconian"); Platte Whooping Crane Critical Habitat Maintenance Trust v. FERC, 962 F.2d 27, 32 (D.C. Cir. 1992) (describing possible measures to protect endangered species from a hydroelectric dam as "draconian"); Delaney v. EPA, 898 F.2d 687, 690 (9th Cir. 1990) (describing Clean Air Act State Implementation Plan deadlines as "draconian").

161. Riverkeeper, Inc. v. EPA., 475 F.3d 83, 99 (2d Cir. 2007) (quoting Natural Res. Def. Council, Inc. v. EPA, 822 F.2d 104, 123 (D.C. Cir. 1987), for the proposition that the Clean Water Act's environment-protecting thermal discharge standards in Section 316 are "technology-forcing"); Crete Carrier Corp. v. EPA, 363 F.3d 490, 491 (D.C. Cir. 2004) (referring to the Clean Air Act standards for heavy-duty vehicles as "technology-forcing").

162. Union Elec. Co. v. EPA, 427 U.S. 246, 272 (1976) (Powell, J., concurring); Trustees for Alaska v. Fink, 17 F.3d 1209, 1211 (9th Cir. 1994); Coal. for Clean Air v. S. Cal. Edison Co., 971 F.2d 219, 223 (9th Cir. 1992) (quoting the EPA); Delaney v. EPA, 898 F.2d 687, 690 (9th Cir. 1990) (summarizing the EPA's view); Union Elec. Co. v. EPA, 593 F.2d 299, 307 n.10 (8th Cir. 1979) (quoting Union Elec. Co. v. EPA, 427 U.S. 246, 272 (1976) (Powell, J., concurring)).

163. Friends of the Earth, Inc. v. Laidlaw Envtl. Servs. (TOC), Inc., 956 F. Supp. 588, 595 (D.S.C. 1997); Hudson River Sloop Clearwater, Inc. v. Consol. Rail Corp., 591 F. Supp. 345, 351 (N.D.N.Y. 1984).

to accomplish whatever needs to be done to achieve sustainably a defined level of environmental health.

Input-focused regulation has dominated environmental and natural resources law, concentrating regulatory attention on emissions, technological controls, best management practices, and access limitations.[164] However, this input-focused approach may impede the evolution of environmental and natural resources law to ecosystem-based approaches. As Robert Adler has recently described that evolution, "[f]irst, we tried to mitigate the increasingly severe environmental damage caused by our accelerating industrial economy and our thirst for more and bigger things."[165] Adler analogizes: "Mitigation is somewhat like a paramedic treating an accident victim. The immediate task is to stop the bleeding and to minimize the resulting harm."[166] At the second stage of environmental law's evolution, the focus shifted to

> *prevent*[ing] environmental harm by providing the same or similar goods and services in ways that cause less damage to the environment, thereby avoiding the debates over the value of environmental mitigation. This second-phase strategy is like the efforts of an epidemiologist to prevent accidents and causes of disease in the first place, rather than treating patients once they become injured or ill.[167]

Although Adler does not emphasize this point, input-based regulation is acceptable, perhaps even necessary, because both mitigation and prevention tend to focus on individual sources of specific environmental problems—the factories emitting smoke

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164. To provide just three non-water examples: The Clean Air Act imposes technology-based standards on stationary and mobile sources to limit pollutant emissions into the air. *See* 42 U.S.C. §§ 7661–7661f (2000). The Resource Conservation and Recovery Act ("RCRA") imposes technological requirements on waste disposal facilities to prevent contamination of land and ground water. *See id.* §§ 6901, 6902, 6921–6926, 6944, 6945 (2000). The Magnuson-Stevens Fisheries Conservation and Management Act requires regional Fisheries Management Councils to create Fisheries Management Plans to manage the fishing of commercially important species, often through restrictions on fishing gear and fishing seasons. *See* 16 U.S.C. §§ 1852(a), 1853 (2000). *See also* LAZARUS, *supra* note 13, at 72 (describing Congress's deliberate turn from water quality standards to source permit requirements in the Clean Water Act); *id.* at 174–75 (describing the evolution of source-based requirements in the Clean Air Act); *id.* at 232–33 (describing the evolving attention to diffuse sources).

165. ADLER, *supra* note 1, at 7.

166. *Id.* at 8.

167. *Id.*

into the atmosphere, the public facilities discharging raw sewage into the waterways, the fishers who catch overfished species and vulnerable bycatch species, the activities that kill animals whose species is at risk of extinction. In other words, mitigation and prevention efforts generally focus on regulatory inputs—the "what is being added or done to" the environment—in order to reduce relatively quickly obvious environmental stresses.

If the immediate goal is reduction of harm, or even prevention of future harm of the same type, this input focus can accomplish a fair amount. When dischargers became subject to technology-based effluent limitations pursuant to the Clean Water Act, rivers stopped burning.[168] When the EPA demanded, pursuant to the Clean Air Act, that lead be taken out of gasoline, blood lead levels in most children dropped below the lead poisoning threshold.[169] A moratorium on whale hunting removed the most immediate threat to these species' survival and even allowed some species to partially recover.[170] However, once those initial efforts are made—in Adler's termi-

168. *See* U.S. EPA, WATERSHED APPROACH FRAMEWORK: SECTION: NEED FOR WATERSHED APPROACHES, EPA 800-F-96-001 (1996), http://www.epa.gov/owow/watershed/framework/ch4.html.

169. It is estimated that in the 1970s, 88% of children in the United States had blood-lead levels greater than 10 micrograms per liter, which defines lead poisoning. *See* Lead Poisoning Resource Center, http://www.aboutlead.com (last visited Feb. 29, 2008); Jamie Lincoln Kitman, *The Secret History of Lead*, THE NATION, Mar. 20, 2000, *available at* http://www.mindfully.org/Pesticide/Lead-History.htm. Today, only about 4% of children suffer from lead poisoning. Lead Poisoning in Children, http://familydoctor.org/617.xml (last updated Nov. 2006); *see also* Ctrs. for Disease Control & Prevention, General Lead Information: Questions and Answers, http://www.cdc.gov/nceh/lead/faq/about.htm (last visited Feb. 29, 2008) ("Approximately 310,000 U.S. children aged 1-5 years have blood lead levels greater than [the CDC recommended level of] 10 micrograms of lead per deciliter of blood," representing "3% of black children compared to 1.3% of white children.").

170. *See, e.g.*, PETER J. BRYANT, BIODIVERSITY AND CONSERVATION: CHAPTER 7: WHALES AND WHALING: RECOVERY OF SOME POPULATIONS (2002), http://darwin.bio.uci.edu/~sustain/bio65 (follow "Whales and Whaling" hyperlink) (noting that since the whaling moratorium, some species have at least partially recovered); Office of Protected Resources, Nat'l Marine Fisheries Serv., NOAA, Draft Recovery Plan for the Fin Whale (Balaenoptera Physalus) vii (June 2006), *available at* http://www.nmfs.noaa.gov/pr/pdfs/recovery/draft_finwhale.pdf (noting that the fin whale populations are expected to be recovering); USFWS Threatened and Endangered Species System, http://ecos.fws.gov/speciesProfile/ SpeciesReport.do (follow "*Eschrichtius robustus*" hyperlink) (last modified Sept. 26, 2000) (noting that the gray whale enjoys the distinction of having recovered to the point of being removed from the endangered species list).

nology, once we stop the bleeding and eliminate the immediate danger—it turns out that "the environment" is more complex than environmental law usually acknowledges,[171] especially when one starts to think about restoring and maintaining ecosystem health.

2. The Limitations of Input-Based Regulation of Water Resources: The Example of Mercury Deposition

If, as Richard Lazarus has stated, "[e]nvironmental law's challenge is to regulate, where possible, the process of ecological transformation[,]"[172] understanding the overall scope and complexity of that transformation and then setting ecosystem-based—that is, output-focused—goals to limit or reverse that transformation would seem to be necessary first steps. As the discussion in Section A detailed, regulatory authority over water resources is divided among a variety of agencies according to the particular uses (hydropower, water diversions, waste assimilation) that regulated entities are making of the water, or according to particular values (navigation, habitat) that the relevant government wants to preserve. Because regulatory authority is based on particular uses and the specific problems either that users cause (overappropriation, polluted water) or that interfere with desired uses (channel blockage), the regulation of freshwater resources to date has consisted almost entirely of medium-specific, source-based regulation—that is, input-based regulation.

Input- or use-based regulation need not lead to regulatory fragmentation. For example, one could imagine a single regulatory entity with plenary authority over all water uses, just as the EPA regulates a variety of different kinds of environmental pollution. Moreover, other factors besides use-based regulation certainly contribute to regulatory fragmentation. Thus, structurally, the federal/state jurisdictional overlap suggests a starting cause of water's regulatory fragmentation. The historical evolution of important uses of waters and of regulation of those uses has also contributed to input-focused regulatory fragmentation. For example, the federal government was concerned

171. *See, e.g.*, LAZARUS, *supra* note 13, at 6–8 (discussing the complexity of Earth's ecosystems).

172. *Id.* at 8.

about preserving navigation long before it was concerned about hydropower or water pollution, and this historical progression helps to explain the uneasy divisions of regulatory authority among the Army Corps, FERC, and the EPA.

However, at the legislative level, the input- or use-based focus has as a practical matter promoted the current fragmentation of water resource management authority. In particular, the various uses of water, and their differing impacts on the relevant water resource, suggest why even further divided, source-based, input-focused regulation is the norm. The result is a water resource management regime that largely ignores the interplay of various uses in favor of a variety of (often conflicting) management goals and standards.

Nevertheless, current understanding of the complexity of the impacts on water resources shows that input-based regulation alone is insufficient to address identified environmental *uber*-problems. These *uber*-problems are multi-source, interjurisdictional, and cross-media (fresh water, salt water, and air) problems that no one regulatory authority or one set of sources currently has the regulatory capacity to redress. In other words, input-based regulation and its associated regulatory fragmentation impede necessary improvements in water resource management. Climate change, of course, is the looming environmental and natural resource *uber*-problem of the 21st century, but other such problems have been recognized.

For example, in many waterbodies, atmospheric deposition of mercury[173] can account for over 90% of existing mercury pollution.[174] However, as the very phrase "atmospheric deposi-

173. *See generally* U.S. EPA, FREQUENTLY ASKED QUESTIONS ABOUT ATMOSPHERIC DEPOSITION: A HANDBOOK FOR WATERSHED MANAGERS, EPA-453/R-01-009 (2001), *available at* http://www.epa.gov/air/oaqps/gr8water/handbook/index.html; *see also* FOOD & DRUG ADMIN. & U.S. EPA, WHAT YOU NEED TO KNOW ABOUT MERCURY IN FISH AND SHELLFISH, EPA-823-F-04-009 (2004), *available at* http://www.epa.gov/waterscience/fishadvice/advice.html [hereinafter WHAT YOU NEED TO KNOW ABOUT MERCURY IN FISH AND SHELLFISH].

174. The EPA has identified mercury as one of the five most important categories of atmospheric deposition pollutants, U.S. EPA, Air Deposition: Assessment and Monitoring: Which Atmospheric Deposition Pollutants Pose the Greatest Problems for Water Quality?, http://www.epa.gov/owow/oceans/airdep/air2.html, and atmospheric deposition of mercury is a significant—indeed, often the primary—source of mercury pollution in many waters. U.S. EPA, GREAT WATERS: THIRD REPORT TO CONGRESS II-6,2000, *available at* http://www.epa.gov/ttn/oarpg/t3/reports/ch2_2kf.pdf (identifying atmospheric deposition as the primary source of mercury pollution of the Great Lakes); U.S. EPA, THE EVERGLADES TMDL

tion" suggests, the source of this mercury pollution is not industrial or municipal effluent discharges, the primary targets of the federal Clean Water Act, but rather emissions of mercury into the air.[175] So far as these air emissions come from domestic sources (and, admittedly, much mercury so deposed is from international sources), these inputs are most naturally the subject of Clean Air Act regulation, but the environmental outputs clearly invoke water quality concerns.

However, regulatory complications from atmospheric deposition of mercury do not end with a simple choice between the Clean Water Act and the Clean Air Act. The most important problem resulting from mercury pollution, for all metrics—ecosystem health, human health and overall water quality, is the bioaccumulation of methylmercury in fish tissue,[176] a biological process that allows fish to become more toxic than the water in which they swim.[177] Mercury-contaminated fish is a food-related health issue for humans, giving the federal Food and Drug Administration ("FDA") some jurisdiction over the mercury pollution issue.[178] However, mercury contamination of fish is also a survival issue for many species higher up the food web. In Florida, for example, officials have designated

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PILOT FINAL REPORT AND RECENT FINDINGS (2003), http://www.epa.gov/owow/tmdl/everglades_fs.html (identifying atmospheric deposition as a significant source of mercury contamination in the Everglades); U.S. EPA, TOTAL MAXIMUM DAILY LOAD (TMDL) DEVELOPMENT FOR TOTAL MERCURY IN THE OCHLOCKONEE WATERSHED, GEORGIA 2 (2002), *available at* http://www.epa.gov/Region4/mercury/documents/OchlockoneeHgFinalTMDL.pdf (estimating that "over 99 percent of the pollutant loads to the River come from the atmosphere") [hereinafter GEORGIA MERCURY TMDL].

175. *See generally* GEORGIA MERCURY TMDL, *supra* note 174.

176. "Human health concerns arise when fish and wildlife from these ecosystems are consumed by humans." U.S. DEP'T OF THE INTERIOR & U.S. GEOLOGICAL SURVEY, MERCURY CONTAMINATION OF AQUATIC ECOSYSTEMS, FS-216-95, at 1 (1995), *available at* http://water.usgs.gov/wid/FS_216-95/FS_216-95.pdf.

177. Mercury bioaccumulates and biomagnifies in the fatty tissues of organisms that, because of contamination of their environment, continually consume mercury, with the result that the fish and wildlife consumed by humans and other animals high on the food chain can contain mercury in concentrations far greater than the mercury concentrations in the ambient water. *Id.*

178. For example, the EPA relied heavily on the FDA's action level for mercury-contaminated fish when the EPA established two human health criteria for the ambient waters in 1986. OFFICE OF WATER, U.S. EPA, QUALITY CRITERIA FOR WATER 1986 ("Gold Book"), EPA 440/5-86-001, 173–77(1986), *available at* http://www.epa.gov/waterscience/criteria/goldbook.pdf. More recently, the FDA and the EPA issued a mercury-contaminated fish advisory for pregnant women. WHAT YOU NEED TO KNOW ABOUT MERCURY IN FISH AND SHELLFISH, *supra* note 173.

mercury contamination in prey (in this case, raccoons which eat the mercury-contaminated fish) as the cause of at least one death among critically endangered Florida panthers,[179] which are listed for protection under the federal ESA and hence fall within the USFWS's jurisdiction.[180] Finally, atmospheric deposition of mercury in the fresh waters also contributes to methylmercury bioaccumulation in marine fish. While marine *fishing* falls within the jurisdiction of NOAA,[181] the regional FMCs,[182] and the states,[183] marine fish *contamination* is a bit of a regulatory orphan, slipping through the Clean Water Act's state/federal regulatory interstices and the ESA's listing requirement to almost purely reactive state public health measures. As a result, many saltwater species are now subject to state fish consumption advisories,[184] often based on FDA crite-

179. In 1989, officials found a dead Florida panther from the Everglades National Park with 110 ppm of mercury in her liver; mercury poisoning was attributed as the cause of death. Florida PantherNet, http://myfwc.com/panther/handbook/threats/mercury.html (last visited Mar. 29, 2008). Panthers are thought to ingest bioaccumulated mercury when they eat raccoons, which in turn eat mercury-contaminated fish. *Id.*; *see also* MICHAEL R. DUNBAR, FLA. GAME & FRESH FISH COMM'N, FLORIDA PANTHER BIOMEDICAL INVESTIGATIONS: FINAL PERFORMANCE REPORT 352–55 (1994), *available at* http://myfwc.com/panther/ handbook/references/dunbar.pdf; Florida Panther Society, Inc., http://panthersociety.org/mercury.html#exec (last visited Feb. 29, 2008); NCCOS: News—Does Everglades Restoration Mean More Florida Bay Mercury?, http://coastalscience.noaa.gov/news/feature/0903.html (last updated Nov. 6, 2006) (suggesting that three panthers have died from mercury poisoning).

180. *See* Draft Environmental Assessment (EA) for "Guidelines for Living with Florida Panthers and the Interagency Florida Panther Response Plan" and Notice of Receipt of an Application for Amendment to an Endangered Species Permit, 71 Fed. Reg. 30,156 (May 25, 2006); Notice of Availability Technical/Agency Draft of the Third Revision of the Florida Panther Recovery Plan for Review and Comment, 71 Fed. Reg. 5066, 5066–67 (Jan. 31, 2006).

181. 16 U.S.C. §§ 1802(39), 1851(b), 1854 (2000). The Act assigns regulatory authority to the Secretary of Commerce, but within the Commerce Department, NOAA's Office of Sustainable Fisheries, part of NMFS, implements the Magnuson-Stevens Act. NOAA, Welcome to the Office of Sustainable Fisheries, http://www.nmfs.noaa.gov/sfa/sfweb (last visited Mar. 27, 2008).

182. 33 U.S.C. § 1852(a)(1) (2000).

183. *Id.* § 1856.

184. *See* U.S. EPA, National Maps and Graphics (PowerPoint presentation), Fish Consumption Advisories for Mercury, 2004, Slide 7 (Sept. 2005), http://www.epa.gov/waterscience/presentations/fish-2004/ (last visited Feb. 25, 2008); U.S. EPA, National Listing of Fish Advisories, http://134.67.99.49/scripts/esrimap.dll?name=Listing&Cmd=StContacts (last visited Feb. 29, 2008).

ria and recommendations,[185] with little regulatory focus on connecting mercury inputs to these ecological outputs.

Thus, input-based regulation and its resulting regulatory fragmentation create at least two shortcomings in water resource management. First, problems such as mercury deposition and climate change are arising that no entity has sufficient regulatory authority to comprehensively or coherently address. Second, no one regulatory authority is charged with looking at the resource (or ecosystem or watershed) as a whole. The next Section discusses this second limitation in greater detail.

C. Ecosystem-Based Regulation and Output Measures

Atmospheric deposition of mercury provides one example of how fragmented input-based regulation can be insufficient to meet ecosystem- or public-health-based output goals. Nor is atmospheric deposition an isolated example. As scientific interest and environmentalist attention increasingly focus upon ecosystems[186] (especially large ecosystems such as watersheds[187]), ecosystem function,[188] ecosystem services, [189] and

185. *See, e.g.*, Food & Drug Admin., *Mercury in Fish: Cause for Concern*, FDA CONSUMER MAG., Sept. 1994 (as revised 1995), *available at* http://www.fda.gov/fdac/reprints/mercury.html.

186. For representative recent examples, see ADLER, *supra* note 1, at xx–xxi (outlining the deep questions of Colorado River ecosystem restoration); Donna R. Christie, *Implementing an Ecosystem Approach to Ocean Management: An Assessment of Current Regional Governance Models*, 16 DUKE ENVTL. L. & POL'Y F. 117, 117 (2006) (noting that the two ocean commissions stressed an ecosystem-based approach); Robin Kundis Craig, *Taking the Long View of Ocean Ecosystems: Historical Science, Marine Restoration, and the Oceans Act of 2000*, 29 ECOLOGY L.Q. 649, 673–97 (2002) (discussing restoration efforts for marine ecosystems and the scientific problem of baselines); Jeremy B.C. Jackson et al., *Historical Overfishing and the Recent Collapse of Coastal Ecosystems*, 293 SCIENCE 629, 629–37 (2001); E.K. Pikitch et al., *Ecosystem-Based Fishery Management*, 305 SCIENCE 346–47 (2004).

187. *See* ADLER, *supra* note 1, at 177 (noting restoration efforts "for large aquatic ecosystems such as the Chesapeake Bay, the San Francisco Bay delta, and the Everglades . . . were prompted initially by more traditional concerns about chemical pollutants. But all evolved into efforts that focus more broadly on a range of chemical, physical, and biological impairments, because eliminating individual sources of harm did not suffice in restoring the integrity of whole ecosystems"); U.S. EPA, DRAFT HANDBOOK FOR DEVELOPING WATERSHED PLANS TO RESTORE AND PROTECT OUR WATERS, EPA 841-B-05-005, at 2-4 (Oct. 2005), *available at* http://www.epa.gov/owow/nps/watershed_handbook/pdf/ch02.pdf (advocating the development of watershed plans for water quality management and advising that a "watershed plan should address a geographic area large enough to ensure that

overall ecosystem health,[190] the limitations of fragmented input-focused regulatory regimes are becoming apparent in a variety of contexts, including marine ecosystem preservation, fisheries management, and terrestrial biodiversity protection:

> Irreversible effects are one obvious result of the increased pace of [ecological] change. . . . Even "flow" resources, which

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implementing the plan will address all the major sources and causes of impairments and threats to the waterbody under review") [hereinafter 2005 DRAFT WATERSHED HANDBOOK]; Bruce A. Wilcox, *Ecosystem Health in Practice: Emerging Areas of Application in Environmental and Human Health*, 7 ECOSYSTEM HEALTH 317, 319 (2001) ("Ecosystem health's potential for indicator based assessment and monitoring probably will best be realized in its application to catchments (or watersheds).").

188. *See, e.g.*, J.P. Grime, *Biodiversity and Ecosystem Function: The Debate Deepens*, 277 SCIENCE 1260, 1260–61 (1997); M. Loreau et al., *Biodiversity and Ecosystem Functioning: Current Knowledge and Future Challenges*, 294 SCIENCE 804, 804–08 (2001); P.V. Sundaresher et al., *Phosphorus Limitation of Coastal Ecosystem Processes*, 299 SCIENCE 563, 563–65 (2003); David A. Wardle et al., *Island Biology and Ecosystem Functioning in Epiphytic Soil Communities*, 301 SCIENCE 1717, 1717–20 (2003).

189. *See* J.B. RUHL, ET AL., THE LAW AND POLICY OF ECOSYSTEM SERVICES 15 (2007):

> [I]t is important not to confuse ecosystem *functions*, which are ubiquitous, with ecosystem *services*, which are the consequence of only some ecosystem functions. The critical difference between the two . . . is that ecosystem services have relevance only to the extent *human* populations benefit from them. They are purely anthropocentric.

Id. Ecosystem services intrigue researchers in a variety of fields. *See generally* NAT'L RESEARCH COUNCIL, NAT'L ACADEMIES, VALUING ECOSYSTEM SERVICES: TOWARD BETTER ENVIRONMENTAL DECISIONMAKING (2005); NATURE'S SERVICES, SOCIETAL DEPENDENCE ON NATURAL ECOSYSTEMS (Gretchen C. Daily ed., 1997); Robert Costanza et al., *The Value of the World's Ecosystem Services and Natural Capital*, 387 NATURE 253, 253–59 (1997); David Pearce, *Ecological Accountancy*, 277 SCIENCE 1783 (1997); J.B. Ruhl, *Ecosystem Services and the Common Law of "The Fragile Land System,"* NAT. RESOURCES & ENV'T, Fall 2005, at 3; James Salzman, *A Field of Green? The Past and Future of Ecosystem Services*, 21 J. LAND USE & ENVTL. L. 133 (2006); Boris Worm et al., *Impacts of Biodiversity Loss on Ocean Ecosystem Services*, 314 SCIENCE 787, 787–90 (2006).

190. *See, e.g.*, ECOSYSTEM HEALTH: NEW GOALS FOR ENVIRONMENTAL MANAGEMENT (Robert Costanza et al. eds., 1992); ROSS W. GORTE, CRS REPORT FOR CONGRESS: FOREST ECOSYSTEM HEALTH: AN OVERVIEW (Feb. 21, 2001); U.S. DEP'T OF AGRIC., AN ASSESSMENT OF FOREST ECOSYSTEM HEALTH IN THE SOUTHWEST (Cathy W. Dahms & Brian W. Geils eds., 1997); Gregory A. Hicks, *Managing State Trust Lands for Ecosystem Health: The Case of Washington State's Range and Agricultural Lands*, 6 HASTINGS W.-N.W. J. ENVTL. L. & POL'Y 1 (1999); Jocelyn Kaiser, *Getting a Handle on Ecosystem Health*, 276 SCIENCE 887 (1997); Robert T. Lackey, *Values, Policy, and Ecosystem Health*, 51 BIOSCIENCE 437, 437–43 (2001); Ganapati P. Patil et al., *Ecosystem Health and Its Management at a Landscape Scale*, ECOSYSTEM HEALTH, Dec. 2001, at 307–16.; Wilcox, *supra* note 187, at 317–25.

> are theoretically renewable to the extent that their supplies may be replenished by natural processes, can become irretrievably lost when the pace of their consumption outstrips the potential for their replenishment.
>
> The now-looming threatening cataclysmic collapses within various aquatic ecosystems suffering from overexploitation are emblematic of the problem. Technological advances in commercial fishing techniques have decimated fishing grounds that not long ago were considered too enormously abundant to be threatened. The rapid destruction of wetlands risks destroying an essential ecological link between land and water ecosystems, both as a place of interaction and redistribution and as an important buffer protecting one system from the excesses of the other.[191]

However, an ecosystem-based approach to environmental and natural resources law means both that output goals and measures should play a larger role in regulation and that environmental law needs to address multiple media and multiple resources simultaneously. While some output-focused requirements do exist in the current federal laws, they are rarer than input-based regulation and remain focused on specific resources or media. Perhaps the most obvious example is NEPA's "requirement that each federal agency assess and consider the significant environmental impacts of its actions and alternative courses of action before the agency acts . . . ."[192] However, NEPA imposes no substantive output requirements on federal agencies.[193] With regard to substantive requirements, the Clean Air Act requires the EPA to set NAAQS, general health-based national standards for air quality, which all areas of the country are (eventually) supposed to attain.[194] The Clean Water Act encourages states (with the EPA acting

191. LAZARUS, *supra* note 13, at 11.

192. *Id.* at 68; *see* National Environmental Policy Act of 1969, 42 U.S.C. § 4332(2)(C) (2000 & Supp. V 2005).

193. Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 350–51 (1989) (citing Strycker's Bay Neighborhood Council v. Karlen, 444 U.S. 223, 227–28 (1980) (*per curiam*); Vermont Yankee Nuclear Power Corp. v. Natural Res. Def. Council, Inc., 435 U.S. 519, 558 (1978)).

194. 42 U.S.C. § 7409 (2000); *see also* LAZARUS, *supra* note 13, at 17 ("National ambient air quality standards for particulate matter under the federal Clean Air Act, for instance, have to take into account not just one source of particulate matter, but all possible sources, both regulated and unregulated, natural and man-made.").

as the backup) to set water quality standards for specific waterbodies, and these standards establish the water quality goals for those water segments.[195] The Magnuson-Stevens Act requires NOAA and the regional Fisheries Management Councils to establish optimum yields, defined as "maximum sustainable yield" limits, for each federally managed fishery.[196]

Nevertheless, none of these output measures is required to take into account larger ecosystem effects or to be set with the goal of protecting the overall health and function of the relevant ecosystem(s). NAAQS focus on human health,[197] which is often but not always the most sensitive impact of air pollution.[198] Water quality standards support whatever the state or the EPA decides the designated use of the water segment should be, not the needs of the aquatic ecosystem *per se*, despite minimal requirements that waters be fishable and swimmable.[199] Even commercial fishing regulation, which has evolved to be more sensitive to general impacts on the relevant ecosystem, such as through bycatch,[200] remains primarily fo-

195. 33 U.S.C. § 1313(a)–(c) (2000).

196. 16 U.S.C. §§ 1802(28) (2000) (defining "optimum"), 1802(29) (defining "overfished"), 1853(a)(3) (requiring a fishery management plan to assess maximum sustainable yield and optimum yield) (West, Westlaw through 2007 amendments); *see also* U.S. COMM'N ON OCEAN POLICY, FINAL REPORT: AN OCEAN BLUEPRINT FOR THE 21ST CENTURY 287 (2004), *available at* http://www.oceancommission.gov/documents/full_color_rpt/welcome.html#full [hereinafter AN OCEAN BLUEPRINT]:

> Recognizing the dangers posed by overfishing, managers began to regulate fishermen by placing controls either on input or output. Input controls include such measures as closing access to fisheries by limiting permits, specifying allowable types and amounts of gear and methods, and limiting available fishing areas or seasons. Output controls include setting total allowable catch (the amount of fish that may be taken by the entire fleet per fishing season), bycatch limits (numbers of non-targeted species captured), and trip or bag limits for individual fishermen.

Id.

197. 42 U.S.C. § 7409(b)(1) (2000).

198. As one example, if the EPA regulates carbon dioxide under the Clean Air Act, the welfare effects of climate change are far more likely to set the NAAQS standards than the health effects of atmospheric carbon dioxide.

199. 33 U.S.C. § 1313(c) (2000); *see also* ADLER, *supra* note 1, at 177 (noting that Clean Water Act-based restoration efforts in the Chesapeake Bay, the San Francisco Bay delta, and the Everglades had to evolve beyond the Clean Water Act to "focus more broadly on a range of chemical, physical, and biological impairments, because eliminating individual sources of harm did not suffice in restoring the integrity of whole ecosystems").

200. 16 U.S.C. §§ 1801(c)(3), 1802(2), 1851(a)(9), 1853(a)(11) (2000 & Supp. V 2005).

cused on the species being fished.[201] Indeed, as evidence of their lack of an ecosystem focus, each of these requirements uses only a single metric to determine the relevant regulatory standard.

This legal elision of ecosystem-level output measures and goals is increasingly becoming an ecological and a policy handicap. Indeed, while medium- and resource-specific statutory regimes remain the norm, administrative agencies are increasingly attempting to address ecological issues—such as atmospheric deposition of mercury—that do not fit neatly or completely into any single statutory regime.

Environmental law's general lack of output measurements and goals—especially broad-based output measurements that assess the functional capacity of ecosystems and goals that establish the desired functions of those ecosystems—raises the question of whether non-adaptive[202] or minimally adaptive[203] input-focused regulation can achieve ecological sustainability, especially in the face of climate change. Indeed, this is the key issue for the next iteration of environmental and natural resources law. To again quote Robert Adler:

> The third, most recent modern environmental strategy . . . is to take affirmative steps to restore the health of ecosystems that have been altered or damaged by our past actions. Restoration is the holistic medicine of environmental policy. Holistic medicine might help a patient to recover and to

201. *See* 16 U.S.C. § 1853(a) (2000) (addressing only the fishery being regulated in 14 out of 15 required components of a fishery management plan).

202. Most federal environmental and natural resources statutes, for example, work by imposing general or national requirements on the target sources. *See, e.g.*, the Clean Water Act, 33 U.S.C. § 1311(b) (2000) (establishing technology-based effluent limitations); the Clean Air Act, 42 U.S.C. §§ 7411, 7412, 7473, 7503, 7521, 7571, 7651(c), 7651(d), 7661(c) (2000) (establishing a variety of technology-based emissions standards); the Endangered Species Act, 16 U.S.C. §§ 1536, 1538 (2000) (establishing federal agency consultations and "take prohibitions").

203. For example, the Clean Water Act contains several mechanisms, such as water quality-based effluent standards and total maximum daily loads, to ensure that regulators adjust national, industry-wide technology-based effluent standards to meet the water quality needs (as defined by the relevant state) of particular waterbodies. 33 U.S.C. §§ 1312, 1313(d) (2000). Similarly, the Clean Air Act requires that, eventually, the EPA will adjust industry-wide technology-based national emissions standards for hazardous air pollutants (NESHAPs) to address any residual health issues. 42 U.S.C. § 7412(f)(1), (2) (2000). Neither statute, however, requires comprehensive review of the technology-based standards to meet more general ecosystem goals.

> prevent further illness through a combination of treatment, exercise, stress relief, diet, and other changes in lifestyle. It requires us to look at the whole patient rather than individual symptoms or body parts. In some cases, it requires the patient to choose between good health and cheeseburgers. To that extent, holistic medicine combines elements of prevention as part of a broader strategy of restoring and maintaining a patient's health.
>
> Similarly, environmental restoration requires us to look at all parts of the ecosystem's anatomy and physiology . . . . It requires us to make hard choices about the value of a healthy environment compared to material wealth, such as the choice between water for off-stream economic use and the value of a free-flowing river.[204]

However, this holistic, ecosystem-based strategy requires three major changes to the current system of fragmented regulation: (1) an assessment of both current and desired regulatory outputs—that is, the states of ecosystem function and health that currently exist and that are desired for the future; (2) regulatory mechanisms that can effectively address cross-media, multi-resource, and multi-jurisdictional problems that impair the relevant ecosystem functions; and, ultimately, (3) political decisions about what the priority goal(s) of environmental and natural resource regulation should be, both generally and for particular ecosystems, coupled with the political will to enforce those priorities.

D. Watersheds as a Regulatory Starting Point

Ecosystem-focused regulatory regimes may eventually become so comprehensive that they seek to address simultaneously all human activities affecting ecosystems and their interactions and effects on human and ecological welfare—a regulatory scope much along the lines of the study scope of the Millennium Ecosystem Assessment.[205] This Article is not nearly so ambitious. Instead, this Article proposes to begin by focusing on watersheds and aquatic ecosystems, emphasizing the

204. ADLER, *supra* note 1, at 9 (citation omitted).

205. Millennium Ecosystem Assessment, Overview of the Millennium Ecosystem Assessment, http://www.millenniumassessment.org/en/About.aspx# (last updated 2005).

relatively simple need to recognize the connections between regulation of freshwater ecosystems and marine ecosystems.

The EPA, for example, has concluded that "[a] watershed approach is the most effective framework to address today's water resource challenges."[206] In accord with this Article, the EPA has emphasized that the laws addressing water pollution, landscape modification, changes in water flow, overharvesting of fish, toxic pollution and bioaccumulation "have tended to focus on particular sources, pollutants, or water uses and have not resulted in an integrated environmental management approach. Consequently, significant gaps exist in our efforts to protect watersheds from the cumulative impacts of a multitude of activities."[207] A watershed approach has several advantages, including allowing water resource managers to identify cumulative effects and priority problems and to establish output goals ("environmental indicators") that can both guide regulatory efforts and measure success.[208] Such environmental indicators often reflect the particular characteristics and vulnerabilities of the aquatic ecosystem in question. For the Gulf of Mexico and the Mississippi River, for example, nutrient concentrations are particularly important environmental indicators; for the Florida Keys' coral reefs, ocean temperatures and pH may be far more important, although nutrients still play a role.

As the EPA recognizes, therefore, a watershed approach to water resources management has much to commend it, structurally. Nevertheless, regulatory fragmentation substantively weakens *any* attempts by regulatory authorities—state, interstate, or federal—to implement a comprehensive watershed approach. Again, the federal EPA provides a good example. First, the EPA has no regulatory authority to deal with certain water-related resource issues, such as aquatic endangered spe-

206. Office of Wetlands, Oceans, and Watersheds, U.S. EPA, A Watershed Approach, http://www.epa.gov/owow/watershed/approach.html (last updated Apr. 20, 2007).

207. Office of Wetlands, Oceans, and Watersheds, U.S. EPA, Need for Watershed Approaches, http://www.epa.gov/owow/watershed/framework/ch4.html (last updated May 8, 2007).

208. Office of Wetlands, Oceans, and Watersheds, Benefits Derived from Taking a Watershed Approach, http://www.epa.gov/owow/watershed/framework/ch5.html (last updated May 8, 2001); *see also* 2005 DRAFT WATERSHED HANDBOOK, *supra* note 187, at 4-8 to 4-17, 9-3 (emphasizing the need to develop watershed goals based on selected environmental indicators, to link those goals and indicators, and to translate watershed goals into management objectives).

cies protection, fisheries regulation, or, in most cases, water allocation.[209] Second, even with respect to pollution regulation, the EPA's legal authority to implement a watershed program under the Clean Water Act is questionable,[210] which helps to explain why the EPA has focused on encouraging state efforts rather than imposing federal requirements. As a result, the EPA has grounded its watershed program in fresh (primarily surface) water, water quality goals, and, most specifically, nonpoint source pollution control.[211] In an indication of the EPA's limited regulatory capacity, habitat considerations, species protection, water flow issues, and marine issues (even marine pollution) have progressively fallen by the wayside.[212]

My point here isn't so much that the EPA *hasn't* addressed watershed issues comprehensively enough but that it *can't*—it lacks sufficient regulatory authority to address all of the relevant issues. Nevertheless, despite water's regulatory fragmentation, the holistic nature of watersheds is fairly obvious.[213] Water flows (or does not, if consumed upstream), and it flows in a particular direction, generally along particular paths, carrying with it both natural constituents and acquired materials. As a result, aquatic ecosystems provide an analytical focus that can suggest transitions from environmental law's current in-

209. *See supra* notes 23, 41–47, 91–99, 105–115 and accompanying text.

210. The Clean Water Act is designed to encourage states to take over implementation of the Act, and both water quality standards and the Act's two permitting programs work largely on a state-by-state basis. 33 U.S.C. §§ 1251(b), 1313, 1342(b), 1344(g) (2000 & Supp. V 2005).

211. *See* 2005 DRAFT WATERSHED HANDBOOK, *supra* note 187, at 2-2 (emphasizing nonpoint source pollution); *id.* at 2-12 to 2-16 (proposing water quality standards as reasonable goals); *id.* at 9-5 (focusing on pollutant reduction).

212. In 1996, for example, as quoted in the text, the EPA's watershed framework looked broadly to landscape modification and land use, water flow issues, and overharvesting of fish. Office of Wetlands, Oceans, and Watersheds, U.S. EPA, Need for Watershed Approaches, http://www.epa.gov/owow/watershed/framework/ch4.html (last updated May 8, 2007). Similarly, it suggested that the National Estuary Program and estuary ecosystems could be relevant considerations. *Id.* These references are entirely missing in the 2005 DRAFT WATERSHED HANDBOOK, *supra* note 187.

213. *See* Wilcox, *supra* note 187, at 319.

> [A]s functionally distinct hydrologic units in which the water cycle is a key driver of ecosystem processes, catchments [watersheds] come reasonably close to what might be considered an idealized ecosystem. Also, their water bodies (i.e., streams, rivers, wetlands, and marine coastal zones) serve as pollution conduits or sinks, the proverbial miner's canary, while their public appeal and appreciation of their values has increased dramatically in recent decades.

Id.

put-focused regulation to more comprehensive ecosystem restoration and output-focused management. Moreover, legal conflicts among the regulatory regimes that govern water have been increasing and are likely to continue to increase as a result of water stress and the effects of climate change, suggesting the need to re-structure the existing system of water resource regulatory fragmentation into something more coordinated. It is to the conflicts over water that this Article now turns.

II. EMERGING CONFLICTS IN THE REGULATION OF WATER AND INTERFERENCE WITH ECOSYSTEM-BASED OUTPUT GOALS

Each of the many regulatory entities involved in managing water and water-related resources in a particular watershed will approach the aquatic ecosystem with a different set of priorities, a different regulatory mission (and for some agencies like the EPA,[214] the Army Corps,[215] and NMFS,[216] perhaps

214. The EPA may have jurisdiction within the aquatic watershed simultaneously through the Clean Water Act, 33 U.S.C. §§ 1251–1387 (2000 & Supp. V 2005), the Coastal Zone Management Act, 16 U.S.C. §§ 1451–1465 (2000 & Supp. V 2005), and CERCLA, 42 U.S.C. §§ 9601–9675 (2000 & Supp. V 2005). Oil spills in fresh or salt water will trigger its regulatory authority under the Oil Pollution Act, which applies to discharges of oil into the waters of the United States, onto adjoining shorelines, or into the Exclusive Economic Zone, which extends 200 miles out to sea. 33 U.S.C. §§ 2701(7), (8), (21), 2702(a) (2000 & Supp. V 2005). At the coast and in the ocean, moreover, its authority under the Ocean Dumping Act, 33 U.S.C. §§ 1401–1445 (2000 & Supp. V 2005), may become relevant. Under this Act, the EPA issues most of the allowable permits for dumping of materials at sea. 33 U.S.C. § 1412(a) (2000 & Supp. V 2005).

215. The Army Corps may have jurisdiction within the aquatic watershed simultaneously through the Rivers and Harbors Act, the Clean Water Act, and project-specific legislation. For example, the Army Corps has jurisdiction in Lake Okeechobee in Florida pursuant to the Rivers and Harbors Act of July 3, 1930, 71 Pub. L. No. 520, 46 Stat. 918, 925 (1930), which specially established the Caloosahatchee River and Lake Okeechobee Drainage Areas Project; the Rivers and Harbors Act of 1899, 33 U.S.C. § 401–18 (2000 & Supp. V 2005); and section 404 of the Clean Water Act, 33 U.S.C. § 1344 (2000 & Supp. V 2005); *see* Sierra Club v. Flowers, 423 F. Supp. 2d 1273, 1355–56 (S.D. Fla. 2006), and Coastal Petroleum Co. v. Sec'y of the Army of the U.S., 315 F. Supp. 845, 846–47 (S.D. Fla. 1970) (both cases detailing the various sources of the Army Corps's regulatory authority in the Everglades). At the coast and in the ocean, moreover, its authority under the Ocean Dumping Act, 33 U.S.C. §§ 1401–1445, may become relevant. Under this Act, the Army Corps issues permits for the dumping of dredged material into the ocean. 33 U.S.C. § 1413(a) (2000 & Supp. V 2005).

216. NMFS may have multiple sources of jurisdiction within the aquatic ecosystem. *See* the Endangered Species Act, 16 U.S.C. §§ 1531–1544 (2000 & Supp. V 2005); Marine Mammal Protection Act, 16 U.S.C. §§ 1371–1421h (2000 & Supp.

with multiple and potentially conflicting regulatory missions), and a different scope of regulatory jurisdiction. In other words, each regulatory authority is likely to view the aquatic ecosystem from a different normative perspective, in terms both of what the relevant input considerations should and/or can be and of what output measurements and goals are desirable, preferable, and jurisdictionally cognizable.

Given this level of regulatory fragmentation, conflicts over jurisdiction and, more importantly, over the absolute and relative prioritization of regulatory goals and norms are inevitable. This Part provides an overview of the most important of these conflicts, both historical and contemporary. While conflicts over freshwater management are not new, those conflicts have become more frequent and more varied in the federal courts over the last decade or so, particularly with respect to protected species and biodiversity preservation. This Part then suggests how climate change will intensify legal conflicts as a result of changing water availability. It ends by demonstrating that regulatory fragmentation and conflict often result in the elision of important environmental problems and potential regulatory solutions.

A. Conflicts over Regulatory and Norm Priority in the Management of Water

1. Navigation and Hydropower

Some conflicts in water regulation are obvious and their resolution fairly well established. For example, among the services that large rivers provide to humans, maintaining navigation and promoting hydropower present obvious implementation conflicts: the river-spanning dams required for hydropower are significant impediments to navigation. The Federal Power Act requires FERC (and previously the FPC) to consider navigation in its licensing decisions,[217] and the agency can require navigation structures at any hydroelectric project.[218] Thus, in

V 2005); and the Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. §§ 1801–1884 (2000 & Supp. V 2005). At the same time, NOAA more generally may have authority in the same watershed pursuant to the Coastal Zone Management Act, 16 U.S.C. §§ 1451–1465 (2000 & Supp. V 2005).

217. 16 U.S.C. § 803(a) (2000).

218. *Id.* § 804(a), (b).

waterways where navigation uses are significant, hydropower dams generally must yield to navigation interests by including navigational bypasses, such as locks and dams.[219]

2. Hydropower and State Water Concerns

Hydropower dams can also impair water quality, water flow, and recreation, all of which are primarily state concerns. States can attempt to protect these qualities through minimum stream flow requirements. However, although the Federal Power Act reserves authority to the states to allocate water rights,[220] the U.S. Supreme Court has held that the Act nevertheless preempts state minimum stream flow requirements.[221] Thus, in the conflict between federal power law and state water law, federal law has won.

However, states have another legal vehicle for preserving minimum stream flows and imposing other water quality requirements on hydroelectric facilities. The Clean Water Act requires "[a]ny applicant for a Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters" to "provide the licensing or permitting agency a certification from the State in which the discharge originates or will originate" that the discharge will comply with the Clean Water Act's requirements.[222] The federal permit cannot issue until the state certifies the discharge or waives its certification rights,[223] and the state can impose conditions on the federal license or permit to ensure compliance with the Act and "any other appropriate requirement of State law."[224] Thus, so long as state water requirements pre-exist the hydropower licensing process, the state can insist on minimum flows, water quality protections, and recreational access. Nevertheless, it took two trips to the U.S. Supreme Court over the course of twelve years (with the most recent decision issuing in

219. *See* Portland Gen. Elec. Co. v. Fed. Power Comm'n, 328 F.2d 165, 174–75 (9th Cir. 1964).

220. 16 U.S.C. § 821 (2000).

221. California v. Fed. Energy Regulatory Comm'n, 495 U.S. 490, 496–500 (1990); First Iowa Hydro-Electric Coop. v. Fed. Power Comm'n, 328 U.S. 152, 175–76 (1946).

222. 33 U.S.C. § 1341(a)(1) (2000).

223. *Id.*

224. *Id.* § 1341(d).

2006)[225] to confirm that state water quality concerns have priority over FERC's mission to expand hydropower in the United States.

3. Water Quality and Endangered Species

The relationship between the Clean Water Act's water quality goals and the ESA's goals of species and habitat protection are less obviously in conflict than hydropower and navigation. Nevertheless, implementation of the Clean Water Act is not always optimal for species, leading to litigation, particularly when states want to set water quality standards for other uses[226] or regulated entities want to dredge and fill waters that threatened and endangered species need for habitat.[227]

More fundamental conflicts as to regulatory priority also occur. For example, when the EPA delegates Clean Water Act permit programs to states,[228] future state-issued permits are not subject to the ESA's requirements for federally issued permits—namely, that the federal agency ensure that the permitted activity will not jeopardize listed species or destroy critical habitat.[229] This raised the question of whether the EPA itself had to take account of these regulatory changes for the ESA before it delegated Clean Water Act permitting authority to a state. While a few cases on this issue reached the lower federal courts,[230] it wasn't until Arizona sought Clean Water Act permitting authority in 2002 that the U.S. Supreme Court (after five years of lower court litigation) finally and narrowly re-

225. S.D. Warren Co. v. Maine Bd. of Envtl. Prot., 547 U.S. 370, (2006); PUD No. 1 of Jefferson County v. Wash. Dep't of Ecology, 511 U.S. 700, 711–20 (1994).

226. *See, e.g.*, Nw. Envtl. Advocates v. U.S. E.P.A., 268 F. Supp. 2d 1255, 1266–67 (D. Or. 2003) (challenging the EPA's approval of temperature water quality standards on the basis that standards would not protect salmon).

227. Defenders of Wildlife v. Flowers, 414 F.3d 1066, 1069–71 (9th Cir. 2005) (challenging Army Corps permits on ESA grounds); Greater Yellowstone Coal. v. Flowers, 359 F.3d 1257, 1275–76 (10th Cir. 2004) (same); Town of Norfolk v. U.S. Army Corps of Eng'rs, 968 F.2d 1438, 1452–53 (1st Cir. 1992) (same); Envtl. Coal. of Broward County, Inc. v. Myers, 831 F.2d 984, 987–88 (11th Cir. 1987) (same); Riverside Irrigation Dist. v. Andrews, 758 F.2d 508, 511–13 (10th Cir. 1985) (same).

228. *See* 33 U.S.C. §§ 1342(b), 1344(g) (2000 & Supp. V 2005).

229. 16 U.S.C. § 1536(a)(2) (2000).

230. Am. Forest & Paper Ass'n v. U.S. E.P.A., 137 F.3d 291, 297–98 (5th Cir. 1998); Am. Iron & Steel Inst. v. E.P.A., 115 F.3d 979, 1002–03 (D.C. Cir. 1997).

solved the regulatory priority issue in favor of the Clean Water Act.[231]

4. State Water Law and the Clean Water Act

State water law and state permitting of water diversions also create conflicts with the Clean Water Act. Some of these conflicts can derive from intrastate, interagency disputes or lack of coordination regarding water priorities. For example, as part of its water quality standards designations under the Clean Water Act, the Oregon Department of Environmental Quality has designated much of the Klamath River Basin for fish habitat.[232] However, at the beginning of the twentieth century, Oregon gave the U.S. Bureau of Reclamation a water right in the Klamath River for regional agricultural irrigation,[233] and the Oregon Water Resources Department manages such water rights in Oregon.[234] This tension between regulatory priorities has contributed to disputes in the Klamath Basin.[235]

In the federal courts, a more prominent conflict between state water law and the Clean Water Act has concerned the transportation of water from one waterbody to another. The issue raised is whether the resulting influx of water in the new location qualifies as an "addition of pollutants" under the Act. In the eastern half of the United States, courts and states have nearly universally determined that the Clean Water Act ap-

231. Nat'l Ass'n of Home Builders v. Defenders of Wildlife, ___ U.S. ___, 127 S. Ct. 2518 (2007). Interestingly, this regulatory showdown occurred not because of potential effects on aquatic species but because of the USFWS's concerns regarding the cumulative and indirect impacts on terrestrial ecosystems as a result of state water quality permitting and subsequent development. *Id.* at 2527.

232. Or. Dep't of Envtl. Quality, Water Quality Standards: Figure 180A: Fish Use Designations, Klamath Basin, Oregon (Nov. 2003), http://www.deq.state.or.us/wq/rules/div041/fufigures/figure180a.pdf.

233. NAT'L RESEARCH COUNCIL, ENDANGERED AND THREATENED FISHES IN THE KLAMATH RIVER BASIN: CAUSES OF DECLINE AND STRATEGIES FOR RECOVERY 67 (2004).

234. Or. Water Res. Dep't, Water Rights, http://www.wrd.state.or.us/OWRD/WR/index.shtml (last visited Feb. 29, 2008).

235. *See, e.g.*, John Robinson, *Klamath Basin Water Dispute Building*, WESTERN LIVESTOCK JOURNAL, Feb. 25, 2008, http://www.wlj.net/editorial/022508_klamath_basin_water_dispute_building.htm; Patrick Symmes, *River Impossible*, OUTSIDE MAGAZINE ONLINE, Aug. 2003, http://outside.away.com/outside/features/200308/200308_klamath_1.html; David Gorn, Nat'l Public Radio, *Klamath River Dams' Removal Hinges on Owner*, Mar. 5, 2008, http://www.npr.org/templates/story/story.php?storyid=87928806.

plies to such water transfers.[236] In contrast, western states that depend on the large-scale movement of water have resisted this interpretation, including, most recently, by intervening in eastern cases.[237]

The Clean Water Act does at least partially address its relationship to state water law:

> It is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this chapter. It is the further policy of Congress that nothing in this chapter shall be construed to supersede or abrogate rights to quantities of water which have been established by any State. Federal agencies shall co-operate with State and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources.[238]

While this provision makes it clear that the EPA and the Army Corps are not in the business of establishing water rights, its applicability to water transfers (which do not directly "allocate quantities of water") is less certain, and the courts have done little to explicate the analysis.[239] Nevertheless, two juxtaposed sets of legal action suggest that the Supreme Court will soon be resolving this issue of regulatory priority: ongoing litigation over the Clean Water Act's applicability to the Everglades has suggested that the Clean Water Act confers broad water quality regulatory authority over water transfers,[240]

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236. Catskill Mountains Chapter of Trout Unlimited, Inc. v. City of New York, 451 F.3d 77, 79–87 (2d Cir. 2006); Miccosukee Tribe of Indians v. S. Fla. Water Mgmt. Dist., 280 F.3d 1364, 1368–69 (11th Cir. 2002), *vacated and remanded for factual determination sub nom.* S. Fla. Water Mgmt. Dist. V. Miccosukee Tribe of Indians, 541 U.S. 95 (2004); Catskill Mountains Chapter of Trout Unlimited, Inc. v. City of New York, 273 F.3d 481, 492–93 (2d Cir. 2001); Dubois v. U.S. Dep't of Agric., 102 F.3d 1273, 1296–99 (1st Cir. 1996).

237. Friends of the Everglades, Inc. v. S. Fla. Water Mgmt. Dist., No. 02-80309, 2006 WL 3635465, at *30–*31, *45 (S.D. Fla. Dec. 11, 2006).

238. 33 U.S.C. § 1251(g) (2000).

239. *But see* Friends of the Everglades, Inc. v. S. Fla. Water Mgmt. Dist., No. 02-80309, 2006 WL 3635465, at *43–*46 (S.D. Fla. Dec. 11, 2006) (briefly discussing this provision).

240. *See* Fla. Water Mgmt. Dist. v. Miccosukee Tribe of Indians, 541 U.S. 95, 104–05 (2004); Miccosukee Tribe of Indians v. S. Fla. Water Mgmt. Dist., 280 F.3d 1364, 1368–69 (11th Cir. 2002); Friends of the Everglades, Inc. v. S. Fla. Water Mgmt. Dist., No. 02-80309, 2006 WL 3635465, at *30–*50 (S.D. Fla. Dec. 11, 2006).

while the EPA has proposed a regulation that would exempt such transfers from the statute's coverage.[241]

5. Water Diversions and the ESA

Litigation conflicts among the Clean Water Act, the ESA, and state water law have been increasing over the last decade.[242] These conflicts not only raise questions about the proper interpretation of statutes and the proper role of federalism but also suggest more fundamental questions about regulatory priorities for the nation's water resources.

The heart of these increasingly frequent conflicts has not, however, been the regulatory intermediary of the Clean Water Act. After all, in regulating water quality through its cooperative federalism regime and through the dual mechanisms of technology-based effluent limitations (focused on inputs) and ambient water quality standards (focused on outputs), the Clean Water Act can accommodate a variety of potential regulatory priorities and tailor them to individual water segments (although not watersheds).[243] While this approach does not comprehensively address ecosystem-level outputs, it at least incorporates sufficient flexibility to avoid most absolute conflicts in water resource use: Hydropower dams still operate, but in accordance with water quality- and water function-preserving conditions.[244] Similarly, while the EPA may not have to consider the ESA in delegating state permitting authority, the ESA still applies to activities that affect any listed

241. National Pollutant Discharge Elimination System (NPDES) Water Transfers Proposed Rule, 71 Fed. Reg. 32887-01 (proposed June 7, 2006) (to be codified at 40 C.F.R. pt. 122).

242. *See, e.g.*, Nat'l Assessment Synthesis Team, U.S. Global Change Research Program, *Water Sector*, *in* CLIMATE CHANGE IMPACTS ON THE UNITED STATES: THE POTENTIAL CONSEQUENCES OF CLIMATE VARIABILITY AND CHANGE: OVERVIEW 98 (2000), *available at* http://www.usgcrp.gov/usgcrp/Library/nationalassessment/16WA.pdf [hereinafter U.S. CLIMATE CHANGE CONSEQUENCES OVERVIEW] ("In many rivers and streams in the US, there is not enough water to satisfy existing water rights and claims. Changing public values about preserving in-stream flows, protecting endangered species, and settling Indian water rights claims have made competition for water supplies increasingly intense.").

243. *See* 33 U.S.C. § 1313(c) (2000) (allowing states to set water quality standards to support a wide variety of uses); *id.* § 1312(a) (allowing water-quality-based effluent limitations); *see also supra* note 95 & accompanying text (describing the local and varying nature of state water quality standards).

244. *See supra* notes 222–25 and accompanying text.

species in states with delegated Clean Water Act permitting authority and, potentially, even to the state permits themselves.[245]

Instead, the most prominent legal and ultimately irreconcilable real conflict between regulatory priorities that has emerged is between water law—in particular, water law's allowance of ecosystem-damaging consumptive uses of water—and the ESA's protections for endangered and threatened species that depend on that water remaining *in situ*. In this context, it is worth remembering that the first Supreme Court ESA decision involved the Tellico Dam, a multipurpose impoundment that interfered with a fish's habitat.[246]

Any peaceful co-existence of the ESA and water law appropriations and diversions requires regulators to presume that they can have their water and drink (or store) it, too. This presumption is increasingly unlikely to hold true, especially in light of population growth, aquifer depletion, and climate change. Population growth increases demand for water[247] and is increasingly important as people move to places already experiencing water stress. For example, according to the California Department of Water Resources, "California will grow from 29.8 million people in 1990 to approximately 46 million by 2020, a 54 percent increase," and the state "can meet new water demands only by shifting supplies from existing users, typically farms."[248] Both aquifer depletion and climate change will reduce the supply of water in many parts of the United States. As one example of aquifer depletion, the Ogallala Aquifer underlying parts of Kansas, New Mexico, Oklahoma, and Texas has dropped more than 100 feet since the 1940s, largely because of withdrawals for irrigation.[249] As Section B will discuss in more detail, climate change is likely to reduce water

245. *See, e.g.*, Strahan v. Coxe, 127 F.3d 155, 163–66 (1st Cir. 1997) (holding that Massachusetts could violate the ESA by issuing fishing permits).

246. Tennessee Valley Authority v. Hill, 437 U.S. 153, 157 (1978).

247. *See, e.g.*, Federation for American Immigration Reform, Immigration & U.S. Water Supply (last updated Oct. 2003), http://www.fairus.org/site/PageServer?pagename=iic.immigrationissuecenters19af (discussing water stresses and water shortages in many parts of the United States).

248. CALIFORNIA DEP'T OF WATER RES., CALIFORNIA WATER: HOW IT'S USED 2 (2003), http://www.cfbf.com/docs/Cal_Water_How_it_used_03.pdf.

249. David E. Kromm, *Ogallala Aquifer*, *in* WATER ENCYCLOPEDIA, http://www.waterencyclopedia.com/Oc-Po/Ogallala-Aquifer.html (last visited Jan. 20, 2008).

supplies in the central United States and in western areas that depend on snowpack for summer water supplies.

The increasing number of conflicts between water consumers and the ESA's requirements attests to the fundamental disconnect between the norms of water-based economic and social growth and of aquatic habitat and ecosystem protection, particularly in areas where human uses already stress limited water supplies. These conflicts have resulted in litigation to protect West Coast steelhead in the Ventura River, California;[250] delta smelt and winter-run Chinook salmon in Tulare Lake and the Bay delta;[251] Chinook salmon, coho salmon, and steelhead trout in the Trinity River in California;[252] Chinook salmon in the Central Valley Project and San Joaquin River in California;[253] coho salmon, shortnose suckerfish, and Lost River suckerfish in the Klamath River basin on the California-Oregon border;[254] various species of salmon and steelhead in the Columbia River, along the Oregon-Washington border;[255] steelhead trout and Chinook salmon in the Chewuch River in Washington;[256] cui-ui and Lahontan cutthroat trout in the Truckee River and Pyramid Lake in Nevada;[257] bald eagle, willow fly-

250. Casitas Mun. Water Dist. v. United States, 76 Fed. Cl. 100, 102 (2007); Casitas Mun. Water Dist. v, United States, 72 Fed. Cl. 746, 748 (2006).

251. Tulare Lake Basin Water Storage Dist. v. United States, 59 Fed. Cl. 246, 247–48 (2003); Natural Res. Defense Council v. Kempthorne, 506 F. Supp. 2d 322, 331 (E.D. Cal. 2007); Pac. Coast Fed'n. Fishermen's Ass'n/Inst. for Fisheries Res, v. Guitierrez, No. 1:06-CV-00245, 2007 WL 1752289, at *2–*3 (E.D. Cal. 2007); Natural Res. Defense Council v. Norton, No. 1:05-CV-01207, 2007 WL 14283, at *2–*3 (E.D. Cal. 2007); Baykeeper v. U.S. Army Corps of Eng'rs, No. CIV. S-06-1908, 2006 WL 2711547, at *2 (E.D. Cal. 2006).

252. Westlands Water Dist. v. U.S. Dep't of the Interior, 376 F.3d 853, 860–63 (9th Cir. 2004).

253. Natural Res. Defense Council v. Houston, 146 F.3d 1118, 1124 (9th Cir. 1998).

254. Klamath Irrigation Dist. v. United States, 75 Fed. Cl. 677, 686–87 (2007); Oregon Trollers Ass'n v. Gutierrez, 452 F.3d 1104, 1110–11 (9th Cir. 2006); Pac. Coast Fed'n of Fishermen's Ass'ns v. U.S. Bureau of Reclamation, 426 F.3d 1082, 1085–89 (9th Cir. 2005); Klamath Water Users Protective Ass'n v. Patterson, 191 F.3d 1115, 1118–19 (9th Cir. 1999); Klamath Water Users Protective Ass'n v. Patterson, 204 F.3d 1206, 1209–10 (9th Cir. 1999).

255. Northwest Res. Info. Ctr. v. Nat'l Marine Fisheries Serv., 56 F.3d 1060, 1063–64 (9th Cir. 1995).

256. County of Okanogan v. Nat'l Marine Fisheries Serv., 347 F.3d 1081, 1083–84 (9th Cir. 2003).

257. Nevada v. United States, 463 U.S. 110, 115–19 (1983); Churchill County v. Norton, 276 F.3d 1060, 1066–67 (9th Cir. 2001); United States v. Orr Water Ditch Co., 256 F.3d 935, 938–39 (9th Cir. 2001); Pyramid Lake Paiute Tribe of Indians v. U.S. Dep't of Navy, 898 F.2d 1410, 1412–14 (9th Cir, 1990).

catcher, and razorback sucker in the San Carlos Reservoir in Arizona;[258] southwestern willow flycatcher in Lake Mead and the Lower Colorado River in Arizona;[259] silvery minnow in the Middle Rio Grande River in New Mexico;[260] fountain darter, San Marcos gambusia, San Marcos salamander, Texas blind salamander, and Texas wild rice along the Edwards Aquifer in Texas;[261] bull trout in the Upper Salmon River in Idaho;[262] pallid sturgeon, least term, and piping plover in the Missouri River as it flows through Montana, North Dakota, South Dakota, Nebraska, Iowa, Kansas, and Missouri;[263] and, most recently, the Gulf sturgeon, fat threeridge mussel, purple bankclimber mussel, and Chipola slabshell mussel in the Apalachicola River-Chattahoochee River-Flint River Basin in Alabama, Georgia, and Florida.[264]

Of course, not all such conflicts manifest themselves through the ESA. For example, in California, a similar conflict between water use and an aquatic ecosystem resulted in public trust protection for Mono Lake.[265] Nevertheless, the ESA has been the dominant regulatory regime for exposing underlying normative conflicts regarding priorities for water between consumption and more general aquatic ecosystem goals.

B. Adding the Chaos of Climate Change

Climate change is likely to increase conflicts over water resources in the United States. Most basically, climate change is

258. San Carlos Apache Tribe v. United States, 272 F. Supp. 2d 860, 877–79 (D. Ariz. 2003).

259. Southwest Ctr. for Biological Diversity v. U.S. Bureau of Reclamation, 143 F.3d 515, 517–20 (9th Cir. 1998); Defenders of Wildlife v. Norton, 257 F. Supp. 2d 53, 59–60 (D.D.C. 2003).

260. Rio Grande Silvery Minnow v. Keys, 355 F.3d 1215, 1219 (10th Cir. 2004); Middle Rio Grande Conservancy Dist. v. Norton, 294 F.3d 1220, 1223–24 (10th Cir. 2002); Rio Grande Silvery Minnow v. Keys, 46 Fed. Appx. 929, 930–31, 2002 WL 31027874 (10th Cir. Sept. 11, 2002) (unpublished).

261. Sierra Club v. Glickman, 156 F.3d 606, 610 (5th Cir. 1998); Sierra Club v. City of San Antonio, 115 F.3d 311, 313 (5th Cir. 1997).

262. Idaho Sporting Cong. v. Rittenhouse, 305 F.3d 957, 961 (9th Cir. 2002).

263. *In re* Operation of Missouri River Sys. Litig., 421 F.3d 618, 635–36 (8th Cir. 2005).

264. *See* Alabama v. U.S. Army Corps of Eng'rs, 441 F. Supp. 2d 1123, 1125–26 (N.D. Ala. 2006) (involving Florida's attempt to have the Army Corps release more water into the Apalachicola River to protect listed species there, rather than store the water for water supply and other consumptive uses).

265. Nat'l Audubon Soc'y v. Superior Court, 33 Cal.3d 419, 443–48 (1983).

expected to reduce water supplies in many regions. In addition, climate change will likely alter the demands made on water supplies and the dynamics among the users:

> Irrigation water needs are likely to change, with decreases in some places and increases in others. It is very likely that demand for water associated with electric power generation will increase due to the increasing demand for air conditioning with higher temperatures, unless advances in technology make it possible for less water to be used for electrical generation. Climate change is likely to reduce water levels in the Great Lakes and summertime river levels in the central U.S., thereby affecting navigation and general water supplies.[266]

As a result, as the effects of climate change begin to be felt in the United States, conflicts between claims for consumptive water use for human populations, agriculture, and development and other *in situ* demands for water, including ecosystem demands, are only likely to escalate.[267]

Within these conflicts, moreover, ESA litigation over water use is especially likely to increase. First, climate change is likely to increase the number of species that qualify for protection under the ESA as a result of climate-related loss of habitat and other effects.[268] According to the U.S. Global Climate Change Research Program ("USGCCRP"), "The natural ecosystems of the Arctic, Great Lakes, Great Basin, Southeast, and the prairie potholes of the Great Plains appear highly vulnerable to the projected changes in climate,"[269] suggesting that their species may become ESA candidates with increasing frequency. Indeed, NMFS has listed the *Acropora* corals as

266. U.S. CLIMATE CHANGE CONSEQUENCES OVERVIEW, *supra* note 242, at 98.

267. *Id.*

268. *See, e.g.*, Am. Lands Alliance v. Norton, 242 F. Supp. 2d 1, 6 (D.D.C. 2003) (noting that ecologists had identified climate change and global warming as factors that warranted listing of the Gunnison sage grouse under the ESA); Greenpeace v. Nat'l Marine Fisheries Serv., 237 F. Supp. 2d 1181, 1188 (W.D. Wash. 2002) (noting that NMFS's Biological Opinion indicated that climate change was a factor in the population reduction of the Stellar sea lion); Friends of the Wild Swan, Inc. v. U.S. Fish & Wildlife Serv., 12 F. Supp. 2d 1121, 1128 (D. Or. 1997) (noting that the Jarbridge River population segment of the bull trout would be most susceptible to global warming).

269. U.S. CLIMATE CHANGE CONSEQUENCES OVERVIEW, *supra* note 242, at 101.

threatened species in part because of climate change effects,[270] and the USFWS has proposed listing the polar bear almost entirely because of the effects climate change is having on the polar bear's habitat.[271]

Second, climate change is likely to place additional stress on species already listed, including and perhaps especially water-dependent species.[272] As the USGCCRP has noted, "Surface water temperature fluctuates more rapidly with reduced volumes of water, likely affecting vital habitats," and "[w]ater quality is also likely to be affected by climate change in a variety of ways."[273] Perhaps not coincidentally, courts' demands that the relevant agencies consider the effects of climate change in their ESA decisions have been most insistent for aquatic and marine species.[274] In May 2007, for example, the Eastern District of California determined that the USFWS had not used the best scientific evidence in its Biological Opinion regarding the effects of the Central Valley Project and State Water Project in California on the California Bay delta smelt because the Service did not consider the effects of climate change.[275] According to the district court, the Service's failure to think about climate change "is potentially significant because the [Biological Opinion's] conclusions are based in part on the assumption that the hydrology of the waterbodies affected by the [Project's Operations Criteria and Plan] will follow historical patterns for the next 20 years."[276] The district court thus emphasized that climate change is likely to alter re-

270. Endangered and Threatened Species: Final Listing Determinations for Elkhorn Coral and Staghorn Coral, 71 Fed. Reg. 26, 852, 50 C.F.R. § 223.12 (May 12, 2008) (listing elevated sea surface temperatures as a result of climate change as one of the three major threats to the staghorn and the elkhorn coral in the Caribbean, south Atlantic, and Gulf of Mexico; in addition, sea level rise as a result of climate change and ocean acidification as a result of elevated levels of carbon dioxide were also considered significant stressors to the coral).

271. Endangered and Threatened Wildlife and Plants, 72 Fed. Reg. 1064 (proposed Jan. 9, 2007).

272. U.S. CLIMATE CHANGE CONSEQUENCES OVERVIEW, *supra* note 242, at 99–100.

273. *Id.* at 99.

274. *See, e.g.*, Greenpeace v. Nat'l Marine Fisheries Serv., 55 F. Supp. 2d 1248, 1261 (W.D. Wash. 1999) (concluding that NMFS adequately considered the effects of climate change on the Stellar sea lions' survival).

275. Natural Res. Defense Council v. Kempthorne, 506 F. Supp. 2d 322 (E.D. Cal. May 25, 2007) (order granting in part and denying in part the plaintiff's motion for summary judgment).

276. *Id.* at 367.

levant water conditions, and it explored those potential changes in some detail.[277]

Third, climate change is likely to change water supplies, either in amount or timing or both, as a result of increased evaporation from higher temperatures, changes in rainfall patterns, reductions in snowpack, and/or changes in groundwater recharge rates.[278] The USGCCRP has emphasized that "[t]hese changes are significant and most apparent during spring through autumn in the contiguous U.S. Despite the overall increase in precipitation, however, it is likely that many interior portions of the nation will experience more extremes related to drought due to increased air temperatures."[279] Furthermore, it notes that

> [r]ising temperatures are very likely to affect snowfall and increase snowmelt conditions in much of the western and northern portions of the US that depend on winter snowpack for runoff. This change in the timing of runoff will very likely have implications for water management, flood protection, irrigation, and planning.[280]

The USGCCRP predicts, nationwide, that summer surface water flows will generally decrease while the potential for flooding in winter and early spring will generally increase.[281] In contrast, according to the Program, "Groundwater supplies are less susceptible than surface water to short-term climate variability; they are more affected by long-term trends. Groundwater serves as the base flow for many streams and rivers. In many areas, groundwater levels are very likely to fall, thus reducing seasonal streamflows."[282] In 2001, it reached the following overall conclusions about climate change and water supplies in the United States:

> More pressure on surface water supplies is likely to come from population shifts and changes in water right allocations to accommodate endangered species and the water rights of Native Americans. Although wetter conditions in

277. *Id.* at 368.
278. U.S. CLIMATE CHANGE CONSEQUENCES OVERVIEW, *supra* note 242, at 96, 98–99.
279. *Id.* at 98.
280. *Id.* at 98–99.
281. *Id.* at 100.
282. *Id.* at 99.

> the Southwest may alleviate some of these stresses, stress is likely to increase in the Northern Great Plains and in snowpack-dependent watersheds.
>
> Groundwater supplies are already over-drafted in many parts of the country, and pressure on groundwater supplies is likely to increase to offset changes in surface water supply availability. However, long-term increases in precipitation will possibly increase recharge rates in some areas.
>
> It is likely that aquatic and riparian ecosystems may be damaged even in the context of higher precipitation, due to higher air temperatures and reduced summer flows. It is also probable that changes in water temperature in lakes and streams will affect species composition.
>
> Water managers have multiple opportunities to reduce future risks by incorporating "no-regrets" changes into their operating strategies that are appropriate regardless of climate change.
>
> Institutions governing water rights are generally very inflexible, and are likely to prove to be obstacles to adaptation.
>
> Improvements are needed in monitoring efforts to identify key impacts related to water quantity and quality, biological conditions of key habitats, snowpack conditions, and groundwater supplies.[283]

Finally, changes in water supply may call into question the continued utility of existing water law rules and water consumption patterns in many areas of the country, unsettling rights and expectations long considered sacrosanct. On the one hand, to the extent state water law allows courts or legislatures to act, climate change may well prompt changes in that law. As noted above, water law is already more sensitive than many other kinds of law to the ecological conditions that dominate in an area—hence the divide in the United States between

283. Katharine Jacobs et al., *Potential Consequences of Climate Variability and Change for the Water Resources of the United States*, *in* NATIONAL ASSESSMENT SYNTHESIS TEAM, U.S. GLOBAL CHANGE RESEARCH PROGRAM, CLIMATE CHANGE IMPACTS ON THE UNITED STATES: THE POTENTIAL CONSEQUENCES OF CLIMATE VARIABILITY AND CHANGE: FOUNDATION REPORT 407 (2001).

riparian and prior appropriation doctrine states.[284] If water-stressed areas begin to receive greatly increased overall supplies of water, or if previously water-rich areas begin to experience continual shortages, their systems of water law may also begin to evolve, unsettling what were considered "settled" rights in water.

Indeed, such legal adaptation to changing water supplies may already be occurring. In South Dakota, for example, several "unseasonably wet years" created three large lakes over what had previously been dry or marshy lands, prompting members of the public to use those lakes for recreation and fishing.[285] When riparian landowners sued to exclude the public, claiming that the new lakes were privately owned, the South Dakota Supreme Court "clarified" the state's public trust doctrine to allow public use:

> [W]e conclude that all water in South Dakota belongs to the people in accord with the public trust doctrine and as declared by statute and precedent, and thus, although the lake beds are mostly privately owned, the water in the lakes is public and may be converted to public use, developed for public benefit, and appropriated . . . .[286]

On the other hand, water law and water management regimes may not change at all. According to the USGCCRP, "Most institutions related to water have not responded well to changing socioeconomic and environmental conditions."[287] Moribund legal systems could, ironically, be even more unsettling than evolving ones in areas where ecological realities no longer bear any relationship to legal rights. Either way, however, changes in water supply as a result of climate change are likely to become legally and politically uncomfortable in many parts of the country, inspiring even more conflict.

284. Frank J. Trelease, *New Water Legislation: Drafting for Development, Efficient Allocation and Environmental Protection*, 12 LAND & WATER L. REV. 385, 414–16 (1977).

285. Parks v. Cooper, 676 N.W.2d 823, 824–25 (S.D. 2004).

286. *Id.* at 825.

287. U.S. CLIMATE CHANGE CONSEQUENCES OVERVIEW, *supra* note 242, at 101.

C. *Remembering What Gets Lost: Regulatory Fragmentation, Water Shortage, and Ecosystem Restoration*

As this Part has suggested, the combination of water's regulatory fragmentation and increasing shortages in water supply as a result of population growth, aquifer depletion, and climate change is likely to hamper efforts to achieve ecosystem-based restoration goals. The current regime of regulatory fragmentation means that achievement of such goals in large watersheds requires the cooperation of multiple states and multiple federal agencies, a difficult task under the best of circumstances. As Richard Lazarus has noted:

> Fragmentation . . . makes it difficult to address issues in a comprehensive, holistic fashion. Ecological injury resists narrow redress; due to the highly interrelated nature of the ecosystem, it is almost always a mistake to suppose that one can isolate a single discrete cause as the source of an environmental problem. Not only is a broader overview needed, accounting for the full spatial and temporal dimensions of the matter, but failure to pursue such an overview is likely to result in an approach that is at best ineffective and at worst unwittingly destructive because of unanticipated consequences. When, however, government jurisdiction over the host of diverse activities affecting the ecosystem is divided between many entities, necessary coordination and overview are surprisingly difficult.
>
> The environment, rather than being treated holistically, is thus subdivided according to the organized principles of social systems, not the natural world.[288]

As this Section will discuss, water's regulatory fragmentation has already been "unwittingly destructive," and actual or anticipated shortages of water will further undermine the political will to engage in the necessary cooperation, particularly when significant consumptive users are involved. One need only look at the decades-long battle over the Colorado River,[289] or

288. LAZARUS, *supra* note 13, at 33 (quoting John W. Bennett & Kenneth A. Dahlberg, *Institutions, Social Organization, and Cultural Values*, *in* THE EARTH AS TRANSFORMED BY HUMAN ACTON: GLOBAL AND REGIONAL CHANGES IN THE BIOSPHERE OVER THE PAST 300 YEARS 73 (B.L. Turner ed., 1990)).

289. ADLER, *supra* note 1, at 18–25.

the growing conflict between Georgia and Florida over the Apalachicola-Chattahoochee-Flint River Basin,[290] or even one of the earliest water conflicts between New York and New Jersey over the Delaware River,[291] to lose all sense of optimism about cooperative watershed-level management in times of water shortage.[292]

Nevertheless, because some potential watershed-level goals fall outside any regulatory entity's cognizance, failure to cooperate leads to *de facto* choices among potential output-based goals for the watershed as a whole, often without any comprehensive debate about those choices. As the example of atmospheric deposition of mercury demonstrates, regulatory fragmentation can cause certain ecological outputs, such as mercury-contaminated fish, to effectively become regulatory "orphans." This regulatory orphaning, in turn, can lead to paradoxical regulatory results.

Again, atmospheric deposition of mercury provides an example. Despite the numerous regulatory agencies with some authority over this problem,[293] no regulatory coalition to address the issue has formed. Instead, the federal EPA has taken the lead in addressing atmospheric deposition,[294] suggesting that there is value to consolidation and centralization of regulatory authority. However, to date the EPA has addressed atmospheric deposition as a freshwater water quality problem with human health implications. Specifically, the EPA has established guidance water quality criteria for mercury based on

290. *See generally* Southeastern Fed. Power Customers, Inc. v. Harvey, 400 F.3d 1 (D.C. Cir. 2005) (addressing Alabama's and Florida's challenges to a settlement between Georgia and the Army Corps); Alabama v. U.S. Army Corps of Eng'rs, 424 F.3d 1117 (11th Cir. 2005) (addressing Florida's and Alabama's motions for preliminary injunction); Georgia v. U.S. Army Corps of Eng'rs, 302 F.3d 1242 (11th Cir. 2002) (addressing Florida's motion to intervene in Georgia's lawsuit seeking more water from the system); J.B. Ruhl, *supra* note 45, at 48–50 (describing the conflict).

291. New Jersey v. New York, 283 U.S. 336, 345–48 (1931).

292. *See also* Joseph L. Sax, *The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention*, 68 MICH. L. REV. 471, 550 (1970) (noting "the need to avoid localism and to mitigate the potential for political pressures on administrative agencies" when dealing with the larger public interests in water resources).

293. *See* discussion Part I.B.2.

294. *See, e.g.*, Office of Wetlands, Oceans & Watersheds, U.S. Envtl. Prot. Agency, Air Pollution and Water Quality (last updated June 6, 2007), http://www.epa.gov/ owow/airdeposition (listing the EPA's efforts to address atmospheric deposition issues, including TMDLs for mercury).

the FDA's assessments of the human health risk potential of methylmercury bioaccumulation, measured in terms of methylmercury concentrations in fish tissue.[295] Moreover, the EPA and the FDA recently entered into a Memorandum of Understanding regarding fish tissue concentrations and fish consumption advisories.[296] Once incorporated into state water quality standards, the new fish tissue criteria become the basis for categorizing the polluted waterway as water quality impaired, triggering the Clean Water Act's total maximum daily load ("TMDL") process,[297] in which the air emitting sources of mercury are treated as nonpoint sources of water pollution.[298] Presumably, states will then address these air emissions of mercury through their state implementation plans pursuant to the Clean Air Act.[299]

If human health is the most sensitive or most important regulatory priority, this choice of regulatory focus is rational, and implementation of the mercury TMDLs could eventually ensure protection of human health. However, an unexamined assumption that protection of human health is the highest priority can unwittingly and paradoxically foreclose the choice of other output goals and measurements that would better protect both human health and larger ecosystem functions and services. For example, it is becoming increasingly clear that humans are *not* the most sensitive species that methylmercury bioaccumulation affects. Instead, other species—like the Florida panther and downstream marine fish (and the species that consume the fish)—are more likely than humans to suffer as a result of consuming the mercury-contaminated fish.[300] In

295. Water Quality Criteria: Notice of Availability of Water Quality Criterion for the Protection of Human Health: Methylmercury, 66 Fed. Reg. 1344, 1348–49 (Jan. 8, 2001).

296. Memorandum of Understanding between the U.S. Food and Drug Admin. Ctr. for Food Safety and Applied Nutrition and the U.S. Envtl. Prot. Agency Office of Water, MOU No. 225-05-2001 (June 1, 2005), *available at* http://www.fda.gov/oc/mous/domestic/225-05-2001.html.

297. 33 U.S.C. § 1313(d) (2000).

298. *See, e.g.*, Office of Wetlands, Oceans, & Watersheds, U.S. EPA, Air Pollution and Water Quality, http://www.epa.gov/owow/airdeposition (last updated June 6, 2007) (also follow links under TMDLs listed).

299. 42 U.S.C. § 7410 (2000).

300. *See, e.g.*, U.S. EPA, MERCURY STUDY REPORT TO CONGRESS, VOL. VII: CHARACTERIZATION OF HUMAN HEALTH AND WILDLIFE RISKS FROM MERCURY EXPOSURE IN THE UNITES STATES, EPA-452/R-97-009, 2-17, 3-7 (Dec. 1997), *available at* http://www.epa.gov/ttn/caaa/t3/reports/volume7.pdf (suggesting that the safe threshold concentration in humans is 0.1 ppm of mercury, while the safe

other words, the substantive choice to regulate for human health outputs—a choice forced, in part, by the existing fragmented regulatory frameworks and the scope of the EPA's regulatory authority—is in fact a choice *not* to protect against other ecosystem effects or regulatory outputs.

Thus, in the case of atmospheric deposition, non-comprehensive evaluation, a narrowly focused prioritization of human health goals, and regulatory fragmentation have at least for now foreclosed better protections for non-human organisms, *even though regulating to protect those other organisms, and the ecosystem in general, would also incidentally protect human health with a much wider margin of safety than current regulation provides.* Humans, it must be remembered, can often (although not always, as environmental justice advocates have pointed out for low-income and several tribal communities) avoid consuming mercury-contaminated fish and other organisms, even though the need for such avoidance is still an undesirable result. Panthers, marine apex predators, and other organisms cannot. In addition, scientific studies have discovered human health effects at progressively more minute concentrations of mercury.[301] While the EPA can adjust its water quality criteria to acknowledge new scientific findings, past experience indicates that such adjustments are often slow to come, and health impairments occur in the interim.

Thus, it may well turn out that ecosystem-based, output-focused regulation is the *only* way to comprehensively protect human health from mercury pollution. A more holistic approach to the ecosystem that considers not only all sources of ecological problems (the regulatory inputs) but also *all* of the desired regulatory outputs—i.e., the overall desired ecosystem result, balancing ecosystem function, ecosystem services, and more commodified human uses of the entire ecosystem—would

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threshold for loons and other animals that consume fish is 0.077 ppm); *see also* Tom Atkeson & Don Axelrad, *Mercury Monitoring, Research and Environmental Assessment*, *in* SOUTH FLORIDA WATER MANAGEMENT DISTRICT, 2004 EVERGLADES CONSOLIDATED REPORT 2B-4 (2004), *available at* https://my.sfwmd.gov/pls/portal/docs/PAGE/PG_GRP_SFWMD_SFER/PORTLET_PREVREPORT/FINAL/chapters/ch2b.pdf (concluding that fish-eating birds are more sensitive to mercury than previously presumed).

301. *See* Robin Kundis Craig, *Removing "The Cloak of a Standing Inquiry": Pollution Regulation, Public Health, and Private Risk in the Injury-in-Fact Analysis*, 29 CARDOZO L. REV. 149, 211–21 (2007) (discussing the evolution of scientific understanding of human health risks from mercury).

provide a more transparent and adaptive regulatory framework both for making and for implementing the legal and political choices regarding which of these ecological values and functions the regulatory scheme should protect and promote.[302]

The regulatory issues that arise as a result of atmospheric deposition of mercury constitute only one aspect of ecosystem-based water management. Nevertheless, they suggest that reformation of freshwater regulation provides an interesting—and important—testing ground for the resolution of regulatory fragmentation and the incorporation of ecosystem goals and outputs, especially in times of increasing water stress and water shortage.[303]

One can perhaps overstate the debilitative effects of water's regulatory fragmentation. Nevertheless, studies of a variety of large aquatic ecosystems consistently conclude that regulatory fragmentation and the resulting inherent conflicts over turf and regulatory norms impede the attainment of desired ecological outputs—*i.e.*, ecosystem restoration and maintenance.[304] For example, with respect to the Florida Everglades, the Office of Technology Assessment ("OTA") concluded in 1993 that:

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302. *See* ADLER, *supra* note 1, at 9 ("In restoration we seek to redress the cumulative effects of human actions on ecosystems rather than focusing only on specific environmental media (e.g., air, water, land, wildlife) or on particular human activities (e.g., steel or power production, farming, hunting)."). In assessing the relative values of various ecosystem functions, the concept and valuation of ecosystem services could play a particularly helpful role. RUHL ET AL., *supra* note 189, at 249–96. Even so, the choice of regulatory priorities is ultimately a political choice, not one that either science or economics can establish.

303. Again, the focus of this Article is purposefully limited to one, hopefully graspable, aspect of a much larger ecosystem problem. As Robert Adler rightly noted,

> watersheds are not just bodies of water, but are connected intimately with the entire associated land mass . . . . Ecologists now conceptualize watersheds as not one but a collection of ecosystems composed of a mosaic of terrestrial 'patches' that are connected (drained) by a network of streams. Under this view, river ecosystems are not just two-dimensional (linear and lateral) but four dimensional in nature.

ADLER, *supra* note 1, at 77 (quotation omitted). Given the significant regulatory fragmentation that exists just with respect to the *water*, however, the proposals in this Article, limited in focus as they may be, already suggest a radical departure from the status quo. Moreover, a regulatory centralization of water with a priority focus on the oceans could be expanded relatively easily in the future to encompass terrestrial activities that can affect the quantity and quality of water and that, in turn, affect the health of marine ecosystems.

304. In addition to the OTA study and Colorado River examples cited here, see *infra* notes 373–78 and accompanying text.

> One of the most vexing [problems], and one encountered many times in OTA's study, is the lack of coordination among the responsible State and Federal agencies. Part of the problem is a result of a lack of shared values among agencies and among the constituencies they represent. Furthermore, each agency has a different mandate, and agencies' jurisdictional boundaries seldom coincide with boundaries of natural systems. One might expect that the preservation mandate of the U.S. Fish & Wildlife Service and the Florida Department of Environmental Regulation would often clash with the flood-control mandate of the Corps of Engineers and with the interests of EAA [Everglades Agricultural Area] farmers, and such has been the case in South Florida. However, lack of coordination has extended even to agencies with similar mandates; a prominent example has been the difficulty of reconciling the National Park Service's ecosystem-wide approach to restoring the Everglades with the Fish and Wildlife Service's mandate under the Endangered Species Act . . . to focus on protection of individual species.[305]

Similarly, regulatory fragmentation and norm conflict can impede restoration of large rivers. For example, as Robert Adler has noted, "with respect to . . . management of the Colorado River, over time Congress legislated a set of conflicting, inconsistent directions in a maze of separate statutes. Those inconsistencies continue to complicate restoration efforts."[306] Most dramatically, he continues, the complex allocation of Colorado River water among the states, known as the "Law of the River," "provided the certainty by which states could forge long-term water policy with stable expectations," but the Law of the River potentially conflicts with the ESA, which "established new requirements that could prevent the upper basin from using all of its allocations under the compact."[307]

Finally, at the end of the watershed, issues of norm conflict and fragmented regulatory jurisdiction plague regulation of

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305. PREPARING FOR AN UNCERTAIN CLIMATE, *supra* note 155, Vol. I, at 30, "Box 1-D Climate Change, South Florida, and the Everglades" (1993) (citations omitted).

306. ADLER, *supra* note 1, at 141.

307. *Id.* at 116; *see also id.* at 121 ("Under the ESA, the FWS must reject a project if no reasonable and prudent alternatives are identified that will avoid jeopardy to a listed species. Stopping projects altogether, however, would propel the ESA headlong into the well-entrenched Law of the River, under which upper basin water users are allowed to continue to develop their water rights.").

marine ecosystems. It is to these marine ecosystems that this Article now turns.

III. THE IMPORTANCE OF THE OCEANS AND MARINE ECOSYSTEMS AND THEIR CONNECTIONS TO FRESHWATER MANAGEMENT

Freshwater ecosystems are not the only aquatic ecosystems to suffer as a result of regulatory fragmentation. The problems associated with marine ecosystems are, if anything, worse. In addition to being regulatorily fragmented in their own right, as analyzed later in this Part, marine ecosystems are also subject to the results of all the regulatory decisions made upstream. However, these decisions are made in freshwater regulatory contexts that generally ignore the existence of downstream marine ecosystems.

Thus, in this era of water conflict and climate change, it is worth emphasizing—as two blue-ribbon commissions have already done[308]—that the existing regulatory fragmentation of freshwater resources has essentially orphaned one of the most important sets of aquatic ecosystems in the United States: the marine ecosystems off the nation's coasts. Re-structuring regulatory priorities for water resources to actively incorporate and account for marine resources could accomplish two important improvements: (1) protecting the oceans themselves and (2) providing a set of output measurements and goals that could begin to rationalize and prioritize holistic aquatic ecosystem management.

A. Focusing on Marine Outputs

1. Why Should the United States Protect and Restore Its Marine Ecosystems?

The United States has over 13,000 miles of coastline.[309] Moreover, in parallel with the provisions of the Third United Nations Convention on the Law of the Sea,[310] the United States asserts national jurisdiction over a 200-nautical-mile-

308. *See infra* notes 373–75 and accompanying text.

309. AN OCEAN BLUEPRINT, *supra* note 196, at iii.

310. *See* United Nations Convention on the Law of the Sea III, Dec. 10, 1982, 1833 U.N.T.S. 396, arts. 2.1, 2.2, 3, 57, 56.1 (entered into force Nov. 16, 1994).

wide Exclusive Economic Zone.[311] As a result, the United States controls "more than 4 million square miles of ocean territory, the largest and richest in the world."[312] Indeed, the marine areas subject to the United States' jurisdiction are "23 percent larger than the nation's land area . . . ."[313]

Marine ecosystems have immense value. Oceans cover more than 70% of our planet,[314] support vast reserves of biodiversity (in all senses),[315] produce at least half of the Earth's atmospheric oxygen,[316] drive the planet's hydrological cycle,[317] sequester carbon dioxide,[318] and play a significant role in the earth's climate and weather.[319] As such, oceans and estuaries are critical providers of ecosystem services—those "myriad of life support functions, the observable manifestations of ecosystem processes that ecosystems provide and without which human civilizations could not thrive."[320] According to a comprehensive study that appeared in *Nature* in 1997, "[a]bout 63% of the estimated value [of the world's ecosystem services] is contributed by marine ecosystems," especially coastal ecosystems.[321] Specifically, "[c]oastal environments, including estu-

311. Exclusive Economic Zone of the United States of America, Proclamation No. 5030, 48 Fed. Reg. 10, 605 (March 10, 1983), 7 C.F.R. § 60.400, Subpt. A, App. A (2007).

312. Lisa Tewell, *Oceans Act Allows Public Input*, SEATTLE POST-INTELLIGENCER, Aug. 16, 2000, at C5; *see also* AN OCEAN BLUEPRINT, *supra* note 196, at iii (noting that the United States' EEZ encompasses "3.4 million square nautical miles of ocean," where a square nautical mile equals 1.3 square miles).

313. PEW OCEANS COMMISSION, AMERICA'S LIVING OCEANS: CHARTING A COURSE FOR SEA CHANGE: 2 (2003) [hereinafter PEW SUMMARY REPORT].

314. THOMAS E. SVARNEY & PATRICIA BARNES-SVARNEY, THE HANDY OCEAN ANSWER BOOK 3, 6 (2000).

315. PEW SUMMARY REPORT, *supra* note 313, at 5 ("The genetic, species, habitat, and ecosystem diversity of the oceans is believed to exceed that of any other Earth system.").

316. John Roach, *Source of Half Earth's Oxygen Gets Little Credit*, http://news.nationalgeographic.com/news/2004/06/0607_040607_phytoplankton.html (June 7, 2004).

317. SVARNEY & SVARNEY, *supra* note 314, at 76.

318. *Id.* at 77.

319. *Id.* at 78–86.

320. NATIONAL RESEARCH COUNCIL, VALUING ECOSYSTEM SERVICES: TOWARD BETTER ENVIRONMENTAL DECISION-MAKING 17 (2005) (citing Gretchen C. Daily, *Introduction: What are ecosystem services?*, *in* NATURE'S SERVICES: SOCIETAL DEPENDENCE ON NATURAL ECOSYSTEMS 1–10 (Gretchen C. Daily ed., 1997); Shahid Naeem et al., *Biodiversity and Ecosystem Functioning: Maintaining Natural Life Support Processes*, 4 ISSUES IN ECOLOGY 2–14 (1999)).

321. Robert Costanza et al., *The Value of the World's Ecosystem Services and Natural Capital*, 387 NATURE 253, 259 (May 15, 1997).

aries, coastal wetlands, beds of sea grass and algae, coral reefs, and continental shelves . . . cover only 6.3% of the world's surface, but are responsible for 43% of the estimated value of the world's ecosystem services."[322]

In its 2004 report to Congress, the U.S. Commission on Ocean Policy "distinguishe[d] between the *ocean economy*, the portion of the economy that relies directly on ocean attributes, and the *coastal economy*, which includes all economic activity that takes place on or near the coast, whether or not that activity has a direct link to the sea."[323] Both calculations, however, reveal that the oceans and coasts are substantial components of the nation's economic well-being:

> In 2000, the ocean economy contributed more than $117 billion to American prosperity and supported well over two million jobs. Roughly three quarters of the jobs and half the economic value were produced by ocean-related tourism and recreation . . . . For comparison, ocean-related employment was almost 1½ times larger than agricultural employment in 2000, and total economic output was 2½ times larger than that of the farm sector.
>
> The level of overall economic activity within coastal areas is even higher . . . . More than $1 trillion, or one-tenth, or the nation's annual gross domestic product (GDP) is generated within *nearshore* areas, the relatively narrow strip of land immediately adjacent to the coast. *Looking at all coastal watershed counties, the contribution swells to over $4.5 trillion, half of the nation's GDP.*[324]

Much coastal tourism in the United States—especially snorkeling, diving, whale watching, bird watching, and recreational fishing—depends on healthy and sustainable marine ecosystems. Caribbean coral reefs provide fisheries, tourism, and shoreline protection benefits worth $3.1 to $4.6 billion per year, and degradation of these ecosystems will cost several hundred million dollars in yearly income by 2015.[325] Hawaiian

322. Robert Costanza, *The Ecological, Economic, and Social Importance of the Oceans*, 31 ECOLOGICAL ECONOMICS 199, 201 (1999).

323. AN OCEAN BLUEPRINT, *supra* note 196, at 31.

324. *Id.* (emphasis added).

325. THE ROYAL SOCIETY, OCEAN ACIDIFICATION DUE TO INCREASING ATMOSPHERIC CARBON DIOXIDE 33 (June 2005), *available at* http://royalsociety.org/document.asp?id=3249 [hereinafter OCEAN ACIDIFICATION].

coral reefs provide "added value" of $364 million per year, most of which derives from the net business revenues from snorkeling and diving; however, that "added value" also includes $40 million per year in increased property values.[326]

Fishing also depends on sustainable marine ecosystems. Commercial fishing was worth $28 billion per year to the United States in 2004, recreational fishing was worth $30 billion, and trade in ornamental fish was worth $3 billion.[327] Nor is the value of fish all in capture. In 2005, processed fisheries products were worth over $7.5 billion to the United States.[328]

In light of these benefits, and in light of the currently inadequate protection of the nation's marine ecosystems, developing a sustainable, comprehensive, and integrated marine regulatory and management regime is critical to the United States' continued wealth, quality of life, and national security. However, these ecosystems are also critically dependent on upstream freshwater management, as the next section will illustrate.

2. Marine Ecosystem Protection and Restoration and the Connection to Freshwater Management

Ocean ecosystems are the end of the line for fresh water. Thus, comprehensive regulation to protect those ecosystems requires an examination of upstream inputs, particularly with regard to water quality (pollution) and water quantity (freshwater influx, which determines salinity levels, especially in estuaries).[329] The effects of upstream inputs on marine ecosystems are widely acknowledged, but a few specific examples are nevertheless appropriate.

In Florida, upstream/downstream effects are important to at least two coastal ecosystems. In the Panhandle, oyster production at the mouth of the Apalachicola River and the continued survival of endangered and threatened mussel species and Gulf sturgeon in the river depend on the amount and quality of water released upstream in the Flint and Chattahoochee Riv-

326. *Id.*

327. AN OCEAN BLUEPRINT, *supra* note 196, at 2.

328. NATIONAL MARINE FISHERIES SERVICE, FISHERIES OF THE UNITED STATES 2005, at iv (Feb. 2007), *available at* http://www.st.nmfs.gov/st1/fus/fus05/fus_2005.pdf.

329. *See* Jacoby, *supra* note 36, at 402–03 (describing Texas's recent legislation to direct more water to estuaries).

ers.[330] However, Atlanta increasingly wants that water for its own municipal purposes, leading to over a decade of conflict and failed attempts at resolution.[331] Legally, the battle has most recently focused on the crux of the ESA and water releases from upstream Army Corps impoundments.[332] Nevertheless, should Florida pursue equitable apportionment of the tri-river system, the economics of the oysters at the end of the line are likely to be a weighty argument in its favor.[333]

At the southern tip of the state, the health of Florida Bay and the Florida Keys coral reef ecosystem depend on the quantity and quality of water flowing in from the Everglades. These marine ecosystems have suffered both from the loss of freshwater influx (and hence increased salinity) when the Everglades were drained and increased pollution as a result of agriculture, cities, and industries in the watershed.[334] Specifically, Everglades drainage and flood control projects both diverted approximately 1.7 billion gallons of fresh water west and east, into the Gulf of Mexico and Atlantic Ocean, and allowed for the farming and development that are the source of much land-based pollution into the southern Florida marine waters.[335] The drainage and other construction projects, such as Highway 1 and a southern Florida railroad, cut off most of the flow of relatively clean fresh water to Florida Bay and interfered with the natural circulation of water between the Bay and the Atlantic Ocean in and around the Florida Keys.[336] Salinity in the Bay increased in conjunction with these projects, leading to a

330. Ruhl, *supra* note 45, at 48–49.

331. *See, e.g.*, Alabama v. U.S. Army Corps of Engineers, 424 F.3d 1117, 1121–27 (11th Cir. 2005); Southeastern Federal Power Customers, Inc. v. Harvey, 400 F.3d 1, 2–3 (D.C. Cir. 2005); Georgia v. U.S. Army Corps of Engineers, 302 F.3d 1242, 1246–49 (11th Cir. 2002) (all explaining the conflict's history).

332. *See generally* Alabama v. U.S. Army Corps of Engineers, 441 F. Supp. 2d 1123 (N.D. Ala. 2006) (deciding an ESA challenge to the Corps' operation of dams on the Apalachicola River).

333. Ruhl, *supra* note 45, at 53–55; *see also* New Jersey v. New York, 283 U.S. 336, 345 (1931) (partially enjoining New York's diversion of the Delaware River in part because of the harm to the downstream oyster fishery resulting from decreased flows and increased salinity).

334. COMPREHENSIVE EVERGLADES RESTORATION PLAN, FLORIDA BAY AND FLORIDA KEYS FEASIBILITY STUDY OVERVIEW 2 (Oct. 2002), *available at* http://www.evergladesplan.org/docs/fs_fl_bay_feas_study.pdf.

335. America's Everglades, *Ecosystem Problems Center on Water*, http://www.evergladesplan.org/about/why_restore_pt_04.aspx.

336. COMPREHENSIVE EVERGLADES RESTORATION PLAN, *supra* note 334, at 2–3.

large region of hypersalinity, and those projects also have been linked to changes in the Atlantic/Florida Keys coral reef strands that occurred at the beginning of the 20th century.[337] The Bay itself experienced a near ecological crash in the late 1980s, when more than 100,000 acres of seagrasses died and algal blooms—probably fed by nutrient pollution—clouded the Bay's waters.[338] Moreover, with the added stressors of increasing ocean temperatures as a result of climate change and ocean acidification from increased carbon dioxide levels, the upstream stressors of nutrient and other pollution were sufficient to induce NOAA to list the elkhorn and staghorn corals for protection under the Endangered Species Act.[339]

In the Gulf of Mexico, a hypoxic zone—an area lacking oxygen, often referred to as a "dead zone"—recurs every year off the coast of Louisiana. According to the National Ocean Service, "After the Mississippi River flood of 1993, the spatial extent of this zone more than doubled in size, to over 18,000 km^2, and has remained about the same size each year through midsummer 1997."[340] In most years, the dead zone covers about 7000 square miles, with a record of 7728 square miles in 1999.[341] In many years, this dead zone is the size of New Jersey.[342] Moreover, the nutrient-fed hypoxic zone could have severe effects on Gulf of Mexico fisheries. In 1999, for example, scientists at NOAA concluded that "[i]f experiences in other systems are applicable to the Gulf of Mexico, then in the face of worsening hypoxic conditions, at some point fisheries and other species will decline, perhaps precipitously." [343] This hypoxia is the product of nutrient (especially nitrogen) inputs, particularly from farms, entering the Gulf from the entire Mississippi River watershed, a system of rivers and other waterways that drains 40% of the United States.[344] As a result, reducing or

337. *Id.*
338. *Id.* at 2.
339. 71 Fed. Reg. 26, 852, 856–59, 50 C.F.R. § 223.102 (May 12, 2008).
340. National Ocean Service, NOAA, National Centers for Coastal Ocean Science Gulf of Mexico Hypoxia Assessment, http://oceanservice.noaa.gov/products/pubs_hypox.html (last revised Aug. 6, 2003).
341. *Id.*
342. National Ocean Service, *supra* note 340.
343. ROBERT J. DIAZ & ANDREW SOLOW, NOAA, ECOLOGICAL AND ECONOMIC CONSEQUENCES OF HYPOXIA xi (May 1999), *available at* http://oceanservice.noaa.gov/products/hypox_t2final.pdf.
344. National Ocean Service, *supra* note 340.

eliminating Gulf hypoxia requires comprehensive examination of the entire watershed.

More progress has been made in restoring the Chesapeake Bay, another marine ecosystem damaged by upstream pollution and in-bay overfishing.[345] The watershed that drains to the Chesapeake Bay encompasses 64,000 square miles, including portions of six states—New York, Pennsylvania, Maryland, Delaware, Virginia, and West Virginia—and the District of Columbia.[346] Efforts to restore the Bay began in the mid-1970s.[347] Current restoration efforts are being guided by Bay-based, ecosystem-based output measurements and goals.[348] To achieve those goals, however, the Chesapeake Bay restoration program has had to reach progressively farther upstream and to expand its regulatory scope. In 1987, Maryland, Virginia, Pennsylvania, and the District of Columbia agreed to reduce nitrogen and phosphorus loading to the Bay by 40%.[349] In 1992, caps on nitrogen and phosphorus were allocated to each of the ten sub-basins in the watershed, but these were modified in 2000 to meet a 2010 Clean Water Act-driven TMDL deadline.[350] In addition, agreements in 2000 formally brought New York, Delaware, and West Virginia into the program.[351] Finally, to meet the ecosystem-based output goals, the program has expanded beyond nutrients to include dissolved oxygen, water clarity, and chlorophyll (a measure of algae growth).[352] The latest 2006 Bay Health and Restoration Assessment indicates that progress is being made for most goals and parame-

345. *See generally* Chesapeake Bay Program, Watersheds, http://www.chesapeakebay.net/wshed.htm (last updated Nov. 1, 2005).

346. *Id.*

347. Chesapeake Bay Program, Chesapeake Bay Restoration, http://www/chesapeakebay.net/resrtn.htm (last updated Jan. 27, 2002).

348. *See* Chesapeake Bay Program, Bay Restoration, http://www.chesapeakebay.net/bayrestoration.aspx?menuitem=13989 (citing goals of restoring water quality and "[r]estoring wildlife habitat for fish, birds, crabs and mammals" and promoting use of "[e]cosystem-based fishery management plans") (last visited Mar. 13, 2008).

349. Chesapeake Bay Program, The Comprehensive Approach to Restoring Bay Water Quality, http://www.chesapeakebay.net/wqcriteriatech.htm (last updated Mar. 15, 2005).

350. *Id.* A TMDL goes into effect in 2011 if the states do not meet the water quality goals for the Bay. *Id.*

351. *Id.*

352. *Id.*

ters, although the Bay remains degraded and more intensive control of agricultural pollution is required.[353]

As noted in the Introduction, consumption of water by the Colorado River states—Colorado, New Mexico, Wyoming, Utah, Arizona, Nevada, and California—has left the Gulf of California/Sea of Cortez parched and stressed, reflecting the "Progressive Era philosophy that water allowed to reach the sea wasted a precious resource."[354] The reduction in flow to the Gulf of California has been significant, from historical maximum flows of 24 to 25 million acre feet of water (maf) per year[355] to average flows of 13.5 to 17 maf per year in the 19th and 20th centuries[356] to, at best, the 1.5 maf per year currently mandated by treaty.[357] Moreover, the water that reaches the sea "consists of salty, polluted return flows from thousands of acres of irrigated agriculture on both sides of the border."[358] As a result, "[s]everal largely marine species in the lower river, including machete, striped mullet, spotted sleeper, and woundfin, were extirpated before 1900; roundtail chub and pikeminnow followed shortly thereafter."[359] In the delta itself, the prior complex of two million acres of wetlands, ranging from freshwater

353. Chesapeake Bay Program, News and Info: 2006 Bay Health and Restoration Assessment, http://www.chesapeakebay.net/newsassessment041807.htm (last updated April 18, 2007).

354. ADLER, *supra* note 1, at 211.

355. *Id.* at 22, 34 ("During the wettest years in the basin over the past several millennia, as much as 24-25 maf of water passed through the delta into the Sea of Cortez."). *See also* Michael Cohen, *The Delta's Perennial Drought: Instream Flow for an Over-Allocated River*, 19 PAC. MCGEORGE GLOBAL BUS. & DEV. L.J. 115, 115–16 (2006).

356. Cohen, *supra* note 355, at 117.

357. *Id.* at 119 (citing Treaty for the Utilization of Waters of the Colorado, Tijuana and Rio Grande Rivers, U.S.-Mex., Feb. 13, 1944, art. 10, 59 Stat. 1219). Moreover, the fact that the Gulf of California is in Mexico has complicated restoration efforts in the United States, because "[a]ny water used to restore riparian ecosystems in the United States, and that could not be diverted to the All American Canal just north of the Mexican border, would increase flows to Mexico beyond the minimum requirements of the 1944 treaty, something the United States has long shunned." *Id.* at 203. "By the time the river reaches the border, roughly nine out of every ten gallons have been diverted to cities outside the basin, consumed by crops or other human uses, or evaporated into the air, due to decisions reached almost entirely in the United States. These depletions have perhaps even more serious impacts on the river and its associated ecosystems as it travels its last few miles in Mexico." *Id.* at 205.

358. *Id.* at 34.

359. *Id.* at 98–99.

to brackish to tidal, has been reduced to 150,000 acres.[360] In turn, these "[w]etland losses and other changes in the river dramatically altered the ecosystem of the delta, the estuary, and the upper Sea of Cortéz,"[361] increasing salinity, changing water circulation patterns, and affecting species such as shrimp, fish, and the vaquita porpoise. [362] Nevertheless, the Gulf of California/Sea of Cortez has largely been ignored in Colorado River restoration discussions. As Robert Adler noted:

> [E]xisting analytical approaches to Colorado River restoration have been confined just as much as the water held behind the dams. We approach restoration decisions in the wrong order by allowing legal and institutional decisions made long ago to constrain choices about our goals for the river for future generations, and about the best means to achieve those goals.[363]

Thus, fresh water's regulatory fragmentation indirectly affects the marine ecosystems at the end of the line. However, these saltwater ecosystems also suffer directly from their own regulatory fragmentation, as the next Section will discuss.

B. Marine Ecosystems as Regulatory Commons

William Buzbee, in his theory of the "regulatory commons," has detailed why regulatory inattention might occur regarding ecosystem-level environmental problems such as watersheds, and especially their marine endpoints.[364] Watersheds and marine ecosystems are often interjurisdictional in nature, a key trigger for the development of Buzbee's "regulatory commons." Specifically, Buzbee posits "that when social ills match no particular political-legal regime or jurisdiction, but instead encounter fragmented political-legal structures, predictable in-

360. *Id.* at 41 (citation omitted); *see also id.* at 207 ("Before the dams, the delta supported one of the world's great desert estuaries, in which nearly 2 million acres of riparian and tidal wetlands hosted a vast diversity of plants, birds, and other wildlife . . . . Now scientists estimate that the delta supports 150,000 acres of wetlands, but those areas remain at risk unless floods recur periodically to rejuvenate them.").

361. *Id.* at 208.

362. *Id.* (citation omitted).

363. *Id.* at 266.

364. *See generally* William W. Buzbee, *Recognizing the Regulatory Commons: A Theory of Regulatory Gaps*, 89 IOWA L. REV. 1 (2003).

centives arise for potential regulators to opt against investing in such regulatory opportunities."[365] These incentives, in turn, create a "regulatory commons," which Buzbee analogizes to Garrett Hardin's "tragedy of the commons." Thus, "where a social ill does not fall squarely within any particular political-legal regime's turf,"[366] potential regulators lack "incentives to invest in efforts to gather information about the resource harms, lead collective efforts to devise curative strategies, or design a responsive strategy."[367]

Buzbee emphasizes four causes of potential regulators' lack of incentives to act. First, "regulators are not likely accurately to perceive the aggregate interest in the underlying ill."[368] Second, regulatory fragmentation is likely "to lead to competing credit claims."[369] Third, information costs are high, leading to free rider problems, and payoffs uncertain for any regulator who chooses to act.[370] Finally, numerous incentives exist for regulators to preserve the status quo.[371]

Aquatic ecosystem management, especially when such management seeks to incorporate marine ecosystems, is almost a textbook example of the regulatory fragmentation that should produce regulatory gaps under Buzbee's theory. First, as in freshwater ecosystems, "a single government regulator seldom exists" for marine ecosystems, and "[i]n settings of regulatory fragmentation, mismatch, and overlap, regulatory commons dynamics will exist."[372]

Recent studies of marine ecosystem management in the United States have confirmed these problems. The Pew Oceans Commission, an 18-member public interest commission sponsored by The Pew Charitable Trusts and assembled in June 2000 to review the United States' ocean policies, issued its final report, *America's Living Oceans: Charting a Course for Sea Change*,[373] in May 2003. The U.S. Commission on Ocean Policy, which President George W. Bush appointed in response

365. *Id.* at 6.
366. *Id.* at 27 (citation omitted).
367. *Id.* at 28.
368. *Id.* at 31.
369. Buzbee, *supra* note 364, at 32.
370. *Id.* at 33
371. *Id.* at 33–36.
372. *Id.* at 21–22.
373. PEW OCEANS COMMISSION, AMERICA'S LIVING OCEANS CHARTING A COURSE FOR SEA CHANGE 12–11 (2003) [hereinafter AMERICA'S LIVING OCEANS].

to the Oceans Act of 2000,[374] issued its report, *An Ocean Blueprint for the 21st Century*,[375] in September 2004. In its report, the U.S. Commission on Ocean Policy recommended the creation of centralizing agencies at the federal level, emphasizing that:

> At the federal level, eleven of fifteen cabinet-level departments and four independent agencies play important roles in the development of ocean and coastal policy. These agencies interact with one another and with state, territorial, tribal, and local authorities in sometimes haphazard ways. Improved communication and coordination would greatly enhance the effectiveness of the nation's ocean policy.[376]

More bluntly, the Pew Oceans Commission concluded:

> Not a system at all, U.S. ocean policy is a hodgepodge of individual laws that has grown by accretion over the years, often in response to crisis. More than 140 federal laws pertain to the oceans and coasts . . . [c]ollectively, these statutes involve at least six departments of the federal government and dozens of federal agencies in the day-to-day management of our ocean and coastal resources.
>
> Authority over marine resources is fragmented geographically as well . . . . This federal/state division of ocean jurisdiction makes it difficult to protect marine ecosystems because it divides their management into a nearshore and an offshore component *with insufficient means or mandate to harmonize the two.*[377]

The Pew Commission also recommended centralization to correct this regulatory fragmentation; specifically, it recommended that Congress "enact a National Ocean Policy Act requiring federal, state, and territorial agencies to protect, maintain, and restore marine and coastal ecosystems, and reorienting national and regional decision-making bodies to these ends."[378]

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374. Oceans Act of 2000, Pub. L. No. 106-256, § 2, 114 Stat. 644 (2000), amended by Pub. L. No. 107-206, 116 Stat. 833 (2003), Pub. L. No. 107-372, 116 Stat. 3096 (2003).

375. AN OCEAN BLUEPRINT, *supra* note 196.

376. *Id.* at 5.

377. AMERICA'S LIVING OCEANS, *supra* note 373, at 26 (emphasis added).

378. *Id.* at 33.

Second, as discussions above have noted, both large watersheds and marine ecosystems suffer as a result of almost all of Buzbee's "jurisdictional mismatches"—that is, the "lack of a regulator with primacy over an activity and its effects . . . ."[379] These jurisdictional mismatches include the following: the regulatory fragmentation resulting from federalism, which divides regulatory authority between the federal government and the states;[380] the problem of interjurisdictional harms, especially as pollution and other inputs upstream flow downstream;[381] the mismatch between the scope of the resource and the scope of governmental regulatory authority, leaving no single regulator with the authority to address the entire problem;[382] and social ills that "arise[] out of dynamics, incentives or actors outside of a government's jurisdiction,"[383] such as the interstate and international atmospheric deposition of mercury. Indeed, Buzbee himself offers aquaculture as a predictable regulatory orphan, because "no primary regulator exists or has reason to step forward," given that "[t]he broad potential harms of aquaculture are unlikely to befall any one jurisdiction."[384] More specifically,

> aquaculture operations . . . are a geographically identifiable and ostensibly confined activity that arises out of market demands that are global in nature, pollution implications that are far from confined, and ecosystem risks that are global. The mixed-media nature of aquaculture and its risks, coupled with the lack of any one prime regulator, has to date left aquaculture subject to incomplete and arguably ineffective regulation.[385]

Buzbee's theory thus predicts a lack of adequate regulatory attention to marine ecosystems problems such as atmospheric deposition of mercury. As noted, two ocean commissions have confirmed this regulatory fragmentation of the nation's marine resources. Moreover, they have also confirmed marine ecosystems' status as regulatory "orphans" vis-à-vis freshwater management and the need for greater integration of all aquatic re-

379. Buzbee, *supra* note 364, at 23.
380. *Id.*
381. *Id.* at 24.
382. *Id.* at 25.
383. *Id.*
384. *Id.* at 9.
385. Buzbee, *supra*, note 364, at 9.

source management. As Donna Christie has emphasized, the two commissions' reports are "largely in agreement on some very fundamental issues," including the need for an integrated, ecosystem-based approach to ocean management that incorporates upstream stressors.[386]

Thus, the Pew Oceans Commission and U.S. Commission on Ocean Policy reports should be particularly provocative for reformation of freshwater resource management. Marine ecosystems are the ecological termini of freshwater watersheds, affected by both the water withdrawals and the water pollution that occur upstream. Recognized problems indicate both that water resources management needs to be more comprehensive and less fragmented *and* that the nation's valuable marine resources need to be incorporated within this more comprehensive management regimes.

Climate change only underscores the need for a comprehensive regulatory approach to protect marine ecosystems. Excess carbon dioxide levels are already acidifying the oceans,[387] and some of the more confidently predicted effects of climate change are increases in ocean temperatures and sea level rise.[388] All of these effects can distress marine—especially coastal—ecosystems[389] and hence already threaten a large sector of the United States' economic productivity. Considering the effects of upstream water resources decisions on coastal and marine ecosystems thus makes economic as well as ecological sense.

However, incorporating marine ecosystem output measures into freshwater regulation could also do much to harmonize and prioritize regulatory goals across the entire watershed. Nevertheless, the evolution to output-based comprehensive aquatic resource regulation that incorporates marine ecosystem concerns poses a fundamental regulatory

386. Christie, *supra* note 186, at 117; *see also id.* at 120–23 (discussing the Pew Oceans Commission Report), 123–29 (discussing the U.S. Commission on Ocean Policy's Report). *See generally* Josh Eagle, *Regional Ocean Governance: The Perils of Multiple Use Management and the Promise of Agency Diversity*, 16 DUKE ENVTL. L. & POL'Y F. 143 (2006); Andrew A. Rosenberg, *Regional Ocean Governance and Ecosystem-Based Management of Ocean and Coastal Resources*, 16 DUKE ENVTL. L. & POL'Y F. 179 (2006).

387. OCEAN ACIDIFICATION, *supra* note 325, at 33.

388. *See* PREPARING FOR AN UNCERTAIN CLIMATE, *supra* note 155, Vol. I, at 39.

389. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY: SUMMARY FOR POLICYMAKERS 3, 11–12, 14–17 (2007).

question: How do we get past the problems of regulatory fragmentation and the regulatory commons? This question provides the starting point for Part IV, which explores regulatory reforms that could better incorporate marine ecological output measures into water resources management.

IV. OUTPUT-BASED, MARINE-INCLUSIVE REGULATORY REFORMS TO WATER RESOURCES MANAGEMENT

A. Marine Ecosystem Health as an Output Measure for Upstream Regulation

As noted, the health of coastal marine ecosystems depends, at least in part, on the quantity and quality of fresh water that reaches those ecosystems.[390] In addition, as the Pew Center of Global Climate Change has pointed out, "[c]limate change may decrease or increase precipitation, thereby altering coastal . . . ecosystems."[391] These facts explain why coastal and ocean regulators must look upstream if they want to ensure that the United States' marine ecosystems can continue to provide the wealth inherent in sustainable marine biodiversity.

Nevertheless, as the examples in Part III.A indicate, marine ecosystems also suggest relevant output measures that could provide regulatory focus and coherence for upstream freshwater resource management. For example, asking what water quality goals in the Mississippi River watershed "should" be is close to a meaningless question when asked in the context of the current Clean Water Act. Because of the Clean Water Act's cooperative federalism, states set water quality goals for particular water segments,[392] a state-local focus that almost never takes account of cumulative watershed effects or large aquatic ecosystems. In other words, applying the Act's requirements for ambient water quality goals to the Mississippi River quickly devolves into an uncoordinated promotion of state and local priorities rather than a comprehensive evaluation of the River (let alone the watershed) as a whole.

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390. KENNEDY ET AL., PEW CENTER ON GLOBAL CLIMATE CHANGE, COASTAL AND MARINE ECOSYSTEMS AND GLOBAL CLIMATE CHANGE, http://pewclimate.org/docUploads/marine-ecosystems.pdf (last visited Feb. 17, 2008).

391. *Id.* at iv.

392. 33 U.S.C. § 1313(c) (2000).

However, if instead one asks how water resources in the Mississippi River should be managed both to promote state-local priorities *and* to restore the Gulf of Mexico by reducing or eliminating the Gulf's hypoxic zone, priority regulatory issues come immediately into focus—namely, controlling nutrient pollution, which in turn requires a focus on agriculture.[393] As such, focusing on marine outputs in this watershed immediately underscores two of the Clean Water Act's gaping regulatory "holes": agriculture[394] and nonpoint source pollution.[395] Such a marine output focus also reveals that water *quantity* regulation is not a particularly important issue for the Mississippi.

In stark contrast, in the Colorado River both water quality and water quantity issues are relevant, while in the Apalachicola River water quantity and water flow regimes are most important.[396] The Gulf of California suffers from both lack of incoming water and water pollution,[397] while the Apalachicola Bay oysters suffer almost entirely as a result of reduced water flows and altered flow regimes.[398] Water quality issues are at least subject to the minimum federal requirements in the Clean Water Act; in contrast, water quantity issues are almost entirely state-local in focus. As Reed Benson has comprehensively discussed, several federal doctrines and statutes do limit the deference accorded to state water allocations and states' power to make such allocations.[399] Nevertheless, no federal law creates a comprehensive water resource management regime. Instead, as was detailed in Part II, federal claims and laws provide one basis for locus-specific water resource disputes, disputes that pit the state-local interest at stake against federal claims of priority *for that particular water or river segment*, whether for navigation, Tribes, reclamation projects, hy-

393. *See* NRC MISSISSIPPI RIVER REPORT, *supra* note 95, at 9–11 (2007).

394. *See generally* David Zaring, *Agriculture, Nonpoint Source Pollution, and Regulatory Control: The Clean Water Act's Bleak Present and Future*, 20 HARV. ENVTL. L. REV. 515 (1996) (discussing the weaknesses of the Clean Water Act in addressing pollution from agriculture).

395. *See generally* Kristi Johnson, *The Mythical Giant: Clean Water Act Section 401 and Nonpoint Source Pollution*, 29 ENVTL. L. 417 (1999) (discussing the Clean Water Act's inability to address nonpoint source pollution, even when federally permitted).

396. *See supra* notes 330–33 and accompanying text.

397. *See supra* notes 355–62 and accompanying text.

398. *See supra* notes 330–33 and accompanying text.

399. Benson, *supra* note 22, at 257–311.

dropower, or endangered fish.[400] Universal application of ecologically motivated minimum flow regimes does not yet exist, to the detriment of the Gulf of California, Apalachicola Bay, and several other coastal ecosystems.

Thus, the first reality that a marine output-based focus reveals is that the regulatory issues for marine and aquatic ecosystems can vary considerably from watershed to watershed. "Protecting the oceans" is thus not a univalent regulatory goal, and incorporation of marine ecosystem goals into freshwater management is as likely to reveal differences in watershed management choices and priorities as it is to reveal similarities.

This recognition of difference, in turn, is important for at least two reasons. First, and most basically, the types of sources that need to be addressed and the types of regulatory refinements that need to be made in order to protect marine ecosystems will vary. Second, in times of decreased water supply and water shortage, regulating to protect marine resources will be far more politically and economically viable in some watersheds than in others. As a result, incorporating marine ecosystem considerations into freshwater management would make it less likely that marine ecosystems will be "unwittingly destroyed" through unconscious triage in those watersheds where, if marine ecosystems were in fact consciously considered, economics, cultural values, and/or the availability of relatively minor regulatory accommodations would accord marine ecosystem protection higher regulatory priority than it currently receives.

Finally, an output-based, marine-inclusive approach to water management would certainly be better for the oceans, but incorporation of marine ecosystem goals is also likely to better protect upstream ecosystems and many upstream uses. For example, reductions in atmospheric deposition of mercury sufficient to prevent contamination of marine fish would also address mercury bioaccumulation in freshwater fish, adverse effects on protected species such as the Florida panther, and potential human health impairments. Similarly, reductions in other types of land-based water pollution to protect ocean water quality would almost certainly simultaneously better protect freshwater quality. Ensuring that enough water flows

400. *See* discussion *supra* Part II.A.

through waterways to support the estuaries and other coastal ecosystems at the end of the line would simultaneously help to ensure that sufficient water remained in those waterways to support the freshwater ecosystems and protected species within them, would support efforts to improve water quality, could improve navigation and recreation when low flows threaten passage, and would support hydropower generation.

B. Expanding the Role of the Federal Government

Admittedly, the federal government has not historically promoted an ecosystem-based approach to water resources management. Indeed, Congress, through directives to the BOR, the Army Corps, and the TVA, among other agencies, can fairly be charged with significant destruction of ecosystems throughout the United States, especially in the West.[401]

While such large-scale impairment of aquatic ecosystems might be cause for doubting the efficacy of an increased federal role in water resources management, the evolution of federal management priorities suggests that a change in substantive outlook would support the structural arguments for an increased federal presence. Federal irrigation, flood control, navigation, and hydropower projects reflected the political priorities for water of the 19th and early 20th centuries. The very enactment of many major federal environmental statutes in the 1960s and 1970s signaled a change in those priorities. Although federal environmental priorities are still evolving (or perhaps more accurately, vacillating between Republican and Democratic Administrations), my advocacy for a regulatory structure that increases the federal role in water management to reduce the impediments of regulatory fragmentation depends on the concurrent enactment of substantive federal legislation that embraces and promotes ecosystem-based management and biodiversity- and marine-ecosystem-preserving goals.

With those caveats, if the nation wishes to create a regulatory structure that effectively includes marine ecosystem considerations in freshwater management, the federal government will probably have to take a more expansive (although certainly not exclusive) role. If nothing else, increased federal involve-

401. *See* MARC REISNER, CADILLAC DESERT: THE AMERICAN WEST AND ITS DISAPPEARING WATER 145–213 (1986) (Penguin rev. ed. 1993).

ment is necessary to provide a national-level perspective to counterbalance the state-local interests that currently dominate both water quality and water quantity regulation. Several strands of jurisprudence and normative theory support such increased federal involvement.

First, the federal government has long acknowledged the need for a federal role in interstate water resources issues. For example, because the Supreme Court has jurisdiction over interstate conflicts, it has always been the arbitrator of interstate water disputes, in terms of both interstate water pollution[402] and interstate water quantity allocation.[403] While Congress's enactment of the federal Clean Water Act displaced federal interstate nuisance law,[404] the Act itself continues to guarantee a substantial federal role in interstate water quality disputes. Moreover, interstate water quality disputes still prompt regular calls for federal intervention. For example, in October 2007, the National Research Council called for the EPA to take a bigger role in addressing Mississippi River water pollution, particularly nutrient pollution, both to improve the health of the River itself and to reduce hypoxia in the Gulf of Mexico.[405] As for water quantity, the federal common law of equitable apportionment and the federal constitutional device of interstate compacts remain not only viable but important tools for resolving interstate disputes. In 2007 alone, the U.S. Supreme Court agreed to resolve New Jersey's interstate compact dispute with Delaware over rights in the Delaware River,[406] while South Carolina filed an original equitable apportionment action seeking to restrain North Carolina's use of the Catawba River.[407]

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402. *See, e.g.*, Vermont v. New York, 417 U.S. 270, 275 n.5 (1974); Illinois v. City of Milwaukee, 406 U.S. 91, 104 (1972); New Jersey v. New York City, 283 U.S. 473, 481 (1931); Missouri v. Illinois, 200 U.S. 496, 520–21 (1906); Missouri v. Illinois, 180 U.S. 208, 238-41 (1901).

403. *See, e.g*, Arizona v. California, 373 U.S. 546, 562 (1963); Nebraska v. Wyoming, 325 U.S. 589 (1945); Hinderlider v. La Plata Co., 304 U.S. 92, 110 (1938); Kansas v. Colorado, 206 U.S. 46, 98 (1907).

404. *See* City of Milwaukee v. Illinois, 451 U.S. 304, 312–22 (1981).

405. NRC MISSISSIPPI RIVER REPORT, *supra* note 95, at 9–11.

406. *See* New Jersey v. Delaware, ___ U.S. ___, 128 S. Ct. 435 (2007) (setting oral argument in the case).

407. Andrew Mackie, *S.C. Lawsuit One Step Closer to Supreme Court Hearing*, HICKORY DAILY RECORD, Oct. 2, 2007, http://www.hickoryrecord.com/servlet/Satellite?pagename=HDR/MGArticle/HDR_BasicArticle&c=MGArticle&cid=1173352962353; Lyle Denniston, *South Carolina sues in Supreme Court over water*,

Second, the oceans enjoy a particularly federal character. Except in certain parts of the Gulf of Mexico, where state authority extends further out to sea, the oceans are subject to exclusive federal regulatory authority more than three nautical miles from shore.[408] By congressional grant, states have extensive jurisdiction over the first three miles of coastal waters,[409] but that regulatory authority is subject to frequent federal regulation and even preemption for navigation, coastal construction, coastal zone management, national security, and marine pollution[410] purposes. Other federal obligations can also come into play. For example, water delivery from the Colorado River to the Gulf of California/Sea of Cortez, which is located in Mexican territory, is governed by treaty.[411]

Third, the regulatory fragmentation that characterizes water resource management also counsels for greater federal involvement. For example, at the end of his discussion of the regulatory commons, William Buzbee suggests that reduction of regulatory fragmentation requires the creation of regulatory hierarchies.[412] Specifically, "[i]n the regulatory commons setting, recourse to federal authority will generally be a constitutionally palatable option,"[413] although some decentralization is generally also advisable.[414]

More expansively, Erin Ryan has argued for the recognition in constitutional federalism jurisprudence of interjurisdictional regulatory "gray areas" subject to both state and federal regulation[415] and the problem-solving value of federalism.[416] The problem-solving value of federalism acknowledges that pragmatism has always been a component of American federal-

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SCOTUSBLOG, http://www.scotusblog.com/wp/uncategorized/south-carolina-sues-in-supreme-court-over-water (June 7, 2007).

408. *See* California v. United States, 332 U.S. 19, 33–39 (1941); Pacific Legal Found. v. Costle, 586 F.2d 650, 655–56 (9th Cir. 1978), *rev'd on other grounds*, 445 U.S. 198 (1980).

409. *See* 43 U.S.C. §§ 1311(a), 1312.

410. *See id.* §§ 1311(d), 1313, 1314.

411. Treaty for the Utilization of Waters of the Colorado, Tijuana and Rio Grande Rivers, U.S.-Mex., Feb. 13, 1944, art. 10, 59 Stat. 1219; *see also* ADLER, *supra* note 1, at 213 (discussing the treaty).

412. *See* Buzbee, *supra* note 364, at 49–51.

413. *Id.* at 53.

414. *See id.* at 56–63.

415. Erin Ryan, *Federalism and the Tug of War Within: Seeking Checks and Balances in the Interjurisdictional Gray Area*, 66:3 MD. L. REV. 503, 567–96 (2007).

416. *Id.* at 620–28.

ism (Ryan traces this value to James Madison and *The Federalist Papers*[417]) and hence that governmental capacity is a relevant factor in dividing regulatory authority among federal, state, and local governments.[418] As such, the "subsidiarity principle" that normally promotes local regulation more generally "directs that decisionmaking take place at the most local level *that can get the job done*."[419] Hence, Ryan concludes, "if the most local level of government lacks the capacity to address [a problem], citizens should be entitled to expect that the next level up with capacity should at least be authorized to try."[420]

Notably, Ryan turns repeatedly to water resource issues as examples of interjurisdictional problems requiring a more balanced view of the federalism interests and problem solving capacities involved in addressing those issues. Thus:

> A prime example of the de jure interjurisdictional regulatory problem is that of water pollution because nearly all water passes through subsequent realms of state and federal jurisdiction on its hydrological journey from sky to sea. This is not simply a matter of rivers and lakes that straddle state boundaries; water moves through state and federal jurisdiction even within state lines.[421]

Even more revealingly, Ryan discusses the Chesapeake Bay's dead zone, Lake Michigan's mercury-contaminated fish, bacteria-infected Boston Harbor,[422] regulation of storm water runoff,[423] and wetlands regulation[424] before emphasizing that, in interjurisdictional problem solving, "disparate communities discover interlinked and interdependent interests in what may at first seem an overtly local or national problem—such as local land use decisions that impact the quality of interjurisdictional waters."[425] Water resources management raises federalism issues precisely because water links all levels of government and all levels of public concern—particularly when one looks at the downstream ecosystems.

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417. *Id.* at 622.
418. *Id.* at 624.
419. *Id.* (emphasis added).
420. *Id.*
421. *Id.* at 574.
422. Ryan, *supra* note 415, at 575.
423. *Id.* at 576–80.
424. *Id.* at 584–85.
425. *Id.* at 619.

In support of an increased role for the federal government, there have been several recent indications that interjurisdictional water resource management requires more active federal participation and significant federal leadership. For example, on July 9, 2007, the National Council for Environmental Policy and Technology advised the federal EPA "that 'neither policymakers or the public have a clear understanding of the concept of a watershed approach to water management, the relationship between a watershed approach and the urgent need to address water supply, water quality, and insufficient deteriorating water infrastructure, or the benefits of a watershed approach.'"[426] It further advised the EPA to "'lead by example'" and coordinate a watershed approach to managing storm water, wastewater, and drinking water systems.[427] More specifically, in October 2007, as noted, the National Research Council advised the EPA to take an aggressive leadership role in addressing nutrient pollution in the Mississippi River and Gulf of Mexico hypoxia, while also acknowledging the Department of Agriculture's potential leadership role.[428]

Perhaps most significantly, on October 10, 2007, the House of Representatives Natural Resources Committee unanimously approved and reported out of committee H.R. 135, which would enact the Twenty First Century Water Policy Commission Act of 2007.[429] The bill finds that "the Nation's water resources will be under increasing stress and pressure in the coming decades," that "a thorough assessment of technological and economic advances that can be employed to increase water supplies or otherwise meet water needs in every region of the country is important and long overdue," and that "a comprehensive strategy to increase water availability and ensure safe, adequate, reliable, and sustainable water supplies is vital to the economic and environmental future of the Nation."[430] If enacted in its current form, the Act would establish a Twenty

426. Amena H. Saiyid, *Advisors Say EPA Should 'Lead by Example' to Effectively Promote Watershed Approach*, 132 DAILY ENVIRONMENT REPORT, July 11, 2007, at A-2 (quoting the National Advisory Council's draft report).

427. *Id.* (quoting National Advisory Council's draft report).

428. NRC MISSISSIPPI RIVER REPORT, *supra* note 95, at 7, 9–11.

429. BNA, Inc., *Water Resources: House Resources Committee Clears Bill, Sets Up Commission to Draft Water Strategy*, 196 DAILY ENVIRONMENT REPORT, Oct. 11, 2007, at A-1, *available at* http://pubs.bna.com/ip/bna/DEN.NSF/eh/a0b5f5q7t8.

430. H.R. 135, § 2(1)-(3), 110th Cong, 1st Sess. (as introduced Jan. 4, 2007).

First Century Water Commission[431] and fund it with $9 million[432] over three years to produce a comprehensive water strategy to plan for *the Nation's* current and future water supply needs.[433] Specifically, while "respect[ing] the primary role of States in adjudicating, administering, and regulating water rights and water uses," the national water strategy would nevertheless seek to provide incentives "to ensure an adequate and dependable supply of water to meet the needs of the United States for the next 50 years," to "eliminate[] duplication and conflict among Federal governmental programs," to "optimize water supply reliability, availability, and quality, while safeguarding the environment," and to provide federal financing for infrastructure improvements and replacements as well as federal suggestions for water conservation.[434] While not yet law, H.R. 135 nevertheless acknowledges that water resource management has a national dimension as well as state-local dimensions.

Regulation to protect ocean ecosystems is the quintessential interjurisdictional problem. Local- and state-based interests have dominated water quality and water quantity issues to date, and neither set of regulatory regimes regularly or comprehensively factors marine ecosystems into regulatory decisionmaking. Expanding the federal role in water resource management could improve protections for the oceans, as both oceans commissions have recommended. Such reforms could also increased marine ecosystems' resilience in the face of climate change and simultaneously better address the economic and public health issues associated with those ecosystems.

C. Recommended Amendments to Existing Statutes

The discussions throughout this Article suggest several immediate improvements that Congress could make to existing federal environmental statutes that would increase the frequency with which regulators consider oceans and marine ecosystems in water resource management decisions. As such, these proposed amendments could reduce the unconscious de-

431. *Id.* § 3.
432. *Id.* § 11.
433. *Id.* §§ 4, 9(b).
434. *Id.* § 4.

struction of marine resources simply by increasing freshwater regulators' awareness of downstream coastal and ocean effects.

1. Amendments to the Clean Water Act

As the Nation's primary federal statute for addressing water resources, and especially in light of the cooperative federalism model that it adopts, the Clean Water Act already does much to link federal, state, and local interests in freshwater resources. Moreover, the Act already addresses coastal and marine waters,[435] although these provisions have not been implemented as thoroughly as they might be. In addition, the Act could, following the U.S. Supreme Court's recognition that water quantity and water quality are connected,[436] more explicitly connect water quality issues to water quantity and flow. With these considerations in mind, this Article suggests seven possible amendments to the Clean Water Act, listed from least to most controversial, that could better prioritize certain water resource issues and better link upstream water resources management to marine ecosystem protection.

First, Congress should amend the Clean Water Act to address nonpoint source pollution and to bring agricultural sources within the regulatory purview of the Act. Agricultural point sources currently exempted from the Act, such as irrigation return flows and agricultural storm water[437] (if channeled), should be subject to normal NPDES permitting requirements, while nonpoint sources currently left to state regulation should be subject to regularized and enforceable best management practices ("BMP") requirements. The exemption of these sources is a long-recognized weakness of the Act, and these sources are the most significant causes of remaining water pollution problems.[438] In particular, nutrient pollution from farms and other nonpoint sources is a major cause of coastal ecosystem problems throughout the country,

435. 33 U.S.C. §§ 1362(8), (9), 1343 (2000).

436. PUD No. 1 of Jefferson County v. Washington Dep't of Ecology, 511 U.S. 700, 719–20 (1994).

437. 33 U.S.C. § 1362(14) (2000) (defining "point source" to explicitly exclude these sources of water pollution).

438. Office of Wetlands, Oceans, and Watersheds, U.S. EPA, *What is Nonpoint Source (NPS) Pollution? Questions and Answers*, http://www.epa.gov/owow/nps/qa.html (last updated Feb. 5, 2008).

including in the Gulf of Mexico, Chesapeake Bay, and the Atlantic Ocean.[439]

Second, Congress should amend the Clean Water Act to explicitly require that the EPA set federal water quality criteria for nutrients, particularly nitrogen and phosphorus. Lack of numeric water quality criteria has impeded efforts to address nutrient pollution in many interjurisdictional waters.[440] To make these criteria most effective, the EPA should establish a range of nutrient criteria to reflect varying sensitivities of different ecosystems to nutrient pollution. For example, humans can tolerate concentrations of ten micrograms per liter of nitrogen in drinking water, but the freshwater springs in Florida experience unnatural algae growth at far smaller concentrations of nutrients.[441] The EPA should also expressly address coastal and marine ecosystems when setting these criteria, establishing numeric criteria sufficiently stringent to avoid nuisance algae growth, harmful algal blooms, and hypoxia.

Third, Congress should amend the Clean Water Act to require that coastal states (or the EPA in their stead) set comprehensive water quality standards for marine coastal waters. States can technically already establish such water quality standards under the Act, because state jurisdiction over the Act's "navigable waters" extends three nautical miles out to sea.[442] However, the provisions of the Act requiring water quality standards and TMDLs often refer to "intrastate waters"[443] or "waters within [the State's] boundaries,"[444] diluting these provisions' direct applicability to coastal waters. Moreover, while the EPA does set ocean discharge criteria for all marine waters,[445] these criteria are *not* water quality standards. As a consequence, unlike water quality standards, the

439. Robert Howarth et al., *Nutrient Pollution of Coastal Rivers, Bays, and Seas*, 7 ISSUES IN ECOLOGY 1, 3 (2000), *available at* http://www.epa.gov/watetrain/pdf/issue7.pdf.

440. *See id.*

441. FLORIDA DEP'T ENVTL. PROTECTION, LET'S PROTECT MANATEE SPRING 2 (Nov. 2000), *available at* http://www.floridastateparks.org/manateesprings/docs/ProtectingTheSpring.pdf.

442. *See* 33 U.S.C. § 1362(7) (2000) (defining "navigable waters" to include the territorial seas); *id.* § 1362(8) (defining "territorial sea" to be the first three miles of coastal waters); *id.* § 1313(c)(2)(A) (discussing water quality standards for the "navigable waters").

443. 33 U.S.C. § 1313(a)(2), (3) (2000).

444. *Id.* § 1313(d)(1)(A).

445. *Id.* § 1343.

ocean discharge criteria cannot trigger the Act's TMDL provisions. TMDLs provide a judicially enforceable means for encouraging states to eventually meet their water quality standards,[446] and, through the Act's certification provisions and interstate provisions,[447] TMDLs and the underlying water quality standards can influence upstream discharges and water quality regulation. An explicit requirement that states or the EPA set water quality standards for coastal waters would thus increase awareness of marine ecological demands and provide a means for influencing upstream water quality regulation that affects marine ecosystems.

Fourth, Congress should amend the Clean Water Act to extend the water quality standard and TMDL requirements to the EPA's jurisdiction over the deeper oceans to the full extent of the United States' 200-mile Exclusive Economic Zone ("EEZ"). The Act clearly applies to the "oceans" and references international law in establishing its geographic extent.[448] Pursuant to customary international law, the United States claims authority to regulate marine environmental matters throughout its EEZ.[449] However, the Clean Water Act's water quality standards requirement extends only three miles from shore,[450] even though marine water quality problems caused by upstream discharges extend into federal waters. One prominent example is the hypoxic zone in the Gulf of Mexico. Although the EPA almost certainly possesses sufficient authority to establish ocean water quality standards,[451] especially in light of the ocean discharge criteria requirements, the Act contains no mechanism—the equivalent of the TMDL provisions—to make ocean ambient water quality standards enforceable upstream. Under this new authority, the EPA should set marine water quality standards for, in particular, nutrients and algal concen-

446. *See id.* § 1313(d) (2000) (requiring TMDLs for all water segments violating applicable water quality standards).

447. *Id.* §§ 1341(a)(1)–(2), 1342(b)(5).

448. *See* 33 U.S.C. § 1362(9)–(10) (2000).

449. Exclusive Economic Zone of the United States of America, Proclamation No. 5030, 48 Fed. Reg. 10,605 (March 14, 1983); *see* Magnuson-Stevens Fishery Conservation and Management Act, Pub. L. No. 94-265, §§ 3(11), 101, 90 Stat. 331 (1976).

450. 33 U.S.C. §§ 1313(b)–(c), 1362(7)–(8) (2000).

451. Robin Kundis Craig & Sarah Miller, *Ocean Discharge Criteria and Marine Protected Areas: Ocean Water Quality Protection Under the Clean Water Act*, 29 B.C. ENVTL. AFF. L. REV. 1, 26–27, 32–37 (2001).

tration (chlorophyll), mercury and other toxics, and, given increasing problems with ocean acidification, pH.

Fifth, Congress should strengthen interstate obligations under the Act by providing a mechanism to make water quality standards and TMDLs in downstream states more directly enforceable against polluters and regulatory agencies in upstream states by both downstream states and citizens. This enforcement mechanism would thus be stronger and more predictable than the federal interstate nuisance law that the Act displaced. As a practical matter, upstream states often effectively dominate water management in the Clean Water Act's current regulatory regime, despite the Act's numerous interstate provisions. For example, the lower Mississippi River states can do little to address the River's water quality because much of the pollution originates from upstream sources outside of the lower states' control.[452] While upstream regulatory backtracking is possible under the current Act, it is *likely* only when federally permitted activities[453] or state-permitted point sources[454] are the immediately recognizable cause of a downstream problem. Using the Act's interstate tools to limit upstream nonpoint source pollution or to reach other aspects of upstream water resource management has proven difficult, if not impossible.

Sixth, Congress should amend the Act's water quality standards provisions to make minimum flows a component of all water quality standards. While states currently have the *authority* to include minimum flow requirements as part of their water quality standards,[455] the Act itself requires only designated uses and water quality criteria.[456] Moreover, as part of these amendments, Congress should explicitly require the coastal states or, if they refuse, the EPA to set minimum flow requirements for all fresh waters that flow into the ocean, measured in the transition/entry zone and made enforceable

452. NRC MISSISSIPPI RIVER REPORT, *supra* note 95, at 2–4.

453. *See* 33 U.S.C. § 1341(a) (2000) (allowing for state certifications and interstate protests when federally permitted or licensed activities could result in discharge of pollutants).

454. *See id.* §§ 1342(b)(5), 1344(h)(1)(C) (requiring state permit-granting agencies to inform other states of point source discharges that could affect other states' water quality).

455. PUD No. 1 of Jefferson County v. Washington Dep't of Ecology, 511 U.S. 700, 720–21 (1994).

456. 33 U.S.C. § 1313(c)(2)(A) (2000).

against upstream states. Adding a minimum flow requirement to water quality standards likely will immediately reveal conflicts—both conflicts between a given state's water law and the Clean Water Act and conflicts among states' water management regimes for the same water resource—that the Act's current regulatory regime obscures. As a result, the minimum flow requirement likely would underscore the need for increased interstate negotiation regarding water resources, and the new interstate enforcement mechanism would provide the legal impetus for doing so.

Finally, Congress should amend Section 101(g) of the Clean Water Act explicitly to subject state primacy in water allocation to the minimum flow requirements and other aspects of water quality standards created and federally approved pursuant to the Act. Currently, Section 101(g) states that "[i]t is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this chapter."[457] As a policy statement, the legal force of this provision is questionable;[458] nevertheless, in 2001 the U.S. Supreme Court gave surprising weight to another of Section 101's pro-state policies,[459] increasing the interpretive force of all such provisions. In any case, as a policy, Section 101(g) ignores—as the Supreme Court in other contexts has not—that the intimate interrelationship of water quantity and water quality issues and the substantial interests of the federal government in both aspects of water resource regulation, particularly where the oceans are concerned.

Section 101(g) also ignores the regulatory fragmentation that often exists *within* states and the fact that a state may not speak univocally regarding its priorities for a particular waterbody. Indeed, in most states, decisions about water allocation already may be in conflict with decisions regarding water quality standards because those decisions were made by two different and uncoordinated state agencies. In other words, by explicitly recognizing the states' primacy in allocating water, the current Section 101(g) already lends weight to one side of what

457. 33 U.S.C. § 1251(g) (2000).

458. 511 U.S. at 720–21.

459. Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers, 531 U.S. 159, 166–67 (2001) (emphasizing Section 101(b), 33 U.S.C. § 1251(b) (2000)).

often may be an intrastate, inter-agency dispute over how to manage water resources. For example, given Oregon agencies' support of both fish and agriculture in the Klamath Basin and the numerous disputes between these interests over water in the last decade, it could be difficult to say which state "allocation" of water should control.[460]

2. Amendments to the Endangered Species Act

As discussed, the ESA is already a major source of conflict for consumptive users of water and hence a powerful tool in preserving minimum water flows and *in situ* uses of water. Nevertheless, the links between a particular listed species and water management obligations are often oblique, fleshed out only in the context of Section 7 consultations, Section 9 "takings" violations, or citizen suit litigation. Both water resources managers and potential water uses would benefit from more specific and advanced warning regarding the practical import of an aquatic species' listing. Therefore, Congress should amend the ESA to explicitly require USFWS and NMFS to establish minimum flow/water quantity and water quality requirements for aquatic species as part of the listing process, with a presumption that violation of these requirements will constitute a violation of the Act.

Congress should also coordinate this ESA requirement with the proposed Clean Water Act minimum flow requirement, perhaps by allowing the USFWS and NMFS to override state water quality standards when the ESA so requires. Such an "override" provision in the ESA would avoid timing problems and potential liabilities for states. For example, under the Clean Water Act, the EPA generally reviews state water quality standards only every three years ("triennial review"),[461] which could result in delays if Congress leaves ESA-required minimum flow requirement adjustments to the Section 7 consultation process. In the meantime, states could face ESA liability under Section 9 if their Clean Water Act-approved minimum flow requirements suddenly prove inadequate for a newly listed species.

460. *See supra* notes 231–34 and accompanying text.
461. 33 U.S.C. § 1313(c)(1) (2000).

3. Amendments to the Clean Air Act

Water pollution issues have not been a major concern in regulating air pollution. Nevertheless, as discussed, atmospheric deposition of pollutants—both direct, when airborne pollutants fall onto water, and indirect, when airborne pollutants fall back to land and are then washed into waterbodies—can be an important source of water quality and aquatic ecosystem impairment, especially with respect to mercury and nutrients. As a result, Congress should amend the Clean Air Act to require the EPA to consider atmospheric deposition when the EPA establishes technology-based emissions standards under the Act—especially the National Emission Standards for Hazardous Air Pollutants ("NESHAPs").[462]

4. Dealing with the Property Rights Objection

Obviously, the thrust of these proposed amendments—of incorporating marine ecosystem goals into freshwater management—is to lend additional weight to arguments in favor of preserving certain levels of *in situ* flows, aligning marine ecosystem output goals with other *in situ* use goals, including species and biodiversity preservation. As a result, the addition of marine ecosystem considerations inevitably raises issues of private property rights in water, especially in light of the proposed amendment to subordinate state water allocation authority to water quality standards and minimum stream flows.

However, water rights are not an insurmountable (or even necessarily expensive) barrier to these proposed regulatory amendments. As discussed in Part I, in the eastern half of the United States, riparian water rights have always been correlative and subject to adjustment to accommodate new future users. While the riparian doctrine has evolved from a natural flow to a reasonable use theory, reasonable use still generally prohibits the destruction or material impairment of downstream values as a result of upstream consumption of water. Many states, regardless of whether they follow the riparian or the prior appropriation doctrine, require water rights holders to comply with water quality requirements.[463] States are often

462. 42 U.S.C. § 7412(d) (2000).

463. *E.g.*, Tulkisarmute Native Cmt'y Council v. Heinze, 898 P.2d 935, 950–51 (Alaska 1995); Cent. Delta Water Agency v. State Water Res. Control Bd., 20 Cal.

less explicit about conditioning water rights to protect species or ecosystems, but the public interest review requirement in many state water permitting statutes generally does consider impacts on fish and wildlife.[464] In addition, many states have robust state public trust doctrines that effectively limit property rights in water and allow for changing circumstances.[465]

Nevertheless, to the extent that state property law would deem any reduction in water rights to support marine ecosystem goals a taking of private property in violation of state or federal constitutional principles, state water rights could in fact limit implementation of the proposed amendments. One means around this limitation, therefore, would be the simultaneous enactment of federal condemnation authority and con-

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Rptr. 3d 898, 910–12 (Cal. Ct. App. 2004); *In re* Plan of Augmentation of the City & County of Denver, 44 P.3d 1019, 1028–29 (Colo. 2002); Save Our Beaches, Inc. v. Fla. Dep't of Envtl. Prot., No. 1D05-4086, 2006 WL 1112700, at *1 (Fla. Dist. Ct. App. Apr. 28, 2006); Shokal v. Dunn, 707 P.2d 441, 448–50, 452 (Idaho 1985); Lake Mary Villas, L.L.C. v. County of Douglas., No. A05-717, 2006 WL 163515, at *3 (Minn. Ct.. App. Jan. 24, 2006); *In Re* Appeal from the Envtl. Mgmt. Comm'n Final Order Granting a Certificate of Auth. to Orange Water & Sewer Auth. Pursuant to G.S. 162A-7, 280 S.E.2d 520, 528 (N.C. Ct. App. 1981); *In re* Town of Nottingham, 904 A.2d 582, 588, 589–90 (N.H. 2006); Stokes v. Morgan, 680 P.2d 335, 339–41 (N.M. 1984); Del-Aware Unlimited, Inc. v. Commonwealth, 508 A.2d 348, 381–82 (Pa. Commw. Ct. 1986); City of Marshall v. City of Uncertain, 206 S.W.3d 97, 103–04 (Tex. 2006); Pub. Util. Dist. No. 1 v. State Dep't of Ecology, 51 P.3d 744, 808–18 (Wash. 2002); Snyder v. Callaghan, 284 S.E.2d 241, 247–48 (W.Va. 1981); Hilton ex rel. Pages Homeowners' Ass'n v. Dep't of Natural Res., 717 N.W.2d 166, 175 (Wis. 2006).

464. *E.g.*, *Shokal*, 707 P.2d at 448–50; Cent. Platte Natural Res. Dist. v. City of Fremont, 549 N.W.2d 112, 117–18 (Neb. 1996); McQueen v. S.C. Coastal Council, 580 S.E.2d 116, 119–20 (S.C. 2003).

465. *E.g.*, San Carlos Apache Tribe v. Superior Court ex rel. County of Maricopa, 972 P.2d 179, 199 (Ariz. 1999); Nat'l Audubon Soc'y v. Superior Court, 658 P.2d 709, 712–13, 718–21 (Cal. 1983); El Dorado Irrigation Dist. v. State Water Res. Control Bd., 48 Cal. Rptr. 3d 468, 490–91 (Cal. Ct. App. 2006); City of Waterbury v. Town of Washington, 800 A.2d 1102, 1131–32, 1138–39 (Conn. 2002); Kelly v. 1250 Oceanside Partners, 140 P.3d 985, 1002–05, 1008–11 (Haw. 2006); *In re* Water Use Permit Applications, 93 P.3d 643, 657–58 (Haw. 2004); *In re* Wai'ola O Moloka'i, Inc., 83 P.3d 664, 694 (Haw. 2004); Idaho Conservation League, Inc. v. State, 911 P.2d 748, 749–50 (Idaho 1995) (citing Kootenai Envtl. Alliance, Inc. v. Panhandle Yacht Club, Inc., 671 P.2d 1085, 1094 (Idaho 1983)); United Plainsmen Ass'n v. N.D. State Water Conservation Comm'n, 247 N.W.2d 457, 460–64 (N.D. 1976); McQueen v. S.C. Coastal Council, 580 S.E.2d 116, 119–20 (S.C. 2003). *But see* R.D. Merrill Co. v. Pollution Control Hearings Bd., 969 P.2d 458, 467 (Wash. 1999) ("Without question, the state water codes contain numerous provisions intended to protect public interests. However, the public trust doctrine does not serve as an independent source of authority for the Department [of Ecology] to use in its decision-making apart from the provisions in the water codes.").

gressional funding to buy out water rights that block the attainment of marine ecosystem goals.

Of course, allocating such funds might, as a practical matter, end up prioritizing some watersheds and marine ecosystems for protection while triaging others, leaving them to their fates for want of cash to buy out critical property rights. At that point, more comprehensive reform of aquatic resource management, both freshwater and marine, might be a more rational approach than piecemeal amendments.

D. Allowing for Water Triage in an Era of Climate Change: Comprehensive Re-Structuring of Water Resources Management

Paradoxically, one of the potential shortcomings of relatively limited amendments to existing federal statutes is that such amendments, which would establish national and unvarying requirements, could well reduce management flexibility in individual watersheds. For example, a minimum flow requirement for fresh waters entering the oceans may leave management authorities with considerable discretion in establishing the level of flow, but in most cases the requirement would remove the regulators' discretion to allow rivers to dry up before they reach the sea. Thus, the minimum flow requirement effectively eliminates the choice of sacrificing the marine ecosystem at the end of the line in favor of upstream consumptive uses of the freshwater resource(s), even if all the interests involved in the watershed would agree that such a sacrifice was the best option. In other words, while limited amendments that force regulators to incorporate marine ecosystem goals should achieve better balance between upstream and downstream uses and ecosystem demands and would do much to eliminate the current problems of the unconscious destruction of marine resources as a result of regulatorily fragmented water resource management, they would also largely eliminate the option of water triage.

As in medical triage, water triage accepts the reality (however lamentable) that not all aquatic ecosystems are likely to survive current and projected future levels of human use. More specifically, water triage would identify three categories of aquatic and marine ecosystems: (1) those that are likely to survive as functional ecosystems regardless, or with only mi-

nimal additional regulatory intrusion over current regulatory practice; (2) those that can be saved as functional ecosystems, but only with significant additional regulatory intervention; and (3) those that are likely to die, or become significantly impaired ecosystems, regardless of what regulatory authorities might do.

To be sure, given the value of marine—and indeed all aquatic—ecosystems, one would hope that waters placed into the third category, or ignored despite being in the second category, would be kept to a minimum through better regulatory coordination, interstate cooperation, and water conservation measures. Nevertheless, given the current impairment of many western (and increasingly eastern) river systems, and especially in light of projected changes in rainfall, snowmelt, and flow regimes as a result of climate change,[466] water triage is already a *de facto* reality and is unlikely to be alleviated anytime in the foreseeable future absent a dramatic drop in water demand. Given this *de facto* state of affairs, a conscious, reasoned, and articulated decision to participate in water triage is preferable—to make government more accountable, to effectuate sound principles of administrative law, and to give the public notice of which theory of public choice is being applied—to the current unconscious, unreasoned, and silent sacrifice of important resources to competing water interests.

Ideally, therefore, a new system of water resources management would pursue several goals simultaneously: (1) reduction of the current regulatory fragmentation while acknowledging the varying levels of governmental, public, and private interests in water resources; (2) maintenance of instrumental regulatory flexibility, in acknowledgement that aquatic ecosystems and the demands upon them differ in important ways; (3) establishment of concrete priorities for specific aquatic ecosystems in the face of water stresses and shortages; (4) deliberative decisionmaking; and (5) public accountability. The most rational restructuring of water resources management to achieve these goals would use a watershed approach, acknowledging that the relevant "watershed" includes the marine eco-

466. Notably, climate change in particular seems to inspire a triage mentality—a recognition that we probably will not be able to save all of the existing biodiversity and ecosystem function. *See, e.g.*, J.B. Ruhl, *Climate Change and the Endangered Species Act: Building Bridges to the No-Analog Future*, 88 B.U. L. REV. 1, 2 (2008) (proclaiming that "[t]he pika is toast").

systems at the end of the line. This much should be relatively uncontroversial.

Of course, watersheds themselves differ in size and complexity, and smaller watersheds often feed into larger. Thus, a national restructuring of watershed management should acknowledge these links and recognize that, at different scales, local, state, and national interests in watersheds are all important. Several models already exist for managing interjurisdictional natural resources across regulatory scales. Despite its substantive weaknesses, for example, the Magnuson-Stevens Fishery Conservation and Management Act is arguably *structurally* sound in the way that it allows regional FMCs, composed of persons who represent more state and local interests, to effectuate federal guidelines and management goals. Comprehensive water resource management, similarly, could be structured so that Congress would set general federal guidelines, standards, and goals. Actual standards would apply where federal interests are directly implicated, such as for navigation or in the oceans, and would be more specific and mandatory in nature. Guidelines and goals, in turn, would suggest more discretionary overall policies, such as "maximum preservation of aquatic and marine ecosystem function," "restoration of wetlands," and so on.

In turn, a watershed-based management authority would implement those federal standards, goals, and guidelines in a particular watershed in light of the specific problems and management issues that arise in that watershed. Nevertheless, the watershed authority itself would be composed primarily of state and local representatives, with compositions dictated to avoid "capture" by any particular coalition of interests. For example, members of the authority should balance not only federal, state, and local governments but also *in situ* and consumptive users and polluting and non-polluting interests. In particularly large watersheds, subordinate sub-basin authorities could also exist to manage even more local water resource issues, in coordination with the encompassing watershed authority and the other sub-basin authorities for that watershed.

Under this kind of watershed-based structure, incorporating marine ecosystem considerations into a water resource management regime would not mean that the oceans always win. Instead, the structure should be designed to ensure that: (1) regulators look at the health of the whole watershed as well

as more local priorities; and (2) those regulators actively consider marine ecosystem output goals when making choices about upstream water resource management.

"Making choices," however, means that the watershed authority would often be selecting among potential priorities for a watershed and hence that public process requirements should also be a part of the restructuring. As one example, an important component of this watershed-based approach would be publicly debated, documented, and legally challengeable watershed assessments and management plans. Like NEPA's environmental impact requirements, this public assessment and decisionmaking process would operate primarily: (1) to prevent unintended and unnecessary adverse impacts on aquatic ecosystems, including marine ecosystems; and (2) to allow for public input into, and public challenges to, the watershed authority's decisionmaking.[467] For example, one gaffe in the massive Everglades restoration project was the failure to manage for both phosphorus and nitrogen pollution. The Everglades are sensitive to the former, but corals in the Florida Keys are sensitive to the latter. Restoration efforts have focused on measures that would remove phosphorus from the water flowing downstream, but those measures removed only 30 to 50 percent of the nitrogen.[468] Between 1996 and 1998, water flows into Florida Bay increased as part of the early restoration efforts.[469] Although these increased flows coincided with the implementation of the agricultural BMP requirements, and hence reflected a decrease in phosphorus levels in the water, scientists found that "38 percent of the living coral in the Keys died off, a problem . . . credited to 'nitrogen overloading.' Other pollutants were clearly in that water, but . . . nitrogen caused an explosion in algae blooms, which led to the reef's demise."[470] When officials decreased the water flow in 1998, corals in the Florida

467. The substantive value of such assessment is rarely contested, even when the economics and time commitments of environmental assessments become burdensome. Indeed, authors regularly call for new kinds of assessments. *See, e.g.*, Noah D. Hall, *Political Externalities, Federalism, and a Proposal for an Interstate Environmental Impact Assessment Policy*, 32 HARV. ENVTL. L. REV. 49, 78–94 (2008) (advocating for a state-based interstate environmental assessment).

468. Hilary Roxe, *Scientist: Everglades Restoration May Kill Reefs in the Florida Keys*, MIAMI HERALD, Feb. 24, 2004, *available at* http://www.flmnh.ufl.edu/FISH/southflorida/news/killreefs2004.html.

469. *Id.*

470. *Id.*

Keys began to recover.[471] Thoroughly and publicly considering the Florida Keys in the Everglades restoration planning process could have avoided further damaging the Keys as a result of these mismatched nutrient sensitivities.

Finally, the legislation implementing this restructured water resource management regime should create an appeals process to allow the watershed authority (or specified state and local authorities) to request exemptions from federal standards that make little sense in the particular watershed at issue. This appeals process could be similar to the ESA's Endangered Species Committee ("God Squad") process,[472] but—again acknowledging the wide range of circumstances that watershed authorities would likely confront—with the requesting party's burden of proof varying according to the degree of the requested departure from the relevant federal standards and the severity of the ecological harm that would likely result. However, because of the potential ecological finality of the decision, requests to sacrifice marine or other aquatic ecosystems in order to devote water resources to other uses should require a demonstration similar to that currently required of federal agencies wishing to jeopardize the survival of a species:

> there are no reasonable and prudent alternatives to the agency action;
>
> the benefits of such action clearly outweigh the benefits of alternative courses of action consistent with conserving the [aquatic or marine ecosystem], and such action is in the public interest;
>
> the action is of regional or national significance; and
>
> neither the [watershed management authority] concerned nor the exemption application made any irreversible or irretrievable commitment of resources [which has the effect of foreclosing the formulation or implementation of any reasonable or prudent alternative measures that could preserve the ecosystem].[473]

471. *Id.*

472. 16 U.S.C. § 1536(e)–(p) (2000).

473. *See generally* 16 U.S.C. § 1536(h)(1)(A) (2000) (providing current requirements for federal agencies seeking exemption from the Endangered Species Act).

This proposal is, of course, just that: an initial proposal. Nevertheless, acknowledging the economic and ecological absurdity of the current regulatory fragmentation of water and rethinking how the nation manages its aquatic resources is more likely than the current system, with its unwitting sacrifice of marine ecosystems, to serve the best interests of the nation as a whole. Moreover, such reform is particularly appropriate as scarcity of and conflict over fresh water continues to increase.

CONCLUSION

The regulatory fragmentation that characterizes water resource management in the United States in effect presumes that aquatic resources are abundant enough that the nation can tolerate their inefficient management and the incidental effects of upstream management on downstream resources. The evidence is increasingly all to the contrary—litigation indicates that conflicts among the fragmented regulatory regimes governing water are becoming more frequent, requiring the piecemeal prioritization of uses and goals.

Fresh water is already in short supply in many parts of the United States. Factors such as population growth and groundwater aquifer depletion are exacerbating existing shortages or creating new shortages in states like Florida that traditionally have been viewed as "water rich." Even when sufficient supply exists for consumptive human uses, those consumptive uses may interfere with *in situ* uses, including aquatic habitat and biodiversity maintenance. Moreover, consumptive use of water can both complicate and create water quality problems.

In coming decades, and especially in combination with population growth and other existing stressors, climate change is likely to underscore the problems of water's regulatory fragmentation by creating or worsening water stress in many parts of the country. Specifically, climate change is likely to increase water shortages and the number of conflicts that such shortages generate. In many areas of the country, as has already been seen in the Colorado River, the likely result will be some form of *de facto* water triage—the unconscious sacrificing of some uses and some ecosystems, especially downstream marine ecosystems, in pursuit of "more pressing" local needs.

If ecosystem restoration is the equivalent of holistic medicine in environmental law, "establishing restoration goals requires some sense of what is possible and what is not, given the magnitude of existing environmental change."[474] Climate change is likely to alter—perhaps repeatedly—what "restoration" is actually possible, especially in combination with existing water stressors. Moreover, increasing water shortages and conflicts over water in an era of climate change may in fact eventually require the ecological equivalent of medical triage: an ability to make quick decisions among competing demands on water resources in the face of system stresses and shocks, with a goal of saving as much as possible. Both of these potential problems counsel for comprehensive, deliberative, public, and conscious decisionmaking regarding water resource priorities, including an explicit recognition that the use priorities and regulatory capabilities are likely to vary from watershed to watershed.

As the country enters the regulatory chaos that climate change may bring, it should also ensure that no water-dependent resources remain unattended regulatory orphans. Two commissions have concluded that significant legal reforms, both structural and substantive, are needed to protect the nation's valuable marine resources, including the incorporation of upstream effects. Nevertheless, examples across the country demonstrate that coastal marine ecosystems often suffer from decisions made under the current reality of water's regulatory fragmentation, in terms of both reductions in flow and increased pollution. These saltwater ecosystems are the regulatory orphans of freshwater management regimes, and increasing water shortages and water conflict are an unpromising context in which to generate spontaneous improvements in watershed-wide cooperation and marine-inclusive management.

Viewing an entire watershed from the perspective of its terminal marine ecosystems can suggest at least some regulatory output priorities, measurements, and goals that better protect the entire system. Restoration of water and sediment flow in the Colorado River system to increase productivity in the Gulf of California/Sea of Cortéz would simultaneously help to restore the function and productivity of the River itself. Nutrient control in the Mississippi River Basin to reduce or elimi-

474. ADLER, *supra* note 1, at 90.

nate the "dead zone" in the Gulf of Mexico would also improve water quality throughout that Basin and encourage more comprehensive and improved nonpoint source regulation. Increased attention to nitrogen in the Everglades restoration efforts to protect (or at least reduce the stresses on) the Florida Keys coral reef ecosystem would also contribute to overall Everglades restoration efforts. Elimination of atmospheric deposition of mercury to protect top-level marine predators simultaneously protects endangered species, freshwater species, and human health.

Many regulatory reformations, ranging from relatively minor tweaking of existing regimes to comprehensive federalization of water resource management, could work to better incorporate marine ecosystem goals and output-based management measures into freshwater resource management. However, both marine ecosystem preservation and the potential chaos of climate change are likely to require "fundamental choices . . . about conflicting values and trade-offs"[475] in watersheds. Unconsciously sacrificing the oceans to fresh water's regulatory fragmentation should not be considered either an ecologically or an economically viable option. Instead, the nation should consider a fundamental restructuring of its water resources management to acknowledge all levels of governmental interest, to coordinate comprehensive decisionmaking and prioritization regarding particular water resources, and to make such decisionmaking and prioritization deliberative, public, and accountable.

"Forcing people to answer the most difficult questions often generates the most useful results."[476] However, before regulators provide "definitive" answers, they should be able to take cognizance of the entire problem so that they can understand all of the stakes involved in their decisions. Seeing the entire system—for purposes of this Article, the fresh water *and* the salt water—already suggests some of the desirable output goals and measures that should be incorporated into water resources management. In turn, those output goals and measurements suggest ways to modify input-based regulation, to the overall improvement of human use values, economic productivity, ecosystem stability, biodiversity preservation, and human health.

475. *Id.* at xxii.
476. *Id.* at xxi.