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OUR CORROSIVE OCEANS: EXPLORING REGULATORY RESPONSES AND A POSSIBLE ROLE FOR TRIBES

Weston R. LeMay

Abstract: The world's oceans act as a carbon sink, absorbing roughly twenty-five percent of humanity's carbon dioxide emissions. As a result, ocean acidity has increased sixty percent since the beginning of the industrial era. Acidification is a burgeoning ocean health crisis—present levels of acidity already threaten species of oyster, plankton, and salmon. Disturbingly, the capacity of the American legal system to respond is unclear: the complexity of climate change-related harms typically precludes a remedy at common law. With respect to mitigating near-shore acidification, this Comment argues that a regulatory strategy utilizing the Clean Water Act's Total Maximum Daily Load (TMDL) regime holds more promise than a tort response. Furthermore, in the Pacific Northwest, it may be possible to bolster TMDL regulation of non-point pollution through engagement with often-overlooked stakeholders: the Stevens Treaties tribes.

INTRODUCTION

In the summer of 2007, oyster larvae at the Whiskey Creek Hatchery began dying by the millions.¹ Located on Netarts Bay in Oregon, the Whiskey Creek Shellfish Hatchery raised larvae (also known as “seed”) for shellfish growers along the Pacific Coast.² Hatchery managers, scrambling to find the cause of the die off, quickly eliminated bacteria or disease in their tanks—other private growers had also suffered significant losses that year, as did wild larvae in Washington's Willapa Bay.³ After two years of research, National Oceanic and Atmospheric Administration (NOAA) scientists suggested a culprit: the rising acidity of seawater.⁴ Under laboratory conditions, studies showed that exposure to increasingly acidic water negatively impacted shell-forming marine organisms, including oysters.⁵ One study specifically investigated the

1. Eric Scigliano, *The Great Oyster Crash*, ONEARTH MAG. (Aug. 17, 2011), <http://archive.onearth.org/article/oyster-crash-ocean-acidification> [<https://perma.cc/3T7M-S43F>].

2. *Id.*

3. *Id.*

4. See generally Scott C. Doney et al., *Ocean Acidification: the Other CO₂ Problem*, 1 ANN. REV. MARINE SCI. 169 (2009).

5. *Id.* at 177–78 (summarizing studies showing that exposure to waters with elevated CO₂ results in shell malformation, slower growth, and impaired calcification (the formation of calcium carbonate shells) in oysters, mussels, and calcifying plankton).

vulnerability of the Pacific oyster (*Cassostrea Gigas*, a species grown by Whiskey Creek) and found that ninety-five percent of the larvae in acidified water developed malformed shells—or grew no shells at all.⁶ NOAA scientists, including Dr. Richard Feely, Ph.D., later replicated these results under real world conditions at the Whiskey Creek Hatchery.⁷ By testing the water flowing into the hatchery during a period of naturally higher acidity, Dr. Feely confirmed that ocean acidification is—at minimum—a contributing factor to oyster seed mortality.⁸

Ocean acidification is the process by which seawater becomes more acidic through the absorption of atmospheric carbon dioxide (CO₂).⁹ Acidification is a global concern, creating risks for shellfish and corals—economically and ecologically important organisms which may struggle to survive in increasingly acidic ocean environments.¹⁰ If scientists' acidification projections are correct, by the year 2100 seawater will be so corrosive that some organisms may simply dissolve.¹¹ Simultaneously, the same chemical reaction increasing seawater acidity also reduces the availability of minerals used by shellfish and other organisms to build their shells and skeletal

6. Haruko Kurihara et al., *Effects of Increased Seawater pCO₂ on Early Development of the Oyster Crassostrea Gigas*, 1 AQUATIC BIOLOGY 91, 91 (2007) (showing negative impact on Pacific oyster larvae from exposure to water with a pH of 7.4 for forty-eight hours). The Pacific oyster was one of the species that exhibited significantly increased larval mortality during the 2007 low-pH event. See Scigliano, *supra* note 1.

7. See generally Alan Barton et al., *The Pacific Oyster, Crassostrea Gigas, Shows Negative Correlation to Naturally Elevated Carbon Dioxide Levels: Implications for Near-term Ocean Acidification Effects*, 57 LIMNOLOGY & OCEANOGRAPHY 698 (2012) (reporting data collected from hatchery intake waters during a period of natural pH fluctuation).

8. *Id.* at 703.

9. When CO₂ in the atmosphere mixes with seawater, it triggers a chemical reaction that makes the oceans more acidic. Because human activity releases CO₂—known as “anthropogenic” CO₂—into the atmosphere, human pollution is a contributing factor to ocean acidification. Oceans have absorbed more than thirty percent of the anthropogenic CO₂ emitted since the beginning of the industrial era; during that time, the ocean surface has become significantly more acidic. See *infra* Section I.A.

10. See, e.g., Elizabeth Kolbert, *The Acid Sea*, NAT'L GEOGRAPHIC MAG. (Apr. 1, 2011), <http://ngm.nationalgeographic.com/print/2011/04/ocean-acidification/kolbert-text> [perma.cc/YM88-69BL]; *Ocean Acidification*, WOODS HOLE OCEANOGRAPHY INST., <http://www.whoi.edu/main/topic/ocean-acidification> [https://perma.cc/DP5P-RJ7C] (last visited Mar. 9, 2015).

11. *What Is Ocean Acidification?*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., <http://www.pmel.noaa.gov/co2/story/What+is+Ocean+Acidification%3F> [https://perma.cc/99WC-A6RA] (last visited Mar. 9, 2015) (showing the shell of a pteropod, a major food source of North Pacific juvenile salmon, completely dissolving after forty-five days at the pH levels projected for 2100).

structures.¹²

Although ocean acidification is a global problem, this Comment focuses on acidification in the context of the Pacific Northwest. This region is uniquely vulnerable to acidification, in part because losses to fish and shellfish harvests could significantly impact the regional economy—shellfish aquaculture alone represents over \$100 million in annual regional revenue.¹³ The Pacific Northwest is also home to a number of fish and shellfish-dependent Native American tribes, including the Swinomish, the Makah, and the Suquamish.¹⁴ These coastal tribes may be disproportionately impacted by acidification due to their higher per capita fish consumption. Members of the Suquamish tribe, for example, consume up to 800 grams of fish per day,¹⁵ compared to the national average of roughly nineteen grams.¹⁶ Furthermore, ocean acidification has the potential to negatively impact tribal treaty rights,

12. Organisms like shellfish are often referred to as “calcifying” organisms because they use carbonate minerals in seawater to synthesize their shells. A meta-analysis of modern scientific examinations of the effects of acidification on calcifying confirmed that in general, the scientific community has reached a consensus: ocean acidification negatively impacts calcification, in part due to its negative impact on the availability of carbonate ions. *See, e.g.*, Pauline M. Ross et al., *The Impact of Ocean Acidification on Reproduction, Early Development and Settlement of Marine Organisms*, 3 WATER 1005, 1010 (2011) (discussing impacts on enchinoderms and mollusks); K.R.N. Anthony et al., *Ocean Acidification Causes Bleaching and Productivity Loss in Coral Reef Builders*, 105 PROC. NAT’L ACAD. SCI. 17442 (2008), <http://www.pnas.org/content/105/45/17442.full> [<https://perma.cc/TKL2-A7HY>].

13. *See* Scigliano, *supra* note 1. A recent University of Oregon study estimates that ocean acidification has already cost the region’s shellfish industry \$110 million. Press Release, Or. State Univ., Study outlines threat of ocean acidification to coastal communities in the U.S. (Feb. 23, 2015), <http://oregonstate.edu/ua/ncs/archives/2015/feb/study-outlines-threat-ocean-acidification-coastal-communities-us> [<https://perma.cc/2QZ8-XWZT>]. Globally, the estimated value of fisheries totals \$91.2 billion; coral reef fisheries alone count for \$5.7 billion. *See* Sarah R. Cooley et al., *Ocean Acidification’s Potential to Alter Global Marine Ecosystem Services*, OCEANOGRAPHY, Dec. 2009, at 172, 174.

14. *See* United States v. Washington, 626 F. Supp. 1405, 1528–31 (W.D. Wash. 1986) (discussing the importance of fish to the area’s tribes, referred to collectively as the Tulalip Tribes, in the context of traditional and accustomed fishing grounds); NW. INDIAN APPLIED RESEARCH INST., NATIVE PEOPLES: THE “MINER’S CANARY” OF CLIMATE CHANGE 9 (Debra McNutt ed., 2008), <http://nwindian.evergreen.edu/pdf/climatechangereport.pdf> [<https://perma.cc/J5Y9-DZAN>] (discussing the economic and cultural importance of shellfish to tribes in the Pacific Northwest).

15. WASH. STATE DEP’T OF ECOLOGY, PUB. NO. 12-09-058, FISH CONSUMPTION RATES, at B-3 (2013), <https://fortress.wa.gov/ecy/publications/documents/1209058.pdf> [<https://perma.cc/AG4S-7UVV>].

16. *See* NAT’L MARINE FISHERIES SERV., PER CAPITA CONSUMPTION 93 (2011), http://www.st.nmfs.noaa.gov/st1/fus/fus11/08_percapita2011.pdf [<https://perma.cc/B8H3-TNGU>]. Older government estimates are lower still, at roughly five grams per person per day. *See* ENVTL. PROT. AGENCY, ESTIMATED PER CAPITA FISH CONSUMPTION IN THE UNITED STATES vii (2002), http://water.epa.gov/scitech/swguidance/standards/criteria/health/upload/consumption_report.pdf [<https://perma.cc/SYW9-ZPLS>].

aspects of tribal culture, and spiritual traditions by further depressing salmon and shellfish populations.¹⁷

While the full extent of harm caused by ocean acidification is unknown, NOAA's research shows that acidification has already contributed to millions of dollars in lost revenue by shellfish producers like the Whiskey Creek Hatchery.¹⁸ However, the traditional recourse in American law for recovering damages—the tort system—has proven to be an unreliable mechanism for remedying climate change-related harms.¹⁹ In short, the complexity of climate change-related harms is ill-suited to the tort system's rigid model of “duty, breach, . . . causation, and harm.”²⁰ There is little reason to expect that the outcome would be any different in the context of ocean acidification. For example, a shellfish producer harmed by acidification might step forward to bring a claim. Her losses would be reasonably easy to calculate—the known monetary value of farmed shellfish makes it straightforward to express damages as a dollar amount.²¹ Nevertheless, sustaining a tort claim for acidification would be an uphill battle. Duty and breach, for example, are difficult to establish when every human alive contributes to the problem simply by breathing.²² More fundamentally, the primary cause of ocean acidification (excessive CO₂ pollution)²³ is far removed from the harm (change to seawater chemistry). Accordingly, our hypothetical

17. Pteropods, a type of plankton commonly known as “sea butterfly,” are a major food source of North Pacific juvenile salmon. Studies show that pteropod development and survival is negatively impacted by ocean acidification. See *Washington*, 626 F. Supp. at 1528–31 (discussing the importance of fish to the Tulalip Tribes in the context of traditional and accustomed fishing grounds); NW. INDIAN APPLIED RESEARCH INST., *supra* note 14, at 9 (discussing the economic and cultural importance of shellfish to tribes in the Pacific Northwest).

18. See generally Barton et al., *supra* note 7 (reporting data collected from hatchery intake waters during a period of natural pH fluctuation); Anar Virji, *The Great American Oyster Collapse*, AL JAZEERA (Jul. 21, 2014, 10:01 GMT), <http://www.aljazeera.com/indepth/features/2014/07/great-american-oyster-collapse-2014720132433957401.html> [https://perma.cc/6928-JLP7] (reporting losses of up to forty-two percent in Pacific oyster harvests).

19. See, e.g., Douglas A. Kysar, *What Climate Change Can Do About Tort Law*, 41 ENVTL. L. 1, 44 (2011) (summarizing the incompatibilities between tort standards for recovery and climate change damages).

20. See, e.g., *id.* at 9.

21. In this respect, our hypothetical claim actually avoids a challenge typical to climate torts: the difficulties associated with calculating damages for complex environmental harms. See Sanne H. Knudsen, *The Long-Term Tort: In Search of a New Causation Framework for Natural Resource Damages*, 108 NW. U.L. REV. 475 (2014) (detailing the complexities presented by long-term environmental harms with respect to damages calculations).

22. Kysar, *supra* note 19, at 11–12, 18.

23. A more complete discussion of the causes and consequences of ocean acidification follows in the next section. See *infra* Section I.A.

plaintiff is likely to find her causal burden insurmountable.²⁴ The study of acidification is a science, and scientific conclusions about complex global phenomena are invariably subject to doubt, uncertainty, and disagreement—all of which heavily favor tort defendants.²⁵ Tort law, as David Kysar observes, appears “fundamentally ill-equipped to address the causes and impacts of climate change.”²⁶

Similarly, the current political system is unlikely to provide an effective legislative solution to ocean acidification. Governments are aware of climate risks: the Intergovernmental Panel on Climate Change (IPCC) recently repeated its warning that without significant mitigation of global emissions, the long-term consequences of climate change become inevitable.²⁷ The IPCC warnings depict shifting climate patterns, massive losses of species biodiversity, and increasingly frequent extreme weather events.²⁸ Eighty-one percent of the American public²⁹ and ninety-seven percent of climate scientists agree that climate change is real and impacted by human activity.³⁰ Nevertheless, effective legislative engagement has yet to occur.³¹ Instead, the nation’s most senior

24. For example, in order to demonstrate causation, a plaintiff must prove every link in the causal chain. In the climate change context, this arguably leaves plaintiffs with the Herculean task of isolating a specific defendant’s contribution to ambient pollutants and tracking those molecules from the moment of emission to the moment of harm. *See* Kysar, *supra* note 19, at 3–4.

25. Luciano Butti, *The Tortuous Road to Liability: A Critical Survey on Climate Change Litigation in Europe and North America*, SUSTAINABLE DEV. L. & POL. J., Winter 2011, at 30, 33 (noting that showing a one-to-one connection between a particular tortfeasor and a specific harm is a core tenet of tort causality—and arguably unknowable when the harm is driven by a naturally occurring and dispersed gas like carbon dioxide); *see also infra* Section I.A.

26. Kysar, *supra* note 19, at 6.

27. Christopher B. Field et al., *Summary for Policymakers*, in CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY 1, 14 (2014), http://www.ipcc.ch/pdf/assessment-report/ar5/wg2/ar5_wgII_spm_en.pdf [<https://perma.cc/G5EP-QVBW>].

28. *Id.*

29. Coral Davenport & Marjorie Connelly, *Most Republicans Say They Back Climate Action, Poll Finds*, N.Y. TIMES (Jan. 30, 2013), <http://www.nytimes.com/2013/01/31/us/politics/most-americans-support-government-action-on-climate-change-poll-finds.html> [<https://perma.cc/HLD7-FNBX>] (reporting on recent polling conducted jointly by the New York Times, Stanford University, and the nonpartisan research group Resources for the Future).

30. *Scientific Consensus: Earth’s Climate Is Warming*, NAT’L AERONAUTICS & SPACE ADMIN., <http://climate.nasa.gov/scientific-consensus/> [<https://perma.cc/4QRU-U24R>] (last visited Feb. 7, 2016). The IPCC’s comprehensive review of climate change further concludes “[i]t is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century.” Field et al., *supra* note 27, at 3 n.1.

31. For example, the most ambitious federal legislative response to ocean acidification, the Federal Ocean Acidification Research and Monitoring Act of 2009, takes no substantive steps to mitigate acidification. Omnibus Federal Lands Management Act of 2009, Pub. L. No. 111–11, §§ 12401–12409, 123 Stat. 991, 1441–42; *see also* NOAA OA Plan, NOAA PMEL CARBON PROGRAM, <http://www.pmel.noaa.gov/co2/story/NOAA+OA+Plan> [<https://perma.cc/JQF4-RL72>]

legislative body appears to be in “climate change denial”: the Senate recently voted down a non-binding resolution simply recognizing that climate change exists and is human-influenced.³² Given the lackluster governmental response to climate change in general, a legislative solution to ocean acidification (a newer, less understood manifestation of broader climate change) seems unlikely.

The tort system’s incompatibility and the political system’s incapacitation indicate that ocean health advocates should look for remedies in existing environmental laws. Many of these statutes date back to the pro-environment legislative era of the 1970s—the challenge is thus to apply the laws of yesterday to the ocean acidification crisis of today.³³ This Comment argues that our nation’s most powerful water quality law, the Clean Water Act (CWA),³⁴ is the best available tool for ocean acidification mitigation. In particular, this Comment demonstrates that modernizing the CWA’s water quality standards (§ 303) could bring ocean acidification within the Act’s regulatory scope. Waters already burdened by acidification would fail modern, scientifically defensible water quality standards.³⁵ Under the requirements of the Act, impacted waters would then be listed as “impaired” under CWA § 303(d). This impairment finding would, in turn, trigger the statutory obligation to develop a TMDL for acidification.³⁶ Because TMDLs focus on holistic water quality, they require regulation of both point and non-point (i.e., diffuse) sources of pollution—thereby providing the legal authority and regulatory framework necessary to address the diffuse carbon sources contributing to ocean acidification.³⁷ However, TMDL-based strategies may be undermined by poor non-point source enforcement. Nevertheless, in the specific context of acidification-impacted waters in the Pacific Northwest, this Comment argues that involving local tribal stakeholders could bolster TMDL enforcement.

The purpose of this Comment is not to argue that TMDLs will fix ocean acidification. Acidification is a global problem; it will require a

(last visited Jan. 28, 2016).

32. Coral Davenport, *Senate Rejects Human Role in Climate Change*, N.Y. TIMES (Jan. 22, 2015), <http://www.nytimes.com/2015/01/23/us/politics/senate-rejects-human-role-in-climate-change.html> [<https://perma.cc/GW7F-Q845>].

33. See, e.g., Miyoko Sakashita, *Harnessing the Potential of the Clean Water Act to Address Ocean Acidification*, 36 ECOLOGY L. CURRENTS 239 (2009).

34. 33 U.S.C. §§ 1251–1387 (2012).

35. Sakashita, *supra* note 33, at 242.

36. 33 U.S.C. § 1313(d).

37. See *infra* note 208 and accompanying text.

global solution. This Comment argues that TMDL regulation of local waters should be part of that solution. Although the CWA can (and should) regulate airborne pollutants that impair protected waters, other statutes are already positioned to regulate atmospheric CO₂—most obviously, the Clean Air Act. The strength of the CWA in this context is the ability of TMDLs to catalogue and regulate individual point and non-point pollution sources. TMDLs represent the opportunity to slow or mitigate the impact of ocean acidification in local waters by these local contributors to acidification.

Setting the stage for this analysis, Part I briefly reviews the science of acidification and discusses the ways in which the tort system is ill-equipped to remedy scientifically complex harms. Given this systemic incompatibility, this Comment argues that regulation represents a more promising pathway to mitigation. Part II focuses on one such regulatory mechanism: the CWA. This Comment argues that meaningful ocean acidification regulation is within the CWA's scope. Although the drivers of acidification are typically diffuse pollutants like atmospheric CO₂ and therefore cannot be regulated by the CWA's point source permits, the Act's § 303 water quality criteria provide an avenue to regulation under the TMDL regime. While this Comment argues in support of TMDLs for acidification, it also acknowledges that TMDL regimes are often criticized for inadequate policing of non-point pollution sources. In response, Part III advances a new strategy for bolstering TMDL enforcement in Washington: engagement with acidification-impacted Native American tribes. In addition to supporting TMDL enforcement through political pressure, tribes party to the Stevens Treaties could safeguard tribal rights to fish and shellfish through treaty enforcement actions to enjoin specific enforcement of TMDLs for non-point pollutants.

I. SCIENTIFIC COMPLEXITY AND THE INADEQUACY OF COMMON LAW REMEDIES

[A]nthropogenic greenhouse gas emissions represent the paradigmatic anti-tort, a collective action problem so pervasive and so complicated as to render at once both all of us and none of us responsible.

—Douglas A. Kysar³⁸

Environmental harms are, in a word, messy. “[D]iffuse and disparate

38. Kysar, *supra* note 19, at 4.

in origin, lagged and latticed in effect,³⁹ the injuries caused by ocean acidification and other aspects of climate change fit poorly into the tort system's model of tortfeasor, victim, and a clear causal chain.⁴⁰ Instead, the complexity and uncertainty surrounding these types of environmental harms favor defendants at each stage of the basic tort analysis: duty, breach, causation, and damages.⁴¹

Section I.A begins by describing the uncertain state of ocean acidification science. Next, Section I.B discusses why, given this uncertainty, acidification will be difficult to remedy using the modern tort regime. Finally, Section I.C examines why a regulatory regime is better equipped to handle complex environmental harms like ocean acidification.

A. *Ocean Acidification: Causes and Consequences for Selected Species*

Any successful application of law to ocean acidification must be grounded in a sound understanding of the basic science.⁴² Simply put, ocean acidification is the process by which seawater absorbs CO₂ from the atmosphere, triggering a chemical reaction that increases ocean acidity.⁴³ This reaction has two key consequences: first, the combination of H₂O and CO₂ “consumes” a carbonate ion (CO₃²⁻),⁴⁴ which reduces the bioavailability of calcium carbonate (CaCO₃) minerals that oysters and other so-called “calcifying” organisms use to construct their shells and skeletal structures.⁴⁵ Second, the reaction decreases the pH of seawater.⁴⁶ By breaking the bonds of water molecules (H₂O), the

39. *Id.*

40. *See generally* RESTATEMENT (SECOND) OF TORTS §§ 281, 328A (1965) (outlining the elements of a tort).

41. *Id.*

42. *See* Aurora Janke & Marcus Pearson, *Breaking the Surface of Ocean Acidification: A Discussion of Science, Law, and Policy* 6 (Spring 2012) (unpublished manuscript) (on file with *Washington Law Review*) (“Any successful ocean acidification solution, whether through law or policy, must rely on sound science.”).

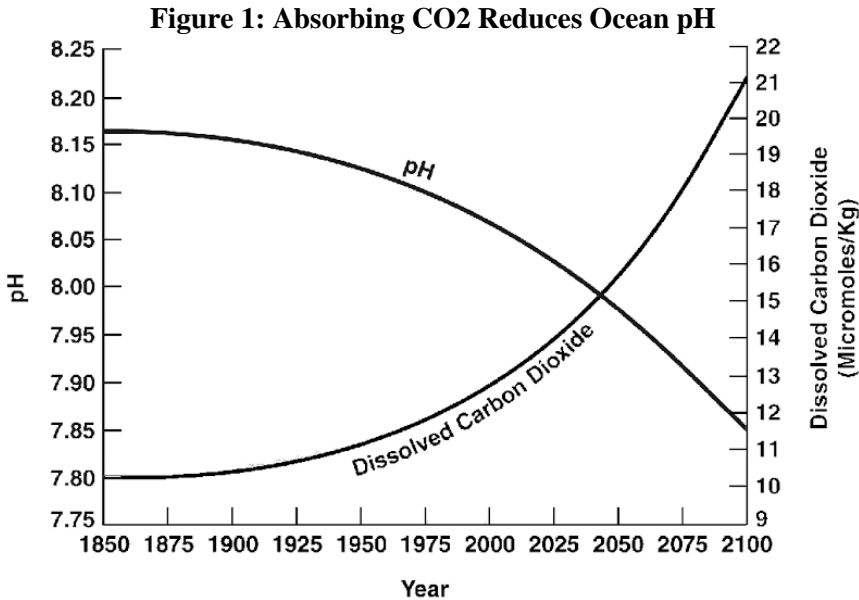
43. *See, e.g.*, Doney et al., *supra* note 4; Richard A. Feely et al., *Uptake and Storage of Carbon Dioxide in the Ocean: The Global CO₂ Survey*, OCEANOGRAPHY, Dec. 2001, at 18; *What Is Ocean Acidification?*, *supra* note 11. Globally, oceans absorb roughly 3.2 gigatons of carbon dioxide per year—far surpassing the rate of uptake at the beginning of the industrial era. *See* Peter Tans, *An Accounting of the Observed Increase in Oceanic and Atmospheric CO₂ and an Outlook for the Future*, OCEANOGRAPHY, Dec. 2009, at 26, 26. Scientists expect this rate increase further as CO₂ levels continue to rise and terrestrial carbon sinks become saturated. *Id.* at 32.

44. Doney et al., *supra* note 4, at 172.

45. *See id.* at 170.

46. *See, e.g.*, Cooley et al., *supra* note 13, at 172–73.

acidification reaction releases some of the component hydrogen (H^+) as “free” hydrogen ions into the water.⁴⁷ In other words, by absorbing CO_2 , oceans increase the concentration of hydrogen ions in seawater; more hydrogen ions in seawater means a lower ocean pH.⁴⁸ Seawater with a lower pH is more acidic.⁴⁹



The two consequences of acidification, decreased carbonate ion saturation and increased seawater pH, each present risks to marine organisms. First, reducing the availability of carbonate ions in the water deprives “calcifying” organisms—including species of oyster, coral, and plankton—of an essential mineral.⁵⁰ Calcifying species use calcium carbonate to construct their shells or skeletal structures.⁵¹ Because ocean acidification reduces the amount of carbonate available to these organisms, scientists believe calcifying species are particularly

47. Tans, *supra* note 43, at 34.

48. *Id.* The pH scale measures from zero (pure acid) to fourteen (pure alkaline). pH is the negative logarithm of hydrogen ions (H^+) in water; as hydrogen ion concentration increases, acidity goes up and pH goes down.

49. *Id.*

50. *Id.*; see also Ross et al., *supra* note 12, at 1008.

51. Tans, *supra* note 43, at 34; see also Ross et al., *supra* note 12, at 1008.

vulnerable to acidification.⁵² Furthermore, shells made of calcium carbonate are water soluble.⁵³ Therefore, even if these organisms do form shells, they may be weakened, malformed, or dissolved by increasingly corrosive seawater.⁵⁴

Although ocean acidification's potential to harm calcifying organisms is not fully understood, there are known risks for at least two thoroughly studied species: the Pacific oyster and pteropods. The Pacific oyster is a mainstay of the Pacific Northwest's shellfish industry.⁵⁵ In 2007, millions of oyster larvae deaths⁵⁶ on the Washington and Oregon coasts coincided with a seasonal upwelling event that naturally reduced the pH of local waters.⁵⁷ Scientists hypothesized that acidification killed the oyster larvae.⁵⁸ Subsequent real-world testing confirmed that low pH negatively impacts Pacific oyster larvae survival.⁵⁹ Twenty-four hours after fertilization, eighty percent of Pacific oyster gametes in reduced pH water displayed malformed shells—or had formed no shell at all.⁶⁰ Outside the laboratory, seasonal upwelling events bring water that is sufficiently acidic to cause nearly one-hundred percent larval mortality.⁶¹ Nor are the impacts limited to larvae: for example, scientists also believe that acidification negatively impacts reproduction, and juvenile oysters exhibited a ten percent decrease in shell formation and growth rate under experimental conditions.⁶²

Another closely studied organism is the pteropod (colloquially known as the “sea butterfly”), a type of calcifying plankton.⁶³ Plankton are an

52. See Ross et al., *supra* note 12, at 1006 (noting the particular impact on marine organisms at the larval stage).

53. See, e.g., Doney et al., *supra* note 4; Feely et al., *supra* note 43; *What Is Ocean Acidification?*, *supra* note 11.

54. See generally Ross et al., *supra* note 12 (surveying scientific studies demonstrating the negative effects of ocean acidification on calcifying organisms, including various shellfish and sea urchin species at the larval stage).

55. Scigliano, *supra* note 1.

56. See Craig Welch, *Acidity Killed NW Oysters, New Study Says*, SEATTLE TIMES (Apr. 11, 2012, 10:45 PM), <http://www.seattletimes.com/seattle-news/acidity-in-ocean-killed-nw-oysters-new-study-says/> [<https://perma.cc/P55Q-B9GH>]; Virji, *supra* note 18 (reporting further significant losses of Pacific oysters by shellfish farmers in succeeding years).

57. See Scigliano, *supra* note 1. An “upwelling event” refers to a natural mixing of colder water from deeper in the ocean with coastal water. Because deep ocean water tends to be more acidic, upwellings may increase the acidity of coastal waters. *Id.*

58. Barton et al., *supra* note 7, at 699.

59. *Id.*

60. Kurihara et al., *supra* note 6, at 96.

61. See Barton et al., *supra* note 7, at 706.

62. Doney et al., *supra* note 4, at 177.

63. *What Is Ocean Acidification?*, *supra* note 11 (showing the shells of pteropods completely

irreplaceable component of the marine food web,⁶⁴ and pteropods are no exception—they are a key prey species for organisms ranging from krill to whales.⁶⁵ Pteropods are also a major food source for North Pacific juvenile salmon.⁶⁶ Like the Pacific oyster, pteropods rely on the availability of carbonate minerals to form their protective shells.⁶⁷ However, studies suggest that pteropods' shells may be particularly vulnerable to corrosion—their shells exhibit microscopic “scoring” at current levels of acidity, and dissolve completely when exposed to the projected ocean pH for the year 2100.⁶⁸ It is important to remember that even as their shells dissolve, pteropods are simultaneously less able to synthesize new shell material because the acidification reaction reduces the bioavailability of shell-forming minerals.⁶⁹ Given the significance of these organisms to the marine food web in general—and their importance to salmon specifically⁷⁰—the apparent vulnerability of pteropods to ocean acidification is cause for grave concern.⁷¹

B. *Scientific Uncertainty Pervades the Study of Ocean Acidification*

Despite scientists' growing awareness of the danger ocean acidification poses to select species, the global threat remains poorly

dissolving at the pH levels projected for 2100).

64. See, e.g., WALKER SMITH ET AL., VA. INST. OF MARINE SCI., MARINE PLANKTON FOOD WEBS AND CLIMATE CHANGE (2008), http://estuaries.noaa.gov/teachers/pdf/Plankton_Food_Webs_VIMS.pdf [<https://perma.cc/7LBJ-BUHF>].

65. Steve Comeau et al., *Response of the Arctic Pteropod Limacina Helicina to Projected Future Environmental Conditions*, PLOS ONE, June 2010, at 1, <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0011362> [<https://perma.cc/BEQ6-U5AB>].

66. *Id.*

67. See generally M. Debora Iglesias-Rodriguez et al., *Phytoplankton Calcification in a High-CO₂ World*, 320 SCIENCE 336 (2008).

68. *What Is Ocean Acidification?*, *supra* note 11 (showing the shell of pteropods completely dissolving at the pH levels projected for 2100). The particular vulnerability of pteropod shells to ocean acidification is likely because of the type of calcium carbonate that pteropods synthesize to construct their shell material: aragonite. Compared to other forms of the mineral, aragonite is unusually water soluble (i.e., prone to dissolving). Victoria J. Fabry et al., *Impacts of Ocean Acidification on Marine Fauna and Ecosystem Processes*, 65 ICES J. MARINE SCI. 414, 423–24 (2008).

69. Fabry et al., *supra* note 68, at 417. This parallels the reduced ability to synthesize shell material observed in juvenile Pacific oysters in low pH conditions. See Doney et al., *supra* note 4, at 177.

70. Salmon, in their own right, also exhibit vulnerabilities to significantly low pH scenarios. See, e.g., W.D. Watter et al., *Evidence of Acidification of Some Nova Scotian Rivers and Its Impact on Atlantic Salmon, Salmo Salar*, 40 CAN. J. FISHERIES & AQUATIC SCI. 462, 472 (1983).

71. Janke & Pearson, *supra* note 42.

understood.⁷² Acidification science involves the measurement of gradual changes, often spanning decades, across the world's oceans.⁷³ Given the scale of the phenomenon, many of scientists' remaining questions will require years of study to answer.⁷⁴ Our incomplete understanding of acidification is also partially the result of funding limitations, which often prevent replication of laboratory experiments under real-world conditions.⁷⁵ Even where research has produced reliable data, those findings may not be generally applicable. For example, there is no guarantee that research into one organism's acidification tolerance will shed light on the tolerance of other species.⁷⁶ As ocean researcher Scott Doney observed, the fact that most research results stem from species-specific laboratory experiments means that "the response of individual organisms, populations, and communities to more realistic gradual changes is largely unknown."⁷⁷

Furthermore, other contributors to acidification represent potential confounding variables to any acidification analysis. While there is broad scientific consensus that CO₂ pollution is the primary cause of acidification,⁷⁸ the amount of CO₂ a waterbody absorbs is not the only factor that determines its pH.⁷⁹ This calculation is particularly complex in coastal waters. For example, in the Pacific Northwest, near-shore waters become (temporarily) more acidic during seasonal upwelling events. An "upwelling" refers to the natural mixing of colder, deep ocean water with coastal waters.⁸⁰ The deep water brings with it

72. Doney et al., *supra* note 4, at 184.

73. *Id.*

74. *Id.*

75. *Id.*; Janke & Pearson, *supra* note 42.

76. Fabry et al., *supra* note 68, at 423–24 (summarizing results of studies analyzing responses of different marine fauna to acidification: North Sea jellyfish exhibited no negative impact from a pH drop of 8.3 to 8.1; sea bass survived at a pH of 7.25 but fed less frequently; the Greenlip abalone survived at a pH of 7.39 but grew at a reduced rate).

77. Doney et al., *supra* note 4, at 184.

78. *Id.*

79. See, e.g., Claudine Hauri et al., *Ocean Acidification in the California Current System*, OCEANOGRAPHY, Dec. 2009, at 61, 66 (discussing the relationship between nutrient loading and acidity).

80. Coastal currents in the Pacific Ocean off the coasts of Washington and Oregon drive upwellings on a seasonal basis. Thus, upwellings must be added to the list of potential contributors to coastal acidification. Furthermore, upwellings demonstrate that an acidification model developed for coastal waters may not apply to deep water, and vice versa. See, e.g., Katherine E. Harris et al., *Aragonite Saturation State Dynamics in a Coastal Upwelling Zone*, 40 GEOPHYSICAL RES. LETTERS 2720, 2722–24 (2013) (noting that coastal upwelling events cause variation in pH levels and the structural minerals relied on by some calcifying organisms); Hauri et al., *supra* note 79, at 66.

nutrients that contribute to the incredible productivity and biodiversity of the waters off Washington's coasts;⁸¹ however, because deep water also tends to be more acidic, these nutrients come at the cost of a natural spike in acidity.⁸²

Indirectly, the nutrients themselves also contribute to acidification.⁸³ In agricultural areas, fertilizer and other terrestrial runoff artificially increase the amount of nutrients in the water.⁸⁴ Thus, both agricultural runoff and upwelling events may elevate nutrient loads in coastal waters.⁸⁵ High nutrient loads, in turn, drive phytoplankton blooms—and when the bloom subsides, the dead phytoplankton sink and decompose.⁸⁶ Decomposing organic matter releases CO₂ into the water, further increasing its acidity.⁸⁷ This discussion of seasonal upwelling and nutrient loads serves as a reminder that atmospheric CO₂ is not the only driver of ocean acidification—local factors contribute to acidification in specific waterbodies as well. It may not always be possible to isolate the impact of one driver of acidification from the other causes.

Even assuming the causes of acidification can be isolated, however, it may still be difficult to identify whether acidification was the sole cause of a given harm. For example, in addition to being acidic, coastal water might also exhibit high temperature⁸⁸ or low dissolved oxygen (DO).⁸⁹ Temperature, DO, and pH all factor into how hostile or hospitable marine organisms find their environment.⁹⁰ Given a singular harm—a shellfish farmer's loss of oyster larvae, for example, or a crop of undersized oysters with malformed shells—it is not always clear which factor (or combination of factors) is at fault.⁹¹

81. See, e.g., *Nutrient Pollution of Coastal Waters—Too Much of a Good Thing*, NCCOS NEWS & FEATURES (Jan. 26, 2008), <http://coastalscience.noaa.gov/news/coastal-pollution/nutrient-pollution-of-coastal-waters-too-much-of-a-good-thing/> [<https://perma.cc/YV9J-J88B>].

82. Hauri et al., *supra* note 79, at 66.

83. See, e.g., *Nutrient Pollution of Coastal Waters—Too Much of a Good Thing*, *supra* note 81.

84. See, e.g., *id.*

85. See, e.g., *id.*

86. See, e.g., *id.*

87. Hauri et al., *supra* note 79, at 66.

88. See, e.g., Ross et al., *supra* note 12, at 1015.

89. See, e.g., Ryan B. Wallace et al., *Coastal Ocean Acidification: The Other Eutrophication Problem*, 148 ESTUARINE, COASTAL & SHELF SCI. 1 (2014); NAT. OCEANIC & ATMOSPHERIC ADMIN., STATE OF THE COAST REPORT: OXYGEN DEPLETION IN COASTAL WATERS (1998), http://oceanservice.noaa.gov/websites/retiredsites/sotc_pdf/HYP.PDF [<https://perma.cc/VG8B-6524>].

90. See, e.g., Wallace et al., *supra* note 89; *Nutrient Pollution of Coastal Waters—Too Much of a Good Thing*, *supra* note 81.

91. *Id.*

C. *The Scientific Uncertainty Associated with Ocean Acidification
Precludes an Effective Tort Response*

Despite many unanswered questions, there is a growing consensus within the scientific community that ocean acidification poses serious risks to marine organisms and ecology.⁹² However, from a legal perspective, the existence of uncertainty is an early indication that tort law is unlikely to provide an adequate remedy for acidification-related harms.⁹³ While problems arise at each stage of an ocean acidification tort analysis—duty, breach, and causation—the scope and complexity of ocean acidification makes proving causation particularly difficult.⁹⁴

The first step in a tort analysis—defining “due care”—is complicated by global responsibility for CO₂ pollution. The baseline assumption in tort law is that “every person owes a duty of ordinary care to all others.”⁹⁵ In the acidification context, due care might mean forbearing from actions that contribute to acidification. An immediate issue arises: given that acidification is driven by atmospheric CO₂, every person on earth “breaches” due care (i.e., contributes to the harm) simply by breathing.⁹⁶ In response, some have argued that “duty” in the climate change context should be reinterpreted as only the “duty to not pollute unsustainably.”⁹⁷ According to the United Nations, this would require each person in the developed world to stay within a “carbon budget” of 2.7 tons of CO₂ per year.⁹⁸ Even assuming this is a practical possibility,⁹⁹ the problem of scope remains: the millions of people and corporations

92. See, e.g., Doney et al., *supra* note 4.

93. See, e.g., Kysar, *supra* note 19, at 3–4 (“Built as it is on a paradigm of harm in which A wrongfully, directly, and exclusively injures B, tort law seems fundamentally ill-equipped to address the causes and impacts of climate change . . .”).

94. See, e.g., *id.*

95. W. Jonathan Cardi & Michael D. Green, *Duty Wars*, 81 S. CAL. L. REV. 671, 671 n.1 (2008); see also David A. Weisbach, *Negligence, Strict Liability, and Responsibility for Climate Change*, 97 IOWA L. REV. 521 (2012) (discussing an alternative approach, the adoption of a modified strict liability standard, being tentatively explored in Europe).

96. See Kysar, *supra* note 19, at 17–19.

97. See *id.* at 18 (describing these polluters and others as “choke points” in the anthropogenic carbon cycle).

98. United Nations Framework Convention on Climate Change, May 9, 1992, 1771 U.N.T.S. 107, 31 I.L.M. 849, 851; Kysar, *supra* note 19, at 51 (noting the 2.7 ton per year threshold as the highest per capita emission level possible without exceeding the two degrees Celsius global warming “tipping point” for catastrophic climate change).

99. Because 2.7 tons of CO₂ emissions is equivalent to driving a standard car for ten weeks, or taking a single roundtrip flight from San Francisco to New York, it seems unlikely that even conscientious Americans would be able to meet this target. See Kysar, *supra* note 19, at 51.

likely to exceed this budget would result in an impractically large defendant pool. One response might be to further limit liability at the proximate cause stage, enforcing breaches of due care against only the largest polluters: fossil fuel companies, electric utilities, and motor vehicle manufacturers.¹⁰⁰ This list should arguably include federal and state governments as well.¹⁰¹ Nevertheless, even if plaintiffs are able to clear these breach and proximate cause hurdles, significant problems remain at the causation stage.

The complexity of acidification science makes the plaintiff's duty to prove causation unreasonably difficult.¹⁰² Under most circumstances, tort plaintiffs must demonstrate a connection between their particularized harm and the alleged tortfeasor's actions.¹⁰³ However, in the case of climate change, "cause" is far removed from "effect." Ocean acidification is no exception: once emitted into the atmosphere, CO₂ does not travel directly to the patch of ocean it will eventually acidify.¹⁰⁴ The variables mentioned in Section I.B, such as high nutrient loading or separate water quality issues like low levels of DO, represent potential intervening causes of the plaintiff's harm. More fundamentally, the study of ocean acidification is a science; uncertainty is a part of science. In this case, and despite advances in scientists' understanding in recent years, the remaining scientific uncertainty heavily favors the defendant in any tort suit.

100. *Id.* at 18 (describing these polluters and others as "choke points" in the anthropogenic carbon cycle).

101. For example, in 2010 the federal government emitted 495,546 million tons of CO₂ (or CO₂ equivalent)—excluding all military and law enforcement emissions. See *FY2010 Federal Government Greenhouse Gas Inventory by Agency*, ENVTL. PROT. AGENCY, <https://catalog.data.gov/dataset/fy2010-federal-government-greenhouse-gas-inventory-by-agency> [<https://perma.cc/3GH4-3RSG>] (last visited Feb. 20, 2015).

102. See David A. Weisbach, *Negligence, Strict Liability, and Responsibility for Climate Change*, 97 IOWA L. REV. 521, 557–58 (2012); Kysar, *supra* note 19, at 29–32.

103. Absent this clear relationship, plaintiffs would be forced to fall back on either a market share theory (rarely applied outside the medical drugs context) or a risk-increase theory (which generally would require plaintiffs to prove that the polluter's emissions more than doubled the risk of the plaintiff's harm) in order to connect the broken links in the causal chain. See Albert C. Lin, *Beyond Tort: Compensating Victims of Environmental Toxic Injury*, 78 S. CAL. L. REV. 1439, 1449–50 (2005) (discussing the limitations of the risk-increase theory); Kysar, *supra* note 19, at 37 (advocating for several liability over the market share theory); Weisbach, *supra* note 102, at 557–58.

104. Diffuse atmospheric CO₂ travels from air to water through "atmospheric deposition," which models the process by which airborne pollutants, such as mercury or CO₂, fall into the water—in rain, dust, or simply due to gravity. See *Impaired Waters and Mercury*, ENVTL. PROT. AGENCY, <http://www.epa.gov/tmdl/impaired-waters-and-mercury> [<https://perma.cc/RZJ5-S3NV>] (last visited Feb. 23, 2015) [hereinafter *EPA TMDLs*].

II. APPLICATION OF THE CLEAN WATER ACT TO OCEAN ACIDIFICATION

If the common law tort system is not equipped to effectively address the problem of acidification, stakeholders must look to alternatives: for example, existing environmental and pollution control regimes. This Comment argues that America's most comprehensive water quality law, the CWA,¹⁰⁵ provides an existing regulatory framework that can be modified to address ocean acidification. In particular, modernizing the CWA's outdated water quality standards for acidity could bring ocean acidification within the regulatory scope of the Act.¹⁰⁶ Updating water quality standards in order to list acidification-burdened waters as "impaired" under CWA § 303(d) would, in turn, trigger the statutory requirement to regulate these waters under a TMDL regime.¹⁰⁷ A TMDL for acidification, at minimum, represents a regulatory framework from which to approach the complex task of ocean acidification regulation.¹⁰⁸

The provisions contained within the CWA¹⁰⁹ offer the possibility of meaningful acidification regulation.¹¹⁰ Acidity itself is already classified as a pollutant under the CWA and is therefore within the regulatory scope of the Act.¹¹¹ Nevertheless, any comprehensive regulation of ocean acidification must address acidification's primary driver: excessive levels of anthropogenic CO₂. In this respect, acidification fits

105. Federal Water Pollution Control Act Amendments of 1972, Pub. L. No. 92-500, 86 Stat. 816 (codified as amended at 33 U.S.C. §§ 1251–1357 (2012)); *see also* William L. Andreen, *Success and Backlash: The Remarkable (Continuing) Story of the Clean Water Act*, J. ENERGY & ENVTL. L., Winter 2013, at 25, 26, <http://groups.law.gwu.edu/jeel/ArticlePDF/4-1-Andreen.pdf> [<https://perma.cc/WF8B-WRCE>] (summarizing the CWA's development and significance).

106. *See, e.g.*, Sakashita, *supra* note 33.

107. *See, e.g.*, *id.*

108. Total Maximum Daily Loads (TMDLs), while arguably an important path towards effective ocean acidification regulation, may not be the entire answer. *See* Oliver A. Houck, *TMDLs, Are We There Yet?: The Long Road Toward Water Quality-Based Regulation Under the Clean Water Act*, 27 ENVTL. L. REP. 10,389, 10,399–400 (1997) (noting poor TMDL enforcement with respect to non-point sources); *infra* Part III (suggesting a possible role for Stevens Treaties tribes in improving TMDL enforcement).

109. *See, e.g.*, 33 U.S.C. § 1251(a) (outlining the water quality standards regime); *id.* § 1342(a) (outlining the NPDES permitting scheme). Because the focus of this paper is the potential for application of CWA water quality standards to ocean acidification, the author treats CWA § 401 certification as outside the scope.

110. *See, e.g.*, Sakashita, *supra* note 33.

111. *See Clean Water Act (CWA): Overview of CWA*, ENVTL. PROT. AGENCY, <http://www.epa.gov/agriculture/lcwa.html> [<https://perma.cc/LJE2-5WT9>] (last visited Mar. 12, 2015).

uncomfortably within the CWA's jurisdiction: navigable waters.¹¹² Ocean acidification is a water quality problem driven by air pollution.¹¹³ In this sense, Congress's jurisdictional distinction—that the CWA presides over water, the Clean Air Act over the air, etc.—is hopelessly impractical. Cross-media pollution demands cross-media regulation.¹¹⁴ To fulfill its mandate, the CWA must reach beyond the water. Because the primary driver of ocean acidification is atmospheric CO₂,¹¹⁵ holistic acidification regulation requires the CWA to limit atmospheric CO₂ emissions into the air.¹¹⁶

To better explore the applicability of the CWA to acidification, Part II begins with a review of the relevant statutory provisions. Next, this Comment argues that the CWA, as currently written, confers to the Environmental Protection Agency (EPA) the authority to regulate ocean acidification. However, regulating acidification would require updating the Act's antiquated water quality standards for acidity. Modern standards would lead to acidification-burdened waters being listed as "impaired" under CWA § 303(d), which would trigger the requirement to promulgate a TMDL for the impaired waters. As this Comment acknowledges, TMDLs are often poorly enforced with respect to non-point sources. Accordingly, Part II concludes by briefly summarizing the TMDL enforcement critique, and recognizing that this legacy of uncertain non-point source regulation suggests that some additional mechanism is needed to bolster enforcement.¹¹⁷

A. *Section 303 of the Clean Water Act Is the Most Applicable Regulatory Regime to Ocean Acidification*

Congress created the Federal Water Pollution Control Act, better known as the Clean Water Act, to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters."¹¹⁸ Within this

112. This is true with respect primarily to airborne CO₂. Other drivers of acidification, such as nutrient runoff, encounter no such awkwardness. *See supra* Section I.B. More importantly, TMDLs for mercury demonstrate that the CWA can "reach the air" under certain circumstances.

113. *See, e.g., Sakashita, supra* note 33.

114. *Id.*

115. CLIMATE CHANGE IMPACTS ON OCEAN AND COASTAL LAW: U.S. AND INTERNATIONAL PERSPECTIVES 28 (Randall S. Abate ed., 2015) [hereinafter CLIMATE CHANGE IMPACTS ON OCEAN AND COASTAL LAW].

116. *Id.* at 38–41.

117. This Comment advances the argument that in the Pacific Northwest, tribal rights under the Stevens Treaties represent a compelling option. *See infra* Part III.

118. 33 U.S.C. § 1251(a) (2012).

broad mandate, Congress directed the EPA to protect “water quality which provides for the protection and propagation of fish, shellfish, and wildlife.”¹¹⁹ Accordingly, the CWA includes two primary regulatory mechanisms: the National Pollution Discharge Elimination System (NPDES)¹²⁰ and the § 303 Water Quality Standards (WQS).¹²¹ Although often treated as separate regimes, the NPDES scheme and the WQS are actually complementary mechanisms: the NPDES imposes effluent limitations on specific point source polluters, while water quality standards allow management of smaller point and non-point sources that might otherwise escape regulation.¹²² Of these two mechanisms, however, only § 303 is likely applicable to ocean acidification.¹²³

1. NPDES Permits Are Inapplicable to CO₂ Regulation Because Atmospheric CO₂ Is Not Delivered to Water from a “Point Source”

The NPDES creates a permitting requirement for each lawful (1) discharge of (2) a pollutant into (3) protected waters.¹²⁴ To qualify as a “discharge,” a point source (a “discernible, confined and discrete conveyance”) must deliver the pollutant to jurisdictional waters.¹²⁵ Regardless of the harm a pollutant causes to water quality, it must emanate from a point source to trigger the NPDES permitting requirement. The point source provision thus limits the program’s scope—a regulator may not utilize NPDES to control a known pollutant flowing into jurisdictional waters until she has identified a point source that “delivers” that pollutant to the water.¹²⁶

The point source provision most likely renders the NPDES regime inapplicable to ocean acidification. Even though acidity is a pollutant regulated by the CWA,¹²⁷ and coastal waters are jurisdictional,¹²⁸ the

119. *Id.*

120. *See id.* § 1342(a)(1).

121. *See id.* § 1313(a)–(c). This Comment’s focus is § 303’s capacity to address non-point air pollution; due to length concerns, the author treats CWA § 401 certification as outside the scope.

122. *EPA v. Cal. ex rel. State Water Res. Control Bd.*, 426 U.S. 200, 205 n.12 (1976).

123. *See generally* Sakashita, *supra* note 33.

124. *Id.*

125. 33 U.S.C. § 1362(14).

126. *See, e.g.*, Kristin Carden, Comment, *South Florida Water Management District v. Miccosukee Tribe of Indians*, 28 HARV. ENVTL. L. REV. 549 (2004) (observing that the Supreme Court’s mechanical consideration of the point source definition precludes considerations of environmental impact and justice). The point source definition also explicitly exempts return flows from agriculture, § 1362(14), which contribute to coastal ocean acidification by increasing nutrient loads. *See supra* Section I.C.

127. *Clean Water Act (CWA): Overview of CWA*, *supra* note 111 (listing pH as a conventional

CO₂ gas that is the primary driver of acidification is not “delivered” to the ocean via a point source. Instead, CO₂—in diffuse, gaseous form—typically reaches the water through the slow process of atmospheric deposition.¹²⁹ Therefore, even if the CO₂ *originates* from a “discernible, confined and discrete conveyance”¹³⁰ (such as a power plant smoke stack),¹³¹ it is *delivered* to seawater through indirect means.¹³²

Courts appear unwilling to tolerate even minimal “air gaps” between the point of emission and the point of entry into water.¹³³ For example, in *Alaska Community Action on Toxics v. Aurora Energy Services, LLC*,¹³⁴ the U.S. District Court for the District of Alaska addressed whether pollutants blown from a coal dust pile into a nearby bay could be subject to NPDES permitting requirements. The court held that the dust was exempt from NPDES because “coal blown into the Bay as airborne dust is not a point source discharge.”¹³⁵ While the court readily identified the coal dust pile as the source of the pollutant,¹³⁶ it was not a “point source” as understood in the CWA context because it did not deliver the dust *directly* to the water.¹³⁷ A “no air gap” rule seems implicit to the court’s analysis. Even though the dust floated only a short distance, the court did not consider air to qualify as a “confined and discrete conveyance.”¹³⁸ In a parallel case, *Chemical Weapons Working Group, Inc. v. United States Dep’t of the Army*,¹³⁹ the Tenth Circuit was more direct: “common sense dictates that [smoke] stack emissions constitute discharges into the air—not water—and are therefore beyond

pollutant under the CWA).

128. The CWA protects navigable waters, including coastal oceans. See 33 U.S.C. § 1362(7); *Rapanos v. United States*, 547 U.S. 715, 732 (2006).

129. See *EPA TMDLs*, *supra* note 104.

130. 33 U.S.C. § 1362(14).

131. See, e.g., *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2012*, ENVTL. PROT. AGENCY, <http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html> [<https://perma.cc/LC5B-EL4Q>] (last visited May 20, 2015).

132. See *CLIMATE CHANGE IMPACTS ON OCEAN AND COASTAL LAW*, *supra* note 115, at 50.

133. See, e.g., *Alaska Cmty. Action on Toxics v. Aurora Energy Servs., LLC*, 940 F. Supp. 2d 1005, 1022 (D. Alaska 2013).

134. 940 F. Supp. 2d 1005 (D. Alaska 2013), *rev’d on other grounds*, 765 F.3d 1169 (9th Cir. 2014).

135. *Id.* at 1022.

136. In fact, the court clarified that the coal dust pile would indeed be subject to regulation under the NPDES program if the pollutants traveled via confined conveyance from pile to water. See *id.*

137. See *id.* at 1022.

138. *Id.* at 1023.

139. *Chem. Weapons Working Grp., Inc. v. U.S. Dep’t of the Army*, 111 F.3d 1485 (10th Cir. 1997).

§ 301(f)'s reach."¹⁴⁰ These cases strongly suggest that the NPDES point source requirement renders § 301 inapplicable to the diffuse atmospheric CO₂ driving ocean acidification.¹⁴¹

2. *The CWA's Water Quality Standards Regime Is a Better Fit for Regulating Ocean Acidification*

In contrast with the NPDES scheme, the CWA's § 303 WQS regime should apply to ocean acidification.¹⁴² NPDES focuses on reducing the effluent discharges of discreet polluters; § 303 aims to protect the overall quality of jurisdictional waters.¹⁴³ Accordingly, the regulatory "reach" of the standards encompasses small or diffuse sources of pollution that might otherwise go unregulated.¹⁴⁴ Ocean acidification, as a water quality issue primarily caused by the aggregate impact of diffuse CO₂ pollution, sits squarely within the purview of § 303.¹⁴⁵

Section 303 of the CWA requires states to promulgate three types of water quality standards: numeric standards, narrative standards, and designated uses.¹⁴⁶ States first establish the designated uses for a given waterbody, which refers to both human uses (e.g., recreation) and natural uses (e.g., fish habitat and breeding grounds).¹⁴⁷ Next, the responsible entity promulgates numerical standards (the maximum acceptable load of each pollutant in a given waterway) and narrative criteria that protect the continued enjoyment of the designated uses.¹⁴⁸ In order to achieve this goal, is it important that the water quality standards are "based on the latest scientific information."¹⁴⁹

140. *Id.* at 1490.

141. A possible counterargument may be found in pesticides cases, in which courts have held that helicopters spraying pesticides onto water are "point sources"—despite the air gap. These cases are distinguishable, first because the air gaps are arguably de minimis, and more importantly, because the spraying equipment used differs from a source like a smoke stack because it was designed for the *specific purpose of delivering pollutants to water*. See *Peconic Baykeeper, Inc. v. Suffolk Cty.*, 600 F.3d 180, 188–89 (2d Cir. 2010) (holding that helicopters spraying mosquito-control pesticides were CWA point sources); *League of Wilderness Defs. v. Forsgren*, 309 F.3d 1181, 1185 (9th Cir. 2002) (holding that when pesticides are sprayed directly from aircraft onto water, requirements for point source classification are met).

142. See, e.g., Sakashita, *supra* note 33.

143. See 33 U.S.C. § 1314(a)(1) (2012); *id.* § 1313(a)–(c); 40 C.F.R. § 130.3 (2015).

144. See *EPA v. Cal. ex rel. State Water Res. Control Bd.*, 426 U.S. 200, 205 n.12 (1976) (discussing the complementary nature of the NPDES and WQS regimes).

145. See, e.g., Sakashita, *supra* note 33.

146. See 33 U.S.C. § 1314(a)(1); *id.* § 1313(a)–(c); 40 C.F.R. § 130.3.

147. 33 U.S.C. § 1251(a).

148. *Id.*

149. See 40 C.F.R. § 131.10.

The EPA also publishes its own water quality criteria, which represent a “minimum bar” that state standards must meet.¹⁵⁰ EPA regulations specify that, like the state standards, the EPA’s national “baselines” should be based on modern science.¹⁵¹ The EPA standards serve the additional purpose of making sure the agency has a continuing seat at the table during state-level water quality discussions. The EPA standards also provide the agency with leverage over state standard-setting agencies: if the EPA updates its own standards, states must either adjust their water quality criteria to match, or supply a scientifically defensible alternative.¹⁵²

The argument that the CWA can “reach” ocean acidification is grounded in the duty § 303 imposes on states to continuously monitor the water quality of state waters.¹⁵³ Under § 303(d), if a given body of water fails any of the water quality standards, states have the obligation to list that waterbody as “impaired.”¹⁵⁴ EPA regulations also require states to identify the cause of impairment, identifying the “pollutants causing or expected to cause violations of the applicable water quality standard.”¹⁵⁵ Thus, if a state like Washington were to list a stretch of its coastal waters as “impaired” due to ocean acidification, the state would have to identify CO₂ as a contributing pollutant. Despite Washington’s active political role in the debate surrounding ocean acidification,¹⁵⁶ the State has thus far declined to list any coastal waters as “impaired” due to

150. *See id.* § 131.11(b); 33 U.S.C. § 1251(a).

151. *See* 40 C.F.R. § 131.10.

152. *See id.*; Sakashita, *supra* note 33, at 243. Previously, the Center for Biological Diversity (CBD) has also unsuccessfully attempted to petition Washington and Oregon directly to include acidified coastal waters in their “impaired” lists under CWA § 303(d). *See* Complaint at 10, *Ctr. for Biological Diversity v. U.S. EPA*, 90 F. Supp. 3d 1177 (W.D. Wash. 2015) [hereinafter CBD Complaint].

153. *See, e.g.*, Sakashita, *supra* note 33 (detailing the CWA application strategy for ocean acidification); 33 U.S.C § 1313(b)(1), (b)(3), (d). Thus, failure of the mandatory numeric, narrative or non-degradation standards, or the necessary for propagation baseline standard, would justify an “impaired” listing. *See id.*

154. 33 U.S.C § 1313(b)(1), (b)(3), (d).

155. 40 C.F.R. § 130.7(b)(4).

156. For example, Governor Gregoire organized the 2012 Blue Ribbon Panel on Ocean Acidification to investigate the threat acidification poses to the state and its citizens. *See generally* WASH. STATE BLUE RIBBON PANEL ON OCEAN ACIDIFICATION, OCEAN ACIDIFICATION: FROM KNOWLEDGE TO ACTION SUMMARY REPORT (2012), http://www.ecy.wa.gov/water/marine/oa/2012report_summary.pdf [https://perma.cc/Y3WW-VBCC]; *see also* 2012 Panel Members and Meetings, WASH. DEP’T ECOLOGY, <http://www.ecy.wa.gov/water/marine/oa/panel.html> [https://perma.cc/F27W-GBA9] (last visited Mar. 11, 2015) (containing written and video footage to the Panel’s meetings).

acidification.¹⁵⁷ The EPA, for its part, approved¹⁵⁸ Washington's most recent impaired waters list despite this omission.¹⁵⁹

*B. Modernized WQS at the State, Federal, or Qualified Tribal Level
Could Allow TMDL Regulation of Acidification*

Water quality standards for acidity already exist under the CWA.¹⁶⁰ These standards, however, are inadequate. Near-shore coastal waters like those off the Washington and Oregon coasts can exhibit a pH range from 6.5 units (slightly acidic) to nine units (alkaline) without violating the current standards.¹⁶¹ In the context of ocean chemistry, this “acceptable” pH range allowed by the CWA—a full 2.5 units—is so overbroad as to be almost meaningless. Recall that the 0.1 unit decrease in ocean pH observed since the start of the industrial era corresponds to a logarithmic *thirty percent increase* in ocean acidity.¹⁶² In this context, it is clear that the CWA's pH standards allow for radical changes in ocean chemistry with no regulatory response. However, if these standards were updated to reflect a more modern understanding of ocean chemistry, waters already burdened by acidification would have to be listed as “impaired” waters under § 303(d), leading to a TMDL for acidification.

1. The CWA's Standards for Acidity, First Promulgated in 1976, Do Not Reflect the “Latest Science”

The baseline standards for pH in the CWA are outdated and

157. *Water Quality: Current EPA Approved Assessment*, WASH. DEP'T ECOLOGY, <http://www.ecy.wa.gov/programs/wq/303d/currentassessmt.html> [https://perma.cc/E26E-6CYZ] (last visited Feb. 7, 2015) (noting that Washington's Section 303(d) list, which does not include any waters impaired by acidification, was prepared in accordance with the state water quality standards, listed at section 173-201A of the Washington Administrative Code).

158. The EPA is tasked with reviewing the impaired waters lists submitted by each state for approval. If the EPA does not approve the list, the agency has thirty days to identify waters that should have been listed as impaired. See 33 U.S.C. § 1313(d)(2); 40 C.F.R. § 130.7(d)(2). This includes a public consultation requirement. 33 U.S.C. § 1313(d)(2); 40 C.F.R. § 130.7(d)(2).

159. See *Water Quality Current EPA Approved Assessment*, *supra* note 157.

160. See *National Recommended Water Criteria*, ENVTL. PROT. AGENCY, <http://water.epa.gov/scitech/swguidance/standards/current/index.cfm#C> [https://perma.cc/9W2Y-5HH3] (last visited Mar. 20, 2015).

161. See, e.g., WASH. STATE DEP'T OF ECOLOGY, PUB. NO. 06-10-091, WATER QUALITY STANDARDS FOR SURFACE WATERS OF THE STATE OF WASHINGTON 21 (2012) <http://www.epa.gov/sites/production/files/2014-12/documents/wawqs.pdf> [https://perma.cc/ENZ7-APRR].

162. See Tans, *supra* note 43, at 34.

insufficient.¹⁶³ Two WQS set out the acceptable pH ranges for CWA-protected waters: the open ocean standard and the freshwater standard.¹⁶⁴ Both were initially promulgated in 1976.¹⁶⁵ The open ocean standard sets 6.5 to 8.5 units as an acceptable pH range, while the fresh water standard allows for a range of 6.5 to 9 pH units.¹⁶⁶ Coastal zones, which exhibit natural pH variability, are evaluated according to the more flexible fresh water standard.¹⁶⁷

Coastal waters present a regulatory challenge due to their chemical complexity.¹⁶⁸ Although the coastal standard's acceptable range—6.5 to 9 pH units¹⁶⁹—is even more expansive than the open ocean standard, the pH of near-shore water is naturally more dynamic.¹⁷⁰ For example, seasonal upwelling events result in significant pH variations in some coastal waters.¹⁷¹ Nevertheless, if the CWA is to achieve Congress's goal of protecting fish and shellfish,¹⁷² a “floor” of 6.5 pH units for coastal zones is dangerously tolerant of acidification.¹⁷³ For example, acidification research on the Pacific oyster demonstrated impairment at a pH of 7.4¹⁷⁴—significantly *less* acidic than the pH of 6.5 allowed by the coastal WQS. Furthermore, scientists question whether WQS for coastal zones should include a fixed pH range at all.¹⁷⁵ For example, ocean

163. *National Recommended Water Criteria*, *supra* note 160.

164. *Id.*

165. *Id.*

166. *Id.* The “normal” pH of surface water in the open ocean is roughly 8.2 (slightly basic). *See, e.g.,* Peter G. Brewer & James Barry, *Rising Acidity in the Ocean: The Other CO₂ Problem*, SCI. AM. (Sept. 1, 2008), <http://www.scientificamerican.com/article/rising-acidity-in-the-ocean/> [<https://perma.cc/D8AZ-YQMR>]. With a “floor” of 6.5 pH units, the current standard thus allows for a radical change in ocean chemistry before requiring waters to be listed as impaired. Alternatively, the WQS do provide that a smaller shift in pH—if sudden—can also trigger an impairment finding. However, even this provision allows for a change of 0.2 pH units—roughly sixty percent—prior to impairment. *See National Recommended Water Criteria*, *supra* note 160.

167. *See National Recommended Water Criteria*, *supra* note 160.

168. Janke & Pearson, *supra* note 42.

169. *National Recommended Water Criteria*, *supra* note 160.

170. Harris et al., *supra* note 80, at 2720 (noting that coastal upwelling events cause variation in pH levels and the structural minerals relied on by some calcifying organisms).

171. *Id.*

172. 33 U.S.C. § 1251(a) (2012).

173. Kurihara et al., *supra* note 6 **Error! Bookmark not defined.**, at 91 (showing negative impact on Pacific oyster larvae from exposure to water with a pH of 7.4 for forty-eight hours).

174. *Id.*

175. Aaron L. Strong et. al., *Ocean Acidification 2.0: Managing Our Changing Coastal Ocean Chemistry*, BIOSCIENCE, May 28, 2014, at 4 (advocating for data-based study of the drivers of pH change to facilitate the development of dynamic, zone-specific management practices). Others advocate for the promulgation of entirely new standards tracking ocean acidification indicators

chemistry researcher Aaron Strong advocates for a science-based management scheme customized to each coastal zone.¹⁷⁶ Of course, developing a dynamic and data-driven management approach would complicate the regulatory process. Difficulty, however, does not justify inaction.

2. *States, the EPA and Certain Native American Tribes Have the Authority to Promulgate New WQS for Ocean Acidification*

Scientific understanding of ocean acidification has advanced since 1976. As discussed above,¹⁷⁷ agency regulations state that the WQS must “reflect the latest scientific knowledge.”¹⁷⁸ The EPA and the states, with their forty-year-old pH standards, are currently failing this mandate. While each actor has the authority—and responsibility—to promulgate modernized WQS, for the sake of efficiency the EPA should be the “first mover.”¹⁷⁹ Because the EPA’s national WQS act as a statutory minimum, a strengthened federal WQS obliges all responsible states to update their own standards to match.¹⁸⁰ This is the strategy advanced by the Center for Biological Diversity (CBD), an organization that has actively advocated for water quality standards that better reflect the threat of ocean acidification.¹⁸¹ However, after years of EPA resistance,¹⁸² it may be time to cast a wider net. One alternate strategy

other than pH. *See, e.g.,* Alexandria B. Boehm et al., *Ocean Acidification Science Needs for Natural Resource Managers of the North American West Coast*, OCEANOGRAPHY, June 2015, 170, 173, <http://dx.doi.org/10.5670/oceanog.2015.40> [<https://perma.cc/6HNN-VVTS>] (advocating for a WQS specific to aragonite saturation). Because the state obligation to promulgate a TMDL is triggered by waters that fail *any* WQS, the scientific debate over how best to update the CWA is outside the scope of this Comment.

176. *See* Strong et al., *supra* note 175, at 4; Boehm et al., *supra* note 175, at 173.

177. *See supra* Section II.A.2.

178. 33 U.S.C. § 1314(a)(1) (2012).

179. *See, e.g.,* Ctr. for Biological Diversity, Petition for Revised pH Water Quality Criteria Under Section 304 of the Clean Water Act, 33 U.S.C. § 1314, to Address Ocean Acidification, Before the EPA (Dec. 18, 2007) [hereinafter CBD Petition], <http://www.biologicaldiversity.org/programs/oceans/pdfs/section-304-petition-12-18-07.pdf> [<https://perma.cc/EE3E-UPGV>].

180. 40 C.F.R. § 131.11(b) (2015).

181. *See, e.g.,* CBD Petition, *supra* note 179.

182. *See generally* Sakashita, *supra* note 33. The CBD first petitioned, then sued, the EPA in order to compel the agency to modernize its aging WQS. *See* CBD Petition, *supra* note 179. The parties ultimately settled—the EPA agreed to evaluate the issue, initiated a public comment process, and encouraged states to update their WQS. *See* Press Release, Ctr. for Biological Diversity, Settlement Will Require EPA to Evaluate How to Regulate Ocean Acidification Under the Clean Water Act (Mar. 11, 2010), http://www.biologicaldiversity.org/news/press_releases/2010/ocean-acidification-03-11-2010.html [<https://perma.cc/36GN-PMHN>]; Clean Water Act Section 303(d): Notice of Call for Public Comment on 303(d) Program and Ocean Acidification, 75 Fed. Reg.

might be to engage with a new type of institutional partner: selected Native American tribes.

Tribes with “Treatment as a State” (TAS) status¹⁸³ under the CWA could be powerful partners in the campaign against ocean acidification. Tribes have been able to petition the EPA for TAS status, which allows a tribe to manage CWA programs and exercise delegated authority as if it were a state,¹⁸⁴ since 1987.¹⁸⁵ CWA and EPA regulations set out four partially overlapping requirements that a tribe must satisfy to receive TAS: (1) federal recognition, (2) capacity to carry out governmental functions over its territory, (3) encumbrance with the governmental authority necessary to regulate water quality, and (4) capacity to administer an effective water quality program.¹⁸⁶

Once granted TAS status, a tribe is eligible to take over management of various CWA programs within its territory.¹⁸⁷ This is a powerful tool for tribes, potentially including the authority to set water quality standards and implementation plans (§ 303), to impose conditions on federal permits in order to ensure compliance with tribal WQS (§ 401), and to issue NPDES permits (§ 402).¹⁸⁸ Tribes would have the same powers and responsibilities as states—including the duty to promulgate WQS “reflecting the latest scientific knowledge.”¹⁸⁹ Also like states, tribal standards can be more stringent than the federal baseline.¹⁹⁰ This is consistent with both the exercise of inherent tribal sovereignty and the EPA’s interpretation of the CWA.¹⁹¹

Tribal administration of CWA § 303 represents a unique opportunity to aim the CWA’s water quality regime squarely at the problem of ocean acidification. The EPA has recognized forty-nine tribes as eligible to

13,537, 13,537–540 (Mar. 22, 2010). However, the process resulted in no binding obligations, and none of the responsible parties promulgated modern standards for acidification.

183. 33 U.S.C. § 1377(e); *see also* Paul M. Drucker, *Wisconsin v. EPA: Tribal Empowerment and State Powerlessness Under § 518(e) of the Clean Water Act*, 5 U. DENV. WATER L. REV. 323 (2002).

184. 33 U.S.C. § 1377(e); *see also* Drucker, *supra* note 183.

185. 33 U.S.C. § 1377(e).

186. *Id.*; 40 C.F.R. § 131.8 (2015).

187. 33 U.S.C. § 1377(e).

188. *See* Drucker, *supra* note 183, at 341.

189. 33 U.S.C. § 1314(a)(1).

190. *City of Albuquerque v. Browner*, 97 F.3d 415, 423 (10th Cir. 1996).

191. *Id.* (“We conclude that the EPA’s construction of the 1987 amendment to the Clean Water Act—that tribes may establish water quality standards that are more stringent than those imposed by the federal government—is permissible because it is in accord with powers inherent in Indian tribal sovereignty.”).

manage the WQS program¹⁹²—fourteen of those are in EPA Region Ten, which includes the Pacific Northwest.¹⁹³ Among those fourteen tribes, at least the Lummi,¹⁹⁴ Makah,¹⁹⁵ and Swinomish¹⁹⁶ are potentially impacted by ocean acidification (because they have tidelands or coastal waters within their reservations). These tribes represent a nexus of relevant interests and authority: non-state entities with jurisdiction over coastal waters impacted by acidification,¹⁹⁷ economic and legal interests in shellfish¹⁹⁸ and other organisms vulnerable to ocean acidification,¹⁹⁹ and the potential statutory authority to promulgate water quality standards for pH.²⁰⁰

3. *Stricter WQS Could Lead to Regulation of Ocean Acidification via the CWA's TMDL Provision*

Given evidence that coastal waters in the Pacific Northwest are already impacted by acidification,²⁰¹ these waters would likely fail to meet modern and sufficiently rigorous water quality standards for acidification.²⁰² The CWA requires states to publish a § 303(d) “impaired waters” list that highlights each waterbody failing one or more WQS.²⁰³ This impairment finding triggers the statutory duty to regulate the pollutants responsible.²⁰⁴ Specifically, the state must establish and

192. *Indian Tribal Approvals*, ENVTL. PROT. AGENCY, <http://water.epa.gov/scitech/swguidance/standards/wqslibrary/approvtable.cfm> [<https://perma.cc/5955-BFB7>] (last visited May 29, 2015).

193. *Id.*

194. *A Sovereign People*, LUMMI NATION, <http://www.lummi-nsn.org/website/index2.html> [<https://perma.cc/V9HV-7QB4>] (last visited Mar. 23, 2015) (noting that the Lummi reservation includes 13,000 acres of tidelands).

195. *History About the Makah and More*, MAKAH TRIBE, <http://makah.com/makah-tribal-info/> [<https://perma.cc/2XED-PUZ5>] (last visited May 29, 2015) (providing general information about the Makah tribe and its territory, abutting Neah Bay).

196. *The Swinomish People*, SWINOMISH INDIAN TRIBAL CMTY., <http://www.swinomish.org/who-we-are/the-swinomish-people.aspx> [<https://perma.cc/K7GY-8MCQ>] (last visited May 29, 2015) (noting that the Swinomish reservation includes 2900 acres of tidelands).

197. *Id.*

198. *See, e.g.*, *United States v. Winans*, 198 U.S. 371 (1905).

199. *See supra* Section I.B.

200. *See Indian Tribal Approvals*, *supra* note 192; 33 U.S.C. § 1314(a)(1) (2012).

201. *See, e.g.*, Kurihara et al., *supra* note 6, at 91 (showing negative impact on Pacific oyster larvae from exposure to acidic water within currently observable pH ranges).

202. *See* CBD Petition, *supra* note 179; CBD Complaint, *supra* note 152.

203. 40 C.F.R. § 130.7(b)(1), (b)(3), (d)(2) (2015).

204. *See* CBD Complaint, *supra* note 152.

enforce a TMDL for each contributing pollutant.²⁰⁵ The TMDL for a given pollutant is the maximum amount that can enter a waterbody each day.²⁰⁶ This is the heart of the CWA application theory: updated water quality standards, when breached, lead to mandatory TMDL regulation of the pollutants driving ocean acidification.²⁰⁷

Importantly, TMDL regulation includes non-point sources of pollution. States calculate TMDL thresholds by examining all sources of pollution—both large individual point sources and smaller, diffuse non-point sources.²⁰⁸ Limits for each pollutant contributing to impairment are incorporated into statewide water quality management plans.²⁰⁹ Therefore, a TMDL for acidification could authorize state regulation of both point and non-point emissions.²¹⁰ In the context of coastal ocean acidification, the TMDL might include drivers of acidification such as point and non-point releases of acidic chemicals and nutrient-rich agricultural runoff.²¹¹ In theory, the TMDL would also include CO₂ emissions, the pollutant known to be the primary cause of ocean acidification.

Regulating airborne gas with a water quality statute is a pragmatic necessity with respect to CWA regulation of ocean acidification.²¹² It is likely, nevertheless, to be jurisdictionally problematic. However, there is precedent for CWA regulation of airborne pollutants—the CWA already regulates airborne mercury,²¹³ polychlorinated biphenyls (PCBs),²¹⁴ and compounds causing acid rain.²¹⁵ Mercury is perhaps the strongest example: thousands of waterbodies appear on state § 303(d) impaired

205. *Id.*

206. 33 U.S.C. § 1313(d) (2012).

207. *See, e.g., Sakashita, supra* note 33, at 244.

208. 33 U.S.C. § 1313(e); 40 C.F.R. §§ 130.6, 130.7(d)(2).

209. 40 C.F.R. §§ 130.6, 130.7(d)(2). Specifically, state implementation plans translate the maximum allowable pollution load into a “pollution budget,” which is divided between local point sources (“wasteload allocation”) and non-point sources (“non-point source load allocation”). *Id.* § 130.2(h).

210. 33 U.S.C. § 1313(e); 40 C.F.R. §§ 130.6, 130.7(d)(2).

211. *See supra* Section I.A.2 (discussing contributors to ocean acidification other than CO₂).

212. *See generally* Sakashita, *supra* note 33.

213. *See EPA TMDLs, supra* note 104.

214. Polychlorinated biphenyls (PCBs) are a class of 209 PCB isomers used in electrical capacitors, turbines, and other industrial applications. They are typically carcinogenic, and inhalation is one of the primary delivery methods. *See Polychlorinated Biphenyls (PCBs)*, UNIV. NEB., http://dwb4.unl.edu/Chem/CHEM869E/CHEM869ELinks/ntp-server.niehs.nih.gov/htdocs/8_RoC/RAC/PCBs.html [<https://perma.cc/JB3G-N6CV>] (last visited Jan. 28, 2016).

215. *See, e.g., Sakashita, supra* note 33, at 244.

waters lists due to mercury pollution.²¹⁶ These impairment findings resulted in the development of TMDLs for airborne mercury.²¹⁷ According to the EPA, “[i]n many waterbodies, mercury originates largely from air sources, such as coal-fired power plants and incinerators.”²¹⁸ Airborne mercury reaches these waterbodies the same way airborne CO₂ reaches the ocean: through atmospheric deposition.²¹⁹

TMDLs for mercury demonstrate that it is both legally and technically feasible to regulate airborne pollutants under the CWA.²²⁰ Because atmospheric deposition results in airborne mercury polluting water, it is proper—even necessary—for the CWA to “reach” into the air.²²¹ Mercury and CO₂ are functionally analogous: both are pollutants that can be emitted into the atmosphere, yet pollute the water.²²² The result is the same—a pollutant crossing from one medium (air) into another (water). By allowing states to regulate airborne mercury emissions, TMDLs for mercury arguably pave the way for application of the CWA to CO₂.²²³

Unfortunately, TMDL-based strategies have a potentially fatal flaw: enforcement. When faced with the daunting task of actually implementing TMDLs, states often focus on point sources over non-point sources.²²⁴ This tendency is understandable—non-point source pollution is, by definition, decentralized, often difficult to identify, and correspondingly expensive to regulate.²²⁵ Oliver Houck, one of the nation’s leading TMDL scholars, has outlined the long history of lackluster enforcement with respect to non-point sources.²²⁶ According to Houck, the most basic weakness of the program is the lack of

216. EPA TMDLs, *supra* note 104.

217. *Id.*

218. *Id.*

219. *Id.*

220. The EPA has conducted years of research into modeling the “spread” of airborne mercury pollution, and provides guidance on its website for entities seeking to promulgate TMDL quantities. *Id.*; see also EPA, No. 453/R-01-009, FREQUENTLY ASKED QUESTIONS ABOUT ATMOSPHERIC DEPOSITION: A HANDBOOK FOR WATERSHED MANAGERS (2001). While the specific models would not apply to carbon dioxide, similar principles apply. *Id.*

221. See, e.g., EPA TMDLs, *supra* note 104.

222. See *id.* (discussing deposition of airborne CO₂ and mercury).

223. See, e.g., *id.*

224. See, e.g., OLIVER A. HOUCK, CLEAN WATER ACT TMDL PROGRAM: LAW, POLICY AND IMPLEMENTATION (2d ed. 2002); Houck, *supra* note 108.

225. See, e.g., Daniel R. Mandelker, *Controlling Nonpoint Source Water Pollution: Can It Be Done?*, 65 CHI.-KENT. L. REV. 479, 479 (1989) (summarizing the challenges regulators face when addressing non-point source pollution).

226. See HOUCK, *supra* note 224.

effective EPA oversight.²²⁷ Officially, the EPA has approval power over state TMDLs.²²⁸ In reality, this power is strictly limited. The EPA can only compel TMDL enforcement by rejecting the state's implementation plan. This rejection authority is limited to plans that are "impracticable."²²⁹ In other words, an *ineffective* TMDL implementation plan, by itself, is not grounds for disapproval by the EPA.²³⁰ Ultimately, it seems that a TMDL for acidity is a step in the right direction—but not a regulatory silver bullet.²³¹

III. A POSSIBLE ROLE FOR TRIBES IN ENCOURAGING NON-POINT SOURCE ENFORCEMENT

Updating the CWA's WQS to obtain a TMDL for ocean acidification could breathe new life into the law.²³² However, the TMDL enforcement issue raises questions about this strategy's likely real-world impact. Accordingly, Part III of this Comment offers a possible fix: engagement with select Native American tribes. In the Pacific Northwest, tribes party to the Stevens Treaties should be treated as key stakeholders in the fight against ocean acidification. Specifically, this Comment argues that tribal treaty rights to fish and shellfish could be used to compel state regulatory action—including enforcement of TMDLs.²³³

Washington State's first governor, Isaac Stevens, negotiated a series of land control treaties with the Native American tribes in the region.²³⁴ Known collectively as the "Stevens Treaties," these agreements exchanged grants of land to settlers for (among other things) guarantees of tribal fishing rights.²³⁵ As demonstrated by the landmark *United*

227. *Id.*; Peter M. Lacy, *Addressing Water Pollution from Livestock Grazing After ONDA v. Dombeck: Legal Strategies Under the Clean Water Act*, 30 ENVTL. L. 617, 623–24 (2000) (asserting that the sections of CWA dealing with nonpoint source pollution, sections 319 and 208, have failed because they are largely driven by federal grants and do not provide EPA with effective enforcement authority).

228. *See, e.g.*, 40 CFR § 130.7(d) (2015).

229. *See, e.g.*, HOUCK, *supra* note 224; Lacy, *supra* note 227, at 623–24.

230. *See, e.g.*, HOUCK, *supra* note 224.

231. *See, e.g., id.*

232. *See supra* Part II.

233. *See* Treaty of Point Elliot art. 5, Jan. 22, 1855, <http://www.goia.wa.gov/treaties/treaties/pointelliott.htm> [https://perma.cc/6AG8-VSYE]; *United States v. Washington (Washington I)*, 384 F. Supp. 312, 401 (W.D. Wash. 1974), *aff'd*, 520 F.2d 676, 685 (9th Cir. 1975) (summarizing case history through 1975 and holding the Stevens Treaties imbue the tribal parties with federally-protected rights to fish).

234. *See, e.g.*, Treaty of Point Elliot, *supra* note 233.

235. *See id.*, at art. 5.

States v. Washington line of cases,²³⁶ the Stevens Treaties establish federally protected tribal rights to harvest fish and shellfish.²³⁷ Because these rights are meaningless if there are no fish or shellfish left, Washington has an obligation to preserve the fisheries.²³⁸ Accordingly, the Stevens Treaties Tribes (“Tribes”) may have a colorable claim against Washington State based on its lack of response to the threat of ocean acidification.²³⁹

While the Tribes could bring this treaty-based allegation as a stand-alone claim, the best chance of achieving meaningful regulations may actually be to combine a treaty enforcement claim with the TMDL strategy discussed in Part II. If updated water quality standards led to a TMDL for acidification, a treaty enforcement claim might be able to address the criticism²⁴⁰ of TMDLs (lackluster non-point source enforcement) by enjoining the state to undertake specific enforcement actions.²⁴¹ This approach re-conceptualizes the TMDL as an enforcement *structure*—lacking the desired real-world effect by itself, but capable of channeling an external source of legal authority.

To better explore the possibility of a treaty rights claim as a response to ocean acidification, Section III.A begins by outlining the tribal interests threatened by acidification. Section III.B then turns to the *United States v. Washington* line of cases, which establish that Washington State has a federally enforceable duty to safeguard treaty-protected fish and shellfish. Of particular interest is the “culverts case,” a sub-proceeding of *United States v. Washington*.²⁴² In that case, a federal district court judge ordered Washington to remove or repair fish-blocking culverts beneath state roads.²⁴³ Currently on appeal to the Ninth Circuit,²⁴⁴ the culverts litigation demonstrates that tribal treaty interests

236. See, e.g., *Washington I*, 384 F. Supp. at 401.

237. *Id.*

238. *Id.*

239. See Treaty of Point Elliot, *supra* note 233, at art. 5.

240. See, e.g., HOUCK, *supra* note 224.

241. This is analogous to the culverts sub-proceeding, in which the U.S. District Court for the Western District of Washington enjoined the State from removing fish-blocking culverts that deprived tribes of access to treaty-protected fish. See *United States v. Washington*, 20 F. Supp. 3d 828, 889–90 (W.D. Wash. 2007) (discussing the six-year history of the culverts sub-proceeding).

242. See *id.*

243. *Id.*

244. A three-judge panel heard oral arguments in Seattle on October 16, 2015. As of this writing, the Ninth Circuit has not yet issued an opinion. See *United States v. Washington*, No. 13-35474, U.S. COURTS FOR NINTH CIRCUIT, http://www.ca9.uscourts.gov/media/view.php?pk_id=0000014845 [https://perma.cc/4AAZ-9E92] (last visited Feb. 14, 2016) (containing the docket information and audio recordings of the oral arguments).

are sufficiently robust to compel state conservation action.²⁴⁵ If upheld, the culverts case represents a possible model for a treaty enforcement action based on ocean acidification.

A. *Ocean Acidification Threatens Protected Tribal Interests*

Ocean acidification threatens tribal welfare because it negatively affects fish and shellfish that are economically, culturally, and religiously important to tribal communities.²⁴⁶ By harming pteropods, a key food source for juvenile salmon,²⁴⁷ acidification threatens populations of salmon that Pacific Northwestern tribes harvest for food and sale.²⁴⁸ Shellfish like the Pacific oyster are also at risk.²⁴⁹ Like salmon, shellfish are important resources for tribes like the Lummi²⁵⁰ and the Swinomish,²⁵¹ whose reservations include thousands of acres of tidelands suitable for shellfish cultivation. Of course, tribal interests in fish and shellfish go beyond cultural and economic concerns—because their right to take fish is codified by treaty, it is also a colorable legal interest.²⁵²

In 1854 and 1855, Native American tribes residing in what is now Washington State entered into a series of agreements allocating land and resources between the native tribes and western settlers. Known as the Stevens Treaties (“Treaties”), these agreements included language guaranteeing the Tribes the right to continue their traditional fishing practices: “The right of taking fish, at all usual and accustomed grounds and stations, is further secured to said Indians, in common with all citizens of the Territory”²⁵³ Intended to secure vital resources for

245. See *Washington*, 20 F. Supp. 3d at 889–99.

246. See *supra* note 14 and accompanying text.

247. See, e.g., Doney et al., *supra* note 4, at 177.

248. The *United States v. Washington* court describes the tribe’s party to the Stevens Treaties as “heavily dependent upon harvesting anadromous fish . . . particularly salmon.” *Washington I*, 384 F. Supp. 312, 355 (W.D. Wash. 1974), *aff’d*, 520 F.2d 676 (9th Cir. 1975). In one of the original treaty rights interpretation cases, *United States v. Winans*, 198 U.S. 371 (1905), the United States Supreme Court noted that fishing was “not much less necessary to the existence of the Indians than the atmosphere they breathed.” *Id.* at 381.

249. See *Kurihara et al.*, *supra* note 6, at 91.

250. *A Sovereign People*, *supra* note 194 (noting that the Lummi reservation includes 13,000 acres of tidelands).

251. *The Swinomish People*, *supra* note 196 (noting that the Swinomish reservation includes 2900 acres of tidelands).

252. See generally *Washington I*, 384 F. Supp. at 327.

253. See *Treaty of Point Elliot*, *supra* note 233, at art. 5; *United States v. Washington (Washington II)*, 506 F. Supp. 187, 189 (W.D. Wash. 1980), *aff’d in part, rev’d in part*, 694 F.2d

the tribes,²⁵⁴ this single sentence has instead produced over a century of litigation.²⁵⁵

In 1974, the famous Judge Boldt opinion, *United States v. Washington (Washington I)*,²⁵⁶ clarified Tribal fishing rights under the Treaties. Judge Boldt affirmed that tribal members have a protected right to fish from their traditional sites (“usual and accustomed grounds and stations”).²⁵⁷ This right remains in force even if those stations are outside modern reservation boundaries, or on private property owned by non-Indians.²⁵⁸ Tribes, in turn, are obliged to allow non-Indians to fish alongside them.²⁵⁹ However, the Treaties reserve a certain portion of the total sustainably harvestable catch for the Tribes: enough to make a “moderate living,” or fifty percent, whichever is lower.²⁶⁰ Later decisions applied these rules to shellfish as well, finding that shellfish are “fish” under the Treaties.²⁶¹ Thus, the Tribes also have the right to harvest shellfish both on and off-reservation—even if the “usual and accustomed” harvesting location is currently occupied by a commercial grower.²⁶²

Although the Treaties are silent on the specific location or amount of fish to be harvested,²⁶³ the United States Supreme Court ultimately upheld Judge Boldt’s “usual and accustomed” stations interpretation, as well as the fifty-fifty allocation of the harvest.²⁶⁴ In its decision, the

1374 (9th Cir. 1982).

254. “A primary concern of the Indians whose way of life was so heavily dependent upon harvesting anadromous fish, was that they have freedom to move about to gather food, particularly salmon.” *Washington I*, 384 F. Supp. at 355.

255. *Winans* was the first of the Stevens Treaty cases to come before the U.S. Supreme Court. See *United States v. Winans*, 198 U.S. 371 (1905).

256. 384 F. Supp. 312, 355 (W.D. Wash. 1974), *aff’d*, 520 F.2d 676 (9th Cir. 1975).

257. *Washington I*, 384 F. Supp. at 331.

258. *Id.*

259. *Washington v. Wash. State Commercial Passenger Fishing Vessel Ass’n*, 443 U.S. 658, 668 n.12 (1979).

260. *Id.* at 686. Neither party has a right to destroy the treaty resource (i.e., the fishery). See *United States v. Washington*, 520 F.2d 676, 685 (9th Cir. 1975).

261. *United States v. Washington*, 873 F. Supp. 1422, 1427 (W.D. Wash. 1994), *aff’d*, 157 F.3d 630 (9th Cir. 1998); *United States v. Washington*, 898 F. Supp. 1453 (W.D. Wash. 1995), *aff’d*, 157 F.3d 630 (9th Cir. 1998).

262. See generally *Washington*, 873 F. Supp. at 1427; *Washington*, 898 F. Supp. 1453. Note that the Treaties do contain a clause limiting tribal shellfish rights relative to non-Indian individuals. This so-called “Shellfish Proviso” states that Indians “shall not take shellfish from any beds staked or cultivated by citizens.” Treaty of Point Elliot, *supra* note 233, at art. V.

263. Treaty of Point Elliot, *supra* note 233, at art. 5; see also *Washington II*, 506 F. Supp. 187, 189 (W.D. Wash. 1980), *aff’d in part, rev’d in part*, 694 F.2d 1374 (9th Cir. 1982).

264. Treaty of Point Elliot, *supra* note 233, at art. 5; see also *Washington II*, 506 F. Supp. at 189.

Court reemphasized the “vital importance of the fisheries”²⁶⁵ to the Tribes, having previously stated in *United States v. Winans*²⁶⁶ that fishing was “not much less necessary to the existence of the Indians than the atmosphere they breathed.”²⁶⁷ Perhaps more significantly, the Court reaffirmed the unique canons of statutory interpretation that modern American courts apply when analyzing tribal treaties.²⁶⁸ Generally speaking, “treaties are construed more liberally than private agreements, and to ascertain their meaning [courts] may look beyond the written words to the history of the treaty, the negotiations, and the practical construction adopted by the parties.”²⁶⁹

Given that accurate historical information is not always available, these canons of interpretation allow ambiguity to be resolved in favor of tribes.²⁷⁰ In the context of *United States v. Washington*, courts apply this canon by considering what the Tribes *believed* the Treaties to guarantee to be as important as the text itself.²⁷¹ Here, the tribes believed—and still believe—that the Treaties guaranteed them the right to a significant amount of fish, forever.²⁷² This interpretation is based on direct representations made by Governor Stevens.²⁷³ Stevens told the Tribes, “this paper secures your fish.”²⁷⁴ As the Ninth Circuit observed, “[d]uring the negotiations, the United States repeatedly assured the Indians that they would continue to enjoy a permanent right to fish as they always had in the places where they always had.”²⁷⁵ On the strength of this record, both the Ninth Circuit and the United States Supreme Court affirmed the Tribes’ right to take up to fifty percent of the available fish from their usual and accustomed stations.²⁷⁶

265. *Washington v. Wash. State Commercial Passenger Fishing Vessel Ass’n*, 443 U.S. 658, 666 n.12 (1979).

266. *United States v. Winans*, 198 U.S. 371 (1905).

267. *Id.* at 381.

268. *Choctaw Nation of Indians v. United States*, 318 U.S. 423, 431–32 (1943).

269. *Id.*

270. *See United States v. Washington*, 157 F.3d 630, 643 (9th Cir. 1998) (stating that courts “[h]ave uniformly held that treaties must be liberally construed in favor of establishing Indian rights.”).

271. “[I]mportance should be given to the Indians’ likely understanding of the . . . words in the treaties and especially the reference to the “right of taking fish,”” *Wash. State Commercial Passenger Fishing Vessel Ass’n*, 443 U.S. at 678.

272. Answering Brief of the Appellee-Cross-Appellant Indian Tribes at 17, *United States v. Washington*, No. 13-35474 (9th Cir. Jan. 21, 2014).

273. *State v. Moses*, 79 Wash. 2d 104, 139, 483 P.2d 838, 851 (1971).

274. *Wash. State Commercial Passenger Fishing Vessel Ass’n*, 443 U.S. at 667 n.11.

275. *Washington*, 157 F.3d at 649.

276. *Wash. State Commercial Passenger Fishing Vessel Ass’n*, 443 U.S. at 668; *Washington I*,

B. *The United States v. Washington Culverts Litigation: A Possible Model for Stevens Treaties Claims Based on Ocean Acidification*

The purpose of Judge Boldt's holding in *Washington I* is to fairly allocate a shared resource—the available fishing stations are divided between Indians and non-Indians, as is the total annual catch.²⁷⁷ Underlying this allocation is the assumption that fish will always be available.²⁷⁸ However, declining fish runs, under pressure from overfishing, habitat destruction, and water quality-related harms, soon called this assumption into question.²⁷⁹ In fact, Judge Boldt himself recognized that because the “right secured by the treaties . . . exists in part to provide a volume of fish which is sufficient to the fair needs of the tribe Neither the Indians nor the non-Indians may fish in a manner so as to destroy the resource.”²⁸⁰ Short of total destruction, however, it was unclear what obligation the parties had to preserve their common resource—or at the very least, to avoid becoming the agent of harm. These questions are at the heart of the ongoing *United States v. Washington* culverts sub-proceeding.

In 2001, the Tribes filed suit against the State of Washington alleging violations of the Treaties.²⁸¹ The Tribes claimed that by constructing and maintaining a statewide system of culverts that blocked salmon from returning upstream, Washington limited the number of salmon returning to the Tribes' usual and accustomed stations.²⁸² The Tribes argued that the culverts impacted salmon runs “to the extent that such diminishment impairs the Tribes' ability to earn a moderate living from their fisheries.”²⁸³ Joined by the United States, the Tribes sought declaratory and injunctive relief, asking the court to affirm their interpretation of the Treaties and order the removal of the offending culverts.²⁸⁴ On August

384 F. Supp. 312, 401 (W.D. Wash. 1974), *aff'd*, 520 F.2d 676 (9th Cir. 1975).

277. *Washington I*, 384 F. Supp. at 401.

278. *Id.* at 430.

279. C. JEFF CEDERHOLM ET AL., *PACIFIC SALMON AND WILDLIFE—ECOLOGICAL CONTEXTS, RELATIONSHIPS, AND IMPLICATIONS FOR MANAGEMENT* iv (2d ed. 2000).

280. *Washington I*, 384 F. Supp. at 401 (emphasis added).

281. *United States v. Washington*, 20 F. Supp. 3d 828, 889–90 (W.D. Wash. 2007) (discussing the six-year history of the culverts sub-proceeding).

282. *Id.*

283. Plaintiff Tribes' Motion and Memorandum in Support of Motion for Partial Summary Judgment, at 1, *United States v. Washington*, No. C70-9213, 2006 WL 2882968 (W.D. Wash. Aug. 14, 2006), 2006 WL 2825386 (emphasis added).

284. *Washington*, 20 F. Supp. 3d at 889–90 (discussing the six-year history of the culverts sub-proceeding).

23, 2007, the district court ruled in favor of the Tribes.²⁸⁵ The court then held a seven day bench trial to determine the appropriate remedy (e.g., which culverts should be removed and how quickly).²⁸⁶ Finally, on March 29, 2013, more than a decade after the Tribes' original Request for Determination, the court issued its final memorandum order and permanent injunction.²⁸⁷

Finding in favor of the Tribes, the district court held that “[t]he right of taking fish, secured to the Tribes in the Stevens Treaties, imposes a duty upon the State to refrain from building or operating culverts under State-maintained roads that hinder fish passage and thereby diminish the number of fish that would otherwise be available for Tribal harvest.”²⁸⁸ Washington’s construction and maintenance of culverts impeding fish return violated the State’s duty under the Treaties. Accordingly, the court ordered Washington to expedite removal of the harmful culverts.²⁸⁹

The district court’s holding in this case is instructive in that the court frames the State’s duty as a negative one. Rather than implying a positive duty to preserve or conserve the fisheries, the court instead finds that the culverts represent a failure of Washington’s *negative* duty—to refrain from harming the fish supply.²⁹⁰ While the court-ordered remedy (timely culvert removal) requires the State to take “positive” action, this does not change the negative nature of the underlying duty: non-interference with tribal rights to fish. Because a treaty allocating fish would be undermined by the destruction of the fishery, the court in *Washington I* found that the Treaties’ fishing clauses necessarily imply a restriction on each party’s authority to destroy their shared resource.²⁹¹ However, Judge Boldt’s holding stops short of finding a general fishery conservation interest inherent in the Treaties—*Washington I*’s limitation on the parties vests only once fish populations decline nearly to the point of extinction.²⁹²

In 1980, the district court further considered whether the Treaties impose habitat protection responsibilities on the State (“Phase II” of the

285. *Id.*

286. *See generally* United States v. Washington, 20 F. Supp. 3d 986, 1023–24 (W.D. Wash. 2013) (issuing permanent injunction regarding Culvert Correction).

287. *Id.*

288. United States v. Washington, 20 F. Supp. 3d 828, 889–90 (W.D. Wash. 2007).

289. *Id.*

290. *Id.*

291. *Washington I*, 384 F. Supp. 312, 401 (W.D. Wash. 1974), *aff’d*, 520 F.2d 676 (9th Cir. 1975).

292. *Id.*

United States v. Washington saga).²⁹³ Although the court held that the Treaties do impose habitat protection duties, it again phrased this obligation negatively.²⁹⁴ The district court held that the Treaties required Washington to “refrain from degrading the fish habitat to an extent that would deprive the tribes of their moderate living needs.”²⁹⁵ Characterizing a proactive conservational responsibility as a *negative* treaty right may begin to strain credulity. Perhaps indicating an awareness of this critique, the *Washington II* opinion directly addresses the negative rights issue:

Contrary to the State’s apprehensions . . . this case [does not] involve an attempt by plaintiffs to impose an affirmative duty on the State to protect the fish habitat. Rather, plaintiffs seek the recognition of a negative duty such that when the State exercises its broad regulatory powers it does not impair the environmental conditions necessary for the survival of the treaty fish.²⁹⁶

Because the district court’s interpretation would require Washington to consider and avoid harm to fish habitat in the course of its normal exercise of regulatory power, it went further than Judge Boldt’s relatively narrow prohibition of destruction in *Washington I*.²⁹⁷

After years of litigation, an *en banc* panel of the Ninth Circuit vacated the district court’s habitat conservation holding in *Washington II*.²⁹⁸ Interestingly, the vacatur did not explicitly reject the district court’s treaty interpretation. The Ninth Circuit could simply have found that a habitat conservation duty *cannot* be implied from the Treaties; instead, the panel took issue with the factual standard required to support a *specific articulation* of Washington’s treaty responsibilities.²⁹⁹ The Ninth Circuit held that the district court’s sweeping prohibition against a category of state actions (i.e., those harmful to fish) was “contrary to the exercise of sound judicial discretion” in the context of a facial challenge like *Washington II*.³⁰⁰ What was missing, in the panel’s view, was a

293. See generally *Washington II*, 506 F. Supp. 187 (W.D. Wash. 1980), *aff’d in part, rev’d in part*, 694 F.2d 1374 (9th Cir. 1982).

294. *Id.* at 208.

295. See *id.*

296. *Id.* at 206–07.

297. In this view, a maximally invasive duty would take the additional step of requiring affirmative action and may run afoul of the constitutional prohibition against state conscription. *Id.* at 208; see also *Washington I*, 384 F. Supp. 312, 401 (W.D. Wash. 1974), *aff’d*, 520 F.2d 676 (9th Cir. 1975).

298. *United States v. Washington*, 759 F.2d 1353, 1357–58 (1985).

299. *Id.*

300. *Id.*

detailed factual record carefully demonstrating the connection between specific state actions and harm to treaty-protected salmon.³⁰¹ Because the court reached the decision to vacate on technical grounds,³⁰² it remained silent on the underlying question of treaty interpretation. The Ninth Circuit’s silence seems to imply that the Treaties may indeed support the very type of conservation obligation found by the district court—provided the duty is “defin[ed] and articulat[ed] upon concrete facts which underlie a dispute.”³⁰³

The *U.S. v. Washington* culverts litigation, by establishing that Washington has a concrete duty to remedy harm to treaty-protected salmon habitat, succeeds where *Washington II* failed. As discussed, the district court’s attempt in *Washington II* to expand Judge Boldt’s narrow prohibition against fishery destruction was ultimately unsuccessful.³⁰⁴ In response, the parties in the culverts litigation adopted a narrower legal strategy: whether or not the Treaties impose a general habitat conservation duty on Washington, the parties argued that the Treaties do impose a negative duty on the State to refrain from specific actions known to harm tribal salmon.³⁰⁵ Moreover, the Tribes and United States arrived in court armed with a detailed factual record demonstrating how building and maintaining culverts (the specific state action) led to a reduction in the number of fish available to tribes (the treaty-proscribed harm).³⁰⁶

On appeal, the parties’ briefs in the culverts litigation discuss the *Washington II* “concrete facts” standard in some detail.³⁰⁷ In the reply brief of the United States, for example, the government dedicates a section to the argument that the factual record adequately supports Judge Martinez’s permanent injunction.³⁰⁸ The key distinction, according to the United States, is that the respondents need not demonstrate every aspect of the complex science behind declining salmon runs to sustain their case. Instead, the only truly important fact is not in dispute: that Washington constructs and maintains culverts that harm treaty-protected

301. *Id.*

302. *Id.*

303. *Id.*

304. *Id.*

305. Response Brief of the United States of America at 45–47, *United States v. Washington*, No. 13-35474 (9th Cir. Jan. 21, 2014).

306. *Id.*

307. *Id.*

308. *Id.*

salmon.³⁰⁹

In addition, the plaintiffs in the culverts case avoided the concerns expressed in *Washington II* by seeking a narrowly tailored remedy—as opposed to asking the court to impose undefined conservation duties on the State.³¹⁰ In terms of effort and cost, the Martinez order is more immediately burdensome on the State than the general conservation duty contemplated in *Washington II*.³¹¹ At the same time, the order is also more limited in scope: the injunction only applies to culverts on state land.³¹² Furthermore, the order establishes a reasonable removal schedule (setting priority based on the number of fish blocked), rather than requiring the immediate removal of all harmful culverts.³¹³

If upheld on appeal, the culverts case may serve as a potential model for treaty-based ocean acidification claims. The culverts litigation demonstrates that the Treaties can be interpreted to compel protective state action.³¹⁴ Moreover, the threshold at which these treaty protections vest—when the fisheries are no longer adequate to support a “moderate living” for the Tribes³¹⁵—is already met. In the culverts opinion, Judge Martinez found as a matter of law that tribal income from fishing is already below the “moderate living” threshold.³¹⁶ Therefore, this element is satisfied with respect to the *United States v. Washington* line of cases.³¹⁷ Importantly, the treaty fishing clauses describe tribal rights in terms of guaranteed income; the Treaties are agnostic as to the *cause* of income impairment.³¹⁸ Therefore, the threshold for abrogating the Treaties is simply when—as now—there are too few fish at the Tribes’ usual and accustomed stations to meet the “moderate living” standard.³¹⁹ The cause of this harm, whether driven by culverts or ocean acidification, should not define the shape of the right itself. In either scenario, the relevant harm is the harm to tribal income. So long as there

309. *Id.*

310. *United States v. Washington*, 759 F.2d 1353, 1357–58 (9th Cir. 1985).

311. *United States v. Washington*, 20 F. Supp. 3d 986, 1023–24 (W.D. Wash. 2013); *Washington*, 759 F.2d at 1357–58.

312. Response Brief of the United States of America, *supra* note 305, at 45.

313. *Id.*

314. *See, e.g.*, *United States v. Washington*, 20 F. Supp. 3d 986; *Washington*, 759 F.2d at 1357–58.

315. Treaty of Point Elliot, *supra* note 233, at art. 5.

316. *United States v. Washington*, 20 F. Supp. 3d 828 (W.D. Wash. 2007).

317. *See, e.g.*, *United States v. Washington*, 626 F. Supp. 1405, 1476–78 (W.D. Wash. 1985).

318. Treaty of Point Elliot, *supra* note 233, at art. 5.

319. *Washington*, 20 F. Supp. 3d at 889–90.

are too few salmon to generate a moderate income from fishing, the guarantees of the Treaties are not being met.³²⁰ The logic for ocean acidification and tribal treaty rights to shellfish is similar: the right of access to usual and accustomed tidelands and beaches is of little use if the water is too acidic to support oyster fertilization and cultivation.

If Tribes were to pair an ocean acidification treaty rights claim with the CWA strategy discussed in Part II, the requested remedy for the treaty claim could be specific enforcement of the acidification TMDL. In addition to addressing Houck's critique of TMDLs, the treaty claim itself would also be strengthened by limiting its requested relief to enforcement of existing state regulations. By contrast, a standalone treaty claim would likely founder on the shoals of *Washington II*: any effective remedy would necessarily involve some form of novel regulation, which is far more ambitious than the district court's (failed) attempt to impose a state duty to *refrain* from degrading fish habitat.³²¹ Instead, seeking improved enforcement of an additional TMDL is both narrower and more analogous to the injunctive dynamic in the culverts litigation. In that case, Washington State had already initiated a program to remove the offending culverts by the time the district court issued the final injunction in 2013. Instead of requiring Washington to initiate a new culvert removal process, Judge Martinez ordered the state to expand and improve its existing program.³²² Similarly, requiring Washington State to redouble its efforts to enforce an existing TMDL would, technically speaking, be "working within the system" rather than seeking to compel the state to promulgate a novel regulatory program.

CONCLUSION

Ocean acidification—and the release of CO₂ that drives it—represents a real and present danger to a host of marine organisms. The danger is real for humans as well, including aquaculture-dependent Native American tribes. Given the difficulty in obtaining tort relief for causally complex harms, updating the CWA water quality criteria provides a potential path to regulation of ocean acidification via the TMDL regime.

320. See generally *United States v. Washington*, 759 F.2d 1353 (9th Cir. 1985); Treaty of Point Elliot, *supra* note 233, at art. 5.

321. *Washington II*, 506 F. Supp. 187, 208 (W.D. Wash. 1980), *aff'd in part, rev'd in part*, 694 F.2d 1374 (9th Cir. 1982).

322. Specifically, the district court ordered the State to prioritize culvert removal based on the significance of harm. The court also rejected Washington's proposed schedule, noting that at its pre-order pace the State would need 100 years to remove all the affected culverts. See *Washington*, 20 F. Supp. 3d at 889–90.

While TMDL enforcement for non-point sources is problematic, it is possible that tribal treaty rights claims could bolster TMDL enforcement. Whatever the solution, it is clear that complex environmental pollution processes like ocean acidification require an evolved regulatory response. America's current environmental regulatory regime, divided amongst media-specific pollution control statutes, is outclassed by trans-media pollutants like CO₂.