Promoting "Climate Change Plus" Industries Through the Administrative State: The Case of Marine Aquaculture

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Climate change has reached its "all hands on deck" moment, requiring simultaneous mitigation and adaptation efforts and the participation of all branches of government at all levels—including (and maybe especially) the administrative state. However, while certain agency exercises of climate change discretion have received considerable commentary, less attention has been paid to the ability of federal and state agencies and tribes to promote what this Article terms "climate change plus" (CC+) industries—that is, new, emerging, or expanding industries that can assist climate change mitigation or adaptation (or both) despite not being obviously connected to climate change. Therefore, unlike renewable energy, these industries are unlikely to inspire major legislative changes in policy or new statutory incentive programs as part of a larger climate change initiative. Nevertheless, these industries can still contribute to the nation's efforts to meet climate change mitigation and adaptation goals, underscoring why the administrative state needs to carefully evaluate such industries through a climate change lens when exercising regulatory discretion.

This Article focuses on U.S. marine aquaculture (mariculture) as a rapidly expanding industry in need of CC+ administrative evaluation, because certain aspects of this industry deserve selective promotion as part of a national climate change policy. Marine aquaculture is recognized worldwide as an increasingly critical facet of food security. However, many kinds of mariculture also contribute to climate change mitigation, coastal adaptation, and water quality improvement. This Article argues that focusing on marine aquaculture as a potential CC+ industry provides all the federal agencies, coastal states, and tribes involved in its regulation with a mechanism for coordinating, streamlining, and promoting the expansion of this industry's most multiply beneficial forms.

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Introduction

When a thoroughly mainstream magazine like *The Economist* proclaims that "[a] 3°C world has no safe place,"[1] one can safely assume that climate change has finally reached its "all hands on deck" moment, requiring simultaneous mitigation and adaptation efforts[2] and the participation of all branches of government at all levels[3]—including, in the United States, the federal, state, and tribal administrative states. Many agencies already have exercised (or attempted to claim) legal discretion to respond to climate change, and many of these activities have both sparked political controversy and prompted judicial review. Perhaps most obviously within the federal administrative state, the U.S. Environmental Protection Agency's (EPA) many attempts[4] to fit climate change mitigation (greenhouse gas emissions reduction) within the structure of the federal Clean Air Act[5] have sparked repeated bouts of litigation.[6] At the same time, significant changes in

1. *A 3°C World Has No Safe Place*, ECONOMIST (July 24, 2021), https://www.economist.com/leaders/2021/07/24/a-3degc-world-has-no-safe-place?utm_campaign=the-economist-this-week&utm_medium=newsletter&utm_source=salesforce-marketing-cloud [https://perma.cc/N6XU-P6FK].

2. "Cutting emissions is thus not enough. The world also urgently needs to invest in adapting to the changing climate." *Id.*

3. For example, on the mitigation side, according to the Intergovernmental Panel on Climate Change (IPCC),

> [p]athways limiting global warming to 1.5°C with no or limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems (high confidence). These systems transitions are unprecedented in terms of scale, but not necessarily in terms of speed, and imply deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options . . . .

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, GLOBAL WARMING OF 1.5°C 15 (2018) (emphasis omitted). Similarly,

> [l]imiting the risks from global warming of 1.5°C in the context of sustainable development and poverty eradication implies system transitions that can be enabled by an increase of adaptation and mitigation investments, policy instruments, the acceleration of technological innovation and behaviour changes . . . .

Id. at 21; *see also id.* at 21-22 (discussing changes in financing, education, technology, and policy).

4. *E.g.*, Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496, 66,497-99 (Dec. 15, 2009) (to be codified at 40 C.F.R. ch. I) (declaring greenhouse gas emissions from mobile sources like cars and trucks to endanger public health and welfare, a necessary finding before the EPA could regulate their emissions of greenhouse gases); Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64,510, 64,522 (Oct. 23, 2015) (to be codified at 40 C.F.R. pts. 60, 70, 71 98) (attempting to regulate greenhouse gas emissions from new power plants).

5. 42 U.S.C. §§ 7401-7671q.

6. *See generally, e.g.*, Util. Air Regul. Grp. v. EPA, 573 U.S. 302 (2014) (overturning the Triggering Rule, 75 Fed. Reg. 17,004 (2010), and the Tailoring Rule, 75 Fed. Reg. 31,514 (2010), but allowing the EPA to regulate greenhouse gas emissions from stationary sources already regulated under the Clean Air Act because of emissions of other pollutants). Most recently, the U.S. Supreme Court accepted certiorari in *American Lung Association v. EPA*, which will likely decide the scope of the EPA's authority under Section 111 of the Clean Air Act to enact nationwide greenhouse gas reduction plans like the Obama EPA's Clean Power Plan. 985 F.3d 914 (D.C. Cir. 2021), *cert. granted sub nom.* West Virginia v. EPA, 142 S. Ct. 420 (Oct. 29, 2021); *see also* N. Am. Coal Corp. v. EPA, 142 S. Ct. 417 (Oct. 29, 2021) (consolidated case); North Dakota v. EPA, 142 S. Ct. 418 (Oct. 29, 2021) (same); Westmoreland Mining Holdings v. EPA, 142 S. Ct. 418 (Oct. 29, 2021) (same).

regulatory approach between successive presidential administrations have simultaneously underscored the (sometimes exceeded) breadth of EPA discretion available to effectuate different visions of a national climate change mitigation effort.[7]

Indeed, attempted and successful exercises of agency discretion with respect to climate change pervade the federal administrative state. The U.S. Fish & Wildlife Service and National Marine Fisheries Service (NMFS), for example, have changed their policy regarding what constitutes a "foreseeable" risk of extinction for species impacted by climate change[8] for purposes of listing those species under the federal Endangered Species Act.[9] How federal public lands agencies should evaluate the climate change impacts of energy leasing—for either traditional oil and gas or coal extraction or new renewable energy installations—remains a hot topic in federal public lands litigation,[10]

7. The first of these reversals involved the EPA's authority to regulate greenhouse gases as "pollutants" under the Act, with the EPA General Counsel under President Clinton, Jonathan Cannon, opining in 1998 that the EPA *did* have such authority, only to have the EPA under President George W. Bush recant in response to a petition to regulate greenhouse gas emissions from mobile sources like cars and trucks. *See* Mass. v. EPA, 549 U.S. 497, 510-12 (2007). The legitimacy of the petition's denial reached the U.S. Supreme Court, which decided 5-4 that the EPA was arbitrary and capricious in concluding that it could not use the Clean Air Act to regulate greenhouse gas emissions. *Id.* at 534-35. Another reversal occurred between the Obama and Trump Administrations. With respect to stationary-source emissions, the Trump Administration EPA withdrew the Obama Administration EPA's Clean Power Plan and replaced it in 2019 with the Affordable Clean Energy Rule, only to have the U.S. Court of Appeals for the D.C. Circuit declare the new rule illegal the day before President Biden took office. *See* Am. Lung Ass'n v. EPA, 985 F.3d 914, 930 (D.C. Cir. 2021) (citing Affordable Clean Energy Rule, 84 Fed. Reg. 32,520 (July 8, 2019); and Clean Power Plan, 80 Fed. Reg. 64,662 (Oct. 23, 2015)). With regard to mobile sources, the Trump Administration EPA and National Highway Traffic Safety Administration (NHTSA) declared Clean Air Act regulation displaced by the Energy Policy and Conservation Act, which in turn preempted California's waiver to regulate greenhouse gas emissions more stringently than federal law requires. *See* The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One: One National Program, 84 Fed. Reg. 51,310 (Sept. 27, 2019) (to be codified at 40 C.F.R. pts. 85, 86, 531, 533). Numerous lawsuits challenged this rule, and in April and May 2021 the Biden Administration EPA and NHTSA began the process of repealing it. Paul Hemmersbaugh & Paul Wierenga, *NHTSA Moves to Repeal Regulatory Preemption of State Auto Emissions Regulation, Advancing Biden Plans to Dramatically Reduce US Greenhouse Gas Emissions*, DLA PIPER (May 19, 2021), https://www.dlapiper.com/en/us/insights/publications/2021/05/nhtsa-moves-to-repeal-federal-rule-preempting-california-automobile-emissions-regulation/ [https://perma.cc/5HLF-TNR8]; *EPA Reconsiders Previous Administration's Withdrawal of California's Waiver to Enforce Greenhouse Gas Standards for Cars and Light Trucks*, EPA (Apr. 26, 2021), https://www.epa.gov/newsreleases/epa-reconsiders-previous-administrations-withdrawal-californias-waiver-enforce [https://perma.cc/86W8-3UDA].

8. *See* Alaska Oil & Gas Ass'n v. Pritzker, 840 F.3d 671, 681-82 (9th Cir. 2016); Alaska Oil & Gas Ass'n v. Ross, 722 F. App'x 666, 668-69 (9th Cir. 2018).

9. 16 U.S.C. §§ 1531-1544.

10. The Bureau of Land Management (BLM) is a frequent defendant in the resulting lawsuits. *See, e.g.*, WildEarth Guardians v. Bureau of Land Mgmt., 870 F.3d 1222, 1233-38 (10th Cir. 2017) (overturning as an abuse of discretion the BLM's "perfect substitution" assumption regarding the climate change impacts of coal leasing); Wilderness Workshop v. U.S. Bureau of Land Mgmt., 342 F. Supp. 3d 1145, 1154-56 (D. Colo. 2018) (holding that the BLM improperly considered the indirect environmental impacts of oil and gas combustion). Offshore wind leases are becoming more prominent in these debates. *See Biden-Harris Administration Proposes Competitive Lease Sale for Offshore Wind Development for New York and New Jersey*, U.S. DEP'T OF THE INTERIOR (June 11, 2021), https://www.doi.gov/pressreleases/biden-harris-administration-proposes-competitive-lease-sale-offshore-wind-development [https://perma.cc/3FDV-HWDY] (deeming offshore wind development an important component of dealing with the "existential threat" of climate change).

as do the environmental justice considerations in federal decisions that facilitate continued fossil fuel use through new pipelines.[11]

However, less attention has been paid to the administrative state's ability to promote what this Article terms "climate change plus" (CC+) industries. CC+ industries are new, emerging, or expanding industries that can assist climate change mitigation or adaptation (or both)—but primarily as a bonus benefit to these industries' primary purpose or *raison d'être*. Scholars have already identified a number of these industries. For example, "biotech firms will become central players in the fight to develop new approaches to agricultural systems worldwide."[12] Insurance companies are likely to put forth a number of creative responses to climate change; as one example, some "like AIG are now offering personalized firefighting services to homeowners in California worried about the risk of increased wildfires as the summers get hotter and drier,"[13] while others are trying to get out of California altogether.[14] Using different

11. Indeed, pipeline cases are becoming their own specialty in environmental litigation. *See, e.g.*, Standing Rock Sioux Tribe v. U.S. Army Corps of Eng'rs, 255 F. Supp. 3d 101, 137-40 (D.D.C. 2017) (holding that the Army Corps failed to adequately assess the Dakota Access Pipeline's (crude oil) potential impacts on the Standing Rock Sioux Tribe); Standing Rock Sioux Tribe v. U.S. Army Corps of Eng'rs, 282 F. Supp. 3d 91, 100-01 (D.D.C. 2017) (concluding, nevertheless, "that the flaws in the Corps' environmental-justice analysis do not support vacatur" of the pipeline's easement), *amended by* 471 F. Supp. 3d 71, 79-88 (D.D.C. 2020) (granting vacatur and emptying of the pipeline on re-evaluation after remand until the Army Corps corrected its assessment), *aff'd in part, rev'd as to remedy*, 985 F.3d 1032 (D.C. Cir. 2021); Friends of Buckingham v. Va. Air Pollution Control Bd., 947 F.3d 68, 87-92 (4th Cir. 2020) (holding that the Board failed to properly conduct an environmental justice analysis in connection with its approval of a new natural gas pipeline and stating that "environmental justice is not merely a box to be checked, and the Board's failure to consider the disproportionate impact on those closest to the Compressor Station resulted in a flawed analysis"); Sierra Club v. Fed. Energy Regul. Comm'n, 867 F.3d 1357, 1368-71, 1373-75 (D.C. Cir. 2017) (holding, in connection with three new interstate natural gas pipelines in the Southeast, that FERC had adequately evaluated the pipelines' environmental justice impacts but needed to quantify the resulting greenhouse gas emissions that the pipelines would facilitate).

12. *5 Industries Benefiting from Climate Change*, INDUSTRY TODAY (Nov. 20, 2020), https://industrytoday.com/5-industries-benefiting-from-climate-change/ [https://perma.cc/W46Q-L27S]; *see also* ORG. FOR ECON. CO-OPERATION AND DEV. (OECD), INDUSTRIAL BIOTECHNOLOGY AND CLIMATE CHANGE: OPPORTUNITIES AND CHALLENGES 4 (2011) ("Industrial biotechnology, based on renewable resources, can save energy and significantly reduce CO_2 emissions. It is an embryonic industry, but has already proven its worth in climate change mitigation. It holds much greater promise for the future by avoiding the use of fossil raw materials. It involves the use of enzymes and microorganisms to make biobased products in a diverse variety of industry sectors. The feedstocks are agricultural biomass and organic waste materials, even wastewaters."); Michelle McMurry-Heath, *To Help Solve Climate Change, Look to the Biosciences*, STAT (May 21, 2021), https://www.statnews.com/2021/05/21/climate-change-solutions-from-biosciences [https://perma.cc/C3SC-2DWZ] ("The biosciences, including biotechnology, will play a pivotal role in the fight against climate change. It is already leading the way on several fronts. According to a report from BIO . . . the biotech industry's green initiatives could mitigate the equivalent of 3 billion tons of carbon dioxide every year by 2030, or about half of the country's annual CO_2 emissions.").

13. Brad Plumer, *Meet the Companies that Are Trying to Profit from Global Warming*, VOX (Sept. 4, 2015, 5:00 PM EDT), https://www.vox.com/2014/8/18/6031219/how-to-profit-off-of-global-warming [https://perma.cc/6DP3-BE45].

14. *Major Insurance Companies Leave/Reduce Underwriting in California due to California Regulations and Fire Exposure*, INLANDEMPIRE.US (Jan. 27, 2022), https://inlandempire.us/california-loses-more-insurance-companies-as-risk-increases-and-profit-is-at-risk/ [https://perma.cc/GJJ6-2WUJ]; Editor, *'Priced Out of California'—How Insurance Industry Is Responding to Risks Posed by Climate Change*, TIMES OF SAN DIEGO (Nov. 11, 2021), https://timesofsandiego.com/business/2021/11/11/priced-out-of-california-how-insurance-industry-is-responding-to-risks-posed-by-climate-change/ [https://perma.cc/MC5R-VTEJ].

terminology, Amy L. Stein has sought to rehabilitate artificial intelligence (AI) as a CC+ industry worthy of the administrative state's attention as such—not just the courts' attention as a threat "to privacy, security, due process, and democracy itself."[15]

Unlike renewable energy, these industries are ancillary contributors to the United States' climate change goals. As a result, they are unlikely to inspire new legislative programs and incentives, at either the federal or state level, to promote them for climate change purposes. Indeed, complicating the potential regulatory issues for a climate-savvy administrative state, CC+ industries' potential benefits to climate change policy may not even be fully acknowledged or assessed yet, and these industries also may encompass different facets or subindustries that vary considerably in their abilities to promote climate change mitigation or adaptation.

Nevertheless, the very fact that these emerging and expanding industries may be flying under the administrative state's climate change radar is exactly the reason why the administrative state needs to more closely evaluate them through a climate change lens. This Article focuses on marine aquaculture, or mariculture, as an expanding industry in the United States in need of CC+ administrative state attention. Marine aquaculture is recognized internationally as an increasingly critical facet of food security.[16] However, many kinds of marine aquaculture also contribute to climate change mitigation[17] and water quality improvement,[18] and this growing industry can also provide one means for coastal fishing communities to adapt to climate change impacts on fisheries.[19] While the United States is already less wedded to the more environmentally damaging forms of marine aquaculture (such as net pen Atlantic salmon aquaculture) than other coastal industrialized nations,[20] it also has been slow to embrace marine aquaculture as a natural priority or climate change strategy.

15. Amy L. Stein, *Artificial Intelligence and Climate Change*, 37 YALE J. ON REGUL. 890, 890 (2020). *See generally* Chris Huntingford, Elizabeth S. Jeffers, Michael B. Bonsall, Hannah M. Christensen, Thomas Lees & Hui Yang, *Machine Learning and Artificial Intelligence to Aid Climate Change Research and Preparedness*, 14 ENV'T RSCH. LETTERS 124,007 (2019) (arguing that machine learning and artificial intelligence can help scientists to better understand the planetary climate system itself, allowing for better warnings and adaptation planning).

16. *E.g.*, *The State of World Fisheries and Aquaculture: Sustainability in Action*, U.N. FOOD & AGRIC. ORG. 2, 3 (2020) [hereinafter *2020 FAO Fisheries & Aquaculture Report*], http://www.fao.org/3/ca9229en/ca9229en.pdf [https://perma.cc/NJQ4-RQFG] (reporting that aquaculture production now accounts for 46% of global fish, crustaceans, mollusks, and other aquatic animal production in the world and over 62% of the value of that production, and that over 87% of the total production is used for human food, with 52% of that food production coming from aquaculture; moreover, consumption of these sources of protein has increased globally at almost twice the rate of population growth); *see also id.* at 4 fig. 1 (showing how marine fisheries production leveled in the late 1980s and 1990s, followed by a rapid increase in marine aquaculture).

17. *See* discussion *infra* Section I.C.

18. *See* discussion *infra* Section I.B.

19. *See* discussion *infra* Section I.D.

20. *See* discussion *infra* Section I.E.

This Article proceeds in four parts. Part I examines the status of marine aquaculture as a CC+ industry, focusing on the rapid increase in marine aquaculture for food, the benefits of shellfish and kelp aquaculture for water quality, the benefits of kelp aquaculture for carbon sequestration, and the potential for a growing aquaculture industry in the United States to aid fishery communities to adapt to shifting coastal fisheries. Part II then examines the complex administrative apparatus that governs marine aquaculture in the United States, focusing on President Trump's Seafood Executive Order (which, so far, President Biden has left in place) and the fragmented yet overlapping jurisdiction over the marine aquaculture industry among the U.S. Army Corps of Engineers, regional federal Fishery Management Councils, the EPA, coastal states, and a variety of coastal Tribes. Seeking to break the unproductive status quo resulting from this jurisdictional fragmentation, Part III suggests a variety of mechanisms that the administrative state could use to promote the CC+ varieties of marine aquaculture, arguing that CC+ recognition provides a policy basis for coordinating federal, state, and tribal agency discretion in favor of climate change benefits, increased marine ecosystem resilience, and a more secure but sustainable domestic food supply. In the United States, an immediate focus on marine aquaculture as a CC+ industry would provide federal agencies, relevant coastal states, and coastal tribes with a mechanism for streamlining the most multiply beneficial forms of mariculture before this expanding industry establishes its own, potentially less helpful, norms and expectations.

I. Marine Aquaculture as a Climate Change Plus Industry

Marine aquaculture, or mariculture, encompasses a diverse range of species and types of facilities that can serve a variety of purposes, from food to species stocking to ecosystem restoration.[21] The United Nations Food & Agriculture Organization (FAO), for example, counted more than 466 individual aquatic (freshwater and marine) species in commercial production in 2018 and reported that an additional 200 to 300 species and hybrids have been farmed.[22]

21. Daniel Peñalosa Martinell, Francisco Javier Vergara-Solana, Marcelo Araneda Padilla, Germán Ponce Díaz, Annie Mejaes, Manuel María Varela Lafuente & U. Rashid Sumaila, *Social Effects of Energy Subsidies and Taxes on CO_2 Emissions: The Case of Mexican Aquaculture Public Policies*, MARINE POL'Y, June 2021, at 1; *Marine Aquaculture and the Environment*, NOAA FISHERIES, https://www.fisheries.noaa.gov/insight/marine-aquaculture-and-environment [https://perma.cc/Y3G3-KCTE] (last visited July 14, 2021).

22. *2020 FAO Fisheries & Aquaculture Report*, *supra* note 16, at 29. Nevertheless,

> [d]espite the great diversity in the species raised, aquaculture production by volume is dominated by a small number of "staple" species or species groups at the national, regional and global levels. Finfish farming, the most diverse subsector, contains 27 species and species groups, which accounted for over 90 percent of total finfish production in 2018, of which the 20 most important species accounted for 83.6 percent of total finfish production . . . . Compared with finfish, fewer species of crustaceans, molluscs and other aquatic animals are farmed.

Id.; *see also id.* at 30-31 tbl. 8 (listing the dominant species).

Among the aquaculture facilities that operate primarily to grow human food, environmental impacts vary considerably.[23] Most people are most familiar with Atlantic salmon net pen aquaculture, a well-established industry that by 2010 dominated the aquaculture market in the Western world.[24] Atlantic salmon is the most common marine fish aquacultured, and the world produced over 2.43 million tonnes of it in 2018.[25] However, this form of marine aquaculture comes with considerable environmental risks. First, farmed Atlantic salmon are a human-bred species, the result of purposeful cross-breeding that doubled the growth rate of any of the natural strains.[26] Indeed, the human-bred strain is different enough that some scientists refer to it as *Salmo domesticus*, and "[t]he tamed-salmon genome is now markedly different from the wild-salmon genome."[27] Second, marine aquaculture has taken this creation to new parts of the ocean, including the southern hemisphere and the Pacific Ocean, prompting concerns about escapements.[28] Third, although continued breeding improvements are lowering the ratio of wild feed fish input to Atlantic salmon output, Atlantic salmon are carnivores, and Atlantic salmon aquaculture traditionally required three to six pounds of wild-caught fish for every pound of salmon produced.[29] Marine pollution and disease became issues when the pursuit of profit pushed Atlantic salmon farms into suboptimal locations that lacked strong currents.[30] Farmed Atlantic salmon also tend to concentrate persistent marine toxic pollutants like

23. *Id.* at 26-31; Sterenn Lucas, Louis-Georges Soler, Xavier Irz, Didier Gascuel & Joël Aubin, *The Environmental Impact of the Consumption of Fishery and Aquaculture Products in France*, J. CLEANER PROD., May 25, 2021, at 1-2, 5.

24. PAUL GREENBERG, FOUR FISH: THE FUTURE OF THE LAST WILD FOOD 42-44 (2010).

25. *2020 FAO Fisheries & Aquaculture Report*, *supra* note 16, at 30 tbl. 8. All the fish species produced in greater quantities than Atlantic salmon in the table are freshwater species. According to the FAO, "[f]armed Atlantic salmon constitute >90% of the farmed salmon market, and >50% of the total global salmon market," and salmon aquaculture occurs in Norway, Scotland, Ireland, Russia, France, Spain, Canada, the United States, Australia (Tasmania), New Zealand, Chile, and the Faroe Islands. *Cultured Aquatic Species Information Programme:* Salmo Salar, U.N. FOOD & AGRIC. ORG. (2021), http://www.fao.org/fishery/culturedspecies/Salmo_salar/en [https://perma.cc/Q8W4-US9T].

26. GREENBERG, *supra* note 24, at 41-42; *see also* Melissa Schatzberg, *Salmon Aquaculture in Federal Waters: Shaping Offshore Aquaculture Through the Coastal Zone Management Act*, 55 STAN. L. REV. 249, 255-56 (2002) (discussing escapements in Washington coastal waters in the late 1990s and noting that "[c]oncern over such massive containment failures has escalated in light of the discovery of juvenile Atlantic salmon in seventy-seven rivers in British Columbia," Canada).

27. GREENBERG, *supra* note 24, at 42, 44.

28. *Id.* at 43, 44.

29. *Id.* at 44.

30. Specifically,

> Farms were sited with poor water circulation and often in proximity to passageways for dwindling runs of wild salmon. As density of salmon farms increased, nitrogen wastes built up, causing algae to bloom and die and, in the process, deoxygenate the water. Overcrowding of farms attracted parasites, like a bloodsucking creature called a sea louse, which has been shown to be transferable from farmed populations to wild salmon runs. Diseases like infectious salmon anemia were born, first in Chile and then in the rest of the world, wiping out whole farms in a week.

Id. at 49.

polychlorinated biphenyls (PCBs) in their tissues to a greater extent than wild salmon do.[31]

Unfortunately, because aquacultured Atlantic salmon has become nearly ubiquitous, it and its problems often serve as the popular and political shorthand for marine aquaculture more generally.[32] While this popular misperception can certainly obstruct the administrative state's ability to promote other forms of mariculture, including as CC+ industries, it also helps to demonstrate why the administrative state needs to take the lead in legally differentiating different types of marine aquaculture. Under the federal Administrative Procedure Act[33] and its state analogues,[34] differential regulation of various forms of aquaculture requires a public process with a robust agency explanation and opportunities for notice and comment.[35] Among other purposes, this process serves a public education function, allowing the administrative state to note the multiple reasons why the species most relevant to a CC+ analysis in the United States—macroalgae (seaweed and kelp) and shellfish such as clams, oysters, mussels, and abalone[36]—differ from salmon aquaculture and warrant preferential regulatory status.

The timing for a CC+ review of marine aquaculture is propitious. Given the expansion of marine aquaculture worldwide, scholars in multiple disciplines recognize that marine aquaculture is a ripe topic for regulatory reconsideration, including in terms of its relationship to climate change.[37]

A. The Growth of Marine Aquaculture for Increased Food Security

The FAO maintains the most reliable and comprehensive sets of data about how the world supplies itself with aquatic food, and roughly every two years it publishes a *State of the World Fisheries and Aquaculture* report.[38] According to the latest 2020 report, in 2018 the world produced (from all

31. *Id.* at 51-55.

32. For example, a Google search for "aquaculture protest" results in stories that are largely about finfish aquaculture, and all but a handful are about salmon.

33. 5 U.S.C. §§ 551-559, 701-706.

34. For a list, see *State Administrative Procedure Acts*, BALLOTPEDIA, https://ballotpedia.org/State_administrative_procedure_acts [https://perma.cc/CC6U-PRQY] (last visited Nov. 2, 2021).

35. *See, e.g.*, 5 U.S.C. § 553.

36. Notably, shellfish as a category, whether wild-caught or aquacultured, tend to have a lesser environmental impact (including climate change impact) than the popular food species of marine fish. *See* Lucas et al., *supra* note 23, at 5.

37. *See* Martinell et al., *supra* note 21, at 4-6 (examining the effects of Mexican emissions taxes on a hypothetical shrimp aquaculture facility); Lucas et al., *supra* note 23, at 8 (advocating for a stronger labeling requirement for fishery and aquaculture products (FAPs) because "the policies aimed at raising the sustainability of diets by advocating increases in FAP consumption must be carefully refined. In order to be efficient, rather than treating FAPs as a homogenous group of products, the message towards consumers should differentiate species and fishing/production methods in order to encourage consumption of the less impacting FAPs").

38. The FAO maintains a full set of these reports online, dating back to 1995. *See Publications: State of the World Fisheries & Aquaculture*, U.N. FOOD & AGRIC. ORG. (last visited July 24, 2021), https://www.fao.org/publications/search/en/?serialtitle=VGhlIFN0YXRlIG9mIFdvcmxkIEZpc2hlcmllcyBhbmQgQXF1YWN1bHR1cmUgKFNPRklBKSA= [https://perma.cc/5R7N-BYC5].

sources, including fishing and freshwater aquaculture) about 179 million tonnes of fish, crustaceans like crab and lobster, mollusks like clams and oysters, and other aquatic animals, worth $401 billion.[39] Of that total harvest, 156 million tonnes, or over 87%, were used for human food.[40] Importantly for this Article, aquaculture (both freshwater and marine) supplied 82 million tonnes of the total production (46%), $250 billion of the total value (over 62%), and 52% of the total human food.[41] Globally, increased consumption of fish and seafood is outpacing both human population growth and the consumption of all other animal-protein foods.[42] Therefore, given aquaculture's growing role in supplying this increasing demand, aquaculture is a critical component of the world's food security and protein supply.[43]

The same is true looking only at marine aquaculture. Wild capture fisheries in the ocean leveled off in the late 1980s and 1990s.[44] Moreover, as the FAO reported in 2020, wild marine fisheries are becoming increasingly unsustainable.[45] Not coincidentally, marine aquaculture industries have been growing rapidly since 1986 to close the gap in global seafood demand.[46]

However, food animals are not the only aquacultured marine species of global importance. While food animals remain the largest sector of marine aquaculture, in 2018 the world produced 32.4 million tonnes of aquacultured algae (kelp, seaweed) worth $13.3 billion and 26,000 tonnes of ornamental

39. *2020 FAO Fisheries & Aquaculture Report*, *supra* note 16, at 2.

40. *Id.*

41. *Id.*

42. Specifically, fish and seafood consumption "increased at an average annual rate of 3.1% from 1961 to 2017, a rate almost twice that of annual world population growth (1.6%) for the same period, and higher than that of all other animal protein foods (meat, dairy, milk, etc.), which increased by 2.1% per year." *Id.* at 3. In developed countries like the United States, per capita fish and seafood consumption peaked in roughly 2007, but current rates of consumption remain significantly higher than they were in 1961. *Id.* at 3, 5 fig. 3.

43. *See id.* at 24 fig. 10.

44. *Id.* at 4 fig. 1.

45. Specifically,

> The state of marine fishery resources, based on FAO's long-term monitoring of assessed marine fish stocks, has continued to decline. The proportion of fish stocks that are within biologically sustainable levels decreased from 90 percent in 1974 to 65.8 percent in 2017 (a 1.1 percent decrease since 2015), with 59.6 percent classified as being maximally sustainably fished stocks and 6.2 percent underfished stocks. The maximally sustainably fished stocks decreased from 1974 to 1989, and then increased to 59.6 percent in 2017, partly reflecting improved implementation of management measures. In contrast, the percentage of stocks fished at biologically unsustainable levels increased from 10 percent in 1974 to 34.2 percent in 2017. In terms of landings, it is estimated that 78.7 percent of current marine fish landings come from biologically sustainable stocks.

Id. at 7.

46. *Id.* at 4 fig. 1. Aquaculture production of marine animals has grown from an average of 6.3 million tonnes per year between 1986 and 1995 to almost 31 million tonnes in 2018 (the latest year for which data is available), a growth rate of 489% over about 35 years. *Id.* at 3 tbl. 1. "In 2018, shelled molluscs (17.3 million tonnes) represented 56.3% of the production of marine and coastal aquaculture. Finfish (7.3 million tonnes) and crustaceans (5.7 million tonnes) taken together were responsible for 42.5%, while the rest consisted of other aquatic animals," *id.* at 6, 26 tbl. 6, including aquatic turtles and marine invertebrates such as sea cucumbers, *id.* at 21, 30-31 tbl. 8.

seashells and pearls worth $179,000.[47] Seaweeds dominate aquacultured algae, and while tropical seaweed aquaculture in Southeast Asia has decreased in recent years, seaweed aquaculture in temperate and cold waters—like those that surround most of the United States—continues to grow, albeit at a slower pace than marine animal aquaculture.[48] Seaweed aquaculture was also the first marine aquaculture sector to surpass wild capture.[49] Some kelp aquaculture directly feeds human beings, particularly in East and Southeast Asia, and some kelp aquaculture indirectly feeds humans, such as when farmers feed aquacultured kelp to aquacultured abalone that humans then eat.[50] Most other algae aquaculture supplies carrageenan, biofuels, and nutrition supplements (from microalgae species like *Spirulina* species).[51]

B. Food Plus Improved Water Quality from Shellfish and Kelp Aquaculture

Shellfish and kelp aquaculture are two of the least polluting forms of human food production, marine or terrestrial. "In global food production, cultured bivalves have a low environmental impact per gram of protein produced, compared with finfish aquaculture, most capture fisheries, and terrestrial livestock."[52] As the FAO has emphasized, mollusks like clams and oysters are filter feeders, meaning that aquacultured mollusks do not need to be fed.[53] Seaweeds, in turn, grow through photosynthesis, but, unlike terrestrial crops, do not require inputs such as fertilizers and pesticides.[54] Because of these traits, "[m]arine bivalves, filter-feeding organisms that extract organic matter from water for growth, and seaweeds, which grow by photosynthesis by absorbing dissolved nutrients, are sometimes described as extractive species."[55] These species can reduce nutrient pollution in marine

47. *Id.* at 21.

48. *Id.* at 21, 23; *see also id.* at 22 fig. 8 (displaying graphically the growth of seaweed aquaculture compared to other types).

49. Notably, marine fish production remains the only sector of marine food production where aquaculture has *not* surpassed wild production:

> Based on time-series data of major species groups, world aquaculture production has progressively surpassed that of capture fisheries. The "farming more than catch" milestones were reached in 1970 for aquatic algae, in 1986 for freshwater fishes, in 1994 for molluscs, in 1997 for diadromous fishes, and in 2014 for crustaceans. However, despite the increasing output from global aquaculture, farming of marine fishes is unlikely to overtake marine capture production in the future.

Id. at 23.

50. *Id.* at 31.

51. *Id.* at 29, 32.

52. Jessica S. Turner, M. Lisa Kellogg, Grace M. Massey & Carl T. Friedrichs, *Minimal Effects of Oyster Aquaculture on Local Water Quality: Examples from Southern Chesapeake Bay*, PLOS ONE, Nov. 7, 2019, at 1; *see also* Matt Parker & Suzanne Bricker, *Sustainable Oyster Aquaculture, Water Quality Improvement, and Ecosystem Service Value Potential in Maryland Chesapeake Bay*, 39 J. SHELLFISH RSCH. 269, 276 (2020) (noting that oyster aquaculture in Maryland did not affect dissolved oxygen or ammonia levels in the water, indicating that the aquaculture was not negatively affecting the environment).

53. *See, e.g.*, *2020 FAO Fisheries & Aquaculture Report*, *supra* note 16, at 26.

54. *Id.* at 27.

55. *Id.*

environments, regardless of whether the pollution comes from fed-finfish aquaculture[56] or other sources, such as fertilizer runoff from upstream agriculture.[57]

Shellfish and kelp aquaculture can thus improve marine water quality as well as feed human beings. Consider the example of oyster aquaculture. "In the U.S., oysters are the largest grossing marine species group for U.S. aquaculture, valued at $192 million in 2016."[58] Oysters are also particularly good at filtering water,[59] including when they are grown in aquaculture. For example, small but statistically significant water quality improvements have been measured in waters around oyster farms in Virginia's portion of the Chesapeake Bay,[60] and the U.S. Geological Survey (USGS) and National Oceanic and Atmospheric Administration (NOAA) have determined that "[a]ll of the nitrogen currently polluting the Potomac River estuary could be removed if 40% of its river bed were used for shellfish cultivation . . . ."[61] In the Maryland portion of the Chesapeake Bay, oyster aquaculture removes nitrogen pollution associated with farm runoff, allowing oyster aquaculture (and clam aquaculture) to participate in nutrient trading programs under the federal Clean Water Act.[62] Some oyster farms, for example, can remove over 200 kilograms of nitrogen pollution per acre per year, at a value of $2.20 to $4873.00 per kilogram, potentially allowing these farms to earn significant water quality trading incomes in addition to the food market value of the oysters themselves.[63]

Kelp aquaculture can also improve water quality. Researchers working in the turbid and highly eutrophic Xiangshan Bay of the East China Sea documented that cultivated kelp (*Saccharina japonica*) reduced dissolved inorganic nitrogen and phosphorus in the Bay by 5.8% and 2.5%,

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56. *Id.* at 27, 29.

57. *See* Parker & Bricker, *supra* note 52, at 277-78.

58. Turner et al., *supra* note 52, at 1.

59. Specifically,

> Water quality can be improved by oyster filtration. Oysters filter sediments, detritus, small phytoplankton, and particulate-bound nitrogen and phosphorus from estuarine waters. On average, one *Crassostrea virginica* individual market-sized oyster (~1 gram dry weight) can filter approximately 6.8 liters/hour, up to 163 liters/day in the summer at 20˚C. The eastern oyster has the ability to ingest tiny particles (~2–38 μm) and selectively choose food particles. When oyster filtration is added to small-scale ecosystem models and large-scale hydrodynamic models, results include clearer water, deeper light penetration, and greater light availability to submerged aquatic vegetation.

Id. at 2 (citations omitted).

60. *Id.* at 9.

61. *Oyster Aquaculture Could Significantly Improve Potomac River Estuary Water Quality*, NOAA (Apr. 9, 2014), https://www.noaa.gov/oyster-aquaculture-could-significantly-improve-potomac-river-estuary-water-quality [https://perma.cc/9ZV2-NXKJ].

62. 33 U.S.C. §§ 1251-1388.

63. Parker & Bricker, *supra* note 52, at 278 tbl. 7. The wide price range reflects the wide range of costs in alternative nutrient removal strategies for farms. *Id.* at 278-79.

respectively.[64] Other species of kelp growing in other conditions are even better at extracting nutrient pollution, removing up to 94% of ammonia pollution and up to 67% of phosphorus.[65] Similar studies along the northeastern (Atlantic) coast of the United States have "demonstrat[ed] that nutrient bioextraction through seaweed aquaculture can be an effective coastal nutrient management tool in urbanized estuaries."[66] These benefits multiply when marine aquaculture facilities grow kelp and shellfish together.[67]

Kelp and shellfish aquaculture thus already offer the United States dual benefits worth pursuing: increased food security and cleaner coastal waters. This fact alone allows water quality agencies to use their discretion to incorporate marine aquaculture into state water quality trading programs, as the Maryland Department of the Environment did in 2020 when it allowed oyster aquaculture operations to earn nutrient trading credits.[68] Water quality authority is thus one source of administrative state discretion to promote these industries through financial incentives—in May 2020, for example, the Orchard Point Oyster Co. earned $1600 in credits for four pounds of nitrogen.[69] The fact that shellfish and kelp aquaculture are also CC+ industries may provide these agencies with additional motivation to exercise their water quality discretion in these industries' favor.

64. Zhibing Jiang, Jingjing Liu, Shanglu Li, Yue Chen, Ping Du, Yuanli Zhu, Yibo Liao, Quanzhen Chen, Lu Shou, Xiaojun Yan, Jiangning Zeng & Jianfang Chen, *Kelp Cultivation Effectively Improves Water Quality and Regulates Phytoplankton Community in a Turbid, Highly Eutrophic Bay*, SCI. TOTAL ENV'T, Mar. 10, 2020, at 1, 6-7.

65. *Id.* at 6-7 and studies cited therein.

66. Jang K. Kim, George P. Kraemer & Charles Yarish, *Use of Sugar Kelp Aquaculture in Long Island Sound and the Bronx River Estuary for Nutrient Extraction*, 531 MARINE ECOLOGY PROGRESS SERIES 155, 160 (2015).

67. As scientists have noted,

> Co-culture of seaweeds and shellfish may even enhance the nutrient bioextraction capacity of urbanized estuaries. Seaweeds and shellfish are in different trophic levels, requiring different nutrient sources for their growth (inorganic nutrients for seaweeds vs. organically bound nutrients for shellfish). Co-cultivation of seaweeds and shellfish enhanced the growth of both species when high concentrations of nutrients were available (e.g. adjacent to a finfish farm) . . . . *Kappaphycus alvarezii* and pearl oysters grew better when co-cultured than when cultured separately. It is probable that oyster culture promotes better water clarity, thereby increasing photosynthesis and growth of seaweeds. Inorganic nutrients excreted into the water column by oysters might ordinarily accumulate and suppress oyster growth. However, these excreted nutrients can be bioextracted by seaweeds under co-culture conditions, thus improving the growth of both oysters and seaweeds.

Id. at 161 (citations omitted).

68. *Generating Water Quality Credits*, MD. DEP'T OF THE ENV'T, https://mde.maryland.gov/programs/Water/WQT/Pages/WQT_Generating_Credits.aspx [https://perma.cc/LU6X-9AJN] (last visited Nov. 2, 2021); *Credit Generation for Oyster Aquaculture*, MD. DEP'T OF THE ENV'T 1-3 (Jan. 2020), https://mde.maryland.gov/programs/Water/WQT/Documents/Guidance%20PDFs/Oyster%20Aquaculture_FAQ.pdf [https://perma.cc/58FP-PNW8].

69. Meg Walburn Viviano, *1st-Time Trade: Offsetting Pollution with Oyster Investments*, CHESAPEAKE BAY MAG. (May 12, 2020), https://chesapeakebaymagazine.com/1st-time-trade-offsetting-pollution-with-oyster-investments/ [https://perma.cc/KB8Y-Q94D].

C. The First "Plus": Seaweed Aquaculture's Contributions to Climate Change Mitigation and Adaptation

1. Climate Change Mitigation Benefits from Kelp Aquaculture

While numerous anthropogenic greenhouse gases contribute to climate change, the most ubiquitous is carbon dioxide, which generally enters the atmosphere as a byproduct of the combustion of fossil fuels.[70] Increasing evidence indicates that kelp aquaculture can sequester carbon dioxide and hence help to mitigate climate change, making these forms of mariculture CC+ industries.

As noted earlier, kelps and marine algae photosynthesize, meaning that they take in carbon dioxide. However, while the potential for terrestrial plants, especially forests, to mitigate climate change as carbon sinks is well-recognized and promoted,[71] the same hasn't been true for seaweed aquaculture. Indeed, although "[t]he world production of marine macroalgae, or seaweed, has more than tripled, up from 10.6 million tonnes in 2000 to 32.4 million tonnes in 2018,"[72] only recently has seaweed aquaculture been "gaining increasing attention to be promoted and monitored for climate and environmentally friendly bioeconomy development."[73]

Nevertheless, seaweed aquaculture's potential contribution to climate change mitigation is significant. In the Asia-Pacific region, for example, seaweed aquaculture beds remove the equivalent of 2.87 million tonnes of carbon dioxide per year.[74] Marine kelps generally have been left out of world "blue carbon" (ocean-based climate mitigation) strategies until recently because, unlike seagrasses and salt marshes, they grow on rocks, not in submerged soil, raising questions about their ability to sequester carbon dioxide for long periods.[75] However, more recent investigations indicate that

70. *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 3, at 4-6.

71. *See, e.g.*, *Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+) Web Platform*, UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (2021), https://redd.unfccc.int/ [https://perma.cc/9P44-H6DK]; Alan Buis, *Examining the Viability of Planting Trees to Help Mitigate Climate Change*, NASA GLOB. CLIMATE CHANGE (Nov. 7, 2019), https://climate.nasa.gov/news/2927/examining-the-viability-of-planting-trees-to-help-mitigate-climate-change/ [https://perma.cc/N2U7-YFYB]; Bruno Locatelli, Carla P. Catteral, Pablo Imbach, Chetan Kumar, Rodel Lasco, Erika Marín-Spiotta, Bernard Mercer, Jennifer S. Powers, Naomi Schwartz & Maria Uriarte, *Tropical Reforestation and Climate Change: Beyond Carbon*, 23 RESTORATION ECOLOGY 337, 337-38 (2015).

72. *2020 FAO Fisheries & Aquaculture Report*, *supra* note 16, at 29.

73. *Id.* at 31.

74. Calvyn F.A. Sondak, Put O. Ang Jr., John Beardall, Alecia Bellgrove, Sung Min Boo, Grevo S. Gerung, Christopher D. Hepburn, Dang Diem Hong, Zhengyu Hu, Hiroshi Kawai, Danilo Largo, Jin Ae Lee, Phaik-Eem Lim, Jaruwan Mayakun, Wendy A. Nelson, Jung Hyun Oak, Siew-Moi Phang, Dinabandhu Sahoo, Yuwadee Peerapornpis, Yufeng Yang & Ik Kyo Chung, *Carbon Dioxide Mitigation Potential of Seaweed Aquaculture Beds (SABs)*, 29 J. APPLIED PHYCOLOGY 2363, 2363 (2017).

75. Dorte Krause-Jensen & Carlos M. Duarte, *Substantial Role of Macroalgae in Marine Carbon Sequestration*, 9 NATURE GEOSCI. 737, 737 (2016). Thus,

natural seaweeds do indeed sequester carbon in the deep ocean (eventually becoming, somewhat ironically, petroleum)[76] and probably sequester about 173 teragrams (one million tonnes) of carbon each year.[77] To put that number in perspective, natural gas production in the United States leaks about fourteen teragrams of methane every year, an amount deemed worthy of regulatory attention.[78]

Given the sequestration capacity of natural seaweeds, researchers have proposed that seaweed aquaculture could also significantly contribute to climate change mitigation.[79] In particular, seaweed aquaculture "should prove to be expandable to the offshore environment and the open sea, . . . unlocking a capacity to greatly increase carbon capt[ure] in biomass. This approach has been termed Seaweed Carbon Capture and Sink ('Seaweed CCS'; analogous to terrestrial Carbon Capture and Storage) . . . ."[80] Another "pathway to broaden Blue Carbon strategies to incorporate the CO_2 sink capacity of seaweeds is to [use seaweeds] to reduce CO_2 emissions derived from fossil fuel use," such as by using seaweeds for biofuels to replace fossil fuels.[81]

In addition, research indicates that adding seaweed to cow feed can reduce cattle methane emissions by as much as 82%, giving aquacultured kelp another potential role in climate change mitigation. "Livestock are responsible for roughly 14.5% of humanity's annual greenhouse gas emissions, and cows are thought to account for about 65% of those emissions. In the United States, the methane cows release accounts for nearly 2% of total greenhouse gas emissions annually."[82] Thus, aquacultured kelp used for cow feed would both

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> it is difficult for seaweeds to be recognized as carbon sink agents under the current concept of CO_2 sequestration as conceived by the UN Framework Convention on Climate Change (UNFCCC). There has been considerable debate about considering seaweeds as a CO_2 sink, particularly with respect to the time period of sequestration of the carbon in their organic matter. It is obvious that seaweeds draw down CO_2 from seawater through photosynthesis in the water column, but a good proportion of this carbon is easily decomposed back to CO_2.

Ik Kyo Chung, Calvyn F. A. Sondak & John Beardall, *The Future of Seaweed Aquaculture in a Rapidly Changing World*, 52 EUROPEAN J. PHYCOLOGY 495, 500 (2017).

76. Krause-Jensen & Duarte, *supra* note 75, at 739 fig. 2.

77. *Id.* at 737, 739-41 & tbls. 1, 2. This rate "compares favourably with estimates for carbon burial rates for salt marshes, mangroves and seagrasses of up to 87.3, 24.9 and 112 Tg C $year^{-1}$, respectively." Chung, Sondak & Beardall, *supra* note 75, at 495.

78. Marianne Lavelle, *Methane Emissions Far Worse Than U.S. Estimates, But Study Concludes Natural Gas Still Better Than Coal*, NAT'L GEOGRAPHIC (Feb. 13, 2014), https://www.nationalgeographic.com/environment/article/methane-emissions-far-worse-than-u-s-estimates-but-study-concludes-natural-gas-still-better-than-coal [https://perma.cc/Y85R-BGW3].

79. Chung, Sondak & Beardall, *supra* note 75, at 499-501. For perspective, seaweed farms could potentially sequester about 1,500 tons of carbon dioxide per square kilometer per year, only about 10% of the carbon dioxide emissions avoided each year through the installation of one square kilometer of offshore wind. Carlos M. Duarte, Jiaping Wu, Xi Xiao, Annette Bruhn & Dorte Krause-Jensen, *Can Seaweed Farming Play a Role in Climate Change Mitigation and Adaptation?*, FRONTIERS MARINE SCI., Apr. 2017, at 3. However, seaweed aquaculture is generally less expensive to install than offshore wind, *id*., and, as Section III.D will discuss, the two uses are not necessarily mutually exclusive.

80. Chung, Sondak & Beardall, *supra* note 75, at 501.

81. Duarte et al., *supra* note 79, at 2.

82. Alex Fox, *Seaweed-Fed Cows Burp Less Planet-Warming Methane*, SMITHSONIAN MAG. (Mar. 23, 2021), https://www.smithsonianmag.com/smart-news/seaweed-fed-cows-burp-less-planet-warming-methane-180977296/ [https://perma.cc/JT2P-ENB4].

remove carbon dioxide from marine waters and reduce livestock methane emissions, a double climate change mitigation benefit.

As such, kelp aquaculture could qualify for climate change trading program credits in any of the numerous such programs that exist globally. As one example, the California Air Resources Board (CARB) issues "[o]ffset [c]redits to qualifying projects that reduce or sequester greenhouse gases (GHG) pursuant to six Board-approved Compliance Offset Protocols."[83] "A 2019 study that looked at the potential for seaweed farming to offset carbon emissions calculated that growing and sinking macroalgae in a tiny fraction of the federal waters off the California coastline could fully offset emissions from the state's enormous agriculture industry . . . ."[84] At the very least, seaweed aquaculture has the potential to render marine aquaculture overall a carbon neutral industry.[85] While kelp aquaculture does not yet have an approved protocol in California, rice cultivation and a number of forestry operations do.[86] Thus, carbon offset credits, like water quality nutrient trading credits, represent another potential use of agency discretion to incentivize this CC+ industry.[87]

2. Climate Change Adaptation Benefits from Kelp Aquaculture

While scientists are more conclusively quantifying kelp aquaculture's potential contributions to carbon dioxide sequestration, seaweed aquaculture can immediately aid efforts to adapt to another of carbon dioxide's impacts on the ocean. The ocean is the world's largest carbon sink, and the absorbed carbon dioxide reacts chemically in the ocean to reduce the ocean's pH, a phenomenon known as ocean acidification.[88] In 2014, the Intergovernmental Panel on Climate Change (IPCC) concluded that the ocean has been absorbing 20% to 30% of anthropogenic carbon dioxide emissions and that global ocean pH has already dropped 0.1 since the beginning of the industrial era.[89] The pH scale is logarithmic, so these changes mean that the ocean is now at least 30% more

83. *Compliance Offset Program*, CAL. AIR RES. BD. (2021), https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program [https://perma.cc/L6UZ-ZBDG].

84. Adele Peters, *Forget Planting Trees: This Company Is Making Carbon Offsets by Putting Seaweed on the Ocean Floor*, FAST CO. (Sept. 15, 2020), https://www.fastcompany.com/90548820/forget-planting-trees-this-company-is-making-carbon-offsets-by-putting-seaweed-on-the-ocean-floor [https://perma.cc/76RB-BGUX]; Halley E. Froehlich, Jamie C. Afflerbach, Melanie Frazier & Benjamin S. Halpern, *Blue Growth Potential to Mitigate Climate Change Through Seaweed Offsetting*, 29 CURRENT BIOLOGY 3087, 3089 (2019).

85. *See* Froehlich et al., *supra* note 84, at 3089.

86. *Compliance Offset Program*, *supra* note 83.

87. Carbon offsets vary considerably in price, currently averaging $3.00 to $6.00 per ton of carbon, but projects with co-benefits—like kelp aquaculture's water quality improvements, discussed below—fetch higher prices. *Purchasing Carbon Offsets FAQs*, SECOND NATURE (last visited Nov. 2, 2021), https://secondnature.org/climate-action-guidance/purchasing-carbon-offsets-faqs/ [https://perma.cc/EN3B-W95W].

88. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2014: SYNTHESIS REPORT 41 (2014).

89. *Id.*

acidic than it was 200 years ago.[90] Moreover, ocean acidification is currently occurring "faster than any known change in ocean chemistry in the last 50 million years,"[91] bringing largescale changes to the ocean's chemical functions that disrupt marine ecosystems and perhaps represent a harbinger of a marine mass extinction event.[92]

Most immediately, however, even small changes in marine pH interfere with shell-forming in marine organisms such as clams, oysters, and coral reefs.[93] Thus, ocean acidification has immediate ramifications for global food security by rendering highly productive coral reef ecosystems prone to collapse, interfering with wild shellfish fisheries, and interfering with shellfish aquaculture.[94] Indeed, Washington State's Puget Sound/Salish Sea is an ocean acidification hot spot, and the shellfish aquaculture industry there has had to cope with the impacts of ocean acidification since the early 2000s.[95] Similar interference with shellfish aquaculture led Maine to enact a state ocean acidification law in 2014.[96]

Seaweed aquaculture can help to buffer areas of the ocean from the effects of ocean acidification.[97] This buffering phenomenon has already been observed in connection with natural seagrass beds and kelp forests,[98] but recent studies in Japan, Korea, and China indicate that kelp farms produce the same effects—namely, a higher pH level (less acidic water) for the waters within the seaweed farm compared to adjacent waters away from the farm.[99] This buffering effect benefits natural marine ecosystems, but it can also help to protect shellfish aquaculture.[100] Specifically, "co-culture of bivalves and seaweed aquaculture in multitrophic aquaculture systems can protect the

90. PMEL Carbon Program, *What Is Ocean Acidification?*, NOAA, https://www.pmel.noaa.gov/co2/story/What+is+Ocean+Acidification%3F [https://perma.cc/KE9H-F9C9] (last visited Feb. 17, 2020).

91. *Ocean Acidification*, SMITHSONIAN (Apr. 2018), https://ocean.si.edu/ocean-life/invertebrates/ocean-acidification [https://perma.cc/D4WY-9XML].

92. Robin Kundis Craig, *Dealing with Ocean Acidification: The Problem, the Clean Water Act, and State and Regional Approaches*, 90 WASH. L. REV. 1583, 1589-1601 (2015).

93. *Id.* at 1594-95; *Ocean Acidification*, SMITHSONIAN (Apr. 2018), https://ocean.si.edu/ocean-life/invertebrates/ocean-acidification [https://perma.cc/D4WY-9XML].

94. Craig, *supra* note 92, at 1594-98.

95. *See generally, e.g.*, Laura Bianucci, Wen Long, Tarang Khangaonkar, Gregory Pelletier, Anise Ahmed, Teizeen Mohamedali, Mindy Roberts & Cristiana Figueroa-Kaminsky, *Sensitivity of the Regional Ocean Acidification and Carbonate System in Puget Sound to Ocean and Freshwater Inputs*, ELEMENTA: SCI. ANTHROPOCENE, Mar. 6, 2018 (studying acidification in Puget Sound).

96. Jason Shemenski, *New Maine Ocean Acidification Law Is Important Step in Protecting Maine's Shellfish and Commercial Fishing Industry*, CONSERVATION L. FOUND. (May 1, 2014), https://www.clf.org/newsroom/new-maine-ocean-acidification-law/ [https://perma.cc/8W3L-L85J].

97. Chung, Sondak & Beardall, *supra* note 75, at 501; Xi Xiao, Susana Agustí, Yan Yu, Yuzhou Huang, Weizhou Chen, Jing Hu, Chao Li, Ke Li, Fangyi Wei, Yitian Lu, Caicai Xu, Zepan Chen, Shengping Liu, Jiangning Zeng, Jiaping Wu & Carlos M.Duarteb, *Seaweed Farms Provide Refugia from Ocean Acidification*, SCI. TOTAL ENV'T, July 1, 2021, at 1.

98. Xiao et al., *supra* note 97, at 2 and sources cited therein.

99. *See id.* at 4. The results were particularly strong at aquaculture facilities growing *Saccharina japonica* (Areschoug), a brown kelp widely aquacultured throughout Asia. *Id.*

100. *Id.*

bivalves from ocean acidification, while also mitigating the impacts associated to nutrient release from the bivalves."[101]

Seaweed aquaculture has other climate change adaptation benefits as well. "For example, the canopies of farmed seaweeds, like those of wild seaweeds, dampen wave energy and hence, serve as live coastal protection structures buffering against coastal erosion."[102] Moreover, as warming oceans deplete the dissolved oxygen necessary to marine animal life, "seaweed farms provide oxygen-rich habitats, providing refugia from hypoxia and declining oxygen levels, [allowing] marine organisms to adapt to this component of a warmer ocean."[103]

D. The Second "Plus": Kelp and Shellfish Aquaculture Allow Fishing Communities to Adapt to Climate-Induced Changes in Marine Fisheries

Overfishing has long been considered the primary threat to marine biodiversity and ecosystem function.[104] However, marine species are now not only dealing with stressors such as overfishing, pollution, ocean acidification, and deoxygenation, but they are also responding to increasing ocean temperatures—one impact of climate change—by migrating toward the North and South Poles.[105] As the IPCC explains, range shifting "has resulted in shifts in species composition, abundance and biomass production of ecosystems, from the equator to the poles. Altered interactions between species have caused cascading impacts on ecosystem structure and functioning . . . ."[106] Species in the top 200 meters of the marine water column are currently shifting their ranges, on average, about fifty-two kilometers (more than thirty-two miles) per decade, while species closer to the bottom shift on average about twenty-nine kilometers (eighteen miles) per decade.[107] "Warming-induced species range expansions have led to altered ecosystem structure and functioning, such as in the North Atlantic, Northeast Pacific and Arctic."[108] More immediately relevant to the United States, a 2018 study of 686 marine species in North America concluded that some species along the Pacific Coast could shift ranges as much as 1500

101. *Id.* (citations omitted).

102. Duarte et al., *supra* note 79, at 4.

103. *Id.* at 5.

104. *See* MELINDA HARM BENSON & ROBIN KUNDIS CRAIG, THE END OF SUSTAINABILITY: RESILIENCE AND THE FUTURE OF ENVIRONMENTAL GOVERNANCE IN THE ANTHROPOCENE 115-17 (2017), and sources cited therein.

105. *See* Elena Ojea, Sarah E. Lester & Diego Salgueiro-Otero, *Adaptation of Fishing Communities to Climate-Driven Shifts in Target Species*, 2 ONE EARTH 544, 544-45 (2020).

106. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, THE OCEAN AND CRYOSPHERE IN A CHANGING CLIMATE: A SPECIAL REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 12 (2019).

107. *Id.*

108. *Id.*

kilometers (more than 930 miles), while those on the Atlantic Coast could shift more than 600 kilometers (more than 370 miles).[109]

As this last set of researchers noted, in this country, pursuant to the federal Magnuson Stevens Fisheries Conservation and Management Act (MSA),[110] "fisheries are managed regionally, including species that are managed by individual states and federally managed fisheries that are governed by regional councils with representatives from neighboring states."[111] The projected marine range shifts are more than sufficient to move commercially important fish stocks across regulatory jurisdictions within the United States, from the United States to Canada, from Mexico to the United States, and, on the Pacific Coast, from Canada to the United States/Alaska.[112] Other management challenges include "shifts in fishing locations, conflict over regional allocation of fisheries quota, displaced fisherm[e]n, and changes in stock boundaries."[113]

Many fishing communities are already feeling these impacts. Ocean heat waves began disrupting Maine lobster fishing in 2012.[114] A recent study of fishing communities in the Northeast identified three responses "to documented shifts in the distribution and abundance of fluke, red and silver hake": "shifting fishing grounds, shifting target species, and shifting port of landing."[115] Following the fish is rare among these communities (and often illegal), so the more common response was to target different species—at least when regulations and markets allowed for such a shift—but species diversity in the catches is nevertheless declining, diminishing these communities' ability to adapt to climate change.[116] On the West Coast, communities dependent on the Dungeness crab have been responding to multiple "climate shocks" to those fisheries, which "represent[] a quarter of California's fishery revenue"[117] and brought $75 million into Oregon's economy in 2018.[118] During the 2014-2016 Pacific marine heat wave, some crab fishers participated in other fisheries or

109. James W. Morley, Rebecca L. Selden, Robert J. Latour, Thomas L. Frölicher, Richard J. Seagraves & Malin L. Pinsky, *Projecting Shifts in Thermal Habitat for 686 Species on the North American Continental Shelf*, PLOS ONE, May 16, 2018, at 12.

110. 16 U.S.C. §§ 1801-1891(d).

111. Morley et al., *supra* note 109, at 23.

112. *Id.* at 17 fig. 7, 18 fig. 8.

113. *Id.* at 23 (citations omitted).

114. *Maine's Lobster Community Confronts Their Changing Climate*, U.S. CLIMATE RESILIENCE TOOLKIT (Feb. 10, 2020, 4:00 p.m.), https://toolkit.climate.gov/case-studies/maines-lobster-fishing-community-confronts-their-changing-climate [https://perma.cc/C7MU-NJDA].

115. Eva A. Papaioannou, Rebecca L. Selden, Julia Olson, Bonnie J. McCay, Malin L. Pinsky & Kevin St. Martin, *Not All Those Who Wander Are Lost—Responses of Fishers' Communities to Shifts in the Distribution and Abundance of Fish*, FRONTIERS MARINE SCI., July 5, 2021, at 1.

116. *Id.*

117. Nicholas Seyfried, *The Dungeness Crab Fishery: Coping with Climate Change*, FISHBIO (Mar. 8, 2021), https://fishbio.com/field-notes/the-fish-report/dungeness-crab-fishery-coping-climate-change [https://perma.cc/5Q8D-C7ND].

118. Keely Chalmers, *Climate Change Hurting Dungeness Crabs off Oregon Coast, Researchers Say*, KGW (Jan. 29, 2020, 8:24 PM. PST), https://www.kgw.com/article/tech/science/environment/climate-change-hurting-dungeness-crabs-off-oregon-coast-researchers-say/283-5c0b3890-5736-47b6-b977-c35a0ac9a54f [https://perma.cc/XY8X-KLPB].

moved to other areas, but "71% of California Dungeness crab fishing vessels temporarily left the industry and stopped fishing altogether . . . ."[119]

No single climate change adaptation measure will be a panacea for all fishing communities,[120] and a plethora of adaptation strategies[121] needs to remain available. Nevertheless, switching from wild caught fisheries to marine aquaculture will be a viable strategy for many fishing communities, and researchers already advocate for policy shifts to make sustainable aquaculture ventures more economically and legally viable precisely to provide these climate change adaptation options.[122] Moreover, although the process is slow, an increasing number of former fishers advocate for a switch to sustainable marine aquaculture in the United States.[123]

Some authority to promote this adaptive switch in livelihoods lies within state and federal administrative discretion. For example, NOAA is already exploring the ways in which aquaculture can provide economic opportunities to diverse communities[124] and invigorate the traditional cultures of indigenous communities,[125] working environmental and climate justice considerations into its more general authority to promote aquaculture, discussed below.

E. The United States' Current Marine Aquaculture Production

As noted, global marine aquaculture production has been increasing rapidly since wild fisheries plateaued or declined in the 1990s, especially because demand for seafood continues to increase. The United States, however, has been more skeptical of marine aquaculture, particularly finfish aquaculture, than many other countries. According to NOAA, the United States is a relatively minor marine aquaculture producer on the global stage, ranking seventeenth in production volume among the nations engaged in aquaculture.[126] The top U.S. marine aquacultured species by value are oysters ($219 million), clams ($122

119. *Dungeness Crab Fishing Industry Response to Climate Shock*, NOAA FISHERIES (Oct. 22, 2021), https://www.fisheries.noaa.gov/feature-story/dungeness-crab-fishing-industry-response-climate-shock [https://perma.cc/99DH-KCJU].

120. Ojea, Lester & Salgueiro-Otero, *supra* note 105, at 550-52.

121. *Id.* at 551 tbl. 1.

122. *Id.* at 553 tbl. 2.

123. *See, e.g.*, Robert Jones, *From Sceptical Fisherman to Aquaculture Conservationist*, FISH SITE (Dec. 13, 2019), https://thefishsite.com/articles/from-sceptical-fisherman-to-aquaculture-conservationist [https://perma.cc/JYX4-PJU7]; BREN SMITH, EAT LIKE A FISH: MY ADVENTURES AS A FISHERMAN TURNED RESTORATIVE OCEAN FARMER (2019).

124. *Digging Up Diversity Opportunities on Shellfish Farms*, NOAA FISHERIES (June 28, 2021), https://www.fisheries.noaa.gov/feature-story/digging-diversity-opportunities-shellfish-farms [https://perma.cc/7RL2-YHHU].

125. *Hawaiian Fishponds: Providing Physical and Cultural Sustenance*, NOAA FISHERIES (May 28, 2021), https://www.fisheries.noaa.gov/feature-story/hawaiian-fishponds-providing-physical-and-cultural-sustenance [https://perma.cc/V5DP-NB96].

126. *Fisheries of the United States 2019*, U.S. DEP'T OF COM., NOAA & NAT'L MARINE FISHERIES SERV., at xiii (May 2021) [hereinafter *2021 NOAA Fisheries Report*], https://media.fisheries.noaa.gov/2021-05/FUS2019-FINAL-webready-2.3.pdf?null= [https://perma.cc/74M7-7A3Z].

million), Atlantic salmon ($66 million), shrimp ($13 million), and mussels ($9 million).[127]

Nevertheless, the United States' slow entry into marine aquaculture gives it a number of advantages from a climate change perspective. First, over 81% of the value of existing U.S. marine aquaculture production already comes from shellfish, one of the CC+ industries, giving the United States a built-in comfort with that industry. (In comparison, in 2013, 93% of #7 Norway's marine aquaculture was Atlantic salmon.)[128] Second, all three continental U.S. coasts already have the CC+ marine aquaculture industries. Specifically, "[t]hriving shellfish industries can be found in all coastal regions of the United States," and while "the Atlantic and Pacific Coast states produce more oysters, clams, and mussels by value ($134.5 and $120.7 million, respectively), . . . the Gulf states produce more by volume (28.7 million pounds)."[129] Seaweed aquaculture has had a slower start in the United States, but that industry is also growing, and "seaweed farming shows promise to become an important contributor to U.S. global competitiveness in seafood production."[130]

CC+ marine aquaculture is thus already growing in the United States, both in value and in total pounds produced.[131] This trend is unlikely to slow any time soon, particularly because there are domestic food-security arguments for increasing the amount of sustainable marine aquaculture in the United States. "The United States imports 70% to 85% of its seafood, and nearly 50% of this imported seafood is produced via aquaculture. Driven by imports, the U.S. seafood trade deficit has grown to $16.9 billion in 2019."[132]

It is thus fair to assume that marine aquaculture in the United States will continue to expand, driven by industry economics and food security issues.[133] Of course, not everyone in the United States is happy about this trend,[134] and there are potentially significant considerations of equity in deciding who gets to engage in marine aquaculture and how to help individuals and communities who

127. *Id.*

128. *Fishery and Aquaculture Country Profiles: The Kingdom of Norway*, U.N. FOOD & AGRIC. ORG. (May 2013), http://www.fao.org/fishery/facp/nor/en [https://perma.cc/59HS-RNN3].

129. *2021 NOAA Fisheries Report*, *supra* note 126, at 26.

130. *Id.*

131. *Id.* at xiii, 26. Specifically, "[i]n 2018, marine aquaculture production increased by 9.4 million pounds (10.7%). The value of marine production increased by $8.4 million (2.0%)." *Id.* at 26.

132. *U.S. Aquaculture*, NOAA FISHERIES (July 8, 2021), https://www.fisheries.noaa.gov/national/aquaculture/us-aquaculture [https://perma.cc/J8AH-WXMB].

133. *See, e.g.*, Rob Fletcher, *Why US Lawmakers Must Take a More Positive View of Aquaculture*, FISH SITE (May 21, 2021, 12:01 AM), https://thefishsite.com/articles/why-us-policymakers-must-take-a-more-positive-view-of-aquaculture [https://perma.cc/2LK6-PUJ7]; Alexandra Carter & Miriam Goldstein, *American Aquaculture*, CTR. FOR AM. PROGRESS (May 13, 2019), https://www.americanprogress.org/issues/green/reports/2019/05/13/469730/american-aquaculture/ [https://perma.cc/JH53-AXU5]; Gunnar Knapp & Michael C. Rubino, *The Political Economics of Marine Aquaculture in the United States*, 24 REVS. MARINE FISHERIES SCI. & AQUACULTURE 213, 214 (2016) (supporting this assumption).

134. *See, e.g.*, Jessica Hathaway, *Farmed and Dangerous: Puget Sound Protesters Float Their Ideas*, NAT'L FISHERMAN (Sept. 19, 2017), https://www.nationalfisherman.com/west-coast-pacific/farmed-dangerous-puget-sound-protesters-float-ideas [https://perma.cc/KYA6-GUTY].

are displaced by it.[135] Nevertheless, this Article takes the position that, given that marine aquaculture is likely to be an expanding industry in the United States, the numerous facets of the U.S. administrative state that govern aquaculture should, as they revamp their regulation of this industry, exercise their discretion to preferentially encourage the two CC+ facets of the industry: kelp and shellfish aquaculture.

NOAA has only very recently begun to actively promote marine aquaculture explicitly as a climate change strategy. In January 2021, for example, it emphasized that,

> [w]hile not immune to the effects of climate change, ocean-based farming operations generally require less fresh water, land resources, and produce fewer greenhouse gas emissions to produce food. Growth of ocean farming of fish, shellfish, and seaweeds can reduce resource pressure and present novel resilience opportunities for a changing environment.[136]

In addition, "[g]rowth of domestic aquaculture presents an opportunity to shorten seafood supply chains and decrease emissions associated with the 85% of seafood currently imported and consumed in the [United States]."[137] Even finfish aquaculture requires far less feed than poultry, swine, and cattle, "making farmed seafood a climate-smart protein . . . ."[138] Moreover, NOAA is now touting the ability of seaweed aquaculture to buffer ocean acidification.[139]

NOAA's recent promotion of aquaculture explicitly in climate change terms underscores again that this is an opportune moment to add a CC+ lens to marine aquaculture regulation in the United States, particularly as aquaculture operations are expanding into federal ocean waters.[140] The administrative regulatory apparatus in the United States that governs mariculture is particularly thick and complex, as the next Part explores, meaning that there are multiple opportunities for the administrative state to recognize and promote CC+ aquaculture.

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135. *See, e.g.*, Lisa M.Campbell, Luke Fairbanks, Grant Murray, Joshua S. Stoll, Linda D'Anna & Julia Bingham, *From Blue Economy to Blue Communities: Reorienting Aquaculture Expansion for Community Wellbeing*, 124 MARINE POL'Y 2021, Feb. 2021, at 1-3; Kevin Donner, Alagamił Nicole Norris, Hoku Kaʻaekuahiwi Pousima, Blair Paul & Melissa Poe, *The 7 R's of Integrating Tribal and Indigenous Partnerships into Aquaculture Literacy*, NOAA (Aug. 12, 2021), https://www.noaa.gov/office-education/stories/7-r-s-of-integrating-tribal-and-indigenous-partnerships-into-aquaculture-literacy [https://perma.cc/2V9T-GVUA]; Henrik Österblom, Colette C.C. Wabnitz & Dire Tladi, *Towards Ocean Equity*, HIGH LEVEL PANEL FOR A SUSTAINABLE OCEAN ECON. 9-10 (2020), https://www.oceanpanel.org/sites/default/files/2020-04/towards-ocean-equity.pdf [https://perma.cc/SH9Z-EFUE].

136. Off. of Aquaculture, *Climate Resilience and Aquaculture*, NOAA FISHERIES 1 (Jan. 2021) (footnotes omitted), https://media.fisheries.noaa.gov/2021-01/Fact-Sheet-Climate-Resilience-Aquaculture-010621.pdf [https://perma.cc/A4X4-R4N6].

137. *Id.*

138. *Id.* at 2.

139. *Id.*

140. *Marine Aquaculture in NOAA Fisheries' Southeast Region*, NOAA FISHERIES (June 22, 2020), https://www.fisheries.noaa.gov/southeast/aquaculture/marine-aquaculture-noaa-fisheries-southeast-region [https://perma.cc/A3NK-7C8Z].

II. The Administrative State and Marine Aquaculture in the United States

As Part I makes clear, certain forms of marine aquaculture are CC+ industries, particularly seaweed and shellfish aquaculture. At the same time, the aquaculture industry is expanding in the United States for other reasons, providing an apt moment to view marine aquaculture regulation through a climate change lens.

The focus of this Part is aquaculture permitting. As noted in Part I, water quality credits and carbon offset credits are also relevant exercises of administrative discretion to promote CC+ aquaculture through financial incentives. However, those incentives do not operate in an open market, meaning that increasing financial incentives alone probably will not be sufficient to promote CC+ aquaculture. The ocean is a public, not private, space, and no one has a *right* to engage in marine aquaculture.[141] Instead, any new aquaculture project must run a gauntlet of permitting, licensing, and leasing processes. Moreover, this regulatory gauntlet has been identified repeatedly as a key impediment to expanded marine aquaculture in the United States.[142] As a result, the future of marine aquaculture in the United States depends acutely on how the relevant administrative agencies choose to exercise their authority, and the exercise of aquaculture permitting and leasing discretion is *the* key focus for the administrative state's promotion of CC+ aquaculture.

The regulatory gauntlet exists in part because three levels of administrative regulatory authority are relevant in U.S. ocean waters: federal, state, and tribal. Most marine aquaculture in the United States currently takes place closer to the coast, in state waters, although there is increasing interest in moving aquaculture further offshore.[143] The history of the division between state and federal offshore authority is complicated. In brief, however, on June 23, 1947, in *United States v. California*,[144] the U.S. Supreme Court declared that the federal government, not the states, had paramount rights over the entire ocean.[145] In the wake of this decision, Congress decided to "correct"[146] the Court's holding by "returning"[147] the first three miles of marine submerged lands to the coastal

141. Knapp & Rubino, *supra* note 133, at 216.

142. *See, e.g.*, *Overcoming Impediments to Shellfish Aquaculture Through Legal Research and Outreach: Case Studies*, NAT'L SEA GRANT L. CTR. (Mar. 2019), https://nsglc.olemiss.edu/projects/shellfish-aquaculture/files/casestudies.pdf [https://perma.cc/ZB65-HXJA]; Knapp & Rubino, *supra* note 133, at 217-19.

143. *Marine Aquaculture in NOAA Fisheries' Southeast Region*, NOAA FISHERIES (June 22, 2020), https://www.fisheries.noaa.gov/southeast/aquaculture/marine-aquaculture-noaa-fisheries-southeast-region [https://perma.cc/A3NK-7C8Z].

144. 332 U.S. 19 (1947).

145. *Id.* at 40-41.

146. *See* H.R. REP. NO. 83-215 (1953), *as reprinted in* 1953 U.S.C.C.A.N. 1385, 1419-25 (questioning the wisdom of the Supreme Court's decision and describing all of the problems that it created as justifying congressional legislation).

147. *See id. at* 1417-19 (emphasizing that "[t]hroughout our Nation's history the States have been in possession of and exercising all the rights and attributes of ownership in the lands and resources beneath the navigable waters within their boundaries," cataloging Congress's attempts to preserve this

states[148] through the Submerged Lands Act of 1953.[149] Congress disclaimed all the federal government's title and claim to the first three miles of offshore submerged lands,[150] with the exceptions of: (i) the federal government's authority and right to regulate such waters for navigation, flood control, and power;[151] and (ii) the submerged lands to which the federal government had already acquired or reserved title.[152] In addition, the United States "retains all its navigational servitude and rights in and powers of regulation and control of said lands and navigable waters for the constitutional purposes of commerce, navigation, national defense, and international affairs . . . ."[153]

Thus, in most coastal waters,[154] the line between state and federal jurisdiction—subject to the federal caveats in the Submerged Lands Act, some of which are relevant to aquaculture regulation—is located three miles offshore,[155] giving states primary jurisdiction over nearshore coastal aquaculture. Jurisdiction over the water column follows the same basic rules. Following the 1982 United Nations Convention on the Law of the Sea's[156] provisions governing an Exclusive Economic Zone (EEZ), in 1983, President Reagan proclaimed a 200-mile EEZ for the United States for all purposes,[157] and so federal ocean waters extend from three to 200 miles off the coast of the United States. Tribal rights overlie both of these areas and derive from tribal treaties with the federal government.

A. Marine Aquaculture and the Federal Administrative State

NOAA's relatively recent promotion of U.S. marine aquaculture in climate change terms occupies the intersection of two successive presidential policies.

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ownership against the Executive Branch, and characterizing the Supreme Court's decision in *United States v. California* as "establish[ing] the law differently from what eminent jurists, lawyers, and public officials for more than a century had believed it to be, but also differently from what the Supreme Court apparently had believed it to be").

148. *See id.* at 1385 (noting that the purpose of the legislation was "to confirm and establish the titles of the States to lands beneath navigable waters within State boundaries and to the natural resources within such lands and waters, and to provide for the use and control of said lands and resources and the resources of the outer Continental Shelf"); *see also id.* at 1388-89 (summarizing Title II of the proposed legislation as "declar[ing] that it is in the public interest that title and ownership of lands beneath navigable waters within the boundaries of the respective States and of the natural resources therein be in the respective States. It provides in addition to but also distinct from title and ownership that the rights and power to administer, lease, control, develop, and use such lands and resources under applicable State laws and in accordance with the terms of the bill").

149. Pub. L. No. 83-31, 67 Stat. 29 (1953) (codified as amended at 43 U.S.C. §§ 1301-1315 (2018)).

150. 43 U.S.C. § 1311(b).

151. *Id.* § 1311(d).

152. *Id.* § 1313.

153. *Id.* § 1314.

154. *See id.* § 1312 (allowing states to press more extensive claims to offshore submerged lands based on historic ownership or control, but only Florida and Texas succeeded, in the Gulf of Mexico).

155. *Id.* § 1301(a).

156. U.N. Convention on the Law of the Sea, arts. 2.1, 2.2, 3, Dec. 10, 1982, 1833 U.N.T.S. 397.

157. Proclamation No. 5030, 48 Fed. Reg. 10,605 (Mar. 10, 1983).

The first and more widely celebrated is President Biden's (re)commitment of the United States to climate change action. A week into his presidency, for example, President Biden issued his climate change executive order,[158] bringing climate change squarely to the forefront of administration policy. Other executive orders[159] and agency actions[160] have followed. Less celebrated (or even noticed), however, was President Trump's 2020 Seafood Executive Order.[161] At the same time, federal agencies are already testing the limits of their jurisdiction to regulate this expanding industry,[162] and Congress has considered a new federal statute—with new administrative authorities—to govern it.[163]

The timing is just about perfect, therefore, for the federal administrative state to blend the goals of food security, economic opportunity, climate change mitigation, and climate change adaptation into a more holistic approach to marine aquaculture regulation. However, regulation of aquaculture within that administrative state is complex, divided among multiple federal agencies. This Section provides an overview of that administrative complexity by highlighting the multiple changes already underway in the federal administrative state regarding marine aquaculture.

1. A New National Strategic Plan under the National Aquaculture Act of 1980

In the National Aquaculture Act of 1980, Congress found that "[a]quacultural production of aquatic plants can provide sources of food, industrial materials, pharmaceuticals, and energy, and can assist in the control and abatement of pollution."[164] This statute sought to identify and reduce the regulatory constraints on U.S. aquaculture,[165] required a National Aquaculture Development Plan,[166] and established the Subcommittee on Aquaculture within the Executive Office of Science and Technology Policy.[167]

While the Act places "[t]he principal responsibility for the development of aquaculture in the United States [on] the private sector,"[168] the National

158. Exec. Order No. 14,008, 86 Fed. Reg. 7619 (Jan. 27, 2021).

159. *See, e.g.*, Exec. Order No. 14,030, 86 Fed. Reg. 27,967 (May 25, 2021) (ordering agency action relating to climate-related financial risk); Exec. Order No. 14,027, 86 Fed. Reg. 25,947 (May 12, 2021) (establishing the Climate Change Support Office within the Department of State).

160. For example, one of Michael Regan's first actions after being confirmed as the new Administrator of the EPA was posting a video announcing that "Climate Change Is Back at EPA," which is available on the EPA's restored climate change web site. *See Climate Change*, U.S. EPA (Oct. 22, 2021), https://www.epa.gov/climate-change [https://perma.cc/7A2A-W46B].

161. Exec. Order No. 13,921, 85 Fed. Reg. 28,471 (May 12, 2020) [hereinafter Seafood Executive Order].

162. *See* discussions *infra* Sections II.A.3 and II.A.5.

163. *See* Advancing the Quality and Understanding of American Aquaculture (AQUAA) Act, H.R. 6191, 116th Cong. (2020); AQUAA Act, S. 4723, 116th Cong. (2020).

164. 16 U.S.C. § 2801(a)(4).

165. *Id.* § 2808.

166. *Id.* § 2803.

167. *Id* § 2805.

168. *Id.* § 2801(a)(6).

Plan can certainly help to facilitate private investment by encouraging supportive science and governmental policies.[169] Notably, the Subcommittee on Aquaculture is in the process of finalizing its *Strategic Plan to Enhance Regulatory Efficiency in Aquaculture*, a revision to the National Plan. The first goal in the draft *Strategic Plan* relates to aquaculture permitting, with the Subcommittee emphasizing that

> the regulatory framework for aquaculture is complex, involving multiple jurisdictions, laws, regulations, and agencies that aim to protect public health, conserve environmental resources, and regulate commerce. These laws and regulations were enacted to serve important public purposes. However, the multiple Federal and State approvals required to farm seafood create time-consuming and costly processes and an unclear operating environment for aquaculture businesses. The objective of the plan is to create a more efficient, timely, coordinated, and structured regulatory process, while at the same time fulfilling critical conservation, public health, and other legal requirements.[170]

The Subcommittee makes five recommendations regarding improved regulatory efficiency, neatly outlining the various federal authorities involved at the same time. First, as discussed in greater depth below, the U.S. Army Corps of Engineers (Army Corps) should expand the number and kinds of general permits available for aquaculture operations, because general permits "make the process more efficient for the permittee by reducing the amount of time between submitting a permit application and verifying the permit authorization," and federal agencies should engage in more programmatic consultations.[171] Second, NOAA should maintain and update compilations of the individual state requirements for shellfish aquaculture.[172] Third, the relevant federal agencies should establish regional interagency coordinating groups and processes to permit aquaculture in the federal waters more than three miles out to sea.[173] Fourth, the EPA should improve its outreach and information regarding the water quality risks from aquaculture.[174] Finally, the federal Food and Drug Administration (FDA) and NOAA should establish a "clear and transparent" food-inspection process to ensure that shellfish grown

169. *Id.* § 2801(a)(7).

170. SUBCOMM. ON AQUACULTURE, COMM. ON ENV'T OF THE NAT'L SCI. & TECH. COUNCIL, A STRATEGIC PLAN TO ENHANCE REGULATORY EFFICIENCY IN AQUACULTURE 3 (2021) [hereinafter 2021 AQUACULTURE DRAFT STRATEGIC PLAN].

171. *Id.* at 10.

172. *Id.* at 13. Notably, NOAA released its state-by-state summaries for shellfish, seaweed, and finfish aquaculture requirements in September 2021. *State by State Summary of Shellfish Aquaculture Leasing/Permitting Requirements (2021)*, NOAA (Sept. 30, 2021), https://www.fisheries.noaa.gov/resource/document/state-state-summary-shellfish-aquaculture-leasing-permitting-requirements-2021 [https://perma.cc/6XG3-UJ8H]; *State by State Summary of Seaweed Aquaculture Leasing/Permitting Requirements (2021)*, NOAA (Sept. 30, 2021), https://www.fisheries.noaa.gov/resource/document/state-state-summary-seaweed-aquaculture-leasing-permitting-requirements-2021 [https://perma.cc/K5DA-9SYR]; *State by State Summary of Finfish Aquaculture Leasing/Permitting Requirements (2021)*, NOAA (Sept. 30, 2021), https://www.fisheries.noaa.gov/resource/document/state-state-summary-finfish-aquaculture-leasing-permitting-requirements-2021 [https://perma.cc/L83Y-ZZJH].

173. 2021 AQUACULTURE DRAFT STRATEGIC PLAN, *supra* note 170, at 14.

174. *Id.* at 17.

in federal waters are safe to eat.[175] While the fifth recommendation is critical to protecting consumers from various food safety issues associated with all seafood, such as bioaccumulation of toxics in fish or shellfish contamination from harmful algal blooms, it does not directly speak to permitting, and this Article thus leaves the FDA's role in marine aquaculture to one side.

2. The Seafood Executive Order Across Administrations

On May 7, 2020, then-President Trump issued his Seafood Executive Order,[176] which seeks "to strengthen the American economy; improve the competitiveness of American industry; ensure food security; provide environmentally safe and sustainable seafood; support American workers; ensure coordinated, predictable, and transparent Federal actions; and remove unnecessary regulatory burdens . . . ."[177] The order emphasizes that "by weight our Nation imports over 85% of the seafood consumed in the United States" and addresses both wild caught marine fisheries and aquaculture.[178] It defines "aquaculture" to be "the propagation, rearing, and harvesting of aquatic species in controlled or selected environments"[179] and establishes federal policies to "identify and remove unnecessary regulatory barriers restricting American . . . aquaculture producers," "provide good stewardship of public funds and stakeholder time and resources, . . . avoid duplicative, wasteful, or inconclusive permitting processes," and "facilitate aquaculture projects through regulatory transparency and long-term strategic planning."[180]

The order's efforts to streamline marine aquaculture approvals gives some sense of the complexity and length of current permitting processes. For example, the order puts NOAA in charge of shepherding aquaculture projects in federal waters through the permitting approval processes when aquaculture facilities[181] need two or more federal permits and an Environmental Impact Statement (EIS)[182] pursuant to the National Environmental Policy Act (NEPA).[183] At the same time, the Army Corps must develop a series of nationwide general permits for marine aquaculture, including for finfish aquaculture, seaweed aquaculture, and multi-species aquaculture "in marine and coastal waters out to the limit of the territorial sea and in ocean waters beyond the territorial sea within the exclusive economic zone of the United States . . . ."[184]

175. *Id.* at 17-18.

176. Seafood Executive Order, *supra* note 161.

177. *Id.* at 28,471.

178. *Id.* § 1, at 28,471.

179. *Id.* § 3(a), at 28,471.

180. *Id.* §§ 2(a), (c), (d), at 28,471.

181. "'Aquaculture facility' means any land, structure, or other appurtenance that is used for aquaculture." *Id.* § 3(b), at 28,471.

182. *Id.* § 6(a)(1), at 28,473.

183. 42 U.S.C. § 4332(C).

184. Seafood Executive Order, *supra* note 161, at 28,473-74. This Article discusses the results of this command *infra* Section II.A.3.

The Seafood Executive Order seeks to promote and streamline the approval process for U.S. marine aquaculture through the designation of federal Aquaculture Opportunity Areas.[185] In effect, Aquaculture Opportunity Areas are pre-approved areas of the U.S. ocean suitable for marine aquaculture, and the programmatic EIS for each area may "include the identification of suitable species for aquaculture in those particular locations, suitable gear for aquaculture in such locations, and suitable reporting requirements for owners and operators of aquaculture facilities in such locations."[186] The Secretary of Commerce (acting through NOAA) designates Aquaculture Opportunity Areas through a public process,[187] and this designation authority gives NOAA plenty of discretion to favor location-appropriate CC+ mariculture. The order also charges NOAA with developing and continually updating a web page that "(i) describes the Federal regulatory requirements and relevant Federal and State agencies involved in aquaculture permitting and operations; and (ii) identifies Federal grant programs applicable to aquaculture siting, research, development, and operations."[188] Again, therefore, the order grants NOAA considerable discretion to communicate preferences for CC+ aquaculture and to highlight financial and other aids available to potential CC+ aquaculture facilities.

The Seafood Executive Order thus seeks to harness existing federal agency discretion to generally promote marine aquaculture in the United States, particularly in federal waters. While President Biden is reviewing all of President Trump's executive orders, he has not, as of March 2022, rescinded the Seafood Executive Order.[189] Unsurprisingly, President Trump did not connect his promotion of marine aquaculture to climate change, but there is no reason why the administrative apparatuses of both the Biden Administration and amenable coastal states and tribes cannot further exercise their discretion to promote CC+ marine aquaculture as the Executive Order continues to be implemented.

3. The Army Corps of Engineers

The Army Corps has jurisdiction to permit marine aquaculture facilities under both Section 404 of the federal Clean Water Act[190] and, more importantly, Section 10 of the Rivers and Harbors Act of 1899.[191] Section 404 gives the Army Corps authority to permit any discharge of dredged or fill material into the waters of the United States,[192] while Section 10 provides that "it shall not be lawful to

185. *Id.* § 7, at 28,474. The executive order does not specifically define "Aquaculture Opportunity Area."

186. *Id.* § 7(b), at 28,474.

187. *Id.* § 7(c), at 28,474.

188. *Id.* § 8, at 28,475.

189. *See, e.g.*, Exec. Order No. 14,029, 86 Fed. Reg. 27,025 (May 19, 2021) (revoking certain actions of the previous administration but neither repealing nor amending the Seafood Executive Order); Exec. Order No. 14,018, 86 Fed. Reg. 11,855 (Mar. 1, 2021) (same).

190. 33 U.S.C. § 1344(a).

191. *Id.* § 403.

192. *Id.* § 1344(a).

build or commence the building of any wharf, pier, dolphin, boom, weir, breakwater, bulkhead, jetty, or other structures in any port, roadstead, haven, harbor, canal, navigable river, or other water of the United States" without an Army Corps permit.[193] Because marine aquaculture facilities—regardless of whether they occur in state or federal ocean waters—include structures placed in waters of the United States and often discharges of dredged or fill material, they require Army Corps permits.[194]

While the Army Corps can and does issue individual permits under both statutes, it has long used general permits, including both nationwide permits (NWPs) and regional permits (RPs), to facilitate the permitting of smaller operations in navigable waters.[195] The Army Corps can create a general permit any time it becomes convinced that a category of activities, either individually or cumulatively, will not significantly impact the environment,[196] giving it broad discretion to promote environmentally beneficial activities such as oil spill responses (NWP 20), aquatic restoration (NWP 27), or aids to navigation (NWP 1).[197]

However, NWPs for mariculture are a relatively new development, with the Army Corps proposing the first limited one, for "work associated with the continued operation of existing commercial shellfish projects, many of which have been in place for hundreds of years," only in 2006.[198] The Corps finalized this proposal as NWP 48 in 2007, allowing the general permit to cover existing shellfish operations of up to 100 acres without prenotification and emphasizing that shellfish aquaculture both provides food and improves water quality.[199] In 2012, the Corps expanded the scope of NWP 48 to allow, among other things, for changes in the species being cultivated, so long as the new species was either native to the area or had been aquacultured there before and was not an invasive species, and to allow for expansions into new areas.[200] The 2017 nationwide permits saw another expansion of NWP 48, with the Army Corps clarifying "that it authorizes new and continuing commercial shellfish aquaculture operations in authorized project areas" and defining "a 'new commercial shellfish aquaculture operation' as an operation in a project area where commercial shellfish

193. *Id.* § 403.

194. Lisa Schiavinato, Catherine Courtier, Danielle Goshen & Shana Jones, *Molluscan Shellfish Aquaculture in Federal Waters of the Exclusive Economic Zone (EEZ): Agencies, Industry, and Academia Working Together on Compliance and Permitting Requirements*, CAL. SEA GRANT 5 (Jan. 2019), https://nsglc.olemiss.edu/projects/shellfish-aquaculture/files/molluscanshellfish.pdf [https://perma.cc/D8MP-CJDW]; Schatzberg, *supra* note 26, at 257-58.

195. *See* 33 C.F.R. pt. 330 (2021).

196. 33 U.S.C. § 1344(e).

197. *Summary of the 2017 Nationwide Permits*, U.S. ARMY CORPS OF ENG'RS 1, 4 (Jan. 5, 2017), https://usace.contentdm.oclc.org/utils/getfile/collection/p16021coll7/id/6711 [https://perma.cc/GR6C-PUG2].

198. Proposal To Reissue and Modify Nationwide Permits, 71 Fed. Reg. 56,257, 56,275 (Sept. 26, 2006).

199. Reissuance of Nationwide Permits, 72 Fed. Reg. 11,091, 11,144 (Mar. 12, 2007).

200. Reissuance of Nationwide Permits, 77 Fed. Reg. 10,184, 10,228-32 (Feb. 21, 2012).

aquaculture activities have not been conducted during the past 100 years."[201] The Army Corps did, however, impose new regional conditions to address impacts on tribal rights after a series of tribal consultations.[202]

Nevertheless, the Army Corps revisited aquaculture general permits in 2020, partially in response to the Seafood Executive Order and partially in response to the U.S. District Court for the Western District of Washington's decisions in the consolidated cases of *Coalition to Protect Puget Sound Habitat v. U.S. Army Corps of Engineers* and *Center for Food Safety v. U.S. Army Corps of Engineers*.[203] In its first decision in *Coalition*, the Western District of Washington reviewed the Army Corps's NEPA Environmental Assessment for NWP 48 and held in October 2019 "that there is insufficient evidence in the record to support the agency's conclusion that the reissuance of NWP 48 in 2017 would have minimal individual and cumulative adverse impacts on the aquatic environment for purposes of the CWA and that the Corps's environmental assessment does not satisfy NEPA's requirements."[204] The court emphasized that the Army Corps's conclusion that shellfish aquaculture operations have minimal impact on the environment

> is based on little more than (1) selectively chosen statements from the scientific literature, (2) the imposition of general conditions with which all activities under nationwide permits must comply, and (3) the hope that regional Corps districts will impose additional conditions and/or require applicants to obtain individual permits if necessary to ensure that the adverse impacts will be minimal.[205]

While noting that vacatur would be the normal remedy, the court granted the Swinomish Indian Tribal Community's request for additional briefing[206] and did not vacate NWP 48 in Washington until June 2020.[207] The intervenors, Taylor Shellfish Company and the Pacific Coast Shellfish Growers Association, appealed, but in February 2021 the U.S. Court of Appeals for the Ninth Circuit agreed with the district court that the Army Corps's reasoning was faulty.[208]

Shortly after the vacatur, and largely in response to the Seafood Executive Order,[209] the Army Corps proposed three new nationwide permits for marine aquaculture—NWP 48, NWP 55, and NWP 56[210]—which it finalized in early

201. Issuance and Reissuance of Nationwide Permits, 82 Fed. Reg. 1860, 1922-31 (Jan. 6, 2017).

202. *Id.*

203. 417 F. Supp. 3d 1354 (W.D. Wash. 2019).

204. *Id.* at 1359.

205. *Id.*

206. *Id.* at 1369.

207. Coal. to Protect Puget Sound Habitat v. U.S. Army Corps of Eng'rs, 466 F. Supp. 3d 1217, 1223-26 (W.D. Wash. 2020).

208. Coal. to Protect Puget Sound Habitat v. U.S. Army Corps of Eng'rs, 843 F. App'x 77, 79-80 (9th Cir. 2021).

209. Reissuance and Modification of Nationwide Permits, 86 Fed. Reg. 2744, 2748-49 (Jan. 13, 2021).

210. Proposal To Reissue and Modify Nationwide Permits, 85 Fed. Reg. 57,298, 57,298 (Sept. 15, 2020).

2021.[211] All three of the new permits emphasize that they apply only in the ocean, which the Army Corps stressed through the use of "mariculture" rather than "aquaculture,"[212] and NWPs 55 and 56 extend the use of general permits to finfish and seaweed aquaculture, which NWP 48 did not cover.[213]

The revised NWP 48 applies to "Commercial Shellfish Mariculture Activities."[214] It authorizes "[s]tructures or work in navigable waters of the United States and discharges of dredged or fill material into waters of the United States necessary for new and continuing commercial shellfish mariculture operations (i.e., the cultivation of bivalve molluscs such as oysters, mussels, clams, and scallops) in authorized project areas," as well as "the installation of buoys, floats, racks, trays, nets, lines, tubes, containers, and other structures into navigable waters of the United States" and "discharges of dredged or fill material into waters of the United States necessary for shellfish seeding, rearing, cultivating, transplanting, and harvesting activities."[215] However, aquaculture operations cannot use NWP 48 to grow new nonindigenous species, to cultivate an aquatic nuisance species, to build more permanent structures such as docks, piers, and boat ramps, or to dispose of waste shells back into the ocean.[216] Preconstruction notice is required for any (new or existing) shellfish operations that disturb more than half an acre of submerged aquatic vegetation, and the Army Corps expanded its review of aquaculture's impacts, distinguishing between "extensive" aquaculture that does not require feeding (or most other additions) and "intensive" aquaculture that does.[217] Operations covered by NWP 48 must also meet the tribal conditions that apply to all the 2021 nationwide permits.[218]

Notably, in drafting this newest version of NWP 48, the Army Corps continued to emphasize the benefits of shellfish aquaculture. For example, it noted that NWP 48 will "help increase the numbers of bivalves in the Nation's coastal waters, and the ecological functions and services those bivalve molluscs provide, especially in coast waters where bivalve shellfish populations have significantly declined as a result of overharvesting."[219] However, the Corps did not connect shellfish aquaculture to climate change adaptation.

New NWP 55 covers "Seaweed Mariculture Activities."[220] It authorizes structures for seaweed mariculture activities and for multitrophic aquaculture consisting of both seaweed and shellfish[221]—the combination that can protect shellfish aquaculture from ocean acidification. Again, however, aquaculture

211. Reissuance and Modification of Nationwide Permits, 86 Fed. Reg. at 2744.
212. Proposal to Reissue and Modify Nationwide Permits, 85 Fed. Reg. at 57,331.
213. *Id.* at 57,298.
214. Reissuance and Modification of Nationwide Permits, 86 Fed. Reg. at 2788.
215. *Id.* at 2862-63.
216. *Id.* at 2862-63.
217. *Id.* at 2790-91.
218. *Id.* at 2792.
219. *Id.* at 2794.
220. *Id.* at 2864.
221. *Id.*

operations cannot use NWP 55 for nonindigenous or nuisance species or for permanent structures.[222] Preconstruction notification is required for all seaweed mariculture proposed to be permitted under NWP 55,[223] but in general NWP 55 received the most support from commenters of the three aquaculture permits, suggesting general public acceptance of kelp aquaculture as a relatively benign activity.

In contrast, new NWP 56, covering "Finfish Mariculture Activities,"[224] was the most controversial of the three mariculture general permits, as is true for finfish aquaculture generally. This new nationwide aquaculture permit authorizes cages, net pens, anchors, floats, buoys, and other structures for finfish mariculture or for multitrophic aquaculture involving any combination of finfish, shellfish, and seaweed,[225] potentially allowing kelp and shellfish to mitigate the nutrient pollution that could result from fish feed and feces. NWP 56 cannot be used for land-based fish hatcheries, new nonindigenous species, nuisance species, or permanent structures.[226] Preconstruction notice is required for all facilities intending to be permitted through NWP 56, and that notice must include more information than NWP 48 and NWP 55 require, including a map of the structures, a list of the species being raised, and a description of water depths.[227] The comments and the Army Corps's responses suggest that only a few finfish mariculture operations will qualify for the general permit and that review in the regional district offices will be important.[228]

Despite notices of intent to challenge the 2021 nationwide permits and a suggestion that the Biden Administration would delay the rule's effective date, the three mariculture NWPs went into effect on March 15, 2021, as scheduled. The Army Corps's repeated amendments to NWP 48 and its creation of NWP 55 and NWP 56 vividly illustrate its discretion to ease the permitting burdens facing offshore aquaculture and to add CC+ industries such as seaweed aquaculture and combined aquaculture into its exercises of this permitting discretion. However, while the new general permits do recognize the water quality and ecological benefits of shellfish aquaculture, they neither recognize similar benefits from

222. *Id.*
223. *Id.*
224. *Id.*
225. *Id.* at 2864-65.
226. *Id.*
227. *Id.* at 2865.
228. For example,

> The Corps believes there are finfish mariculture activities that can result in no more than minimal individual and cumulative adverse environmental effects and are appropriate for NWP authorization. In addition, the NWP regulations at 33 CFR part 330 include numerous provisions that allow district engineers to exercise discretionary authority to require individual permits for activities when the determine those activities will cause more than minimal adverse environmental effects. Division engineers have the authority to modify, suspend, or revoke an NWP on a regional basis (see 33 CFR 330.5(c)). District engineers have the authority to modify, suspend, or revoke an NWP authorization on a case-by-case basis (see 33 CFR 330.5(d)). The potential individual and cumulative adverse environmental effects caused by finfish mariculture activities will be assessed by district engineers when they review PCNs for proposed activities.

Id. at 2807.

kelp aquaculture, nor explicitly connect marine aquaculture to climate change policies, nor privilege new CC+ facilities on the basis of their potential contributions to climate change mitigation or adaptation. It remains to be seen whether the Biden Administration will hone these general permits further, but the Draft *Strategic Plan* suggests that this Administration may pursue a broader and more nuanced use of general permits for marine aquaculture.[229] Given the Biden Administration's pervasive interest in addressing climate change, the ability of kelp and shellfish aquaculture to enhance climate change policies may become an additional reason for the Army Corps to promote these subindustries through expedited permitting procedures.

4. The U.S. Environmental Protection Agency

The EPA helps NOAA to administer the Coastal Zone Management Act, discussed below, especially in connection with coastal nonpoint source pollution.[230] The EPA's more significant regulatory role vis-à-vis marine aquaculture, however, comes through the Clean Water Act. The Clean Water Act generally prohibits the discharge of pollutants from point sources, including into the ocean,[231] and discharges of anything other than dredged or fill material require a National Pollutant Discharge Elimination System (NPDES) permit.[232] While most states have taken over the NPDES permitting program from the EPA, their permitting authority extends only three miles offshore.[233] Thus, an aquaculture facility located in federal waters that discharges pollutants other than dredged or fill material will require an NPDES permit from the EPA.

However, Congress also imposed special water quality regulatory requirements on most intensive aquaculture in the Clean Water Act, regardless of where located. In Section 319, it authorized the EPA to issue special versions of the NPDES permit requirements for "approved aquaculture project[s]."[234] The EPA's regulations implementing this part of the statute make clear that the EPA considers finfish aquaculture to be the most problematic form of aquaculture in terms of impacts on water quality because

229. *See* discussion *supra* notes 170-175 and accompanying text; 2021 AQUACULTURE DRAFT STRATEGIC PLAN, *supra* note 170, at 14.

230. 16 U.S.C. § 1455b(a).

231. 33 U.S.C. §§ 1311(a), 1362(12).

232. *Id.* § 1342(a).

233. *Id.* § 1342(b) (allowing state assumption but limiting it to the "navigable waters within [the state's] jurisdiction"); *id.* § 1362(7) (defining "navigable waters" to include the territorial seas); *id.* § 1362(8) (defining "territorial seas" by cross-reference to limit it to the first three miles of ocean); *see also NPDES State Program Authority*, U.S. ENV'T PROT. AGENCY (Sept. 23, 2021), https://www.epa.gov/npdes/npdes-state-program-authority [https://perma.cc/JN9P-24PK] (listing state authorizations); Costle v. Pac. Legal Found., 445 U.S. 198, 201 n.3 (1980) (noting that despite a delegation of NPDES permitting to California, "the EPA retain[s] jurisdiction over discharges beyond the limits of the territorial sea, that is, more than three miles out from the coastline. EPA permits are thus required for the Hyperion plant's discharges through the 5- and 7-mile outfalls").

234. 33 U.S.C. § 1328.

these regulations focus on "concentrated aquatic animal production facilities."[235] Like confined animal feeding operations on land, these forms of aquaculture require an NPDES permit.[236] Thus, by exercise of its discretion, the EPA has already focused its water quality regulatory attention on finfish aquaculture, rather than potentially all marine aquaculture, implicitly subjecting the CC+ aquaculture industries to less regulatory scrutiny.[237]

5. NOAA and Regional Fishery Management Councils

a. NOAA and the Seafood Executive Order

In recognition that the ocean and atmosphere are linked, President Nixon established NOAA in 1970 through presidential proclamation. As a presidential creation, NOAA lacks an organic act giving it general authority over marine activities, and its administrative discretion derives from a patchwork of statutes, executive orders, and delegations of authority. For example, the Secretary of Commerce has delegated its authority with respect to marine and anadromous fish under the Endangered Species Act to the National Marine Fisheries Service, a subagency within NOAA.[238]

Another example of NOAA's accreting authority comes from President Trump's Seafood Executive Order, which, as noted, named NOAA the lead federal agency for aquaculture facilities in federal waters and included the Department of Commerce and NOAA in the group of federal authorities charged with developing Aquaculture Opportunity Areas. On August 20, 2020, NOAA named the federal waters off the coast of southern California and in the Gulf of Mexico as the focus of its first two Aquaculture Opportunity Areas, "based on the already available spatial analysis data and current industry interest in developing sustainable aquaculture operations in the region."[239] NOAA is also engaging in marine spatial planning using suitability models to identify areas of highest opportunity for aquaculture.[240]

235. 40 C.F.R. § 122.24 (2021).

236. *Id.* § 122.24(a).

237. While these regulations can apply to onshore facilities that grow mollusks or crustaceans, in-water facilities subject to the regulation use net pens, a growing method associated almost exclusively with finfish. *See Concentrated Aquatic Animal Production Effluent Guidelines*, U.S. ENV'T PROT. AGENCY (Apr. 24, 2020), https://www.epa.gov/eg/concentrated-aquatic-animal-production-effluent-guidelines [https://perma.cc/N7E4-WTMB].

238. Endangered and Threatened Wildlife and Plants; Regulations for Designating Critical Habitat, 85 Fed. Reg. 55,398, 55,398 (Sept. 8, 2020) (to be codified at 50 C.F.R. pt. 17).

239. *NOAA Announces Regions for First Two Aquaculture Opportunity Areas Under Executive Order on Seafood*, NOAA FISHERIES (Aug. 20, 2020), https://www.fisheries.noaa.gov/feature-story/noaa-announces-regions-first-two-aquaculture-opportunity-areas-under-executive-order [https://perma.cc/FGE6-Y52L].

240. *Aquaculture Opportunity Areas Update*, NOAA FISHERIES 6, 11, 12 (Mar. 23, 2021), https://gulfcouncil.org/wp-content/uploads/X.-AOA-Update-Presentation-ShrimpAP_03_23_2021.pdf [https://perma.cc/MDZ6-8RLP].

b. The Magnuson-Stevens Fishery Conservation and Management Act

Beyond the Seafood Executive Order, NOAA's strongest claim to regulatory authority over marine aquaculture comes from the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and its regional Fishery Management Councils (FMCs). The federal government manages fisheries through the MSA,[241] which Congress enacted in 1976[242] and renamed to its current appellation in 1996.[243] With certain exceptions, federal jurisdiction over fisheries generally applies more than three miles out to sea, while states generally have authority to manage fisheries within the three miles of ocean closest to shore.[244]

Emphasizing the importance of commercial and recreational fishing to the United States,[245] the MSA proclaims fisheries' status as a renewable and sustainable resource—so long as overfishing can be avoided.[246] The MSA proclaimed a 200-nautical-mile "fishery conservation zone" around the United States,[247] anticipating international law developments in the 1982 third United Nations Convention on the Law of the Sea (UNCLOS III, in effect 1994) that would allow coastal nations to claim a 200-nautical-mile EEZ for purposes that included fisheries management.[248] The Act then generally excluded foreign fishing vessels from this zone.[249] As a result, fishing in the United States' EEZ since 1977 has been reserved almost exclusively for Americans.

For domestic fisheries management, the Act created eight regional FMCs, for New England, the Mid-Atlantic, the South Atlantic, the Caribbean, the Gulf of Mexico, the Pacific, the North Pacific, and the Western Pacific regions.[250] These regional FMCs are overseen by the Secretary of Commerce, who has delegated much of his/her authority to the NMFS within NOAA.[251] One of the primary functions of each regional FMC is to "prepare and submit

241. 16 U.S.C. §§ 1801-1884.

242. Fishery Conservation and Management Act of 1976, Pub. L. No. 94-265, 90 Stat. 331 (codified at 16 U.S.C. §§ 1801-1884).

243. Omnibus Consolidated Appropriations Act, 1997, Pub. L. No. 104-208, § 211, 110 Stat. 3009, 3041 (1996) (designating the renaming and requiring it to be used everywhere fifteen days after enactment of the Sustainable Fisheries Act of 1996).

244. 16 U.S.C. § 1856.

245. Fishery Conservation and Management Act § 2(a)(3) (codified at 16 U.S.C. § 1801(a)(3)).

246. *Id.* § 2(a)(5) (codified at 16 U.S.C. § 1801(a)(5)).

247. *Id.* § 101 (codified as amended at 16 U.S.C. § 1811).

248. *See* Robin Kundis Craig, *Regulation of U.S. Marine Resources: An Overview of the Current Complexity*, 19 NAT. RES. & ENV'T 3, 4-5 (2004) (providing an overview of UNCLOS III's jurisdictional provisions and the United States' adoption of them through presidential proclamations).

249. Fishery Conservation and Management Act § 201(a) (codified as amended at 16 U.S.C. § 1821(a)).

250. *Id.* § 302(a) (codified as amended at 16 U.S.C. § 1852(a)).

251. *See About Us*, NOAA FISHERIES, http://www.nmfs.noaa.gov/aboutus/aboutus.html [https://perma.cc/4U6U-ZE9G] (last visited Nov. 30, 2021).

to the Secretary [of Commerce] (A) a fishery management plan [FMP], and (B) amendments to such plan that are necessary from time to time . . . ."[252] NMFS (also known as "NOAA Fisheries") and the regional FMCs currently manage 460 fish stocks under forty-six FMPs.[253]

A key issue for the MSA and aquaculture is whether aquaculture constitutes a "fishery." The FMCs and the courts have reached different opinions on this issue. Under the MSA's definitions, "[t]he term 'fish' means finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds,"[254] while a "fishery" is "one or more stocks of fish which can be treated as a unit for purposes of conservation and management and which are identified on the basis of geographical, scientific, technical, recreational, and economic characteristics . . . ."[255] Finally, "fishing" is:

> (A) the catching, taking, or harvesting of fish;
>
> (B) the attempted catching, taking, or harvesting of fish;
>
> (C) any other activity which can reasonably be expected to result in the catching, taking, or harvesting of fish; or
>
> (D) any operations at sea in support of, or in preparation for, any activity described in subparagraphs (A) through (C).
>
> Such term does not include any scientific research activity which is conducted by a scientific research vessel.[256]

Marine aquaculture does not precisely fit within these definitions, but Congress's use of the word "harvest" and its inclusion of marine plants as "fish" allow for a plausible argument that the regional FMCs can regulate aquaculture. Moreover, the history of regulating marine aquaculture in federal waters supports this interpretation. In the 1980s, for example, American Norwegian Fish Farm, Inc. proposed an Atlantic salmon aquaculture complex[257] of ninety salmon net pens located twenty-seven miles due east of Cape Ann, Massachusetts.[258] The net pens would have been attached to nine moored barges, and the operation would have produced 46.8 million pounds of salmon while occupying forty-seven square miles of federal ocean.[259] The Army Corps granted a Rivers and Harbors Act permit to the facility on December 14, 1990, issuing a Finding of No Significant Impact under NEPA but relocating the facility ten miles further offshore.[260] However, litigation with the Conservation Law Foundation and the Navy's concerns about

252. 16 U.S.C. § 1852(h)(1).

253. *Fisheries*, NOAA FISHERIES (Nov. 19, 2021), http://www.noaa.gov/fisheries [https://perma.cc/EPD5-C49L].

254. 16 U.S.C. § 1802(12).

255. *Id.* § 1802(13).

256. *Id.* § 1802(16).

257. BILIANA CICIN-SAIN ET AL., DEVELOPMENT OF A POLICY FRAMEWORK FOR OFFSHORE MARINE AQUACULTURE IN THE 3-200 MILE U.S. OCEAN ZONE 2 (2001).

258. *Id.* at 21, 46.

259. *Id.* at 46-47.

260. *Id.* at 47.

interference with submarines in the area led the Army Corps to withdraw its permit nine months later,[261] and these increasing concerns led to its refusal to permit American Norwegian Fish Farm's scaled-down application in 1994.[262] In response to this development, NOAA's General Counsel opined in 1993 that it and the regional FMCs had authority to regulate aquaculture under the MSA,[263] and in 1999 the New England FMC issued an aquaculture policy.[264]

However, the U.S. Court of Appeals for the Fifth Circuit recently called NOAA's MSA authority over aquaculture into doubt. In 2016, the Gulf of Mexico FMC finalized rules to regulate marine aquaculture in the federal waters of the Gulf of Mexico.[265] Both the U.S. District Court for the Eastern District of Louisiana and the U.S. Court of Appeals for the Fifth Circuit declared the regulations invalid because aquaculture is not fishing.[266] Thus, whether these arms of the federal administrative state possess authority and sufficient discretion to actively promote CC+ aquaculture as a favored fishery requires further legal resolution.

6. Using Federal Agency Discretion to Promote CC+ Aquaculture

As noted, the Army Corps has already begun to develop nationwide general permits that distinguish among the types of marine aquaculture. While general permits are usually easier to get than individual permits, the bar for NWP 56 for finfish aquaculture appears to be the highest of the three 2021 mariculture permits, meaning that the Army Corps has effectively used its discretionary authority to promulgate a preference (however inchoate at the moment) for shellfish and kelp aquaculture. As the Draft *Strategic Plan* suggests,[267] the Army Corps can continue to differentiate these general permits, perhaps creating regional variations to acknowledge different CC+ aquaculture opportunities along the different coasts. A broader array of coordinated general permits would be especially beneficial after NOAA begins designating Aquaculture Opportunity Areas, allowing the Corps and coastal states to take advantage of the environmental and cultural reviews NOAA produces during its designation process to further reduce the permitting burden on CC+ aquaculture operations located in these areas that meet NOAA's specifications regarding species raised and size of operations. The EPA already subjects finfish aquaculture to more extensive water quality-based regulation than kelp and seaweed aquaculture, but it remains to be seen

261. *Id.*

262. *Id.* at 50.

263. *Id.* at 78 (citing 50 C.F.R. § 229.2).

264. *Id.* at 20.

265. Fisheries of the Caribbean, Gulf, and South Atlantic; Aquaculture, 81 Fed. Reg. 1761, 1762 (Jan. 13, 2016) (to be codified at 50 C.F.R. pt. 600, 622).

266. Gulf Fishermens Ass'n v. Nat'l Marine Fisheries Serv., 968 F.3d 454, 456 (5th Cir. 2020).

267. *See* discussion *supra* notes 170-175 & accompanying text; 2021 AQUACULTURE DRAFT STRATEGIC PLAN, *supra* note 170.

whether other FMCs outside the Fifth Circuit will attempt to regulate marine aquaculture as fisheries at all, let alone with preferences for CC+ aquaculture.

B. The Coastal States' Variety of Approaches to Permitting Marine Aquaculture

States enjoy the full range of their police-power authority to regulate marine aquaculture in the first three miles of the ocean, subject only to federal preemption and tribal treaty rights. As one might expect, coastal states exercise this authority in a variety of different ways. In general, nearshore aquaculture requires a combination of state and federal permits and a lease of the submerged lands from the appropriate state agency. However, state aquaculture laws also reflect some of the unique concerns and situations of the particular coastal state.

Within this variety, states have developed both more efficient and less efficient methods of permitting marine aquaculture. This Section provides three examples of state administrative apparatuses for mariculture, two of which offer productive examples that other states might learn from and adapt to promote CC+ industries. The discussion begins, however, with Alabama's cumbersome and lengthy permitting regime.

1. Oyster Permitting in Alabama: How to Construct a Daunting Permitting Gauntlet for a CC+ Operation

On the Gulf Coast, Alabama is the largest oyster processor in the United States,[268] but oyster aquaculture is a relatively new and limited industry for the state that began in 2009 and, as of 2021, was still limited to eighteen operations.[269] However, Alabama already touts many of the environmental benefits of oyster farming, noting that "it's good for the ecosystems of Coastal Alabama": "Oysters help to improve the water quality in our bays by feeding on excess phytoplankton. Additionally, the presence of additional on-bottom oyster farms creates new artificial reefs, which are beneficial to a number of aquatic species."[270]

Despite this appreciation for the benefits of oyster aquaculture, getting an operation up and running in Alabama requires considerable perseverance through a sequence of steps involving multiple agencies. The Alabama Department of Public Health conditionally approves sites for oyster aquaculture,[271] but each applicant needs to complete an initial screening interview with the Marine Resources Division of the Alabama Department of Conservation and Natural Resources and lease the submerged lands from the

268. *Why Oyster Farming?*, ALA. SEAFOOD MKTG. COMM'N (2021), https://alaquaculture.com/state/ [https://perma.cc/S226-PZAU].

269. *Id.*

270. *Id.*

271. *Alabama Oyster Aquaculture: Permit Application Guide*, ALA. SEAFOOD MKTG. COMM'N (2021), https://alaquaculture.com/permit-application-guide/ [https://perma.cc/7JD5-XKND].

State Lands Division.[272] Leasing is done through a competitive bidding process under state law, but "[p]roposing a site that exists within a natural oyster reef or a site that will impact any submerge[d] aquatic vegetation is prohibited."[273] After site approval from the Department of Public Health, the oyster farmer applies for a Shellfish Aquaculture Easement from the State Lands Division and submits a joint permit application to the U.S. Army Corps of Engineers and the Alabama Department of Environmental Management.[274] As part of this last application, moreover, "the U.S. Army Corps of Engineers district archeologist will determine if [the] proposed oyster aquaculture site requires a cultural resources survey."[275] Once the joint application is approved, the next step is the U.S. Coast Guard[276] and a Private Aids to Navigation Permit,[277] followed by submission of an operating plan to the Alabama Department of Public Health.[278] A commercial operation also needs an Oyster Aquaculture License from the Marine Resources Division, which costs $250.00 per year.[279] When the State Lands Division sees that the operator has obtained all the other permits and licenses, it will finalize the Shellfish Aquaculture Easement and send notice to the operator that the facility can proceed.[280]

This multistep permit process may be one reason why Alabama's oyster aquaculture industry has been slow to expand. Luckily, other agencies in states with more marine aquaculture experience have developed promising innovations that can be further adapted to promote CC+ aquaculture.

2. Washington State: Streamlining Aquaculture Permitting Through a Centralized Process

Washington State on the Pacific Coast is the nation's leading producer of aquacultured clams, oysters, and mussels.[281] Aquaculture operations in Washington require a number of permits, but the Governor's Office for Regulatory Innovation and Assistance has streamlined the permitting process for this state's high-volume industry through an electronic Joint Aquatic Resources

272. *Id.*

273. *Id.* (citing ALA. CODE § 9-15-70 (2019)).

274. *Id.*

275. *Id.*

276. The Coast Guard plays a relatively minor role in marine aquaculture, but it is in charge of permitting Private Aids to Navigation—that is, the buoys, lights, and beacons that marine aquaculture facilities use to warn ships, boats, other watercraft, and swimmers to stay away from the facility. *See Private Aids*, U.S. COAST GUARD, https://www.pacificarea.uscg.mil/Our-Organization/District-11/Prevention-Division/PatonOne/ [https://perma.cc/5N6B-BPKU] (last visited Aug. 5, 2021). The Coast Guard requires such permits pursuant to 14 U.S.C. §§ 83-85 and 43 U.S.C. § 1333(d). Its permit regulations can be found at 33 C.F.R. subpart 66.01.

277. *Alabama Oyster Aquaculture: Permit Application Guide*, *supra* note 271.

278. *Id.*

279. *Id.*

280. *Id.*

281. SHELLFISH AQUACULTURE IN WASHINGTON STATE: FINAL REPORT TO THE WASHINGTON STATE LEGISLATURE, WASH. SEA GRANT, at i (Dec. 2015), https://wsg.washington.edu/wordpress/wp-content/uploads/Shellfish-Aquaculture-Washington-State.pdf [https://perma.cc/EZ5U-HXSE].

Permit Application (JARPA).[282] JARPA encompasses multiple federal, state, and local permits and evaluations, including: Rivers & Harbors Act Section 10 and Clean Water Act Section 404 permits from the Army Corps;[283] Private Aids to Navigation (PATON) permits from the Coast Guard;[284] a Clean Water Act Section 401 water quality certification from the Washington Department of Ecology (discussed below);[285] a Hydraulic Project Approval from the Washington Department of Fish and Wildlife; an Aquatic Use Authorization from the Washington Department of Natural Resources; and Shoreline Substantial Development Permits, Shoreline Conditional Use Permits, Shoreline Variances, and Shoreline Exemptions from the relevant local governments.[286] The combined permit process saves new aquaculture facilities from a multistep gauntlet. However, Washington also encompasses a number of tribes with treaty rights to coastal fisheries and other marine resources, and these tribes are actively involved in state aquaculture approvals.[287]

Aquaculture facilities also must lease the submerged lands from the Washington State Department of Natural Resources[288] pursuant to the requirements of the 1984 Aquatic Lands Act.[289] As amended in 2018, this Act forbids new leasing of state submerged lands or extensions or renewals of then-existing leases for "nonnative marine finfish aquaculture."[290] The Washington Legislature by statute decided to phase Atlantic salmon aquaculture out of the state after more than 300,000 farmed Atlantic salmon escaped from a net pen in August 2017,[291] effectively eliminating the administrative state's authority to

282. *ePermitting - Home of the JARPA*, WASH. STATE GOVERNOR'S OFF. FOR REGUL. INNOVATION & ASSISTANCE (2021), https://www.epermitting.wa.gov/site/alias__resourcecenter/9978/default.aspx [https://perma.cc/V53X-ALFQ].

283. For a more detailed discussion of the Army Corps's authority, see *supra* Section II.A.3.

284. *See supra* Section II.A.6.

285. *See infra* Section II.B.5.

286. *Introduction to the JARPA*, WASH. STATE GOVERNOR'S OFF. FOR REGUL. INNOVATION & ASSISTANCE (2021), https://www.epermitting.wa.gov/site/alias__resourcecenter/jarpa_introduction/10042/introduction.aspx [https://perma.cc/8BXE-7UD7].

287. As the Washington State Department of Natural Resources explains:

> Treaties signed with western Washington Indian Tribes in 1854 and 1855 reserved the right for tribes to harvest fish and shellfish from all usual and accustomed fishing areas in common with citizens of Washington. In 1994, Judge Edward Rafeedie upheld the right of Treaty Indian tribes, or their successors in interest, to harvest up to fifty percent of the harvestable surplus of shellfish from natural shellfish beds. To implement the ruling, a procedure for notification of tribes about DNR aquaculture leases and potential harvest agreements on state lands was formalized in an implementation plan.

Aquaculture, WASH. STATE DEP'T OF NAT. RES. (2021), https://www.dnr.wa.gov/programs-and-services/aquatics/shellfish/aquaculture [https://perma.cc/CYS9-XAH3].

288. *Id.*

289. WASH. REV. CODE § 79.105 (2021).

290. *Id.* § 79.105.170 (2021).

291. Lynda V. Mapes, *8 Months After Farmed-Fish Escape, Lively Atlantic Salmon Caught 40 Miles Upriver*, SEATTLE TIMES (Apr. 20, 2018, 9:52 a.m.), https://www.seattletimes.com/seattle-news/atlantic-salmon-caught-in-skagit-8-months-after-escape-from-pen-had-eaten-a-fish/ [https://perma.cc/77UN-4H4V]. Despite fears that the escapees would colonize the region and perhaps extirpate native species, the Atlantic salmon apparently could not eat sufficiently well in the wild. *Id*.

allow this form of marine aquaculture. Aquaculture of native finfish species, however, is still permitted.

3. Aquaculture Permitting in Maine: Different Permits and Procedures for Different Aquaculture Operations and Needs

In contrast to Alabama, aquaculture has been present in Maine's Atlantic coastal waters since the 1800s, with regulation beginning in 1905.[292] Modern aquaculture leasing laws went into place in 1973, and initially marine aquaculture focused on blue mussels and oysters, but it has now expanded to include clams, scallops, sea urchins, and Atlantic salmon.[293] To accommodate these various subindustries and expansions to other species, the Maine Department of Marine Resources can grant four types of aquaculture leases.[294] The Maine Legislature created the Limited-Purpose Aquaculture License at the request of shellfish growers so that they could "try out" different locations; the lease covers 400 square feet, lasts one year, and has minimal approval requirements.[295] The "Experimental" Lease, in contrast, allows for commercial and scientific aquaculture research on four acres or less and lasts for three years, again with fewer application requirements than a standard lease.[296] The Emergency Shellfish Lease is a short-term (up to six months) lease that allows existing shellfish lease holders to move their stock "off an existing lease when the health and safety of the shellfish are threatened,"[297] such as from an ocean acidification event. Finally, the Standard Lease allows for aquaculture on up to 100 acres, lasts for up to twenty years, can be used "for both bottom and suspended culture and of shellfish, finfish, and/or marine algae," and "can be renewed, transferred, or expanded," but it also has the most requirements, including public participation and, potentially, a hearing.[298] Would-be operators must meet with the Department's staff before submitting an application,[299] and the application is subject to siting requirements (for example, only kelp aquaculture not intended for human consumption can be located near a wastewater treatment plant's outfall), must include an environmental characterization and baseline, must describe the other uses of the area and the vessels that will service the site, is subject to financial responsibility

292. *What Is Aquaculture?*, ME. DEP'T OF MARINE RES. (2021), https://www.maine.gov/dmr/aquaculture/whatis.html [https://perma.cc/7WJE-CXDX].

293. *Id*.

294. *Aquaculture Lease Applications and Forms*, ME. DEP'T OF MARINE RES. (2021), https://www.maine.gov/dmr/aquaculture/forms/index.html [https://perma.cc/WJ4Q-3JG2]; *see also* ME. REV. STAT. ANN. tit. 12, § 6072 (2021) (standard leases); *id.* § 6072-A (2021) (limited-purpose lease for commercial or scientific research); *id.* § 6072-B (2021) (emergency aquaculture lease for shellfish); *id.* § 6072-C (2021) (limited-purpose aquaculture license).

295. *Aquaculture Lease Applications and Forms*, ME. DEP'T OF MARINE RES. (2021), https://www.maine.gov/dmr/aquaculture/forms/index.html [https://perma.cc/WJ4Q-3JG2].

296. *Id.*

297. *Id.*

298. *Id.*

299. 13-188-002 ME. CODE R. § 2.07 (LexisNexis 2021).

requirements, and must include riparian landowner permission for any use of the intertidal area between high tide and low tide.[300] In the case of competing applications, the Department gives priority first to itself; "second, to the riparian owner of the intertidal zone within the leased site area; third, to fishermen who have traditionally fished in or near the proposed lease area; and fourth, to the riparian owner within 100 feet of the territorial waters proposed to be leased."[301] In addition to the lease, lessees and license holders must have an aquaculture harvest license and a Private Aids to Navigation permit from the U.S. Coast Guard.[302]

4. Lessons for CC+ Aquaculture

As these different approaches to state aquaculture suggest, coastal states could develop a suite of best practices to encourage CC+ aquaculture. For example, coastal state agencies might create differential permitting and lease requirements that favor aquaculture of native species of kelp and shellfish, perhaps especially when the proposed aquaculture operations allow climate-impacted coastal fishing communities to develop new livelihoods. These requirements could, for example, minimize environmental review of smaller operations in pre-approved areas. In addition, state agencies could then incorporate these preferences into consolidated permitting processes for operators of proposed kelp and shellfish aquaculture facilities, streamlining the proposed permitting process. Coordination with the Army Corps in the development of regionally appropriate general permits and with NOAA regarding preferred aquaculture in Aquaculture Opportunity Areas would streamline the process even more.

5. Coastal State Certification of Marine Aquaculture in Federal Waters

As aquaculture moves into federal waters, states will also have a voice in how those facilities conduct their operations—at least if the aquaculture facilities are close enough to the three-mile line to affect water quality and activities in state ocean waters. Two federal laws grant coastal states this authority. First, Section 401 of the Clean Water Act provides that "[a]ny applicant for a Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters" must obtain a certification from the relevant state that the discharge will comply with water quality requirements.[303] The federal permit cannot issue without the state certification, giving states an effective veto over

300. *Id.* § 2.10 (LexisNexis 2021).

301. *Id.* § 2.41 (LexisNexis 2021).

302. *Additional Aquaculture Forms*, ME. DEP'T OF MARINE RES. (2021), https://www.maine.gov/dmr/aquaculture/forms/additionalforms.html [https://perma.cc/76HR-JHKF]. The U.S. Coast Guard plays a relatively minor role in marine aquaculture regulation.

303. 33 U.S.C. § 1341(a)(1).

the proposed operations,[304] and states can also condition the federal permit to ensure compliance with "any other appropriate requirement of State law."[305] The U.S. Supreme Court has twice upheld broad state Section 401 authority to condition federal licenses and permits that could affect state water quality and uses of state waterways.[306] While caselaw applying Section 401 in federal ocean waters is nonexistent, Sea Grant has recognized Section 401 certifications as a potential requirement for aquaculture operations in federal ocean waters in connection with its case study[307] of the Catalina Sea Ranch,[308] the first permitted aquaculture operation in federal waters. States could thus use their Clean Water Act authorities to promote CC+ aquaculture in federal waters, emphasizing the water quality benefits from kelp and shellfish aquaculture to make certification of those subindustries noticeably easier.

In addition, coastal states with federally approved Coastal Zone Management Plans (currently, all coastal states and territories except Alaska)[309] can use the Coastal Zone Management Act's (CZMA)[310] federal consistency requirement to shape marine aquaculture in federal ocean waters. Section 307(c) of the Act requires that "[e]ach Federal agency activity within or outside the coastal zone that affects any land or water use or natural resource of the coastal zone shall be carried out in a manner which is consistent to the maximum extent practicable with the enforceable policies of approved State management programs."[311] Federal consistency has already helped to shape offshore oil and gas development in the federal waters,[312] and the California Coastal Commission imposed requirements on the Catalina Sea Ranch to ensure consistency with California's Coastal Zone Management Plan.[313] However, as various phases of the CZMA's application to offshore oil and gas development have shown,[314] federal consistency leaves considerable discretion to both the federal and state administrative states. Both NOAA and the coastal state agencies that implement

304. *Id.*

305. *Id.* § 1341(d).

306. PUD No. 1 of Jefferson Cnty. v. Wash. Dep't of Ecology, 511 U.S. 700, 713-21 (1994) (upholding Washington's instream flow restrictions on a federal hydropower license to protect native salmon); S.D. Warren Co. v. Me. Bd. of Env't Prot., 547 U.S. 370, 385-87 (2006) (upholding Maine's imposition of numerous conditions on the renewal of federal hydropower licenses and emphasizing the states' roles in protecting water quality).

307. Schiavinato et al., *supra* note 194, at 9.

308. *Catalina Sea Ranch*, CATALINA SEA RANCH, https://catalinasearanch.com/ [https://perma.cc/8RER-YVYZ] (last visited Aug. 6, 2021).

309. *Coastal Zone Management Programs*, OFF. FOR COASTAL MGMT. (2021), https://coast.noaa.gov/czm/mystate/ [https://perma.cc/V9K3-CDZH].

310. 16 U.S.C. §§ 1451-1466.

311. *Id.* § 1456(c)(1)(A).

312. Eric Laschever, *Resisting Regulatory Rollback in the Trump Era: The Case for Preserving CZMA Consistency*, 50 ENV'T L. REP. 10,134, 10,136-41 (2020).

313. *See* Schiavinato et al., *supra* note 194, at 6-8 (discussing the requirements that the California Coastal Commission imposed on the Catalina Sea Ranch to ensure consistency with California's Coastal Zone Management Plan); *see also* Schatzberg, *supra* note 26, at 271-84 (discussing how Washington and Alaska could use their Coastal Zone Management Plans (Alaska participated at the time) to shape aquaculture in federal waters).

314. Laschever, *supra* note 312, at 10,139-43.

the Coastal Zone Management Act could therefore use their respective authorities under the CZMA to better promote CC+ aquaculture.

C. Coastal Tribes and Marine Aquaculture

Tribal regulatory jurisdiction is one of the most difficult issues within federal Indian law, raising complexities far beyond the scope of this Article. Nevertheless, coastal tribes are very much a part of the U.S. marine aquaculture conversation. For example, as noted for the State of Washington, many coastal tribes in the Pacific Northwest have reservations and treaty rights that encompass the coast and ocean, and these tribes have a long and rich cultural tradition encompassing husbandry of marine resources, especially salmon.[315] Federally recognized and unrecognized tribes still inhabit the Gulf Coast as well.[316] Within their reservation boundaries, coastal tribes can exercise near plenary authority over marine aquaculture, and tribes have used this authority to advance a number of tribal goals, including cultural preservation, economic development, and marine conservation and restoration. A coastal tribe that wanted to promote CC+ aquaculture within its own boundaries could therefore certainly do so.

Coastal tribes like the Jamestown S'Klallam Tribe have engaged in aquaculture for 3,500 years in the form of clam gardens.[317] This tribe has turned that long-term expertise into an economic development and coastal restoration plan. It currently operates "four aquaculture enterprises and has formed many community partnerships, including with the University of Washington to produce geoduck seed, and with the Puget Sound Restoration Fund to help bring back the scarce Olympia oyster."[318] It is also partnering with Cooke Aquaculture Pacific to replace Cooke's Atlantic salmon farm in the Port Angeles Harbor—now illegal under Washington law—with a facility that raises sterile steelhead, a species native to the area.[319]

The Lummi Nation, in turn, uses marine aquaculture to enhance its cultural resources and food security as well as to provide itself with a stable economy. The Lummi Nation currently occupies a five-mile-long peninsula that separates Lummi Bay and Bellingham Bay in Washington's Puget Sound, about ninety miles north of Seattle and sixty miles south of Vancouver, British

315. *See generally* D. Bruce Johnsen, *Customary Law, Scientific Knowledge, and Fisheries Management Among Northwest Coast Tribes*, 10 N.Y.U. ENV'T L.J. 1 (2001) (discussing the anthropological evidence of these traditions and how they might work with contemporary fishery management).

316. *See* Erick J. Rhoan, Comment, *The Rightful Position: The BP Oil Spill and Gulf Coast Tribes*, 20 SAN JOAQUIN AGRIC. L. REV. 173, 173-74 (2011).

317. Kurt Grinnell, *Aquaculture: A Tribal Perspective*, STRONGER AM. THROUGH SEAFOOD (Feb. 28, 2020), https://www.strongerthroughseafood.org/tipping-the-scales/2020/2/28/aquaculture-a-tribal-perspective [https://perma.cc/5TX4-WWQF].

318. *Id.*

319. Paul Gottlieb, *Jamestown Tribe, Cooke Aquaculture Still Plan Fish Farm in Port Angeles Harbor*, SEQUIM GAZETTE (Oct. 7, 2020, 1:30 AM), https://www.sequimgazette.com/news/jamestown-tribe-cooke-aquaculture-still-plan-fish-farm-in-port-angeles-harbor/ [https://perma.cc/J5NE-6G2B].

Columbia.[320] Its coastal reservation encompasses 10,500 acres of tidelands.[321] Pursuant to the tribe's zoning plan, most of these tidelands are part of the marine zone district, which "comprises an area for treaty-reserved and tribally controlled fishing activities, seafood production, and harvest for the benefit of tribal members."[322]

Like many of the Pacific Coast tribes with so-called "Stevens Treaties" that preserved their rights to hunt and fish in all "usual and accustomed fishing grounds" (the Lummi Nation's treaty is the Point Elliott Treaty),[323] the Lummi Nation needed the federal courts to make those rights real.[324] However, those rights now protect the tribe from nontribal aquaculture by allowing the Army Corps to deny permits to finfish aquaculture operations within the Nation's treaty fishing grounds because such nontribal operations can impair their treaty rights.[325]

The Lummi Nation itself turned to aquaculture in the late 1960s to provide itself with a nonpolluting economic industry, borrowing techniques from the Native Hawaiians.[326] It now operates a shellfish hatchery facility[327] that supplies geoduck seed to a variety of customers,[328] supplies enough manila clams to allow the Nation to plant 20 million clam seeds in its tidelands each year,[329] and supplies enough oyster seed that "Lummi Shellfish plants about 2,500 bags and about 4 million single oysters on the Lummi Tidelands annually. [Their] goal is to get to about 3,000 bags and 4 million [] single oysters in the coming years."[330]

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320. LUMMI NATION ATLAS, LUMMI INDIAN BUS. COUNCIL 5, 6 map 1 (Mar. 2016), https://www.lummi-nsn.gov/userfiles/63_2016LummiAtlas.pdf [https://perma.cc/8XVH-68YT].

321. *Id.* at 11.

322. *Id.* at 49, 50 map 22.

323. *Id.* at 63-67. The "usual and accustomed" language is found in Article 5. *Id.* at 64.

324. Susan Rae Sampson, *The Fights for Rights and the Age of Aquaculture Begins*, ARCHIPELAGO (Apr. 27, 2018) [hereinafter Sampson, *Fights for Rights*], https://archipelagojournal.com/lummi-nation-the-fights-for-rights-and-the-age-of-aquaculture-begins-5dd772be7711 [https://perma.cc/DS5Z-MPJ2]; Susan Rae Sampson, *Lummi Nation: Boldt Decision Restores Rights*, ARCHIPELAGO (May 4, 2018), https://archipelagojournal.com/lummi-nation-boldt-decision-restores-rights-626f71721207 [https://perma.cc/75BY-9LUZ]. These legal battles continue. *See, e.g.*, Lower Elwha Klallam Indian Tribe v. Lummi Nation, 849 F. App'x 216, 217-18 (9th Cir. 2021) (resolving more disputes about the Nation's "usual and accustomed" fishing grounds around Whidbey Island and Trial Island in Puget Sound). For a map of the Lummi Nation's usual and accustomed grounds and stations, see LUMMI NATION ATLAS, *supra* note 320, at 8 map 2.

325. Nw. Sea Farms, Inc. v. U.S. Army Corps of Eng'rs, 931 F. Supp. 1515, 1520-22 (W.D. Wash. 1996).

326. Sampson, *Fights for Rights*, *supra* note 324.

327. *Shellfish Hatchery*, LUMMI NAT. RES. DEP'T (Nov. 30, 2021), https://www.lummi-nsn.gov/Website.php?PageID=42 [https://perma.cc/G6WD-ZHP7]. For a map showing the location of the Seapond Aquaculture Facility within the reservation, see LUMMI NATION ATLAS, *supra* note 320, at 12 map 4.

328. *Geoduck Info: Geoduck Seed*, LUMMI NAT. RES. DEP'T (Nov. 30, 2021), https://www.lummi-nsn.gov/Website.php?PageID=123 [https://perma.cc/G66U-TZ55].

329. *Manila Clam Info*, LUMMI NAT. RES. DEP'T (Nov. 30, 2021), https://www.lummi-nsn.gov/Website.php?PageID=126 [https://perma.cc/UL3A-M35L].

330. *Pacific Oyster Info*, LUMMI NAT. RES. DEP'T (Nov. 30, 2021), https://www.lummi-nsn.gov/Website.php?PageID=124 [https://perma.cc/V6G9-EX6H].

Since the 1987 statutory amendments to the Clean Water Act, tribes are also entitled to receive Treatment-as-a-State status under the Act.[331] Coastal tribes that secure this status can receive authority to set their own water quality standards, engage in their own water quality permitting, and issue their own water quality certifications.[332] According to the EPA, seventy-seven tribes have secured this status for water quality standards and Section 401 certifications,[333] including several coastal tribes such as the Lummi Nation, the Confederated Tribes of the Chehalis Reservation (Washington), the Hoopa Valley Tribe (California), and the Port Gamble S'Klallam Tribe (Washington).

Thus, like states, coastal tribes—particularly those whose reservations encompass the shoreline or treaty fishing rights—have considerable authority to promote CC+ aquaculture should they choose to do so. And, indeed, many of these nations are pursuing what is effectively a CC+ policy regarding shellfish aquaculture. In 2007, seventeen treaty tribes in western Washington entered a settlement with commercial shellfish growers to avoid the complications of tribal members trying to harvest naturally growing shellfish on privately managed commercial tidelands within the tribes' usual and accustomed fishing grounds.[334] The settlement makes nontribal commercial shellfish aquaculture easier because the tribes gave up their treaty right to harvest on those growers' beds (worth about $2 million at the time) in exchange for ten years of shellfish enhancement on public tidelands and a $33 million trust that allows the tribes to acquire and enhance other tidelands for their own exclusive use.[335] The Northwest Indian Fisheries Commission has a Shellfish Aquaculture Policy to guide the implementation of the settlement, which "acknowledges that wild and cultured shellfish are ecologically important to the health of Washington's marine waters. Their filtering improves water clarity, encourages eelgrass and macroalgae growth and can help remove excess nutrients where they are a problem."[336] The policy "supports the continued development of shellfish aquaculture in Puget Sound and its surrounding waters. The Commission encourages Tribes to explore shellfish aquaculture as a means of enhancing shellfish resources for cultural and economic gain."[337]

331. 33 U.S.C. § 1377(e).

332. *Id.*

333. *Tribes Approved for Treatment as a State (TAS)*, U.S. ENV'T PROT. AGENCY (Nov. 23, 2021), https://www.epa.gov/tribal/tribes-approved-treatment-state-tas [https://perma.cc/5LSM-XPH9].

334. *Commercial Shellfish Growers Settlement*, NW. INDIAN FISHERIES COMM'N (2016), https://nwifc.org/about-us/shellfish/commercial-shellfish-growers-settlement/ [https://perma.cc/4A86-QASJ].

335. *Id.*

336. *Shellfish Aquaculture Policy of the Northwest Indian Fisheries Commission*, NW. INDIAN FISHERIES COMM'N (2016), https://nwifc.org/about-us/shellfish/shellfish-aquaculture-policy-of-the-northwest-indian-fisheries-commission/ [https://perma.cc/F765-PP77].

337. *Id.*

D. Additional Administrative State Oversight of Marine Aquaculture

As several of the discussions above have suggested, the numerous federal permit requirements for marine aquaculture in the United States in turn trigger other forms of environmental and cultural review. This list can be extensive and includes, for example, NEPA's EIS requirement,[338] a Section 7 consultation under the federal Endangered Species Act,[339] state water quality certification,[340] tribal consultation, federal consistency review under the Coastal Zone Management Act,[341] and National Historic Preservation Act review.[342] These additional review requirements only lengthen the regulatory gauntlet that marine aquaculture facilities currently face.

III. Exercising Administrative Discretion in Favor of Climate Change+ Aquaculture

The discussions in Parts I and II have suggested multiple ways in which individual administrative agencies and tribes can use both their regulatory authorities and their discretion within those authorities to promote CC+ aquaculture, advancing marine aquaculture's potential contribution to national climate change goals. Part I noted that the administrative state could increasingly qualify kelp and shellfish aquaculture to participate in water quality trading and carbon offset programs, providing facilities with additional sources of income in recognition of the public goods and ecosystem services that they provide. Focusing on permitting and leasing, Part II emphasized that the Army Corps, NOAA, states, and coastal tribes have considerable authority to privilege kelp and shellfish aquaculture through general permits, differentiated leases, and reduced water quality regulation. Viewing kelp and shellfish aquaculture through a climate change lens gives these administrative state authorities additional *reasons* to exercise that authority and discretion, consciously incorporating these CC+ subindustries into the national climate change conversation, as NOAA has already begun to do.

This Part, in turn, takes a more comprehensive approach to administrative state promotion of CC+ aquaculture. Specifically, it suggests ways in which the multiple facets of the administrative state could work together structurally and substantively to facilitate and promote the subindustries of marine aquaculture that advance national climate change goals.

338. 42 U.S.C. § 4332(C).
339. 16 U.S.C. § 1536(a).
340. 33 U.S.C. § 1341(a), (d); *see also* discussion *supra* Section II.B.5.
341. 16 U.S.C. § 1456(c).
342. 54 U.S.C. §§ 300101-307108.

A. Transform Aquaculture Opportunity Areas into Location-Specific Pre-Approvals of CC+ Marine Aquaculture Facilities That Meet Consensus Criteria

The Army Corps's new nationwide general permits for aquaculture demonstrate some beginning criteria for identifying when marine aquaculture is unlikely to be an environmental problem, such as the use of native species[343] and the avoidance of nuisance or invasive species; others have recommended greater scrutiny of or moratoriums on finfish aquaculture and aquaculture using genetically engineered species.[344] Criteria for presumptively acceptable CC+ marine aquaculture would focus regulatory criteria more specifically on native species of shellfish and seaweed, perhaps with more detailed preferences for natives with particular talents for improving water quality or buffering ocean acidification, established market use as biofuels, or an economic market sufficient to support a fishing community's adaptation to impoverished fish stocks.

The larger point is that CC+ marine aquaculture preferences will be regional, not national. From this perspective, NOAA's ongoing process of designating Aquaculture Opportunity Areas presents an entrepreneurial occasion for implementing, with an aquaculture- and climate change-specific focus, longstanding recommendations from the Pew Oceans Commission (2003)[345] and the U.S. Commission on Ocean Policy (2004)[346] that the United States engage in regional ocean governance, as well as President Obama's National Ocean Policy Executive Order, which attempted to institute regional marine spatial planning.[347] Among the many stakeholders involved in the designation of Aquaculture Opportunity Areas should be the representatives of the administrative state themselves. The designation process could seek pre-agreement to and pre-approval of location-appropriate CC+ marine aquaculture operations, akin to but greatly expanding upon the Alabama Department of Public Health's pre-identification of specific areas of coastal Alabama suitable for oyster aquaculture.

Aquaculture Opportunity Area designation provides, in other words, an occasion for the entire administrative state to say with one voice: "We like these kinds of CC+ aquaculture facilities growing these species in this location." If

343. *See also* U.S. COMM'N ON OCEAN POL'Y, AN OCEAN BLUEPRINT FOR THE 21ST CENTURY 331-32 (2004) (expressing concerns about the use of nonnative species).

344. PEW OCEANS COMM'N, AMERICA'S LIVING OCEANS: CHARTING A COURSE FOR SEA CHANGE: SUMMARY REPORT 28 (May 2003); U.S. COMM'N ON OCEAN POL'Y, *supra* note 343, at 331 (expressing concerns about the use of genetically engineered species). It should be noted, however, that some genetic enhancements might increase the climate change benefits of CC+ aquaculture, such as those that allow species to better tolerate warming temperatures and ocean acidification.

345. PEW OCEANS COMM'N, *supra* note 344, at 21-25.

346. U.S. COMM'N ON OCEAN POL'Y, *supra* note 343, at 86-97.

347. For a review of this order and the potential for regional marine spatial planning, see Robin Kundis Craig, *An Historical Look at Planning for the Federal Public Lands: Adding Marine Spatial Planning Offshore*, 6 J. ENERGY & ENV'T L. 1, 9-20 (2015).

NOAA designates at least some Aquaculture Opportunity Areas with climate change and CC+ aquaculture in mind, that more specific focus for Area development, coupled with clear and region-specific criteria for the types of operations and species allowed, would allow for fairly determinative areawide EISs and Endangered Species Act consultations rather than project-by-project evaluations. Similarly, if all relevant administrative agencies at all levels of government operating in the same geographical area agreed on common criteria for favored CC+ aquaculture operations, that agreement should facilitate even easier consolidated permitting than Washington's JARPA, increased use of general permits, and categorical exclusions under NEPA[348] for proposed aquaculture facilities meeting the favored CC+ profile(s) for the Aquaculture Opportunity Area involved. Moreover, if states and tribes fully participate in Aquaculture Opportunity Area site selection, include pre-approved CC+ aquaculture areas in their marine spatial plans, and/or (for states) include the common criteria in their Coastal Zone Management Plans, marine aquaculture facilities meeting the CC+ criteria sited in those areas should fairly quickly receive state or tribal Section 401 certifications and pass Coastal Zone Management Act consistency review.

B. Make Better Use of General Permits and Offshore Leasing

As Maine already recognizes, not all marine aquaculture operations are the same. It and other states that wish to favor CC+ aquaculture can enact categories of submerged-lands leases and state permits that subject qualifying marine aquaculture operations to less arduous review. Similarly, the EPA could expand its so far rather limited use of its aquaculture permitting authority under the Clean Water Act to not only recognize the potentially most harmful marine aquaculture operations but also to create general permits for those operations that that it expects will produce net water quality improvements.[349] As noted, the Army Corps could also better tailor its nationwide permits to favor CC+ aquaculture and, consistent with the recommendations in Section III.A, create even more tailored regional general permits that reflect the consensus CC+ marine aquaculture criteria for that region.[350] Finally, if the federal government engages in leasing for aquaculture in federal ocean waters,[351] it could similarly incorporate leasing preferences for CC+ aquaculture.

348. 40 C.F.R. § 1501.4 (2021).

349. The EPA uses fewer general permits than the Army Corps of Engineers, but it does use them—especially for stormwater NPDES permitting. *See About NPDES*, U.S. ENV'T PROT. AGENCY (May 28, 2021), https://www.epa.gov/npdes/about-npdes [https://perma.cc/9VGU-HFT9]; *2017 Construction General Permit (CGP)*, U.S. ENV'T PROT. AGENCY (Sept. 29, 2021), https://www.epa.gov/npdes/2017-construction-general-permit-cgp [https://perma.cc/2L4H-NDQP].

350. The Army Corps already issues regional general permits. *See, e.g.*, *Regional General Permits*, L.A. DIST. U.S. ARMY CORPS OF ENG'RS, https://www.spl.usace.army.mil/Missions/Regulatory/Regional-General-Permits/ [https://perma.cc/JRT2-CCZ3] (last visited Nov. 30, 2021).

351. The U.S. Commission on Ocean Policy recommended such a leasing program for marine aquaculture in federal waters. *See* U.S. COMM'N ON OCEAN POL'Y, *supra* note 343, at 334-35.

C. Incorporate Kelp and Shellfish Aquaculture into Water Quality Trading

As a policy matter, the EPA has formally allowed water quality trading for nutrients and sediment under the Clean Water Act since 2003,[352] and it renewed its policy enthusiasm for this approach in 2019.[353] However, that policy allows an interested state to set up water quality trading if the state so desires, but does not mandate any such trading. As of 2016, roughly twenty states had implemented or were developing trading programs, including several coastal states.[354] In addition, some coastal states, like Maryland, have already incorporated marine aquaculture—in Maryland's case, oyster aquaculture—into their water quality trading programs.[355] However, even in Maryland, that incorporation is a relatively recent event[356]—the first trade involving an oyster farm took place in 2020—and few coastal states have followed suit.

As Section I.B discussed, water quality trading is potentially very lucrative for marine shellfish aquaculture operations. If both the Army Corps and the EPA fully and explicitly recognize the water quality benefits of CC+ aquaculture, they will make it easier for coastal states to allow those facilities to engage in water quality trading under the Clean Water Act. Such trading would not only provide additional pathways for *all* sources of coastal nutrient pollution to improve coastal water quality, but it would also provide fledgling CC+ aquaculture operations with an additional stream of revenue, helping to ensure their economic sustainability. Such economic assistance is particularly likely to encourage seaweed aquaculture, given the as-yet limited appetite for seaweed in the American diet and the need to further develop the potential of seaweed for use as biofuels.[357]

D. Colocate Offshore Wind and CC+ Mariculture

Another emerging path for the U.S. administrative state that has multiple climate change benefits is colocation of offshore wind facilities and CC+ aquaculture. The United States' first offshore commercial wind farm, the Block Island Wind Farm off the coast of Rhode Island, began its commercial operations

352. *Water Quality Trading Policy*, U.S. ENV'T PROT. AGENCY (Jan. 13, 2003), https://www.epa.gov/sites/default/files/2016-04/documents/wqtradingtoolkit_app_b_trading_policy.pdf [https://perma.cc/2NWJ-ME47].

353. *Water Quality Trading Memos*, U.S. ENV'T PROT. AGENCY (May 14, 2021), https://www.epa.gov/nutrient-policy-data/water-quality-trading-memos [https://perma.cc/BAB4-K5VV].

354. *Water Quality Trading*, U.S. ENV'T PROT. AGENCY (Nov. 16, 2021), https://www.epa.gov/npdes/water-quality-trading [https://perma.cc/DVK8-G75Y].

355. *Water Quality Trading Program Home*, MD. DEP'T OF THE ENV'T., https://mde.maryland.gov/programs/Water/WQT/Pages/index.aspx [https://perma.cc/SVC7-YCRS] (last visited Aug. 7, 2021).

356. *See* Meg Walburn Viviano, *1st-Time Trade: Offsetting Pollution with Oyster Investments*, CHESAPEAKE BAY MAG. (May 12, 2020), https://chesapeakebaymagazine.com/1st-time-trade-offsetting-pollution-with-oyster-investments/ [https://perma.cc/KB8Y-Q94D].

357. *See* JangKyun Kim, Michael Stekoll & Charles Yarish, *Opportunities, Challenges and Future Directions of Open-Water Seaweed Aquaculture in the United States*, 58 PHYCOLOGIA 446, 456 (2019).

only in 2016, but additional offshore wind facilities are being permitted and built at an increasing rate.[358] Offshore wind farms are part of a national climate change mitigation policy, providing renewable energy with a greatly reduced carbon footprint.[359] However, like NOAA's Aquaculture Opportunity Areas, the projected rapid buildout of offshore windfarms in the United States provides an opportune moment for administrative state intervention to promote CC+ marine aquaculture.

Offshore windfarms can provide ideal structures to support marine aquaculture operations, a practice known as colocation.[360] European nations are looking to colocation as a way of keeping marine space open for biodiversity preservation, because both marine aquaculture and offshore windfarms can occupy considerable amounts of ocean space.[361] I have previously argued that the U.S. administrative state should actively encourage colocation of offshore wind and marine aquaculture as a food security matter.[362] That proposal can be more narrowly tailored to CC+ marine aquaculture so that the federal, tribal, and state administrative states incentivize colocation of CC+ aquaculture with offshore windfarms, providing the nation with multiple climate change benefits on a smaller ocean footprint, while leaving space for other national priorities, such as national security and marine biodiversity protection.

Conclusion

This Article has established that certain forms of marine aquaculture—specifically, kelp and shellfish aquaculture—have collateral benefits beyond the provision of food and, in kelp's case, biofuels. Some of these benefits directly advance climate change mitigation and adaptation goals—sequestering carbon, reducing methane emissions from livestock, buffering ocean acidification, and providing new opportunities for communities to adapt to changing livelihoods. Aquacultured seafood is also a low-carbon food source, and domestic aquaculture reduces greenhouse gas emissions associated with transporting seafood for import to the United States. Even the water quality benefits from kelp and shellfish aquaculture are climate-relevant, because removing nutrient pollution from marine waters reduces the stressors to marine ecosystems and makes harmful algal blooms less likely.

358. *See, e.g.*, *Our Offshore Wind Projects in the U.S.*, ØRSTED, https://us.orsted.com/wind-projects [https://perma.cc/QH8V-Y4R9] (last visited Aug. 7, 2021); *FACT SHEET: Biden Administration Jumpstarts Offshore Wind Energy Projects to Create Jobs*, WHITE HOUSE (Mar. 29, 2021), https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/29/fact-sheet-biden-administration-jumpstarts-offshore-wind-energy-projects-to-create-jobs/ [https://perma.cc/8VUS-3AE2].

359. Robin Kundis Craig, *It's Not Just an Offshore Wind Farm: Combining Multiple Uses and Multiple Values on the Outer Continental Shelf*, 39 PUB. LAND & RES. L. REV. 59, 70 (2018).

360. Robin Kundis Craig, *Harvest the Wind, Harvest Your Dinner: Using Law to Encourage an Offshore Energy-Food Multiple-Use Nexus*, 59 JURIMETRICS J. 61, 73-75 (2018).

361. Craig, *supra* note 359, at 63, 118-20; Craig, *supra* note 360, at 71-78.

362. Craig, *supra* note 360.

At the moment, however, the administrative state considers almost *none* of these benefits in regulating the United States' marine aquaculture industries, and so far, never explicitly in climate change terms. With a little more attention and thought, however, federal and state administrative agencies and tribes could do much to adjust marine aquaculture regulation to simultaneously improve domestic food security, provide economic opportunity, improve marine water quality and ecosystems, *and* contribute to climate change mitigation and adaptation goals. Parts I, II, and III identified numerous ways in which these administrative states can exercise their regulatory authorities and discretion to promote CC+ marine aquaculture—both by recognizing that some (but, importantly, not all) marine aquaculture qualifies as CC+ industries and then streamlining the approval process for qualifying facilities, perhaps with additional financial incentives in the form of nutrient credits and carbon offsets.

The larger point of this Article, however, is that mariculture is not the only CC+ industry in the United States. Some emerging and expanding industries in the United States—even industries with aspects that are rightly subjected to public skepticism and intense regulation—provide real, if not always touted or well-recognized, benefits to the nation's capacity to address climate change. If regulatory agencies are not primed to evaluate these industries through a climate change lens as well as the agencies' normal regulatory criteria, they will miss opportunities to exercise their authorities and discretion to harness the climate change advantages that these industries offer.

In some ways, this argument replicates suggestions that scholars have made regarding direct regulation of climate change, such as the EPA's and states' direct regulation of greenhouse gas emissions under the Clean Air Act: pay attention, and don't let opportunities to improve climate change mitigation and adaptation slip away.[363] However, this argument also takes to heart the wedge approach to climate change policy,[364] seeking not one massive and comprehensive overall solution to climate change, but instead a series of smaller approaches and improvements that cumulatively reduce greenhouse gas emissions and improve social-ecological resiliency to unavoidable climate change impacts.

Most importantly, however, this Article posits that CC+ industries present an opportunity for administrative agencies to expand their comfort zones in terms of how they approach the regulation of new industries. Whatever an agency's primary mission (for marine aquaculture, for example, most explicit agency authority relates to environmental protection and preservation of navigation), it

363. *See, e.g.*, Matt Haber & Seema Kakade, *Revitalizing Greenhouse Gas Permitting Inside a Biden EPA*, 51 ENV'T L. REP. 10,384 (2021).

364. *See, e.g.*, Amanda R. Carrico, Michael P. Vandenbergh, Paul C. Stern, Gerald T. Gardner, Thomas Dietz & Jonathan M. Gilligan, *Energy and Climate Change: Key Lessons for Implementing the Behavioral Wedge*, 2 GEO. WASH. J. ENERGY & ENV'T L. 61 (2011); John R. Nolon, *The Land Use Stabilization Wedge Strategy: Shifting Ground to Mitigate Climate Change*, 34 WM. & MARY ENV'T L. & POL'Y REV. 1 (2009); Thomas Dietz, Gerald T. Gardner, Jonathan Gilligan, Paul C. Stern & Michael P. Vandenbergh, *Household Actions Can Provide a Behavioral Wedge to Rapidly Reduce US Carbon Emissions*, 106 PNAS 18,452 (2009).

is a rare administrative law apparatus that does not allow that agency sufficient discretion to pursue other beneficial goals at the same time—in climate change terminology, *co-benefits*. CC+ industries challenge the administrative state as a whole to fully evaluate these industries' relative costs and benefits, *including their abilities to address climate change*, and to promulgate policies and regulations that both acknowledge these co-benefits and appreciate the sometimes subtle nuances that distinguish the industries' different facets. As with marine aquaculture, it will likely often be the case that various aspects of a new industry differ regarding these co-benefits, in terms both of climate change efficacy and of broader risk-benefit (or, given that it's climate change, risk-risk) calculations.

In other words, CC+ industries require the administrative state to work with a scalpel, not a chainsaw, in sculpting law and policy if climate change co-benefits are to be maximally realized without sacrificing other regulatory goals. Thus, in marine aquaculture, finfish aquaculture generally presents agencies with a different environmental risk/climate change benefit analysis than either kelp or shellfish aquaculture, and agencies should use their authorities and discretion to acknowledge those differences. In addition, as is true with marine aquaculture, maximizing the climate change co-benefits of a new or expanding industry may require agencies to work together in new ways and to actively pick regulatory winners and losers if some facets of the industry to in fact offer more overall benefits to the public good.

In short, CC+ industries prove what the late Justice Scalia taught us more than thirty years ago: "Administrative law is not for sissies."[365] The first step, however, is for the U.S. administrative state to acknowledge that CC+ industries exist and are worthy of increased regulatory attention to recognize their climate change co-benefits.

365. Antonin Scalia, *Judicial Deference to Administrative Interpretations of Law*, 1989 DUKE L.J. 511, 511.