

A R T I C L E

ENSNARED: 21ST-CENTURY AQUACULTURE LAW AND THE COMING BATTLE FOR THE OCEAN

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SUMMARY

As overfishing has depleted wild fisheries, U.S. policymakers have pushed aquaculture as an ideal paradigm for ocean fisheries. However, the public perception and myths of finfish commercial aquaculture are far from its reality. This Article examines the industrial aquaculture debate through the lens of *Gulf Fishermens Ass'n v. National Marine Fisheries Service*, where conservationists and fishermen challenged the first-ever rulemaking to set up a new aquaculture industry in U.S. federal waters. It gives an overview of industrial net pen aquaculture and its adverse environmental and socioeconomic impacts; offers an “aquaculture law 101” overview, providing the legal and regulatory basis; and recounts *Gulf Fishermens* and its ramifications for open ocean aquaculture. It then details the post-*Gulf Fishermens* efforts to continue to promote aquaculture development in U.S. waters and the current regulatory and litigation landscape, and concludes with “lessons learned” for the broader debate over the future of our oceans.

As overfishing has depleted wild fisheries to the breaking point, many U.S. policymakers have pushed aquaculture, or farming fish, as the ideal new 21st-century paradigm for ocean fisheries. Internationally, other parts of the world have already shifted to an aquaculture industry model, the products of which dominate U.S. seafood imports. Indeed, aquaculture has become the fastest-growing animal food-producing industry in the world, expanding dramatically in the past 30 years and now supplying more than half the world’s seafood demand. The United States imports more than 80% of its seafood, about half of which is farmed, and while the U.S. aquaculture industry has mainly thus far consisted of inland or coastal farms, proponents for the past decade and a half have pushed hard for its expansion into the open ocean.

However, the public perception and myths of finfish commercial aquaculture, or fish farming, is far from its reality, at least at the industrial scale and form. While humans have farmed some aquatic environments for millennia in a regenerative fashion, modern industrial aquaculture bears little resemblance to its ancient predecessors. Instead, it more closely emulates the same factory production mindset and methods now dominant across U.S. farmland. And like the tragedy of industrial agriculture, industrial aquaculture causes similar environmental and socioeconomic damage: monoculture deserts, externalized environmental costs, species confined and crowded contrary to their natural behaviors, ecosystem destruction and/or colonization, pesticide and drug output and overuse, waste effluent pollution, displacement of traditional localized farmers/fishers with corporations, and the privatization of what were

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formerly public resources. And—again strikingly similar to industrial agriculture—nor do the purported benefits of industrial aquaculture withstand scrutiny.

The difference is mainly one of timing: whereas industrial agriculture has now had decades of entrenchment, the paradigm has yet to shift fully to the water, at least in the United States, and some parts of our oceans have yet to be so fundamentally altered. That wave is cresting, however, and as such society has reached an important inflection point to decide the future of the oceans, through law, values, and markets: whether to double down on the unsustainable factory farm model or chart a different path. Will the United States allow fish “CAFOs [concentrated animal feeding operations] of the sea” to proliferate the same way we have for pigs, chickens, turkeys, and cows? Which legal standards and duties are enacted by the U.S. Congress, applied by agencies, and codified by courts will have much to say about the answer.

This Article examines the 21st-century industrial aquaculture debate through the lens of a case study and its fallout. In *Gulf Fishermens Ass’n v. National Marine Fisheries Service*,¹ conservationists and fishermen challenged the first-ever rulemaking by the U.S. Department of Commerce to set up a new net pen finfish aquaculture industry in U.S. federal waters. The rules covered only the Gulf of Mexico, but the permit system promulgated was the Department’s test case for all federal waters planned subsequently, the culmination of a decade-long agency rulemaking.

Crucially, there is no U.S. law authorizing offshore aquaculture in federal waters, known as the “exclusive economic zone” (EEZ), from three to 200 miles off U.S. shores. Instead, the federal agency predicated its rulemaking on its authority over “fishing” under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) of 1976, after lobbying Congress unsuccessfully for new, aquaculture-specific authority for the decade prior to the rulemaking. In 2018, the reviewing district court agreed with the challengers, holding that fish farming was not fishing as defined by the statute, and struck down the regulations as ultra vires, scuttling the agency’s plans. Commerce appealed, but in 2020, the U.S. Court of Appeals for the Fifth Circuit affirmed across the board.

The precedential decisions together codify the differences between traditional fishing and industrial aquaculture, and underscore that the separate, novel socioeconomic and environmental impact considerations of aquaculture should not be shoehorned into oversight frameworks never intended for that purpose. The judicial guidance in the reasoning of the *Gulf Fishermens* decision to commercial aquaculture industrial proponents was blunt and straightforward: this is the wrong venue and the wrong approach. If proponents wish to establish a new aquaculture industry in U.S. ocean waters, they should go back to Congress and get new aquaculture-specific, 21st-century law passed that will responsibly regulate that new

activity and its environmental and socioeconomic risks to the oceans and fishing industries.

Since the *Gulf Fishermens* decision, two countries—Denmark and Argentina—chose to prohibit offshore aquaculture due to environmental impacts. In 2022, so did the state of Washington in its state waters. But elsewhere in the United States, industry and agency efforts to push aquaculture development through Congress continue to tread water. And instead—remarkably, but perhaps not surprisingly—renewed open ocean aquaculture development efforts in U.S. federal waters are nonetheless now underway, attempting to circumnavigate around the *Gulf Fishermens* decision and the need to pass new oversight legislation, yet again, even while other countries around the world respond to aquaculture’s environmental, socioeconomic, and public health problems with prohibitions.

This “damn the torpedoes” industry development movement is happening on multiple fronts at once. First, in May 2020, the then-Donald Trump Administration issued Executive Order No. 13921, Promoting American Seafood Competitiveness and Economic Growth, to encourage offshore aquaculture’s development on a national scale, under the guise of food insecurity needs related to the COVID pandemic. But executive orders cannot give agencies new authority, only direct them to act under existing congressional authority. Then, the U.S. Army Corps of Engineers (the Corps) issued nationwide permit (NWP) 56 under the Rivers and Harbors Act (RHA) in January 2021, which allows for adopting Corps districts to streamline review of aquaculture structures’ placement in state and federal ocean waters, a first. But it is entirely unclear how the RHA, originally passed in 1899, encompasses 21st-century aquaculture operations and their adverse impacts. And that decision is now under court challenge.

At the same time, the Department of Commerce, through its subagency the National Marine Fisheries Service (NMFS), designated two “aquaculture opportunity areas” in federal ocean waters off southern California’s coast and in the Gulf of Mexico (again!), defined as regions “suitable” for aquaculture. But Commerce’s fishing authority under the MSA was the very one struck down by the courts in *Gulf Fishermens*. On a regional scale, Commerce and NMFS also released for public comment a draft programmatic environmental impact statement (EIS) for industrial aquaculture in May 2021, and finalized it in August 2022.

An EIS is a National Environmental Policy Act (NEPA)-implementing document that essentially analyzes the foreseeable environmental and socioeconomic impacts of proposed agency actions or programs, here being amending fishery ecosystem plans to include industrial aquaculture in half of the United States’ EEZ surrounding the U.S. Pacific Islands Region. The amended regional plan is expected in 2023, but NEPA is a solely procedural statute that requires agencies to have underlying substantive authority to act, and it is again left unclear under exactly what organic authority the agency is acting. Such a decision likely portends a *Gulf Fishermens* litigation redux.

Finally, unable to enact an entire regional permitting program like that struck down in *Gulf Fishermens*, indus-

1. 968 F.3d 454, 50 ELR 20182 (5th Cir. 2020).

try has opted for a “whack-a-mole” approach, attempting to get agencies to approve individual experimental net pen facilities. The U.S. Environmental Protection Agency (EPA) granted the first Clean Water Act (CWA) national pollutant discharge elimination system (NPDES) permit for an offshore aquaculture facility in federal ocean waters to Ocean Era, Inc. in October 2020 for a single isolated finfish facility in the Gulf. That decision also is under court challenge. Additionally, in March 2020, the Corps issued a proposal to issue the first ever RHA §10 permit to an offshore shellfish facility, Avalon Aquafarms, in federal waters 3.3 miles offshore near Huntington Beach, California. A few months later, NMFS issued a notice of intent to prepare an EIS for Pacific Ocean Aquafarms, a finfish aquaculture facility in federal waters approximately four nautical miles off the San Diego coast.

And so, in sum, the seascape ahead appears murky and rocky, with big legal questions to be mulled and decided, which reflect the broader debate over societal values. What 21st-century U.S. ocean waters will look like, what activities will be prioritized, how they will be regulated, who will have access, how healthy their ecosystems will be, and who will benefit—essentially, *what the essence of oceans will be*—depends on the outcome.

Part I of this Article launches with an overview of industrial net pen aquaculture, the difference between commercial open ocean aquaculture and other forms, and its adverse environmental and socioeconomic impacts. In so doing, it steers through the difference between industrial aquaculture’s myths and its realities. Part II navigates an “aquaculture law 101” overview, providing the legal and regulatory basis. Part III sails into the story of *Gulf Fishermens*, its history, and why it matters, discussing the case’s broader ramifications for open ocean aquaculture. Part IV then tacks into the current winds, discusses the multi-pronged aftermath summarized above, bringing the reader up to the present, detailing the post-*Gulf Fishermens* efforts to continue to promote and approve aquaculture development in U.S. waters and the current regulatory and litigation landscape. Finally, Part V docks into port by providing “lessons learned” guidance for future trips, a sailor’s compass for the broader debate over the future of our oceans.

I. Overview of Industrial Aquaculture

A. Aquaculture 101: Aquaculture, Global Fisheries Markets, and the United States’ Role

Aquaculture has become the fastest growing animal food-producing industry in the world, expanding dramatically in the past 30 years and now supplying half of the world’s seafood demand.² Global production of aquaculture is

around \$265 billion.³ Total global fishery production from capture fisheries and aquaculture combined reached 214 million tons in 2020, with 57% of that coming from aquaculture.⁴ The top aquaculture-producing countries are China by far (two-thirds of world production), India, Vietnam, and Indonesia.⁵ The top aquaculture species are carp, shrimp, oysters, mussels, salmon (first in value), catfish, tilapia, and trout.⁶ Seafood imports account for the second largest portion of the U.S. trade deficit, after oil (\$17 billion in 2020).⁷

The United States imports 70%-85% of its seafood, half of which is farmed.⁸ America’s domestic aquaculture industry currently meets only 5%-7% of domestic demand for seafood, mostly catfish.⁹ Marine products such as farmed oysters, clams, mussels, and salmon supply about 1% of American seafood demand.¹⁰

Despite industrial aquaculture’s status as one of the fastest-growing global food industries, at the same time it has become one of the most significant threats to our waters and the health of aquatic organisms, endangered species, and human health.¹¹ In recent decades, finfish farming in nearshore or coastal waters has experienced tremendous growth. Global production of farmed ocean fish grew at an average annual rate of 9.3% in the past decade.¹²

Although comparatively new to aquaculture, with persistent lobbying presence and strong federal support, U.S. aquaculture is a booming \$1.5 billion industry.¹³ U.S. farming of ocean fish far surpassed the global growth rate: between 1989 and 1998, U.S. production of farmed Atlantic salmon increased by 468%.¹⁴ While interest is growing in diversifying the species farmed, the predominant salmon farming industry has dwindled, due to lack of suitable nearshore sites and public uproar against the adverse environmental and health effects of industrialized aquacul-

2. FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, THE STATE OF WORLD FISHERIES AND AQUACULTURE 2022: TOWARDS BLUE TRANSFORMATION xvi (2022), <https://reliefweb.int/report/world/state-world-fisheries-and-aquaculture-2022-enarruzh>.

3. *Id.* at 1.

4. *Id.* at xvi.

5. *Id.* at 30.

6. *Id.* at 42-45.

7. Andrea Miller, *The U.S. Is Not Harvesting as Many Fish as It Could, Driving Up Imports*, CNBC (Oct. 5, 2022), <https://www.cnbc.com/2022/10/05/us-underfishing-drives-up-imports.html>.

8. National Oceanic and Atmospheric Administration (NOAA) Fisheries, *Sustainable Seafood: Seafood Communities*, <https://www.fisheries.noaa.gov/national/aquaculture/us-aquaculture#:~:text=The%20United%20States%20now%20ranks,is%20produced%20via%20foreign%20aquaculture> (last visited Mar. 20, 2023).

9. NOAA FISHERIES, 2020 FISHERIES OF THE UNITED STATES 16-17 (2022), <https://media.fisheries.noaa.gov/2022-05/Fisheries-of-the-United-States-2020-Report-FINAL.pdf>.

10. *Id.*

11. See U.S. GOVERNMENT ACCOUNTABILITY OFFICE, GAO-08-594, OFFSHORE MARINE AQUACULTURE: MULTIPLE ADMINISTRATIVE AND ENVIRONMENTAL ISSUES NEED TO BE ADDRESSED IN ESTABLISHING A U.S. REGULATORY FRAMEWORK 1 (2008).

12. FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, THE STATE OF WORLD FISHERIES AND AQUACULTURE 2012, at 36 (2012).

13. *Id.* at 16.

14. REBECCA J. GOLDBURG ET AL., PEW OCEANS COMMISSION, MARINE AQUACULTURE IN THE UNITED STATES: ENVIRONMENTAL IMPACTS AND POLICY OPTIONS 2 (2001); see FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, YEARBOOK OF FISHERY STATISTICS: AQUACULTURE PRODUCTION (2000).

ture.¹⁵ Thus—driven in part by lucrative sales of ocean fish in high-end markets, the decreasing availability of near-shore sites, and the opportunity to put the impacts of its activities beyond sight and out of mind—the aquaculture industry has eyed development farther out to sea, past busy state waters and into the federally regulated U.S. EEZ.¹⁶

B. Definitions and What Aquaculture Forms Are Not Covered Here

Aquaculture, or fish farming, is a broadly defined term that can mean many ways of raising many different types of fish species in many different types of settings.¹⁷ As such, it is important to define what this Article *will* cover, and what is *beyond* its scope.

First, aquaculture has a long history: for centuries, native cultures around the globe farmed some types of fish in various sustainable ways (and some still do). The traditional rice-fish aquaculture of southeast Asia is one famous example.¹⁸ In this type of symbiotic farming normally using carp, the flooded rice fields provide shelter as well as vegetation and nutrients, while the fish produce nutrition for the plants in the form of carbon dioxide and its waste. The cycle reduces the need for any external chemicals, increasing biodiversity.¹⁹

In Hawaii, native people have practiced sustainable aquaculture since at least the 13th century²⁰; in fact, the stone and coral fishponds Hawaiians built on the south coast of Molokai 800 years ago are still in use.²¹ The walls of the ponds allow seawater to flow in and out, and gates just big enough for small fish to swim in; but like the proverbial *Hotel California*,²² once fish get too big to fit thru the gate, they can never leave.²³ Hawaiian advocates have worked for decades to rebuild this aspect of their culture, to make it a reality once again.²⁴ As discussed below, these regenerative forms are the antithesis of the industrialized model discussed here.

Second, there is commercial *freshwater* aquaculture, which takes place in inland holding ponds, such as the

farming of catfish, trout, and tilapia, both in the United States and internationally.²⁵ These types of freshwater aquaculture have their own pros and cons and debate over their sustainability, which vary depending on various global locations.²⁶ In general, freshwater-farmed herbivorous fish like catfish and tilapia have a primarily vegetarian diet and thus require less high-protein fish feed than carnivorous species like salmon or trout,²⁷ reducing one of the impacts discussed in detail below with open ocean fish farming: the overfishing of global forage fisheries to grind them up for fish feed and fish oil in order to produce higher market-priced aquacultured fish. This type of freshwater, inland aquaculture is also outside the scope of this Article.

Third, there is *shellfish* aquaculture, the farming of various shellfish bivalve species in coastal areas in the United States and globally, including shrimp, oysters, mussels, and more. This is more than one-third of the world's aquaculture, with more than 70% in China.²⁸ These facilities vary by location and type, with corresponding varying degrees of sustainability and adverse environmental impacts.

On the one hand, shellfish are filter feeders, cleaning the water in which they live.²⁹ They can also sequester carbon.³⁰ On the other hand, some forms are notoriously destructive, such as shrimp farming in southeast Asia, which since the 1980s has decimated the globe's mangrove coastline ecosystems,³¹ nurseries for marine life, which also sequester vast amounts of carbon in their complex root systems.³² The replacement of these naturally protective mangrove forest coasts with concrete shrimp farm ponds also eliminated natural buffers against cyclone storm surges, now made more extreme by climate change and sea-level rise.³³

In the United States, Washington State is ground zero for shellfish aquaculture, where it is a greater than \$150

15. MARINE AQUACULTURE TASK FORCE, WOODS HOLE OCEANOGRAPHIC INSTITUTE, SUSTAINABLE MARINE AQUACULTURE: FULFILLING THE PROMISE; MANAGING THE RISKS 16 (2007).

16. See U.S. GOVERNMENT ACCOUNTABILITY OFFICE, *supra* note 11, at 1.

17. National Oceanic and Atmospheric Administration, *What Is Aquaculture?*, <https://oceanservice.noaa.gov/facts/aquaculture.html> (defining aquaculture).

18. *The Chinese Symbiotic Rice-Fish Aquaculture System*, U. BRIGHTON: PRODUCTIVE URB. LANDSCAPES BLOG, <https://blogs.brighton.ac.uk/pultr/related-design-projects/the-chinese-symbiotic-rice-fish-aquaculture-system/> (last visited Mar. 4, 2023).

19. Feifan Li et al., *Biodiversity and Sustainability of the Integrated Rice-Fish System in Hani Terraces, Yunnan Province, China*, 20 AQUACULTURE REPS. 100763 (2021), available at <https://www.sciencedirect.com/science/article/pii/S2352513421001794>.

20. Hawaii Tourism Authority, *Hawaiian Fishponds*, <https://www.gohawaii.com/islands/molokai/regions/central-molokai/fishponds-of-molokai> (last visited Mar. 4, 2023).

21. *Id.*; Erica Gies, *Hawaii's Ancient Aquaculture Revival*, BIOGRAPHIC (June 12, 2019), <https://www.biographic.com/hawaii-ancient-aquaculture-revival/>.

22. THE EAGLES, *Hotel California*, on HOTEL CALIFORNIA (Asylum Records 1976).

23. *Id.*

24. Gies, *supra* note 21.

25. Nathan Stone, *Catfish Farming*, FRESHWATER AQUACULTURE (Aug. 26, 2019), <https://freshwater-aquaculture.extension.org/catfish-farming/>; Greg Lutz, *The Lutz Report: US Catfish Industry Enters a New Era*, FISH SITE (July 28, 2020), <https://thefishsite.com/articles/us-catfish-industry-enters-a-new-era>.

26. Elisabeth Rosenthal, *Another Side of Tilapia, the Perfect Factory Fish*, N.Y. TIMES (May 2, 2011), <https://www.nytimes.com/2011/05/02/science/earth/02tilapia.html>.

27. Pallab Sarker, *Taking Fish Out of Fish Feed Can Make Aquaculture a More Sustainable Food Source*, CONVERSATION (Dec. 14, 2020), <https://theconversation.com/taking-fish-out-of-fish-feed-can-make-aquaculture-a-more-sustainable-food-source-150728>.

28. Shucheng Zhang et al., *Early Impact of COVID-19 Pandemic on the Molluscan Shellfish Supply Chain in China*, 213 OCEAN & COASTAL MGMT. 105852 (2021), available at <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8497015/>.

29. Rachel Lovell, *The Simple Food That Fights Climate Change*, BBC, <https://www.bbc.com/future/feature/bespoke/follow-the-food/the-simple-shellfish-that-fights-climate-change.html> (last visited Mar. 4, 2023).

30. Australian Centre for International Agricultural Research, *Blue Economy: Valuing the Carbon Sequestration Potential in Oyster Aquaculture*, <https://www.aciar.gov.au/project/fis-2020-175> (last visited Mar. 4, 2023).

31. Alister Doyle, *Mangroves Under Threat From Shrimp Farms: U.N.*, REUTERS (Nov. 14, 2012), <https://www.reuters.com/article/us-mangroves/mangroves-under-threat-from-shrimp-farms-u-n-idUSBRE8AD1EG20121114>; *Is Your All-You-Can-Eat Shrimp Killing the Mangroves?*, GRIST (Jan. 4, 2012), <https://grist.org/food/2012-01-03-is-your-all-you-can-eat-shrimp-killing-the-mangroves/>.

32. Gabriel Popkin, *Mangrove Loss Has Fallen Dramatically, but the Forests Are Still in Danger*, WASH. POST (Sept. 12, 2020), https://www.washingtonpost.com/science/mangrove-forest-loss-protection/2020/09/11/e722652a-d694-11ea-9c3b-dfc394c03988_story.html.

33. *Id.*

million-a-year industry, farming oysters, clams, mussels, and geoducks.³⁴ Bivalves are either grown on the ocean floor (“bottom culture”) or with some kind of support (“off-bottom culture”), both of which require significant amounts of plastic.³⁵ For example, geoducks, a type of clam, are often grown in the substrate by using polyvinyl chloride (PVC) tubes stuck into the bed (at a rate of 42,000 tubes per acre), which are then covered with anti-predator netting.³⁶ And oysters may be grown using bottom culture; long lines (oysters suspended on nylon ropes strung on stakes in rows in tidal bed); rack and bag culture (plastic net bags hold oysters, rack suspends off ground, including emerging “flip bag” technique); or stake culture (oyster attached to stakes in tidal bed).³⁷ To prepare the tide bed, growers may “harrow” (use an oversized rake over the tide beds), till, or add crushed oyster shell or gravel to the ocean floor.

Once the shellfish are fully grown, harvesting may be done using hand rakes, hydraulic harvesters, or mechanical harvesters.³⁸ In Washington today, industrial shellfish aquaculture exists in Willapa Bay, Grays Harbor, Hood Canal, and Puget Sound, covering between 38,700 and 50,000 acres of tidelands (or about one-quarter of all tidelands) in the state.³⁹

Finally, there is *recirculating* indoor tank aquaculture.⁴⁰ This is an inland, indoor form of aquaculture that takes place in closed containers in a “controlled” environment rather than open air.⁴¹ The water is recirculated, meaning less water is required, and there is less risk from fish escapes, pollution, and other environmental impacts normally associated with traditional outdoor, net pen aquaculture. As such, in theory, recirculating inland aquaculture systems could be the most sustainable form of aquaculture.

But what sounds great in theory is not always practicable in the real world. Operating recirculating systems takes significant energy and technology, and there are still major questions as to whether they will ever be commercially viable at market share scale.⁴² Larger recirculating facilities are more vulnerable to upsets during the production cycle, such as issues with water infrastructure, electrical outages, and insufficient filtration.⁴³ This makes it difficult for recirculation ventures to increase production and achieve economies of scale.

C. Industrial Finfish Open Ocean Aquaculture

Now, what *is* covered. The focus here is open ocean aquaculture, not aquaculture done inland or in coastal ecosystems. It is finfish, not shellfish species. And it is the carnivorous finfish species, not herbivorous species, because these are the fish that command the highest market prices and consequently dominate the aquaculture seafood market, particularly salmon. Why this focus? Because these are the species and methods now being proposed for U.S. federal waters, and these are the species grown in a similar manner in the open ocean waters of other nations around the globe, but particularly salmon,⁴⁴ albacore jack, red drum, striped bass,⁴⁵ and trout.⁴⁶

These fish are grown in floating or submersible net pens or cages. A cage or net pen refers to a system that confines finfish in a mesh enclosure placed directly in the water, allowing for free exchange between the farmed fish and the surrounding environment.⁴⁷ Operators commonly use flexible nylon or polyethylene nets for cages and pens, while cage flotation materials often include bamboo, PVC pipes/containers, steel or plastic drums, Styrofoam, or aluminum floats.⁴⁸ Operators frequently deploy these cages and pens in groups or clusters, sharing common walkways, work areas, and protective netting.⁴⁹ The facilities remain in place with a complex system of anchors, chains, cables, and buoys.⁵⁰ Designs for net pens and cages continue to evolve, as EPA has recently approved a submersible net pen system for

34. Rachel Sapin, *The Largest Shellfish Economy in the US Could Be Shut Down by a Permitting Issue*, INTRAFISH (Oct. 21, 2019), <https://www.intrafish.com/aquaculture/the-largest-shellfish-economy-in-the-us-could-be-shut-down-by-a-permitting-issue/2-1-691410>.

35. Seth J. Theuerkauf et al., *Habitat Value of Bivalve Shellfish and Seaweed Aquaculture for Fish and Invertebrates: Pathways, Synthesis, and Next Steps*, REVS. AQUACULTURE (Apr. 7, 2021), <https://oceanium.world/wp-content/uploads/2021/07/Reviews-in-Aquaculture-habitat-value.pdf>.

36. Sam Mehmet, *Expansion of Washington Industrial Shellfish Aquaculture Ruled Unlawful*, NEW FOOD (Oct. 16, 2019), <https://www.newfoodmagazine.com/news/95755/expansion-of-washington-industrial-shellfish-aquaculture-ruled-unlawful/>.

37. Connie Lu, *The Different Methods of Growing Oysters*, PANGEA SHELLFISH CO. (July 3, 2015), <https://www.pangeashellfish.com/blog/the-different-methods-of-growing-oysters/>; see also NOAA ET AL., GULF COAST OFF-BOTTOM OYSTER FARMING GEAR TYPES, <http://shellfish.ifas.ufl.edu/wp-content/uploads/Off-bottom-Oyster-Culture-Gear-Types.pdf>.

38. U.S. ARMY CORPS OF ENGINEERS SEATTLE DISTRICT, PROGRAMMATIC BIOLOGICAL ASSESSMENT: SHELLFISH ACTIVITIES IN WASHINGTON STATE INLAND MARINE WATERS (2015), https://www.nws.usace.army.mil/Portals/27/docs/regulatory/NewsUpdates/Shellfish_PBA_30_Oct_2015.pdf.

39. Conor O'Brien, *Seattle Army Corps District Unlawfully Expands Shellfish Harvesting*, *Suit Says*, WESTLAW ENERGY & ENV'T DAILY BRIEFING, 2017 WL 3494903 (Aug. 16, 2017).

40. JACOB BREGNBALLE, FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS & EUROFISH INTERNATIONAL ORGANISATION, A GUIDE TO RECIRCULATION AQUACULTURE (2015), <https://www.fao.org/3/i4626e/i4626e.pdf>.

41. ScienceDirect, *Recirculating Aquaculture Systems*, <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/recirculating-aquaculture-systems> (last visited Mar. 4, 2023).

42. *Are Recirculating Aquaculture Systems the Future of Mariculture?*, EUROFISH INT'L ORG. (Oct. 21, 2021), <https://eurofish.dk/are-recirculating-aquaculture-systems-the-future-of-mariculture/>.

43. Megan Howell, *Scaling RAS Projects Might Need a Rethink*, FISH SITE (Nov. 9, 2021), <https://thefishsite.com/articles/scaling-ras-projects-might-need-a-rethink-mark-rottmann-icell-aqua>.

44. In 2019, 37% of all U.S. aquaculture produced salmon. See KENNETH RILEY ET AL., NOAA, UNITED STATES AQUACULTURE ATLAS: GULF OF MEXICO 6 (2021), <https://repository.library.noaa.gov/view/noaa/33304>.

45. *Id.* at 10.

46. Mississippi State University Coastal Research and Extension Center, *Finfish Aquaculture Production, Farm-Gate Values, and Prices in the United States*, <https://coastal.msstate.edu/finfish-aquaculture-production-farm-gate-values-and-prices-united-states> (last updated Mar. 3, 2023).

47. ELVIRA A. BALUYUT, FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, AQUACULTURE SYSTEMS AND PRACTICES: A SELECTED REVIEW ch. 4 (1989), <https://www.fao.org/3/t8598e/t8598e05.htm>.

48. *Id.*

49. C. Greg Lutz, *Offshore Aquaculture Production*, AGRIC. MKTG. RES. CTR. (Feb. 2022), <https://www.agmrc.org/commodities-products/aquaculture/offshore-aquaculture-production>.

50. *Id.*

Veella Epsilon, the first permitted finfish facility in U.S. federal waters, using a rigid copper alloy mesh in its cages.⁵¹

D. Adverse Impacts From Open Ocean Aquaculture

One reason industrial open ocean aquaculture remains a subject of great controversy in the United States and abroad is because it carries with it a flotilla of well-known adverse environmental and intertwined socioeconomic consequences. These adverse impacts include but are not limited to the escape of farmed fish from their containment; the spread of potentially deadly diseases and parasites from aquaculture facilities to wild fish and other marine wildlife; the pollution of ocean ecosystems from the inputs (e.g., drugs, pesticides, fungicides, algacides) and outputs (wastes) of industrial aquaculture; the privatization of public ocean resources; threats to marine life and marine ecosystems from aquaculture systems; market displacement and price competition from cheaply produced farmed fish; adverse economic effects on fishing businesses; trickle-down effects to communities and families that depend on healthy wild fish stocks and ocean ecosystems for their livelihoods; and infringement on Indigenous peoples' rights to traditional fishing grounds.

1. Escapes

It is well accepted that fish grown in net pens and cages regularly escape into surrounding waters. The number of fish escapes from industrial aquaculture is immense: more than 25 million fish worldwide from 1996-2012.⁵² As William Shakespeare explained, “what’s past is prologue,”⁵³ and aquaculture’s abysmal track record shows that continuous and chronic escapes are inevitable. This can happen from multiple causes: equipment failure, human error, storms. And deep ocean waters are rougher than nearshore waters, increasing further the likelihood of fish escapes.⁵⁴

To give just a few examples, in January 2020, 73,600 salmon escaped from a net pen during a storm in Mowi, Scotland, marking the third major escape in the area since October 2019.⁵⁵ From facilities in Norway, a series of storms resulted in approximately four million escaped

fish over eight years.⁵⁶ Even without extreme weather, in August 2017, an industrial net pen operation maintained by Cooke Aquaculture Pacific, LLC allowed for approximately 250,000 farmed Atlantic salmon to escape into Puget Sound and the Pacific.⁵⁷ In Puget Sound, a “normal” year without a large-scale failure resulting in a massive fish escape still results in thousands of escaped fish.⁵⁸ Following this catastrophic 2017 incident, Washington State first banned the farming of non-native fish in 2018 and then in 2022 banned all finfish net pen aquaculture in state waters.⁵⁹

AquaChile, for example, reported the escape of 787,929 fish in 2013 due to bad weather damaging cages.⁶⁰ Five years later, 680,000 fish escaped from Marine Harvest Chile due to bad weather.⁶¹ Bakkafrost Faroe Islands, too, reported weather as the cause of 109,515 fish escaping in 2017; Scottish Sea Farms in Scotland, of 258,000 fish escaping in 2000; and Huon Aquaculture in Tasmania, of 120,000 fish escaping in 2018.⁶² Recognizing the regularity of fish escapes from ocean-based net pens, the U.S. Council on Environmental Quality (CEQ) has concluded that it “must be assumed that escapes will occur” from net pens, even in the absence of severe weather.⁶³

Once escaped, aquacultured fish threaten already-depleted wild fish populations in the open ocean environment in myriad ways.⁶⁴ They compete for food and habitat and spawning areas and displace other marine species. For example, Atlantic salmon that have escaped from aquaculture operations in Washington State and British Columbia

51. U.S. EPA & U.S. ARMY CORPS OF ENGINEERS, DRAFT BIOLOGICAL EVALUATION: KAMPACHI FARMS, LLC-VELELLA EPSILON 5 (2019), https://www.epa.gov/sites/default/files/2020-10/documents/ocean_era_inc_-_velella_epsilon_environmental_assessment_ea_including_essential_fish_habitat_assessment_baseline_environmental_survey_and_ocean_discharge_criteria_evaluation.pdf.

52. CENTER FOR FOOD SAFETY, REPORTED ESCAPES FROM FISH FARMS 1996-2012, https://www.centerforfoodsafety.org/files/fish-escapes-chart_14767.pdf.

53. WILLIAM SHAKESPEARE, *THE TEMPEST* act 2, sc. 1.

54. Marc Gunther, *Can Deepwater Aquaculture Avoid the Pitfalls of Coastal Fish Farms?*, *YALE ENV'T* 360 (Jan. 25, 2018), <https://e360.yale.edu/features/can-deepwater-aquaculture-avoid-the-pitfalls-of-coastal-fish-farms>.

55. *Escape Calls High Energy Salmon Sites Into Question*, *FISH SITE* (Jan. 20, 2020), <https://thefishsite.com/articles/mowi-reports-mass-salmon-escape-from-colonsay>.

56. PACIFIC ISLANDS REGIONAL OFFICE, NMFS, PACIFIC ISLANDS AQUACULTURE MANAGEMENT PROGRAM DRAFT PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT (2021) [hereinafter PIR DPEIS].

57. E. Tammy Kim, *Washington State's Great Salmon Spill and the Environmental Perils of Fish Farming*, *NEW YORKER* (Sept. 13, 2017), <https://www.newyorker.com/tech/elements/washington-states-great-salmon-spill-and-the-environmental-perils-of-fish-farming>. Washington subsequently passed a law prohibiting Atlantic salmon net pen aquaculture in Washington State waters by 2022. John Ryan, *After 3 Decades, Washington State Bans Atlantic Salmon Farms*, *NPR* (Mar. 26, 2018), <https://www.npr.org/sections/thesalt/2018/03/26/597019406/after-three-decades-washington-state-bans-atlantic-salmon-farms>.

58. NMFS, REINSTITUTION OF ENDANGERED SPECIES ACT SECTION 7(a)(2) BIOLOGICAL OPINION, AND MAGNUSON-STEVENSON FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE FOR THE ENVIRONMENTAL PROTECTION AGENCY'S APPROVAL OF WASHINGTON STATE DEPARTMENT OF ECOLOGY'S SEDIMENT MANAGEMENT STANDARDS (WAC 173-204-412) REGARDING MARINE FINFISH REARING FACILITIES 126 (2022), https://wildfishconservancy.org/wp-content/uploads/2022/04/2022_02-16_Fin-fishRearingReinit_WCRO-2018-00286-3.pdf.

59. *Finfish Net Pen Aquaculture Banned in Washington*, *KING 5* (Nov. 18, 2022), <https://www.king5.com/article/tech/science/environment/washington-fin-fish-net-pen-aquaculture-ban/281-41ec49e2-251d-4678-9b8e-5a7edfe7ead4>; Isabella Breda, *WA Bans Commercial Net-Pen Fish Farming in State Waters*, *SEATTLE TIMES* (Nov. 18, 2022), <https://www.seattletimes.com/seattle-news/environment/wa-lands-commissioner-bans-net-pen-fish-farming-in-state-waters/>.

60. Lola Navarro, *Here Are the Largest Recorded Farmed Atlantic Salmon Escapes in History*, *INTRAFISH* (Aug. 30, 2019), <https://www.intrafish.com/aquaculture/here-are-the-largest-recorded-farmed-atlantic-salmon-escapes-in-history/2-1-388082>.

61. *Id.*

62. *Id.*

63. CEQ & OFFICE OF SCIENCE AND TECHNOLOGY POLICY, CASE STUDY NO. 1: GROWTH-ENHANCED SALMON 23 (2001), <https://clintonwhitehouse5.archives.gov/media/pdf/salmon.pdf>.

64. PIR DPEIS, *supra* note 56, at 158.

compete with wild Pacific stocks, and increasing numbers of Atlantic salmon have been observed returning to rivers on the West Coast.⁶⁵ In the Atlantic region, the U.S. Fish and Wildlife Service (FWS) has determined that “Atlantic salmon that escape from farms and hatcheries pose a threat to native Atlantic salmon populations.”⁶⁶ And escaped fish will often spread a multitude of parasites and diseases to wild stocks, which could prove fatal when transmitted.⁶⁷

Studies have also shown that when farmed and wild fish interbreed, their offspring have diminished survival skills, reduced fitness, and potentially altered life history characteristics such as altered timing of development events.⁶⁸ Due to the practice of genetic selection in fish farming—inbreeding related fish, for example, to increase growth rates over time—escape and interbreeding of farmed fish with wild fish ultimately reduces genetic diversity, decreasing the resiliency of our invaluable marine resources. For example, researchers in Ireland have found that the interactions of farm escapees and wild salmon reduced the overall fitness of wild species and could lead to the extinction of wild populations.⁶⁹

Even when aquaculture operations source broodstock from the wild, escape poses a threat to wild stocks.⁷⁰ The longer a broodstock line is developed (i.e., bred to improve growth, quality, and disease resistance, etc.), the greater the chance that their genes may begin to drift from their wild counterparts.⁷¹ Imagine indoor house cats suddenly set out in the wild to fend for themselves. Escaped salmon pass that genetic makeup to hybrid wild salmon, and they lack the awareness needed to thrive and survive.⁷² And recapturing escaped fish comes with its own adverse impacts. In February 2022, NMFS noted in its biological opinion on aquaculture in the Puget Sound that efforts to recapture escaped fish result in significant bycatch.⁷³ These efforts continue despite the likely resultant harm and infeasibility of recapture.⁷⁴

2. Increased Risk of Disease and Parasite Transmission

Caging millions of genetically identical fish in a confined, concentrated space is a breeding ground for parasites and disease, inducing faster evolutions toward more resistant strains. Thus, even when aquacultured fish do not escape, they can still harm wild fish by increasing the risk of pathogens, viruses, parasites, and diseases that are transferable between aquacultured fish and wild fish.⁷⁵ Recent research indicates that the probability of detecting pathogen environmental DNA is 2.72 times higher at active versus inactive salmon farm sites.⁷⁶

This recipe invariably leads to disease and parasite outbreaks that are difficult to control, which can then spread to nearby wild fish, as with sea lice in farmed Atlantic salmon.⁷⁷ Sea lice are parasites that eat at fishes’ skin and muscle, making them vulnerable to infections (or eating them alive).⁷⁸ Norway’s wild salmon population has been cut in half since the introduction of their aquaculture industry, partially because of the spread of sea lice from aquacultured fish to wild salmon runs passing the net pens during their ocean migration.⁷⁹ Studies have also shown Scotland’s salmon farming industry has harmed its wild salmon populations through sea lice and other impacts.⁸⁰ Similarly, the rise of Canada’s farmed salmon industry has corresponded with the region’s plummeting wild salmon populations, with sea lice and other pathogens a major culprit.⁸¹ In the United States, a massive viral outbreak in Atlantic salmon net pens off the coast of Bainbridge Island in 2012 led to the deaths of more than one million pounds of farmed Atlantic salmon.⁸²

65. REBECCA J. GOLDBURG ET AL., PEW OCEANS COMMISSION, MARINE AQUACULTURE IN THE UNITED STATES: ENVIRONMENTAL IMPACTS AND POLICY OPTIONS (2001), https://fsi-live.s3.us-west-1.amazonaws.com/s3fs-public/marine_aquaculture_pew_2001.pdf.

66. Endangered and Threatened Species; Proposed Endangered Status for a Distinct Population Segment of Anadromous Atlantic Salmon (*Salmo salar*) in the Gulf of Maine, 64 Fed. Reg. 62627, 62635 (Nov. 17, 1999).

67. JILLIAN FRY ET AL., JOHNS HOPKINS UNIVERSITY CENTER FOR A LIVABLE FUTURE, ECOSYSTEM AND PUBLIC HEALTH RISKS FROM NEARSHORE AND OFFSHORE FINFISH AQUACULTURE 6-7 (2018), <https://clf.jhsph.edu/sites/default/files/2019-09/ecosystem-and-public-health-risks-from-nearshore-and-offshore-finfish-aquaculture.pdf>.

68. This occurs because farmed fish selected for aquaculture are bred to thrive in controlled, rather than wild, environments. CONG. RSCH. SERV., RL32694, OPEN OCEAN AQUACULTURE 7 (2010), <https://crsreports.congress.gov/product/pdf/RL/RL32694/19>; see also Stephen Castle, *As Wild Salmon Decline, Norway Pressures Its Giant Fish Farms*, N.Y. TIMES (Nov. 6, 2017), <https://www.nytimes.com/2017/11/06/world/europe/salmon-norway-fish-farms.html>.

69. Maritza Sepúlveda et al., *Escaped Farmed Salmon and Trout in Chile: Incidence, Impacts, and the Need for an Ecosystem View*, 4 AQUACULTURE ENV’T INTERACTIONS 277-78 (Dec. 19, 2013), <https://www.int-res.com/articles/aei2013/4/q004p273.pdf>.

70. PIR DPEIS, *supra* note 56, at 171.

71. *Id.*

72. Castle, *supra* note 68.

73. NMFS, *supra* note 58.

74. *Id.* at 105.

75. Castle, *supra* note 68; Samuel Shephard & Patrick Gargan, *Wild Atlantic Salmon Exposed to Sea Lice From Aquaculture Show Reduced Marine Survival and Modified Response to Ocean Climate*, 78 ICES J. MARINE SCI. 368 (2021), available at <https://academic.oup.com/icesjms/article/78/1/368/5864917>.

76. L. Neil Frazer et al., *Environmental DNA From Multiple Pathogens Is Elevated Near Active Atlantic Salmon Farms*, 287 PROC. ROYAL SOC’Y B 20202010 (2020), available at <http://dx.doi.org/10.1098/rspb.2020.2010>.

77. Mark J. Costello, *How Sea Lice From Salmon Farms May Cause Wild Salmonid Declines in Europe and North America and Be a Threat to Fishes Elsewhere*, 276 PROC. ROYAL SOC’Y B 3385 (2009), available at <https://royalsocietypublishing.org/doi/10.1098/rspb.2009.0771>.

78. Castle, *supra* note 68; Brian Owens, *Overlooked Sea Louse May Be a Big Problem for Salmon*, HAKAI MAG. (Sept. 16, 2020), <https://hakaimagazine.com/news/overlooked-sea-louse-may-be-a-big-problem-for-salmon/>.

79. Castle, *supra* note 68.

80. Fiona Harvey, *Global Salmon Farming Harming Marine Life and Costing Billions in Damage*, GUARDIAN (Feb. 11, 2021), <https://www.theguardian.com/environment/2021/feb/11/global-salmon-farming-harming-marine-life-and-costing-billions-in-damage>.

81. Tatum McConnell, *2022 Could Be the Beginning of the End for Open-Net Fish Farms in Canada*, SCIENCELINE (Feb. 25, 2022), <https://scienceline.org/2022/02/2022-could-be-the-beginning-of-the-end-for-open-net-fish-farms-in-canada/>.

82. *New Federal Analysis Finds Puget Sound Commercial Net Pens Are Harming Salmon, Steelhead, and Other Protected Fish*, OUR SOUND, OUR SALMON (May 20, 2022), <https://www.oursound-oursalmon.org/news/2022/5/18/new-federal-analysis-finds-puget-sound-commercial-net-pens-are-harming-salmon-steelhead-and-other-protected-fish>.

3. Ocean Pollution From Inputs (Drugs and Chemicals) and Outputs (Wastes)

First, the inputs. Any time livestock operations confine animals in cages—whether they be pigs, chickens, cows, or, in this case, fish—preventing their natural behaviors, and do it in large numbers, the dense conditions are ripe for increasing disease transmission, a problem for the confined animals, and, as noted above, one that can be spread and also harm wild fish.

The “solution”? The prophylactic use of large doses of drugs and chemical additives in industrial aquaculture: antibiotics,⁸³ pesticides,⁸⁴ fungicides, antifoulants, and hormones. The majority of these chemicals are applied directly into the water, yet little is known about how this significant new form and method of pollution release may affect marine ecosystems, other aquatic organisms, or human health. Indeed, just as with land CAFOs of pigs and chickens, studies have concluded that reliance on antibiotic applications in fish farming has fostered the development of bacterial antibiotic resistance in our waters.⁸⁵ In fact, the surrounding environment directly absorbs up to 75% of antibiotics used by industrial aquaculture.⁸⁶

Pesticides are routinely used in aquaculture, with adverse effects on the surrounding environment.⁸⁷ For example, a 2021 report showed that when Scotland tried to address its sea lice epidemic, insecticide products containing azamethiphos (an organophosphate), deltamethrin, and hydrogen peroxide contaminated the surrounding seawater, threatening swimmers in the areas around the farms.⁸⁸ Further, use of emamectin benzoate for sea lice has caused “widespread damage to wildlife,” including “substantial, wide-scale reductions” in crabs, lobsters, and other crustaceans.⁸⁹ In Nova Scotia, an 11-year-long study found

that lobster catches plummeted as harvesters got closer to marine finfish aquaculture facilities.⁹⁰

Aquaculture operations also frequently use formaldehyde as a fungicide.⁹¹ But formaldehyde poses risks to both public health and the marine ecosystem. Namely, it is highly toxic to invertebrate species, integral to the food chain, wreaking havoc on ecosystems.⁹² Additionally, formaldehyde is a “probable human carcinogen” and poses a risk to public health.⁹³

Antifoulants, such as copper, also pose risks to the surrounding waters. Aquaculture operators use antifouling coating on equipment to prevent marine organisms from covering pens and nets, which create lower oxygen levels within nets and, as a result, slower fish growth.⁹⁴ However, extensive use of copper for antifouling purposes bioaccumulates and leads to high copper concentrations in sediments near aquaculture facilities.⁹⁵

And mirroring the current herbicide-resistant “superweed” epidemic currently covering 120 million acres of U.S. industrial agriculture, a 2022 study showed that sea lice are showing widespread resistance to pesticides used to try and control them.⁹⁶ Recent research indicates that more than half of the sea lice at fish farms on both sides of the Atlantic Ocean are resistant to both organophosphates and pyrethroids, even at fish farms that do not use chemicals.⁹⁷ As we have already seen in industrial agriculture, increased resistance from overuse creates a pesticide “treadmill,” with ever-increasing toxic cocktails needed to kill the pests.

Second, there are also “outputs” of these industrial facilities. Industrial aquaculture unloads massive amounts of pollution and wastes directly into the ocean environment, including excess fish feed, dead fish, and fish feces, resulting in nutrient pollution and eutrophication (the

83. Matilde Mereghetti, *Antibiotic Resistance Risk Is Growing Issue for Aquaculture*, UNDERCURRENT NEWS (Feb. 2, 2018), <https://www.undercurrentnews.com/2018/02/02/antibiotic-resistance-risk-is-growing-issue-for-aquaculture/>.

84. *Changes to Canadian Aquaculture Rule Raises Pesticide Concerns*, BEYOND PESTICIDES: DAILY NEWS BLOG (Feb. 20, 2015), <https://beyondpesticides.org/dailynewsblog/2015/02/changes-to-canadian-aquaculture-rule-raises-pesticide-concerns/>.

85. UNITED NATIONS ENVIRONMENT PROGRAMME, FRONTIERS 2017: EMERGING ISSUES OF ENVIRONMENTAL CONCERN 15 (2017), <https://www.unep.org/resources/frontiers-2017-emerging-issues-environmental-concern>.

86. *Id.*

87. *Pesticides in Bay Cause of Concern for Local Fisherman*, BEYOND PESTICIDES: DAILY NEWS BLOG (Feb. 18, 2010), <https://beyondpesticides.org/dailynewsblog/2010/02/pesticides-in-bay-cause-of-concern-for-local-fisherman/>; *Changes to Canadian Aquaculture Rule Raises Pesticide Concerns*, *supra* note 84.

88. OWEN GREEN & KATE ROYLANCE, WCA ENVIRONMENT, ASSESSMENT OF POTENTIAL RISK TO HUMAN HEALTH FOLLOWING USE OF AZAMETHIPHOS, DELTAMETHRIN, AND HYDROGEN PEROXIDE IN FISH FARMS: REPORT TO SCOTTISH SALMON PRODUCERS ORGANISATION FROM WCA (2021), <https://s3.documentcloud.org/documents/21746810/document-22585306.pdf>; *Pesticides Used in Farmed Fish Operations Threaten Health of Swimmers*, BEYOND PESTICIDES: DAILY NEWS BLOG (May 6, 2022), <https://beyondpesticides.org/dailynewsblog/2022/05/pesticides-used-in-farmed-fish-operations-threaten-health-of-swimmers/>.

89. Rob Edwards, *Scottish Government Accused of Colluding With Drug Giant Over Pesticides Scandal*, HERALD (June 2, 2017), http://www.heraldsotland.com/news/15326945.Scottish_government_accused_of_colluding_with_drug_giant_over_pesticides_scandal/.

90. Inka Milewski et al., *Sea-Cage Aquaculture Impacts Market and Berried Lobster (*Homarus americanus*) Catches*, 598 MARINE ECOLOGY PROGRESS SERIES 85 (2018), available at <https://www.jstor.org/stable/26503083>.

91. Food and Drug Administration (FDA), *Approved Aquaculture Drugs*, <https://www.fda.gov/animal-veterinary/aquaculture/approved-aquaculture-drugs> (last updated Feb. 2, 2023).

92. U.S. EPA, NPDES PERMIT FACT SHEET: SANDWICH STATE FISH HATCHERY 15-16 (2015), <https://www3.epa.gov/region1/npdes/permits/2015/final-ma0110027permit.pdf>.

93. American Cancer Society, *Formaldehyde and Cancer Risk*, <https://www.cancer.org/cancer/cancer-causes/formaldehyde.html> (last revised Oct. 24, 2022).

94. *Anti-Fouling Treatment of (Sub)marine Textiles Used in Aquaculture*, CENTEXBEL (Nov. 30, 2020), <https://www.centexbel.be/en/news/anti-fouling-treatment-submarine-textiles-used-aquaculture>.

95. Marina Nikolaou et al., *Fish Farming and Anti-Fouling Paints: A Potential Source of Cu and Zn in Farmed Fish*, 5 AQUACULTURE ENV'T INTERACTIONS 163 (2014).

96. Sean C. Godwin et al., *Salmon Lice in the Pacific Ocean Show Evidence of Evolved Resistance to Parasiticide Treatment*, 12 SCI. REPS. 4775 (2022), available at <https://www.nature.com/articles/s41598-022-07464-1>; *Changes to Canadian Aquaculture Rule Raises Pesticide Concerns*, *supra* note 84; *Ocean Health: First Reports of Salmon Lice Resistance in the Pacific Ocean Threatens Local Ecosystems*, BEYOND PESTICIDES: DAILY NEWS BLOG (Apr. 12, 2022), <https://beyondpesticides.org/dailynewsblog/2022/04/ocean-health-first-reports-of-salmon-lice-resistance-in-the-pacific-ocean-threatens-local-ecosystems/>.

97. Bob Yirka, *Widespread Use of Chemicals to Combat Aquatic Lice in Fish Farms Has Led to Resistance in Other Areas*, PHYS.ORG (June 2, 2021), <https://phys.org/news/2021-06-widespread-chemicals-combat-aquatic-lice.html>.

over-enrichment of waters with organic material).⁹⁸ Nutrient pollution decreases oxygen levels in our waters, killing off aquatic life and creating low-oxygen “dead zones” and harmful algal blooms.⁹⁹ In the Gulf of Mexico, EPA has concluded that aquaculture contributes to algal blooms and coastal eutrophication.¹⁰⁰ Many harmful algal blooms produce toxic chemicals that can kill fish and other vertebrates by affecting their central nervous systems, and can cause serious illness in humans with severe or chronic respiratory conditions.¹⁰¹ Increasing sea surface temperatures, in combination with increased nutrient output, increases the occurrence of toxic algal blooms, ciguatera fish poisoning, and the prevalence of various shellfish diseases.¹⁰²

Despite the open ocean proponents’ assertion that pollution from offshore aquaculture would be diluted in deeper waters, studies show that “dilution is not the solution to pollution”—it all goes somewhere and has effects.¹⁰³ Accumulation of pollutants continues to occur and has even been found to affect a larger area due to the unpredictability of ocean currents.¹⁰⁴

4. Forage Fish Overfishing

The fact is that the vast majority of fish grown and harvested in ocean industrial aquaculture are those the market deems the most valuable and expensive: namely, predatory, carnivorous species such as, and especially, salmon. These fish require protein, as they would in the wild: namely, lower trophic-level “forage fish,” which are already at risk of collapse. As such, another major adverse impact of aquaculture on the oceans is the impact on ocean forage fisheries from providing aquaculture feed in the form of fishmeal and fish oil, which carries its own environmental, public health, and human rights effects.¹⁰⁵

The rising demand of this aquaculture input for other countries’ aquaculture industries has already caused the rapid depletion and crash of numerous ocean forage fisheries that were previously thought to be sustainable, such as menhaden, anchovies, herring, mackerel, sardine, and pollack.¹⁰⁶ Forage fish swim in schools, susceptible to modern fishing techniques like seines and trawls, trapping these fish in vast numbers to be ground up and made into fish oil and meal. Worldwide, aquaculture accounts for 70% of all fishmeal uses (with the rest used in land-based CAFOs for chickens and pigs).¹⁰⁷ Forage fish make up more than 30% of the total global catch of wild fish, with *remarkably* 98% of those going to processing for fishmeal and oil for the aquaculture industry.¹⁰⁸

More forage fish for aquaculture facilities means the marine food web is missing an indispensable link in its chain. As marine wildlife have less to eat, salmon runs fail, sea lion pups starve, and seabird populations decline. One study shows that by 2037 aquaculture demands could outstrip the global forage fish supply.¹⁰⁹ Some companies are experimenting with other alternative aquaculture feed sources, such as genetically engineered (GE) algae and yeasts, but it is unclear whether these sources will ever become commercially viable at scale (and even if they did, if they would not create different unforeseen problems, as GE organisms have in other areas).¹¹⁰ It remains unknown what impact these alternative feeds would have on farmed fishes’ nutritional value.¹¹¹ Finally, the fish feed industry is a global contributor to human trafficking and slavery.¹¹² There are very few requirements for the industry to include traceability of ingredients or sourcing methods in

98. Akeem Babatunde Dauda et al., *Waste Production in Aquaculture: Sources, Components, and Managements in Different Culture Systems*, 4 AQUACULTURE & FISHERIES 81 (2019), available at <https://www.sciencedirect.com/science/article/pii/S2468550X18300352>; Brianna Healey et al., *Aquaculture and Its Impact on the Environment*, U. MASS. AMHERST: DEBARING SCI. (Apr. 20, 2016), <https://blogs.umass.edu/natsci397a-eross/aquaculture-and-its-impact-on-the-environment/>.

99. DONALD BOESCH ET AL., PEW OCEANS COMMISSION, MARINE POLLUTION IN THE UNITED STATES 20-22 (2001).

100. GOLDBURG ET AL., *supra* note 65.

101. *Id.*

102. FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, IMPACTS OF CLIMATE CHANGE ON FISHERIES AND AQUACULTURE 185, 192 (Manuel Barange et al. eds., 2018), <https://www.fao.org/3/i9705en/i9705EN.pdf>.

103. Bela H. Buck et al., *State of the Art and Challenges for Offshore Integrated Multi-Trophic Aquaculture (IMTA)*, FRONTIERS MARINE SCI. (May 15, 2018), <https://www.frontiersin.org/articles/10.3389/fmars.2018.00165/full>.

104. Han W. Lee et al., *Temporal Changes in the Polychaete Infaunal Community Surrounding a Hawaiian Mariculture Operation*, 307 MARINE ECOLOGY PROGRESS SERIES 175 (2006) (seafloor biodiversity “severely depressed” by organic deposits from offshore aquaculture); Patrick Rapp et al., *Measurement of Organic Loading Under an Open-Ocean Aquaculture Cage, Using Sediment Traps on the Bottom*, 23 J. APPLIED ICHTHYOLOGY 661 (2007) (excess nutrients accumulated directly on the seafloor and over time spread downstream).

105. Alastair Bland, *Tiny Forage Fish at Bottom of Marine Food Web Get New Protections*, NPR (Apr. 7, 2016), <https://www.npr.org/sections/the-salt/2016/04/07/473293477/tiny-forage-fish-at-bottom-of-marine-food-chain-get-new-protections>. See generally CHANGING MARKETS FOUNDATION

ET AL., UNTIL THE SEAS RUN DRY (2019), <http://changingmarkets.org/wp-content/uploads/2019/04/REPORT-WEB-UNTILL-THE-SEAS-DRY.pdf> (concluding that using wild fish to feed farmed fish “raises concerns of overfishing, poor animal welfare and disruption of aquatic food webs; it also undermines food security in developing countries, as less fish is available for direct human consumption”).

106. Christopher J. Shepherd & Andrew J. Jackson, *Global Fishmeal and Fish-Oil Supply: Inputs, Outputs, and Markets*, 83 J. FISH BIOLOGY 1046 (2013), available at <https://pubmed.ncbi.nlm.nih.gov/24090562/>.

107. Lynne Shannon & Lauren Waller, *A cursory Look at the Fishmeal/Oil Industry From an Ecosystem Perspective*, FRONTIERS ECOLOGY & EVOLUTION (Apr. 22, 2021), <https://www.frontiersin.org/articles/10.3389/fevo.2021.645023/full>.

108. PEW CHARITABLE TRUSTS, FORAGE FISH FAQ (2013), <https://www.pewtrusts.org/-/media/assets/2013/pffforagefishfaq.pdf>; Brian Payton, *Taking the Fish Out of Fish Feed*, HAKAI MAG. (Aug. 24, 2020), <https://hakai magazine.com/features/taking-the-fish-out-of-fish-feed/>; Clare Leschin-Hoar, *90 Percent of Fish We Use for Fishmeal Could Be Used to Feed Humans Instead*, NPR (Feb. 13, 2017), <https://www.npr.org/sections/thesalt/2017/02/13/515057834/90-percent-of-fish-we-use-for-fishmeal-could-be-used-to-feed-humans-instead>.

109. Meg Wilcox, *Can Aquaculture Survive Without Forage Fish?*, CIV. EATS (Aug. 16, 2018), <https://civileats.com/2018/08/16/can-aquaculture-survive-without-forage-fish/>; Halley E. Froehlich et al., *Avoiding the Ecological Limits of Forage Fish for Fed Aquaculture*, 1 NATURE SUSTAINABILITY 298 (2018), available at <https://www.nature.com/articles/s41893-018-0077-1>.

110. Wilcox, *supra* note 109.

111. *The Future of Fish Feed May Lie in Insects, Mold, and Algae*, NOAA (Oct. 26, 2020), <https://www.fisheries.noaa.gov/feature-story/future-fish-feed-may-lie-insects-mold-and-algae>.

112. David Tickler et al., *Modern Slavery and the Race to Fish*, 9 NATURE COMM’NS 4643 (2018), available at <https://www.nature.com/articles/s41467-018-07118-9>.

fish feed, rendering it difficult to link specific products to labor abuses.¹¹³

5. Broader Ecological Effects

Industrial aquaculture facilities also directly threaten marine wildlife, including endangered and threatened species. Naturally, a densely stocked cage full of captive fish attracts predators, marine mammals, and other wildlife, exacerbating risks of entanglements and vessel strikes as species are drawn to the facilities.¹¹⁴ Indeed, an industrial ocean fish farm caused the death of an endangered monk seal in Hawaii, which was found entangled in the net.¹¹⁵ And in August 2018, Cooke Aquaculture entangled an endangered humpback whale in large gill nets it cast to recapture escaped farmed fish from a facility in Canada.¹¹⁶

Current estimations indicate that entanglements in fishing gear—similar to aquaculture net pens—already result in the deaths of some 300,000 marine mammals each year.¹¹⁷ Net pens can also entrap wildlife, Endangered Species Act (ESA)-listed species, and other marine mammals, and result in them drowning.¹¹⁸ Of the 53 whale entanglements documented by NMFS in 2020, 29 of confirmed live and dead cases (or, 55%) involved commercial or recreational fishing gear.¹¹⁹ Offshore aquaculture containment structures may also block migratory paths or alter essential habitats of endangered species and wild fisheries.¹²⁰

Industrial aquaculture also creates noise pollution from both the facilities and the boats that serve them. Noise pollution can harm marine mammals by masking their communications at almost all frequencies these mammals use.¹²¹ “Masking” refers to a “reduction in an animal’s ability to detect relevant sounds in the presence of other sounds.”¹²² Such an impairment to communication results in harmful impacts to these protected species.

The *Gulf Fishermens* case study discussed in Part III below provides one vivid example of aquaculture’s adverse habitat alterations. The plaintiffs’ arguments under the ESA centered on the aquaculture facilities’ potential impacts to endangered Gulf of Mexico species, including loggerhead turtles. NMFS admitted that “potential routes of effect with listed species involve entanglement and/or capture via physical interaction with aquaculture structures and behavior disruption in habitats used as feeding or breeding grounds.”¹²³ And huge swaths of the Gulf are designated as the loggerhead’s critical habitat,¹²⁴ mostly *Sargassum* habitat, a floating marine grass that turtle hatchlings use for food and shelter.¹²⁵ The agency’s permitting scheme did not prohibit the siting of aquaculture facilities in the turtle habitat or protect it in any way (which would be difficult to impossible regardless in the real world, since the grass is *floating*, and thus constantly moving).¹²⁶

6. Socioeconomic Effects on Traditional and Indigenous Fishing Cultures and Communities

Then, there are the intertwined socioeconomic and cultural adverse impacts that accompany the adoption of industrial ocean aquaculture.

Coastal towns on all edges of the United States have centered on local fishing since their very founding. To this day, many towns from Oregon to Texas to Maine still have vibrant small boat commercial fishing traditions going back generations, passed from father to son, from mother to daughter. Fishing provides livelihoods, but also identity. Already threatened by depleted wild fisheries, international fishing conglomerates,¹²⁷ and climate change,¹²⁸ industrial aquaculture has damaged these communities wherever introduced.¹²⁹ The same will be true to U.S. coastal fishing towns if/when the United States adopts a dominant open ocean aquaculture.

For example, the history of farmed salmon illustrates that aquaculture and its resulting supply of farmed salmon in the global market drastically reduced the price of both farmed and wild varieties of salmon. From the late 1980s to 2004, the value of wild Alaskan salmon plummeted from

113. *Id.*

114. Luke T. Barrett et al., *Impacts of Marine and Freshwater Aquaculture on Wildlife: A Global Meta-Analysis*, 11 REVS. AQUACULTURE 1022 (2019).

115. Caleb Jones, *Rare Monk Seal Dies in Fish Farm off Hawaii*, USA TODAY (Mar. 17, 2017), <https://www.usatoday.com/story/news/nation/2017/03/17/rare-monk-seal-dies-fish-farm-off-hawaii/99295396/>.

116. Terri Coles, *Humpback Whale Freed From Net Meant for Escaped Farm Salmon in Hermitage Bay*, CBC NEWS (Aug. 14, 2018), <https://www.cbc.ca/news/canada/newfoundland-labrador/whale-caught-gill-net-cooke-aquaculture-1.4784732>.

117. PIR DPEIS, *supra* note 56, at 22.

118. PACIFIC ISLANDS REGIONAL OFFICE, NMFS, PACIFIC ISLANDS AQUACULTURE MANAGEMENT PROGRAM PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT 177 (2021).

119. NOAA FISHERIES, NATIONAL REPORT ON LARGE WHALE ENTANGLEMENTS CONFIRMED IN THE UNITED STATES IN 2020, at 9 (2022), <https://media.fisheries.noaa.gov/2022-06/National%20Report%20on%20Large%20Whale%20Entanglements%20Confirmed%20in%20the%20United%20States%20in%202020.pdf>.

120. CONG. RSCH. SERV., *supra* note 68.

121. See, e.g., John Hildebrand, *Impacts of Anthropogenic Sound*, in MARINE MAMMAL RESEARCH: CONSERVATION BEYOND CRISIS 101 (John E. Reynolds III et al. eds., Johns Hopkins Univ. Press 2006); Lindy S. Weilgart, *The Impacts of Anthropogenic Ocean Noise on Cetaceans and Implications for Management*, 85 CANADIAN J. ZOOLOGY 1091 (2007).

122. NATIONAL RESEARCH COUNCIL, OCEAN NOISE AND MARINE MAMMALS 96 (2003), available at http://www.nap.edu/openbook.php?record_id=10564&page=R1.

123. Memorandum from Phil Steele, Assistant Regional Administrator, NMFS Sustainable Fisheries Division, to David Bernhart, Assistant Regional Administrator, NMFS Protected Resources Division 2 (Apr. 2, 2009).

124. NOAA Fisheries, *Loggerhead Turtle—Northwest Atlantic Ocean DPS Critical Habitat Map*, <https://www.fisheries.noaa.gov/resource/map/loggerhead-turtle-northwest-atlantic-ocean-dps-critical-habitat-map> (last updated Apr. 18, 2022).

125. Janet McConnaughey, *Critical Habitat Designated for Loggerhead Turtles*, SAVANNAH NOW (July 10, 2014), <https://www.savannahnow.com/story/news/2014/07/10/critical-habitat-designated-loggerhead-turtles/13539738007/>.

126. Because the court ruled for the plaintiffs on their first claim and vacated the regulations on that ground alone, it did not reach the ESA cause of action.

127. JELTO MAKRIS ET AL., TRANSNATIONAL INSTITUTE, DANGEROUSLY EFFICIENT INDUSTRIAL FISHING: THE THREAT OF MULTINATIONAL DUTCH FISHING COMPANIES TO EUROPEAN SMALL-SCALE FISHERIES (2021), https://www.tni.org/files/publication-downloads/dutch_industr_fishing_web.pdf.

128. FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, *supra* note 2, at 203.

129. CONG. RSCH. SERV., *supra* note 68, at 7.

\$800 million to \$300 million per year.¹³⁰ Many Alaskan salmon fishermen saw their livelihoods destroyed. By the time the wild salmon industry rebranded itself as a high-quality niche product, many had declared bankruptcy and gone out of business.¹³¹ As aquaculture operations expanded through consolidation, local jobs were eliminated, to the detriment of local fishing communities. Similarly, while Norwegian salmon and trout aquaculture production more than quadrupled between 1992 and 2003, the employment rate fell dramatically—from 24.4 to 5.7 jobs per thousand metric tons of production.¹³²

Experts predict that open ocean aquaculture will require a similar scale to be profitable, while being farther out at sea will require automated systems with minimum human input (and thus create few new jobs).¹³³ Thus, rather than reinvigorating local economies, open ocean aquaculture will only flood the market with an abundance of farmed finfish—resulting in a net loss to local fishermen and fishing communities.

These negative economic impacts fundamentally injure the cultural heritage of traditional fishing communities. Offshore aquaculture creates competition that drives down the price of wild fish, and results in the loss of fishing and fishing-related employment and income. For example, in the Gulf of Mexico region, commercial and recreational fishing is an economic engine, and contributes greatly to the quality of life for thousands of recreational enthusiasts.¹³⁴ Businesses and families up and down the Gulf Coast depend on healthy wild fish stocks for their livelihoods. Adverse impacts on fish from the introduction of commercial industrial aquaculture could further strain already imperiled fish, affecting fishing communities' abilities to maintain themselves long term. The loss of a livelihood as a fisherman is economic, but also a loss of personal and social identity.

□ *Indigenous communities.* Many Indigenous communities oppose industrial aquaculture for a number of reasons, including impacts to cultural heritage, fishing rights, and general concern over the health of their communities and waters.¹³⁵ For example, Indigenous communities in British Columbia such as Bella Bella or Alert Bay are fundamentally opposed to finfish aquaculture in their fishing grounds because it directly conflicts with traditional and commercial livelihoods, and has generated only marginal

local employment opportunities.¹³⁶ Similarly, the Quinault Indian Nation in Washington State opposes aquaculture that would harm the fish and fish habitat it relies on to exercise its federally guaranteed treaty fishing rights.¹³⁷ Salmon is a culturally significant species to all Indigenous communities in the Pacific Northwest, regardless of their distance from the coast,¹³⁸ and for many Indigenous communities, concern over aquaculture's impacts on wild fisheries (including wild salmon, shellfish, and others) outweighs any potential economic benefits derived from fish farming.¹³⁹ Additionally, communities remain concerned about the bioaccumulation of chemicals and antibiotics in the environment and the possibility for these to negatively impact community health.¹⁴⁰

□ *Privatization of the oceans.* Offshore aquaculture also harms fishing communities through privatizing ocean resources, once held in public trust. Industrial aquaculture operations exclude local fishermen as they enclose portions of the ocean with net pens, claiming exclusive rights to use these public resources (surface water, the water column, and the ocean bottom), thus monopolizing trust resources for private use.¹⁴¹ Additionally, many aquaculture facilities appropriate wild fish for their use as seed stock for farmed fish when those fish would otherwise be available for public fishing.¹⁴² Privatization harms small-scale fishermen, who increasingly face sharply dwindling catches due to both overfishing, and pollution and destruction of fishing grounds and other critical aquatic habitats by large-scale industrial players.¹⁴³ As a result, privatization to make way for aquaculture impacts local fishers' livelihoods and food sovereignty, which depend on accessing ocean resources.¹⁴⁴

E. Separating Myths From Reality

In light of the above adverse impacts, let us focus in on some of the common misconceptions about aquaculture's benefits, and in so doing separate the flotsam and jetsam.

The *first* common myth is that aquaculture will help relieve pressure on the ocean's fisheries, and thus is a solu-

130. GUNNAR KNAPP ET AL., TRAFFIC NORTH AMERICA, THE GREAT SALMON RUN: COMPETITION BETWEEN WILD AND FARMED SALMON I (2007), https://iseralaska.org/static/legacy_publication_links/2007_01-GreatSalmonRun.pdf.

131. *Id.* at 1.

132. NOAA, OFFSHORE AQUACULTURE IN THE UNITED STATES: ECONOMIC CONSIDERATIONS, IMPLICATIONS & OPPORTUNITIES 167 (2008), [https://media.fisheries.noaa.gov/dam-migration/econ_report_all\(1\)_508_version.pdf](https://media.fisheries.noaa.gov/dam-migration/econ_report_all(1)_508_version.pdf).

133. *Id.* at 19-20, 39.

134. *Fisheries Are Vital to Coastal Economy*, MISS. STATE U. (Jan. 20, 2021), <http://extension.msstate.edu/news/extension-outdoors/2021/fisheries-are-vital-coastal-economy>.

135. Brett Freake et al., *Salmon Farming Near First Nations in BC: A Structured Decision Making Approach*, <https://doczz.net/doc/8940457/salmon-farming-near-first-nations-in-bc>.

136. Kira Gerwing & Tim McDaniels, *Listening to the Salmon People: Coastal First Nations' Objectives Regarding Salmon Aquaculture in British Columbia*, 19 SOC'Y & NAT. RES. 259 (2006), available at https://www.researchgate.net/publication/249015586_Listening_to_the_Salmon_People_Coastal_First_Nations%27_Objectives_Regarding_Salmon_Aquaculture_in_British_Columbia.

137. Complaint, Institute for Fisheries Res. v. Food & Drug Admin., No. 16-cv-01574 (N.D. Cal. filed Mar. 30, 2016), ECF No. 1.

138. Columbia River Inter-Tribal Fish Commission, *Tribal Salmon Culture*, <https://critfc.org/salmon-culture/tribal-salmon-culture/> (last visited Mar. 4, 2023).

139. *Id.*

140. *Id.*

141. Hope M. Babcock, *Grotius, Ocean Fish Ranching, and the Public Trust Doctrine: Ride 'Em Charlie Tuna*, 26 STAN. ENV'T L.J. 3, 56 (2007).

142. *Id.*

143. JENNIFER FRANCO ET AL., TRANSNATIONAL INSTITUTE ET AL., THE GLOBAL OCEAN GRAB: A PRIMER (2014), https://www.tni.org/files/download/the_global_ocean_grab.pdf.

144. *Id.*

tion to the global overfishing problem.¹⁴⁵ Yet, contrary to claims that farmed fish production will replace wild fish consumption or alleviate fishing pressure on wild fish stocks, as explained above, in reality aquaculture is the proverbial “robbing of Peter to pay Paul”¹⁴⁶ for the marine ecosystem.¹⁴⁷ Raising carnivorous fish species requires a diet high in fishmeal and/or fish oil that is derived from wild-caught fish stocks such as mackerel, herring, menhaden, and anchovies. Depending on the species, many more wild forage fish are often needed to grow aquacultured fish.¹⁴⁸ For example, growing one pound of bluefin tuna requires 15 pounds of forage fish.¹⁴⁹ As such, industrial aquaculture has actually *exacerbated* the diminishing overall populations of wild fish, by depleting forage fish stocks.

The *second* common myth is that aquaculture is helping to “feed the world” and meet the ever-increasing demand for seafood.¹⁵⁰ In reality, as detailed above, aquaculture harms wild species and commercially important fisheries that have fed humans for centuries.¹⁵¹ Farming of large finfish requires large amounts of byproducts for feed, which contributes to overfishing of wild stocks.¹⁵² Escaped fish compete with the wild and spread diseases.¹⁵³ Industrial aquaculture grows species that are a luxury to most, like salmon.¹⁵⁴ And world hunger is not from the lack of food, but from the destruction of local, regional, and cultural food sovereignty.¹⁵⁵

Relatedly, the *third* common myth is that aquaculture is necessary to reduce the seafood trade deficit in the United States because the United States currently imports the majority of its seafood (70%–85%).¹⁵⁶ But the U.S. fishing industry actually catches plenty of fish; the real problem is that we export too much of it, and other countries are

willing to pay more.¹⁵⁷ And some of that is only exported for cheaper processing only to re-import it.¹⁵⁸ For example, China imports around one-third of all U.S. seafood exports for processing and ships back around 57%.¹⁵⁹ Off-shore aquaculture is an expensive endeavor, and these fish will likely follow the same existing trajectory—exported to earn more money, instead of reducing the United States’ trade deficit.

The *fourth* common myth is that aquaculture is necessarily good for human health. Eating fish is healthy, but not all fish are created equal. In fact, industrial aquaculture raises significant human health and food safety concerns. Farmed fish have higher rates of harmful substances than wild-caught fish, including antibiotics and pesticides, since the chemicals used in fish farming to prevent disease and parasites can accumulate in the fish.¹⁶⁰

For example, the largest study to ever compare pollutants in wild and farmed salmon, analyzing more than two metric tons of farmed and wild salmon from around the world, found that farm-raised salmon contained significantly higher concentrations of environmental contaminants than those found in wild-caught salmon.¹⁶¹ The consumption of fish feed made from wild-caught fish may also be heavily contaminated with dioxins and polychlorinated biphenyls (PCBs).¹⁶² The potential spread of diseases and parasites from wild fish to farmed fish raised exclusively for human consumption adds another threat to public health.¹⁶³

In addition to the accumulation of toxic chemicals, studies have found farmed fish to be less healthful than their wild counterparts, negating the perceived advantages of eating seafood. For example, despite having 18% fat content compared to 6% in wild salmon, farmed salmon have two to three times fewer omega-3 fatty acids than their wild counterparts.¹⁶⁴

In sum, global fisheries are in drastic decline and efforts must be placed toward saving them through adequate oversight, not through using industrial aquaculture as a panacea. Similarly, seafood benefits to health and trade/markets can be helped by focusing on how and what fish we farm and eat (e.g., localized, native, regenerative methods for

145. Brian Owens, *Aquaculture Doesn't Reduce Pressure on Wild Fish*, HAKAI MAG. (Mar. 7, 2019), <https://hakaimagazine.com/news/aquaculture-doesnt-reduce-pressure-on-wild-fish/>; Emma Bryce, *The Aquaculture Boom Hasn't Taken the Pressure Off Wild Fisheries*, ANTHROPOCENE (Mar. 15, 2019), <https://www.anthropocenemagazine.org/2019/03/aquaculture-doesnt-soothe-the-stress-on-wild-fish/>.

146. Grammarist, *Rob Peter to Pay Paul*, <https://grammarist.com/idiom/rob-peter-to-pay-paul/> (last visited Mar. 4, 2023).

147. Jane Lubchenco, *Aquaculture: Not an Easy Answer to Overfishing*, OR. STATE U. (Nov. 25, 2009), <https://today.oregonstate.edu/archives/1998/oct/aquaculture-not-easy-answer-overfishing>.

148. Björn Kok et al., *Fish as Feed: Using Economic Allocation to Quantify the Fish In : Fish Out Ratio of Major Fed Aquaculture Species*, 528 AQUACULTURE 735474 (2020), available at <https://www.sciencedirect.com/science/article/pii/S0044848620309741?via%3Dihub>.

149. MONTEREY BAY AQUARIUM SEAFOOD WATCH, PACIFIC BLUEFIN TUNA (2016), <https://seafood.ocean.org/wp-content/uploads/2016/12/Tuna-Bluefin-Japan-Farmed.pdf>.

150. NOAA Fisheries, *U.S. Aquaculture*, <https://www.fisheries.noaa.gov/national/aquaculture/us-aquaculture> (last updated Sept. 20, 2022).

151. *Supra* note 67 and accompanying text.

152. *Supra* note 27 and accompanying text.

153. *Supra* note 75 and accompanying text.

154. *Supra* note 44 and accompanying text.

155. Lourene Maffra, *Food Sovereignty: Sustainable Solution to World Hunger and Climate Change*, COMUNICACIÓN Y TECNOLOGÍA (June 21, 2017), <https://institucionales.us.es/ambitos/food-sovereignty-sustainable-solution-to-world-hunger-and-climate-change/>.

156. Yonathan Zohar & Russell T. Hill, *America Has an Opportunity in Aquaculture, but Congress Needs to Clear Regulatory Path First*, BALTIMORE SUN (May 27, 2021), <https://www.baltimoresun.com/opinion/op-ed/bs-ed-op-0528-american-aquaculture-20210527-ln24smkferjrg3ipcmlynpuq-story.htm>; NOAA Fisheries, *supra* note 150.

157. NPR Food, “*The Great Fish Swap*”: *How America Is Downgrading Its Seafood Supply*, KQED (July 1, 2014), <https://www.kqed.org/bayareabites/84398/the-great-fish-swap-how-america-is-downgrading-its-seafood-supply>.

158. Craig A. Morris, *A Tale of a Fish From Two Countries*, U.S. DEP’T AGRIC. (Feb. 21, 2017), <https://www.usda.gov/media/blog/2016/12/05/tale-fish-two-countries>.

159. Jessica A. Gephart et al., *To Create Sustainable Seafood Industries, the United States Needs a Better Accounting of Imports and Exports*, 116 PNAS 9142 (2019), available at <https://www.pnas.org/doi/10.1073/pnas.1905650116>.

160. David W. Cole et al., *Aquaculture: Environmental, Toxicological, and Health Issues*, 212 INT’L J. HYGIENE & ENV’T HEALTH 369 (2009), available at <https://www.sciencedirect.com/science/article/abs/pii/S1438463908000631>.

161. Press Release, Indiana University, *Farmed Salmon More Toxic Than Wild Salmon, Study Finds* (Jan. 9, 2004), <https://www.sciencedaily.com/releases/2004/01/040109072244.htm>.

162. Ida-Johanne Jensen et al., *An Update on the Content of Fatty Acids, Dioxins, PCBs, and Heavy Metals in Farmed, Escaped, and Wild Atlantic Salmon (Salmo salar L.) in Norway*, 9 FOODS 1901 (2020), <https://pubmed.ncbi.nlm.nih.gov/33352671/>.

163. *See supra* note 67.

164. Jensen et al., *supra* note 162.

herbivorous fish), but not by an inherently unsustainable, industrial paradigm.

A *final* myth is that aquaculture is adequately regulated. But as the next section details, the United States does not have a federal law specific to aquaculture because Congress has never passed such legislation. Instead, a patchwork of federal laws apply, but their ambit, overlap, and adequacy is murky at best.

II. Aquaculture Law

Having navigated through aquaculture's factual background, it is time to traverse the choppy legal waters, beginning with an overview. Let us start by reiterating the key prerequisite: there is no U.S. federal law that is intended to oversee 21st-century industrial aquaculture.

It should be said that the Department of Commerce and industry proponents in favor of EEZ ocean aquaculture certainly have *tried* to get a new law passed, to establish regulatory certainty (and perhaps a regulatory liability shield for any damages they cause) for their commercial operations. In fact, for most of the first decade of this century, such an aquaculture-enabling bill was the Commerce Department's highest legislative priority. At the agency's behest from 2005 to 2011, Congress introduced numerous bills that would have given the agency such authority,¹⁶⁵ declaring that the legislation's purpose was "[t]o provide the necessary authority to the Secretary of Commerce for the establishment and implementation of a regulatory system for offshore aquaculture in the United States Exclusive Economic Zone."¹⁶⁶ But these bills have all failed.¹⁶⁷

So, without an enabling statute specific to aquaculture, multiple agencies regulate aquaculture through a hodgepodge of laws, an overlapping patchwork of more general environmental laws never intended for such purpose, all with differing policy and legal mandates and varying degrees of strengths and foci. These laws include but are not limited to the MSA, the CWA, the RHA, NEPA, the ESA, the Coastal Zone Management Act (CZMA), the

Marine Mammal Protection Act (MMPA), the Migratory Bird Treaty Act (MBTA), the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), and the Federal Food, Drug, and Cosmetic Act (FFDCA). (The federal laws also include the National *Aquaculture* Act, which misleadingly sounds like the perfect law for the need in question, but actually is not, as explained below.) There are also various state laws that come into play—its own patchwork—for coastal state-governed waters and inland aquaculture, but these laws do not reach the federal waters of the EEZ, which is the focus here.

Without clarity from Congress, significant questions remain as to how the federal government may establish and regulate aquaculture in federal ocean waters, beyond the reach of state permitting. There is the major issue of the MSA, central to the *Gulf Fishermens* litigation and the Commerce regulations covered in Part III. Then, there is the CWA, a broad and powerful, but in this case, imperfect tool to regulate the burgeoning industry, requiring EPA to issue permits for some, but not all, aquaculture operations. There is the Corps' use of the ancient RHA to permit dredging and filling as well as aquaculture structures' placement in navigable waters.

Then, there is the overlay of various other core environmental laws that may also require EPA or the Corps to analyze and consider all or particular environmental impacts, or consult with other agencies, or seek authorization from NMFS and/or FWS to protect endangered species, marine mammals, fish habitat, and federally designated marine protected areas, depending on the biological resources impacted. Finally, some aquaculture inputs require other agency processes and approvals, such as Food and Drug Administration (FDA) approval for pharmaceuticals and EPA approval for pesticide use. Each of these is summarized below.

A. *The National Aquaculture Act*

First, there actually is one law with aquaculture in its title: the National Aquaculture Act of 1980 (aka, the National Aquaculture Policy, Planning, and Development Act), which remains the only federal statute expressly addressing aquaculture in the United States.¹⁶⁸ But nobody—not even aquaculture's most ardent supporters—argues that it by itself creates substantive authority to regulate commercial aquaculture and permit aquaculture facilities, in the EEZ or elsewhere. (Tellingly, nor has any agency tried to so apply it.) Rather, it is undisputed that this Act does not grant substantive *authority* to any federal agency to regulate aquaculture anywhere, let alone specifically the EEZ waters.

Instead, the succinct National Aquaculture Act speaks only to creating a national aquaculture policy and development plan by several agencies,¹⁶⁹ with several reports and working groups, addressing their testing and feasibility,

165. *E.g.*, National Offshore Aquaculture Act of 2005, S. 1195, 109th Cong. (2005), available at <https://www.congress.gov/bill/109th-congress/senate-bill/1195/text>; National Offshore Aquaculture Act of 2007, H.R. 2010, 110th Cong. (2007), available at <https://www.congress.gov/bill/110th-congress/house-bill/2010/text>; National Offshore Aquaculture Act of 2007, S. 1609, 110th Cong. (2007), available at <https://www.congress.gov/bill/110th-congress/senate-bill/1609/text>; National Sustainable Offshore Aquaculture Act of 2009, H.R. 4363, 111th Cong. (2009), available at <https://www.congress.gov/bill/111th-congress/house-bill/4363/text>; National Sustainable Offshore Aquaculture Act of 2011, H.R. 2373, 112th Cong. (2011), available at <https://www.congress.gov/bill/112th-congress/house-bill/2373/text>.

166. *E.g.*, National Offshore Aquaculture Act of 2005, S. 1195, 109th Cong. (2005) (stating the legislation's purpose was "[t]o provide the necessary authority to the Secretary of Commerce for the establishment and implementation of a regulatory system for offshore aquaculture in the United States Exclusive Economic Zone"); National Offshore Aquaculture Act of 2007, H.R. 2010, 110th Cong. (2007) (same).

167. And the congressional fight continues: a 2020 bill, the Advancing the Quality and Understanding of American Aquaculture (AQUAA) Act (S. 4723) would pave the way for federal approval of offshore finfish aquaculture facilities in the EEZ, whereas another 2021 bill, the Keep Finfish Free Act (H.R. 274), would place a moratorium on commercial permitting of marine finfish aquaculture in federally controlled areas of the ocean.

168. 16 U.S.C.A. §§2801-2810.

169. 16 U.S.C. §2803.

and “encouraging” aquaculture activities in both the public and private sectors in order to reduce U.S. trade deficits in seafood products.¹⁷⁰ What the Act does illustrate is the widespread belief in the view (at least in 1980) that aquaculture would help the United States meet “future food needs” and be part of the “solution to world resource problems,”¹⁷¹ myths addressed in Part I above. In short, it is a kind of pregame, cheerleading type of statute that might presage the passage of an aquaculture licensing law. But one never followed.

B. *The Magnuson-Stevens Act*

The MSA is the nation’s long-standing program aimed at the management and conservation of ocean fish and fishing resources.¹⁷² In order to address threats to wild fisheries and the coastal communities that rely on them, in 1976, Congress passed the MSA to “prevent overfishing, to rebuild overfished stocks, to insure conservation, to facilitate long-term protection of essential fish habitats, and to realize the full potential of the Nation’s fishery resources.”¹⁷³ The MSA aims to conserve and protect these resources through a system for setting catch levels for the nation’s wild fisheries.¹⁷⁴ It created regional fishery management councils, charged with preparing fishery management plans (FMPs) and implementing regulations that are necessary and appropriate to manage and conserve the fisheries under their authority.¹⁷⁵

As discussed further in Part III, the key definition of the MSA as applied to aquaculture is “fishing,” which is defined as

(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 [above].¹⁷⁶

Under this authority, the agency may grant fishing permits to fishing “vessels,” the operators of such vessels, and processors.¹⁷⁷

The MSA requires that FMPs, among other things and as most relevant to aquaculture, contain conservation measures, minimize impacts to essential fish habitat, use the best scientific information, and be consistent with the Act’s national standards, which include preventing overfishing, achieving optimum yield, reasonably allocating fishing

privileges among fishermen, and minimizing impacts to fishing communities and bycatch.¹⁷⁸

Finally, the Act’s key regulatory unit is a “fishery,” defined as “(A) 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; and (B) any fishing for such stocks.”¹⁷⁹ A key purpose of the Act is to prevent “overfishing,” defined as “a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the maximum sustainable yield.”¹⁸⁰

Each of these statutory provisions is important as to the MSA’s application—or lack thereof—and will be discussed further in Part III.

C. *NEPA*

NEPA is “our basic national charter for protection of the environment,”¹⁸¹ and basically requires federal agencies to assess the environmental and intertwined socioeconomic consequences of their proposed actions, to ensure that their decisions are fully informed, and to make the public aware of the effects of agency actions.¹⁸² This of course would include activities that might affect U.S. ocean ecosystems, like development of an industrial aquaculture system in the EEZ.

For every qualifying final agency action, NEPA requires federal agencies to prepare an environmental assessment (EA) or EIS.¹⁸³ An EIS must comprehensively analyze the action’s impacts, and consider reasonable alternatives to avoid or minimize adverse impacts.¹⁸⁴ Courts refer to complying with NEPA as the “hard look” doctrine—that is, requiring agencies to take a “hard look” at the environmental and intertwined socioeconomic consequences of its actions so that they “are integrated into the very process of decision making.”¹⁸⁵ To take NEPA’s requisite “hard look,” agencies must discuss all reasonably foreseeable direct, indirect, and cumulative impacts of a proposed action, including intertwined socioeconomic effects, and any environmental mitigation being considered or relied upon in the federal action.¹⁸⁶ Additionally, consideration of reasonable alternatives to the agency’s preferred proposal is the “heart” of the NEPA process, and must provide a “clear basis for choice among options.”¹⁸⁷

As such, NEPA broadly applies to many types of agency rules or project approval actions having to do with aquaculture, and the adequacy or inadequacy of such NEPA analysis has been the subject of some aquaculture litigation. For

170. *Id.* §2801.

171. *Id.*

172. *Id.* §1801(a), (b)(1).

173. *Id.* §1801(a)(6), (a)(1)-(3).

174. *Id.* §§1851, 1801.

175. *Id.* §1852(h). As covered in Part III, the Gulf Council is one such council, charged with managing fisheries in federal waters off the coasts of Alabama, Florida, Louisiana, Mississippi, and Texas.

176. *Id.* §1802(16).

177. *Id.* §1853(b)(1).

178. *Id.* §§1801, 1851, 1853, 1854.

179. *Id.* §1802(13)(A)-(B).

180. *Id.* §1802(34).

181. 40 C.F.R. §1500.1(a).

182. 42 U.S.C. §§4321, 4332; 40 C.F.R. §§1502.1, 1503.1.

183. 42 U.S.C. §4332(2)(C); 40 C.F.R. §1502.3.

184. 40 C.F.R. §§1502.2, 1502.16, §1502.1.

185. *See, e.g.,* *Kleppe v. Sierra Club*, 427 U.S. 390, 410 n.21, 6 ELR 20532 (1976).

186. 40 C.F.R. §§1508.7, 1508.8, 1508.14, 1508.25, 1502.14(f), 1502.16(h).

187. 42 U.S.C. §4332(2)(C)(iii), (E); 40 C.F.R. §1502.14(a).

example, the *Gulf Fishermens* case to be discussed below in Part III had NEPA claims regarding the EIS that Commerce had prepared for the new Gulf regulations. Another important aquaculture litigation—the first ever challenge to a shellfish aquaculture CWA permit, for the state of Washington—also involved NEPA claims.¹⁸⁸ And yet another aquaculture case—addressing the approval of the first ever GE salmon—also centered on NEPA.¹⁸⁹ Several current ongoing aquaculture cases also involve NEPA.¹⁹⁰

Even though NEPA and its implementing regulations define “agency action” very broadly,¹⁹¹ including not just individual projects, but also new programs,¹⁹² some aquaculture activities may still evade NEPA review due to gaps in the CWA. Specifically, NEPA review is required for mandatory permits from the Corps.¹⁹³ But CWA §511(c) exempts from NEPA most NPDES permits issued for aquaculture.¹⁹⁴ This is because NEPA review is only required for “a new source as defined in section [306]” of the CWA.¹⁹⁵ Many aquaculture operations do not qualify as “new sources” as defined by §306 of the CWA¹⁹⁶ because they do not have new source performance standards, which only exist for concentrated aquatic animal production facilities (CAAPs) producing 100,000 pounds or more annually.¹⁹⁷ As a result, smaller aquaculture facilities, many cold-water CAAPs, and other CAAPs falling under exceptions to the effluent limitation guidelines for CAAPs may not require NEPA review.

Finally, famously—and importantly for discussion of cutting-edge aquaculture law—NEPA is only a procedural, not substantive, statute. It is an action-forcing analysis, to inform the agency’s decision, but does not provide any substantive protections by itself, only procedural ones.¹⁹⁸ Agencies do not comply with NEPA in a vacuum: it is only triggered by another underlying substantive agency action that the agency must analyze.¹⁹⁹ NEPA does not expand an agency’s existing authority,²⁰⁰ and thus cannot be a source of authority for addressing environmental

effects or mandating a particular result.²⁰¹ Rather, NEPA’s procedural safeguards ensure that an agency’s consideration of environmental effects is meaningful; that is, that the required NEPA analysis informs the ultimate substantive agency decision.²⁰²

D. The ESA

U.S. ocean environments are home to more than 150 endangered and threatened marine species, including numerous endangered Atlantic and Pacific salmonids, steelhead trout, sturgeon, seals, whales, turtles, dolphins, and sharks,²⁰³ implicating the ESA. The ESA is the most comprehensive legislation for the preservation of endangered species ever enacted by any nation.²⁰⁴ Congress’ “plain intent . . . in enacting [the ESA] was to halt and reverse the trend towards species extinction, whatever the cost.”²⁰⁵ The Act’s “language, history, and structure” make plain that “Congress intended endangered species to be afforded the highest of priorities.”²⁰⁶ The ESA contains a variety of protections designed to meet this end, including §7, known as the “heart” of the Act,²⁰⁷ which mandates that all federal agencies “insure” its actions are not likely to jeopardize ESA-protected species or adversely modify their designated critical habitat.²⁰⁸

To carry out these substantive mandates, the ESA and its regulations require agencies to undertake a consultation process under §7 with the wildlife agencies on the effects of their proposed actions when the agency determines the proposed action “may affect” a listed species or its critical habitat.²⁰⁹ As with the breadth of NEPA, the scope of agency actions subject to ESA consultation is broadly defined,²¹⁰ as is the definition of “covered effects.”²¹¹ And

188. *Coalition to Protect Puget Sound Habitat v. U.S. Army Corps of Eng’rs*, 466 F. Supp. 3d 1217 (W.D. Wash. 2020), *aff’d*, 843 F. App’x 77 (9th Cir. 2021).

189. *Institute for Fisheries Res. v. Food & Drug Admin.*, 499 F. Supp. 3d 657, 668, 51 ELR 20246 (N.D. Cal. 2020).

190. See *infra* Part IV (discussing the Velella Epsilon case and NWP 56 case).

191. 40 C.F.R. §1508.1(q).

192. *Id.* §1502.4(b).

193. When the Corps issues a letter of permission in lieu of a permit, see 33 C.F.R. §325.2(e)(1), NEPA is not required. 33 C.F.R. pt. 325, app. B.

194. See CWA §511(c), 33 U.S.C. §1371(c) (stating that with two exceptions, “no action of the [EPA] taken pursuant to the [CWA] shall be deemed a major [f]ederal action significantly affecting the quality of the human environment within the meaning of [NEPA]”).

195. CWA §511(c), 33 U.S.C. §1371(c); see also CWA §306(a)(2), 33 U.S.C. §1316(a)(2) (defining “new source”).

196. See CWA §306, 33 U.S.C. §1316.

197. 40 C.F.R. §122, app. C(b)(2); see also *id.* §122.24(b)-(c).

198. See, e.g., *Conservation Cong. v. Finley*, 774 F.3d 611, 615, 45 ELR 20270 (9th Cir. 2014); 40 C.F.R. §1500.1(c) (“NEPA’s purpose is not to generate paperwork . . . but to foster excellent action.”).

199. *Kern v. Bureau of Land Mgmt.*, 284 F.3d 1062, 1066, 32 ELR 20571 (9th Cir. 2002) (NEPA’s procedures are “action-forcing”).

200. *Natural Res. Def. Council v. Environmental Prot. Agency*, 859 F.2d 156, 169, 19 ELR 20016 (D.C. Cir. 1988).

201. *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 353, 19 ELR 20743 (1989); *Winter v. Natural Res. Def. Council*, 555 U.S. 7, 23, 39 ELR 20279 (2008).

202. *Robertson*, 490 U.S. at 350 (NEPA procedures “almost certain to affect the agency’s substantive decision”). See also *Oregon Nat’l Desert Ass’n v. Bureau of Land Mgmt.*, 625 F.3d 1092, 1099 (9th Cir. 2010).

203. NOAA Fisheries, *Species Directory—ESA Threatened & Endangered*, <https://www.fisheries.noaa.gov/species-directory/threatened-endangered> (last visited Mar. 4, 2023).

204. *Tennessee Valley Auth. v. Hill*, 437 U.S. 153, 180, 8 ELR 20513 (1978).

205. *Id.* at 184.

206. *Id.* at 174; see also 16 U.S.C. §§1536(a), 1531(c)(1) (“[A]ll Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authority in furtherance of the purposes of this [Act].”).

207. *Karuk Tribe of Cal. v. U.S. Forest Serv.*, 681 F.3d 1006, 1019, 42 ELR 20116 (9th Cir. 2012) (en banc).

208. 16 U.S.C. §1536(a)(2); 50 C.F.R. §402.14(a). Critical habitat consists of “the specific areas within the geographical area occupied by the species, at the time it is listed . . . on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection.” 16 U.S.C. §1532(5)(A).

209. 16 U.S.C. §1536(a)(2); 50 C.F.R. §§402.12.16. Consult, or in some cases, if it is a wildlife agency taking the action, such as NMFS, a subagency of the Department of Commerce, self-consult.

210. 50 C.F.R. §402.02 (includes “all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies”).

211. *Id.* (“effect” to include “all consequences to listed species and critical habitats that are caused by the proposed actions, including the consequences of other activities that are caused by the proposed action,” including those that “may occur later in time”).

the “may affect” threshold for triggering this precautionary regulatory scheme is an extremely low bar: “[A]ctions that have *any chance of affecting* listed species or critical habitat—even if it is later determined that the actions are ‘not likely’ to do so—require at least some consultation under the ESA.”²¹² The low threshold reflects the ESA’s overall “institutionalized caution” mandate, ensuring that all federal actions that could have any effect on species on the brink of extinction are scrutinized by the expert wildlife agencies.²¹³ In fulfilling §7 consultation duties, the ESA also mandates that agencies use the best scientific and commercial data available.²¹⁴

Thus, if a proposed action “may affect” a listed species or designated critical habitat, formal consultation is required, unless the expert agency concurs in writing with an action agency’s finding that the proposed action “is not likely to adversely affect” listed species or designated critical habitat (known as informal consultation).²¹⁵ Formal consultation is concluded with the issuance of a biological opinion determining whether the proposed agency action is likely to jeopardize the continued existence of ESA-protected species.²¹⁶ If the expert wildlife agency concludes that the proposed action “will jeopardize the continued existence” of a listed species, the biological opinion must outline “reasonable and prudent alternatives.”²¹⁷

If the biological opinion concludes that the action is not likely to jeopardize the continued existence of a listed species, and will not result in the destruction or adverse modification of critical habitat, the agency must provide an “incidental take statement,” specifying the amount or extent of such an incidental taking on the listed species, providing any “reasonable and prudent measures” that the agency considers necessary or appropriate to minimize such impact, and setting forth the “terms and conditions” that must be complied with to implement those measures.²¹⁸ Finally, during consultation, the ESA prohibits federal agencies from making “any irreversible or irretrievable commitment of resources” that would “foreclos[e] the formulation or implementation of any reasonable and prudent alternative measures” through the consultation process.²¹⁹

Accordingly, as with NEPA, these core ESA standards overlay other laws²²⁰ and agency organic statutes, and thus apply to federal agency actions involving aquaculture

projects, programs, their approvals, their funding, and so forth—any federal action that might involve aquaculture oversight and might affect endangered species or their habitat. As such, ESA case law has already been a part of 21st-century aquaculture law in the courts. The *Gulf Fishermens* case involved ESA Gulf-based species and ESA claims as noted above in Part I.²²¹ The Washington State shellfish aquaculture litigation²²² as well as GE salmon litigation²²³ also involved ESA arguments. Current litigation also involves the ESA, as discussed below.

So far, agencies have been attempting to evade programmatic ESA review for aquaculture programs by promising later review for specific aquaculture facilities. For example, the Corps neglected to conduct programmatic consultation for both NWP 48 for shellfish aquaculture and NWP 56 for finfish aquaculture, instead relying on general condition 18 in the NWPs. This condition requires prospective permittees to submit a preconstruction notice to district engineers if any listed species (or species proposed for listing) or designated critical habitat (or critical habitat proposed for such designation) might be affected, or if the proposed facility is located in designated critical habitat or proposed critical habitat.²²⁴ District engineers then must make ESA determinations and consult if necessary.²²⁵ Similarly, NMFS claims that ESA consultation for its Pacific Islands Region aquaculture management plan will occur only in response to individual proposals to amend fishery ecosystem plans to include aquaculture, instead of for the entire program, which seeks to allow aquaculture in half of the U.S. EEZ.²²⁶

E. The CWA

The purpose of the CWA is nothing less than to “restore and maintain the chemical, physical, and biological integrity of the Nation’s waters.”²²⁷ First, to achieve this objective, the CWA requires EPA to issue NPDES permits to certain aquaculture facilities in federal waters to regulate wastewater discharges by limiting the quantities of pollutants to be discharged and imposing monitoring requirements and other conditions. However, aquaculture facilities may evade NPDES permitting requirements altogether if they do not qualify as CAAPs, regulated as point sources.²²⁸ And the production requirements for CAAPs are high: cold-water facilities that produce more than 20,000 pounds of fish per

212. *Karuk Tribe of Cal.*, 681 F.3d at 1027 (en banc); *id.* (consultation triggered by “[a]ny possible effect, whether beneficial, benign, adverse or of an undetermined character”) (emphasis added) (quotations omitted). Interagency Cooperation—Endangered Species Act of 1973, as Amended; Final Rule, 51 Fed. Reg. 19926, 19949 (June 3, 1986).

213. *Cottonwood Env’t L. Ctr. v. U.S. Forest Serv.*, 789 F.3d 1075, 1091, 45 ELR 20114 (9th Cir. 2015).

214. 16 U.S.C. §1536(a)(2).

215. 50 C.F.R. §§402.02, 402.13(a), 402.14(a).

216. *Id.* §402.14(h)(3).

217. 16 U.S.C. §1536(b)(3)(A).

218. *Id.* §1536(b)(4); 50 C.F.R. §402.14(i).

219. 16 U.S.C. §1536(d).

220. Permitting agencies may also need to consult on essential fish habitat under the MSA if a facility may “adversely affect” essential fish habitat. *Id.* §1855(b)(2).

221. Complaint, *Gulf Fishermens Ass’n v. National Marine Fisheries Serv.*, No. 16-1271 (E.D. La. filed Feb. 12, 2016), ECF No. 1 (Claim 7).

222. *Coalition to Protect Puget Sound Habitat v. U.S. Army Corps of Eng’rs*, 466 F. Supp. 3d 1217 (W.D. Wash. 2020).

223. *Institute for Fisheries Res. v. Food & Drug Admin.*, 499 F. Supp. 3d 657, 667-68, 51 ELR 20246 (N.D. Cal. 2020).

224. *Reissuance and Modification of Nationwide Permits*, 86 Fed. Reg. 2744, 2869 (Jan. 13, 2021).

225. *Id.*

226. PACIFIC ISLANDS REGIONAL OFFICE, NMFS, PACIFIC ISLANDS AQUACULTURE MANAGEMENT PROGRAM FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT (2022), https://media.fisheries.noaa.gov/2022-09/NOAA-NMFS-2021-0044-0158_content.pdf [hereinafter PIR FINAL PEIS].

227. 33 U.S.C. §1251.

228. 40 C.F.R. §122.24(a).

year and use 5,000 pounds or more of feed per month, or warm-water facilities that produce at least 100,000 pounds of fish annually.²²⁹ EPA may designate smaller facilities as CAAPs on a case-by-case basis²³⁰; otherwise these facilities fall under nonpoint source management.

Second, then, in the case of “nonpoint” source management, the CWA offers minimal oversight of aquaculture in federal waters, not authorizing EPA to implement nonpoint source management plans for the EEZ, nor providing any provisions for enforcement of a plan or citizen suits. Instead, the CWA only requires EPA to prepare an assessment report that identifies federal waters as impaired as a result of nonpoint source pollution and to identify processes to reduce nonpoint source pollution through best management practices.²³¹ Further, the strongest mechanism for states to control nonpoint source pollution from smaller aquaculture facilities does not apply to federal ocean waters. The CWA requires states to establish total maximum daily loads (TMDLs), which dictate the maximum amount of a pollutant that can be discharged into state waters from a nonpoint source *or* point source without violating the water quality standard.²³² However, no water quality standards exist for federal ocean waters; even if they did, EPA only possesses authority to set TMDLs for state waters when states fail to do so.²³³

This lack of water quality standards also results in looser regulation for point source CAAPs in federal waters. In state waters, water quality standards provide an essential tool to protect water quality when technology-based effluent limitations “are not stringent enough to implement any water quality standard applicable to such waters.”²³⁴ Without these, the only tool remaining for EPA to protect water quality in federal waters is the ocean discharge criteria (ODC), which provide factors for the EPA Administrator to consider when determining whether a CAAP in federal waters “will cause unreasonable degradation of the marine environment.”²³⁵

EPA must include in its ODC evaluation a variety of specific considerations, including but not limited to the effect of pollutants on “human health or welfare” (including on fish, shellfish, and wildlife), “marine life” (including “changes in marine ecosystem diversity, productivity,

and stability; and species and community population changes”), and “other possible locations and methods of disposal or recycling of pollutants including land-based alternatives.”²³⁶ If EPA finds that a CAAP would result in unreasonable degradation, EPA cannot issue an NPDES permit.²³⁷ However, the ODC do not require ongoing monitoring, nor provide numeric standards for water quality in the EEZ.

So far, in the context of offshore aquaculture, EPA has only issued an NPDES permit to Vellela Epsilon in the Gulf of Mexico. In response, petitioners before the Environmental Appeals Board challenged the ODC evaluation’s adequacy under the CWA because EPA left out numerous pollutants and failed to evaluate other pollutants under the mandatory ODC factors. But the Board found that EPA’s permit conditions, mitigation measures, monitoring requirements, and discussion of discharges in the EA sufficiently supported EPA’s determination, considering the project’s “pilot size.”²³⁸

Third, the CWA seeks to protect federal waters in the EEZ through requiring the Corps to issue a general or individual permit to CAAPs that will discharge dredged or fill material into waters of the United States under CWA §404.²³⁹ Section 404 authorizes the use of general permits, in lieu of individual permits, on a state, regional, or national (NWP) basis, but only if the Corps determines that (1) the activities and their environmental impacts are similar in nature, and (2) individually or cumulatively will not cause more than minimal adverse impacts.²⁴⁰ The Corps may not legally adopt an NWP if the activities covered will cumulatively cause more than minimal adverse impacts to the environment. This determination for general permits must be supported, in accordance with the §404(b) guidelines, which require the Corps to provide documentation to support each factual determination, including cumulative impacts and secondary effects.²⁴¹ If the Corps relies on mitigation measures to meet the CWA standard of no more than minimal adverse cumulative impacts, it must adequately document those mitigation measures and support their efficacy.²⁴²

While some CAAPs may be covered under CWA §404, others are excluded/exempted. The Corps often issues §404 permits for aquaculture projects in state waters because they typically discharge seabed sediments that constitute “fill materials” under the CWA. But EPA recently stated, without explanation, that the Vellela Epsilon net pen project does not require a §404 permit,²⁴³ and the Corps only issued NWP 56 for finfish production under RHA §10,

229. *Id.* §122.24, app. C(b)(1)-(2).

230. *Id.* §122.24(c).

231. 33 U.S.C. §1329(d)(3).

232. *Id.* §1313(d)(1)(C). See *Alaska Ctr. for the Env’t v. Browner*, 20 F.3d 981, 984-85, 24 ELR 20702 (9th Cir. 1994) (noting that TMDLs are an effective tool for achieving water quality standards in waters impaired by nonpoint source pollution).

233. 33 U.S.C. §1313(d)(2); see also *Browner*, 20 F.3d at 986-87 (affirming a district court order that EPA set TMDLs for Alaska).

234. 33 U.S.C. §1313; see also *id.* §1312(a).

235. The CWA regulations define “unreasonable degradation” as

(1) Significant adverse changes in ecosystem diversity, productivity and stability of the biological community within the area of discharge and surrounding biological communities, (2) Threat to human health through direct exposure to pollutants or through consumption of exposed aquatic organisms, or (3) Loss of esthetic, recreational, scientific or economic values which is unreasonable in relation to the benefit derived from the discharge.

40 C.F.R. §125.121(e); see also *id.* §125.122(a).

236. 33 U.S.C. §1343(c)(1); see also 40 C.F.R. §125.122.

237. 33 U.S.C. §1343(a).

238. *In re Ocean Era, Inc.*, 18 E.A.D. 678, 709-11 (EAB 2022).

239. 33 U.S.C. §1344.

240. *Id.* §1344(e)(1); 33 C.F.R. §323.2(h); 40 C.F.R. §230.7(a).

241. 40 C.F.R. §§230.7(b), 230.11.

242. *Id.*

243. U.S. EPA, OCEAN ERA, INC.-VELELLA EPSILON FINAL RESPONSE TO SIGNIFICANT COMMENTS 49 (2020) (NPDES Permit FLOA00001), https://www.epa.gov/sites/default/files/2020-10/documents/response_to_comments_-_ocean_era_inc_-_vella_epsilon_.pdf [hereinafter VELELLA EPSILON RESPONSE TO SIGNIFICANT COMMENTS].

as discussed below. In contrast, the Corps has made plain that shellfish aquaculture requires a §404 permit because it involves mechanical or hydraulic harvesting techniques that may discharge dredged material,²⁴⁴ and the Corps issued NWP 48 for shellfish production under both RHA §10 and CWA §404.²⁴⁵ It remains unclear if offshore net pen projects that qualify as CAAPs will require §404 permits in the future.

For shellfish aquaculture, plaintiffs brought a challenge under CWA §404 to the Corps' minimal impacts finding for NWP 48. In October 2019, the U.S. District Court for the Western District of Washington held that the 2017 reissuance of NWP 48 violated CWA §404 because the Corps failed to adequately consider the individual and cumulative impacts on the environment.²⁴⁶ Specifically, the court held that the Corps' minimal impacts finding was improperly based on

- (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.²⁴⁷

The district court held that the Corps may not “rely solely on post-issuance procedures to make its pre-issuance minimal impact determinations.”²⁴⁸ In June 2020, the district court vacated the permit, and in February 2021, the U.S. Court of Appeals for the Ninth Circuit affirmed the district court's decision.²⁴⁹

F. The Rivers and Harbors Act

Aquaculture facilities' construction in federal waters may require the Corps to issue a dredge and fill permit under the CWA and/or an RHA §10 permit for construction. In contrast to CWA §404, which only requires a permit for CAAPs that discharge dredged or fill material into waters of the United States,²⁵⁰ RHA §10 requires permits for any aquaculture structures or work affecting navigable waters of the United States.²⁵¹

Enacted in 1899(!), the RHA renders unlawful “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 . . . except on plans recommended by the Chief of Engineers and authorized by the Secretary of the Army.”²⁵² The Corps' regulations broadly define a “structure” as “any pier, boat dock, boat ramp, wharf, dolphin, weir, boom, breakwater, bulkhead, revetment, riprap, jetty, artificial island, artificial reef, permanent mooring structure, power transmission line, permanently moored floating vessel, piling, aid to navigation, or any other obstacle or obstruction.”²⁵³

As with the CWA, the Corps may issue either individual or general RHA §10 permits.²⁵⁴ The Corps must issue individual permits for proposed activities with potentially significant impacts,²⁵⁵ and general permits for an entire category of activities on a regional or nationwide basis where permitted activities (1) are substantially similar in nature or to avoid unnecessary duplication and (2) cause only minimal individual and cumulative environmental impacts.²⁵⁶ Federal agencies issuing permits under the CWA or the RHA also need to comply with other federal environmental statutes, depending on the biological impacts associated with the project.

An NWP is a general permit that authorizes specific activities across the country, unless a district or division commander revokes the NWP in a state or other geographic region.²⁵⁷ If a proposed activity falls under an existing NWP, an applicant may request authorization under the existing NWP rather than applying for an individual permit.²⁵⁸

The Corps issued its first RHA §10 permit, NWP 56, for offshore finfish aquaculture on January 13, 2021.²⁵⁹ NWP 56, discussed further in Part IV, remains in litigation.

G. The Outer Continental Shelf Lands Act

The Outer Continental Shelf Lands Act (OCSLA) extends the Corps' permitting authority under RHA §10 to the outer continental shelf (OCS). The OCSLA has two overarching purposes: (1) “[t]o provide for the jurisdiction of the United States over” OCS lands,²⁶⁰ and (2) “to authorize the Secretary of the Interior to lease such lands for certain purposes.”²⁶¹ Accordingly, the OCSLA authorizes the Corps “to prevent obstruction to navigation in the navigable waters of the United States . . . to artificial islands and fixed structures located on the [OCS].”²⁶² Congress made plain that the OCSLA should “be construed in such manner that the character as high seas of the waters above the

244. U.S. ARMY CORPS OF ENGINEERS, DECISION DOCUMENT: NATIONWIDE PERMIT 48, at 11 (2021), <https://usace.contentdm.oclc.org/utis/getfile/collection/p16021coll7/id/16842>.

245. *Id.* at 2.

246. Coalition to Protect Puget Sound Habitat v. U.S. Army Corps of Eng'rs, 417 F. Supp. 3d 1354, 1367 (W.D. Wash. 2019).

247. *Id.* at 1359.

248. *Id.* at 1367.

249. Coalition to Protect Puget Sound Habitat v. U.S. Army Corps of Eng'rs, 466 F. Supp. 3d 1217 (W.D. Wash. 2020), *aff'd*, 843 F. App'x 77 (9th Cir. 2021).

250. 33 U.S.C. §1344.

251. *Id.* §403.

252. *Id.*

253. 33 C.F.R. §322.2(b).

254. *Id.* §320.1(c).

255. *Id.* §330.1(c).

256. *Id.* §§322.2(f), 1344(e)(1); *see also* 40 C.F.R. §230.7.

257. *See* 33 C.F.R. §330.1.

258. *Id.* §§320.1(a)(3), 330.6(a).

259. 86 Fed. Reg. 2744 (Jan. 13, 2021).

260. Pub. L. No. 83-212, 67 Stat. 462, 462 (1953).

261. *Id.*

262. 43 U.S.C. §1333(f) (1953).

outer Continental Shelf and the right to navigation and fishing therein shall not be affected.”²⁶³

Over the years, Congress has slowly allowed for additional activities and structures on the OCS for purposes of oil, gas, and mineral extraction and renewable energy, but has not yet mentioned aquaculture specifically. As originally enacted, the OCSLA only authorized the Secretary of the Interior to issue leases for the extraction of oil, gas, and mineral resources from the OCS.²⁶⁴ However, Congress amended the OCSLA in 2005 to add an authorization for the Secretary of the Interior to issue leases, easements, and rights-of-way for specified “activities not otherwise authorized [by the OCSLA], the Ocean Thermal Energy Conversion Act of 1980, or other applicable law.”²⁶⁵

These specified activities include those that (1) support the development, extraction, and transportation of oil or natural gas; (2) support the development and production of energy from sources other than oil and gas; and (3) “use, for energy-related purposes or for other authorized marine-related purposes, facilities currently or previously used for activities authorized under” the OCSLA.²⁶⁶ Congress thus specifically amended the OCSLA to authorize the issuance of leases, easements, and rights-of-way for offshore renewable energy projects,²⁶⁷ but nowhere mentions aquaculture, begging the question of how the OCSLA could possibly authorize aquaculture on the OCS. Nevertheless, the Corps used its RHA §10 authority to issue NWP 56 for finfish aquaculture on the OCS, another issue in that pending litigation.

H. The MBTA

Congress passed the MBTA²⁶⁸ to implement the respective conventions between the United States and Great Britain, Japan, Mexico, and Russia. The MBTA requires any agency permitting aquaculture to determine if the action will result in the “take” of migratory birds, broadly defining “take” as:

to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any covered migratory bird . . . or any part, nest, or egg of any such bird.²⁶⁹

The Secretary of the Interior may authorize the otherwise prohibited take of migratory birds through regulations;

263. Pub. L. No. 83-212, §3(b), 67 Stat. 462, 462 (1953) (current version at 43 U.S.C. §1332).

264. See 43 U.S.C. §1337.

265. *Id.* §1337(p)(1).

266. *Id.* §1337(p)(1)(D).

267. *Id.* §1337(p).

268. *Id.* §§703 et seq.

269. *Id.* §703(a).

however, current regulations do not expressly address the incidental take of migratory birds.

So far, agencies are evaluating offshore aquaculture facilities under the MBTA on an individual basis. For example, EPA evaluated potential takes of two migratory shorebirds due to Velella Epsilon and concluded that they are not expected to interact with the proposed project due to the distance from the proposed project to the shore.²⁷⁰ However, despite commenters requesting an MBTA evaluation for the proposed aquaculture management plan in the Pacific Islands Region, NMFS stated it would complete evaluations only for individual amendments to fishery ecosystem plans.²⁷¹

I. The National Marine Sanctuaries Act

The National Marine Sanctuaries Act (NMSA) prohibits the destruction of, loss of, or injury to any sanctuary resource managed under the law or by permit, and requires federal agencies to consult with the National Oceanic and Atmospheric Administration (NOAA) on actions that are likely to destroy, injure, or cause the loss of any sanctuary resource.²⁷² If an applicant plans to conduct activities prohibited under the NMSA but authorized under a valid federal or state lease, permit, license, approval, or authorization, the applicant must obtain a permit from NOAA for the activities and comply with terms and conditions to protect marine sanctuaries.²⁷³ Currently, both aquaculture opportunity areas in southern California and the Gulf of Mexico overlap with national marine sanctuaries and will likely require consultation under the NMSA, although NMFS has not yet indicated it will so consult.²⁷⁴

J. The MMPA

All marine mammals are protected under the MMPA. The MMPA prohibits, with certain exceptions, the “take” of marine mammals.²⁷⁵ “Take” is defined under the Act as “harass, hunt, capture, kill or collect, or attempt to harass, hunt, capture, kill or collect.”²⁷⁶ Pursuant to this law, NMFS is charged with protecting whales, dolphins, porpoises, seals, and sea lions, and FWS is charged with protecting walrus, manatees, otters, and polar bears. Aquaculture permittees must seek authorization for potential takes or face the potential for liability if a take does occur.²⁷⁷

270. VELELLA EPSILON RESPONSE TO SIGNIFICANT COMMENTS, *supra* note 243, at 38.

271. PIR FINAL PEIS, *supra* note 226, at 315.

272. 16 U.S.C. §§1431-1445; 15 C.F.R. pt. 922.

273. 15 C.F.R. §§922.48-49.

274. See RILEY ET AL., *supra* note 44 (revealing overlap with the Florida Keys National Marine Sanctuary); see JAMES A. MORRIS JR. ET AL., NOAA, AN AQUACULTURE OPPORTUNITY AREA ATLAS FOR THE SOUTHERN CALIFORNIA BIGHT 36, 59 (2021), <https://doi.org/10.25923/tmx9-ex26> (revealing overlap with the Channel Islands National Marine Sanctuary).

275. 16 U.S.C. §1371(a).

276. *Id.* §1362(13).

277. *Id.* §1374.

K. The CZMA

Federal permitting agencies must also obtain a consistency determination under the CZMA. This statute 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.”²⁷⁸ A federal agency ensures consistency of its actions with a state management program by submitting a “consistency determination to the relevant State agency.”²⁷⁹

After receipt of the consistency determination, the “[s]tate agency shall inform the Federal agency of its concurrence with or objection to the Federal agency’s consistency determination.”²⁸⁰ Offshore aquaculture in the EEZ may require a consistency determination if it affects state waters. In the case of *Vellella Epsilon*, Florida concluded that the project would remain consistent with the Florida Coastal Management Program, despite the project’s location approximately 45 miles southwest of Sarasota, Florida.²⁸¹

L. The FFDCA

New animal drugs for aquaculture also require FDA authorization under the FFDCA. Under the Act, a new animal drug is deemed “unsafe” unless FDA has approved a new animal drug application for the drug, and its use conforms to its labeling and the conditions of the approved application.²⁸² The FFDCA requires an applicant to submit reports to demonstrate whether the drug is “safe and effective for use.”²⁸³ FDA’s approval of an application hinges upon the agency’s finding that the new animal drug is “safe and effective” for the purposes intended and for use under the prescribed conditions.²⁸⁴

FDA’s approval of a new animal drug application is a major federal action subject to the requirements of NEPA.²⁸⁵ In the case of aquaculture, new animal drugs to be used on aquacultured fish require FDA authorization. So too do GE fish require FDA approval under the FFDCA, since they are considered “new animal drugs” themselves.²⁸⁶

M. FIFRA

Pesticides, including those approved for use in aquaculture, require approval by EPA under FIFRA.²⁸⁷ EPA may not register a pesticide unless it first determines and supports with substantial evidence that the pesticide “will perform its intended function without unreasonable adverse effects on the environment; and when used in accordance with widespread and commonly recognized practice it will not generally cause unreasonable adverse effects on the environment.”²⁸⁸ FIFRA defines “unreasonable adverse effects on the environment” to include “any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide.”²⁸⁹

FIFRA’s “unreasonable adverse effect” safety standard requires EPA to conduct a careful balancing of the costs and benefits of pesticide use.²⁹⁰ Aquaculture operators can only use a pesticide product according to the directions on the labeling accompanying it at the time of sale. Currently, EPA has numerous pesticides registered under FIFRA for use in aquaculture, including azamethiphos (an organophosphate), deltamethrin, and hydrogen peroxide.

N. State-Law Regulation of Aquaculture

Finally, state governments currently regulate most aquaculture operations through various licenses and permits dealing with land use zoning, building, water use, waste discharge, species certification related to wildlife management, marketing or processing, and trade. Often, regulations differ based on an operation’s location: inland, coastal, offshore, or wetland. Due mainly to environmental concerns, requirements vary for each type of operation, with states administering permits based on their own specific rules.

However, some states do have modern, aquaculture-specific laws in place that account for their specific risks and regulatory challenges.²⁹¹ California’s for example, passed in 2006, is considered the “gold standard” of state-based aquaculture regulation.²⁹² Other states have passed laws limiting or outright banning aquaculture. As noted above, following the catastrophic net pen failure and escape of more than 250,000 farmed Atlantic salmon in 2017 in Puget Sound, Washington first passed a 2018 law prohibiting non-native Atlantic salmon net pen aquaculture and then outright prohibited all finfish aquaculture in 2022.²⁹³

278. *Id.* §1456(c)(1)(A).

279. *Id.* §1456(c)(1)(C); *see also* 15 C.F.R. §930.36.

280. 15 C.F.R. §930.41.

281. *VELELLA EPSILON RESPONSE TO SIGNIFICANT COMMENTS*, *supra* note 243, at 16.

282. 21 U.S.C. §360b(a)(1).

283. *Id.* §360b(b)(1)(A); *see also* 21 C.F.R. §514.1(8) (FDA regulations requiring applicant to submit evidence to establish the “safety and effectiveness” of a new animal drug).

284. *See, e.g.*, 21 U.S.C. §360b(d)(1)(A), (B), (D), (E).

285. *See* 21 C.F.R. §25.20(m).

286. *See Institute for Fisheries Res. v. Hahn*, 424 F. Supp. 3d 740, 751-55 (N.D. Cal. 2019).

287. 7 U.S.C. §136a(a).

288. *Id.* §136a(c)(5)(C), (D).

289. *Id.* §136(bb).

290. *National Fam. Farm Coal. v. Environmental Prot. Agency*, 960 F.3d 1120, 1142, 50 ELR 20139 (9th Cir. 2020) (“FIFRA requires the EPA to consider” economic, social, and environmental costs “as part of a cost-benefit analysis.”).

291. *E.g.*, California Sustainable Oceans Act (CAL. FISH & GAME CODE §15400(a) (2006)).

292. *See infra* Part V.

293. Ryan, *supra* note 57; News Release, Washington State Department of Natural Resources, Commissioner Franz Ends Net Pen Aquaculture in Washing-

That said, state laws and jurisdiction will not reach the development of aquaculture in the federal EEZ that is the great future hope of aquaculture proponents and the scope of this Article. As the next section explains, NMFS' authority to regulate "fishing" in the EEZ does not extend to aquaculture, leaving agencies scrambling for an enabling statute to permit this brand-new industry.

III. Gulf Fishermens Ass'n v. National Marine Fisheries Service

A. The Gulf EEZ Aquaculture Procedural History

The Gulf EEZ aquaculture scheme resulted from a convoluted rulemaking saga starting in 2004 and spanning a decade-plus, propelled by Commerce's singular focus to put industrial fish farms in federal waters for the first time.²⁹⁴ After Congress did not pass the national legislation pushed by the agency in 2005 that would authorize these agencies to issue industrial aquaculture permits,²⁹⁵ Commerce began an end run around Congress, by supporting the development of a permitting scheme through the regional Gulf of Mexico Fishery Management Council, made possible by overextending the Council's authority to manage "fishing" under the MSA.

After several years of back and forth between the agency and the Gulf Council, in early 2009, a new draft of the Aquaculture FMP was presented and approved by the Council. In June 2009, NMFS published in the *Federal Register* the proposed FMP, with a comment period running until August. Then, on April 20, 2010, an explosion occurred on the *Deepwater Horizon* oil platform in the Gulf of Mexico, causing the "biggest offshore oil spill in American history."²⁹⁶ As a result, no further action was taken until January 2013, when NMFS announced their intent to prepare a supplemental EIS under NEPA, taking into account the spill in the Gulf plan.

Then, in February 2013, the Gulf Council voted that implementing regulations were necessary and appropriate for the Aquaculture FMP.²⁹⁷ NMFS moved forward with the final step to authorize offshore aquaculture by sending revised draft regulations for the Gulf Council's approval in August 2014.²⁹⁸ Finally, in early 2016, after another long delay, Commerce and NMFS, with the assistance of the

Gulf Council, finalized the aquaculture MSA regulations in a new FMP treating all farmed fish as a fishery unit under the MSA, as well as the programmatic EIS pursuant to NEPA.²⁹⁹ However, despite repeatedly acknowledging that aquaculture could affect federally listed species and their critical habitat, NMFS never completed the consultation and analysis required under the ESA.³⁰⁰

B. The Gulf Aquaculture FMP

The first-of-its-kind aquaculture plan authorized Gulf operations producing more than 64 million pounds annually of seafood in its first 10 years.³⁰¹ This was no small start: the total permitted annually was more than the 2000-2006 annual average of *all* wild-caught fish in the Gulf apart from menhaden and shrimp.³⁰²

The FMP regulations had a number of parts. The plan classified all farmed fish under a new "aquaculture fishery management unit," and authorized farming of all federally managed fish species besides corals and shrimp.³⁰³ They established the commercial permitting scheme for conducting commercial aquaculture in Gulf waters, created a Gulf aquaculture permit, and authorized NOAA Fisheries Southeast Region regional administrator to review and approve individual applications.³⁰⁴ The permit duration set an initial 10-year permit term, with renewals for five-year terms thereafter. The renewals were administrative; no additional substantive review was required.³⁰⁵ Approval of the actual aquaculture structure (e.g., cage, net pen, etc.) was deferred to the individual application phase.

Consideration of a structure's potential threats to essential fish habitat, federally protected species, and the marine ecosystem was also made discretionary.³⁰⁶ The rules permitted siting of the aquaculture operations in traditional fishing grounds and critical habitats for federally listed species.³⁰⁷ The rules set up restricted access zones, prohibiting fishing and fishing vessels in areas surrounding aquaculture facilities.³⁰⁸ Recordkeeping and self-reporting requirements were included, instituting after-the-fact reporting for entanglements with marine species (including those protected under the ESA), disease outbreaks, and incidents of "major" fish escapes.³⁰⁹ And as noted, production capacity capped annual total aquaculture production at 64 mil-

ton's Waters (Nov. 18, 2022), <https://www.dnr.wa.gov/news/commissioner-franz-ends-net-pen-aquaculture-washington%E2%80%99s-waters>.

294. Fisheries of the Caribbean, Gulf of Mexico, and South Atlantic; Draft Generic Amendment to Gulf of Mexico Fishery Management Plans for Offshore Aquaculture, 69 Fed. Reg. 53682 (Sept. 2, 2004).

295. See National Offshore Aquaculture Act of 2005, S. 1195, 109th Cong. (2005).

296. Campbell Robertson & Clifford Krauss, *BP May Be Fined Up to \$18 Billion for Spill in Gulf*, N.Y. TIMES (Sept. 4, 2014), <https://www.nytimes.com/2014/09/05/business/bp-negligent-in-2010-oil-spill-us-judge-rules.html>.

297. Fisheries of the Caribbean, Gulf, and South Atlantic; Aquaculture, 81 Fed. Reg. 1762, 1769 (Jan. 13, 2016).

298. See Fisheries of the Caribbean, Gulf, and South Atlantic; Aquaculture, 79 Fed. Reg. 51424 (Aug. 28, 2014).

299. *Gulf Fishermens Ass'n v. National Marine Fisheries Serv.*, 341 F. Supp. 3d 632, 637 (E.D. La. 2018); 79 Fed. Reg. 51424 (Aug. 28, 2014); 81 Fed. Reg. 1762 (Jan. 13, 2016) (codified at 50 C.F.R. pts. 600 and 622).

300. See Memorandum from Phil Steele, Assistant Reg'l Admin., Sustainable Fisheries Div. to David Bernhart, Assistant Reg'l Admin., Protected Res. Div. at 2 (Apr. 2, 2009); Memorandum from Jack McGovern, Assistant Reg'l Admin., Sustainable Fisheries Div. to David Bernhart, Assistant Reg'l Admin., Protected Res. Div. (June 11, 2015).

301. *Gulf Fishermens Ass'n v. National Marine Fisheries Serv.*, 968 F.3d 454, 459, 50 ELR 20182 (5th Cir. 2020).

302. *Id.*

303. 50 C.F.R. §622.105(b).

304. *Id.* §622.101.

305. *Id.* §622.101(d)(4), (6).

306. *Id.* §622.105(a).

307. *Id.* §622.103.

308. *Id.* §622.104.

309. *Id.* §622.102.

lion pounds, and annual production for each operator at 20% of the total, or 12.8 million pounds.³¹⁰

NMFS thus created a commercial offshore aquaculture permitting scheme where a permit holder could farm fish in most areas of the Gulf with little oversight.³¹¹ Once issued, permits would have been effective for at least 10 years; there were no grounds for automatic revocation. Fish farms could have been sited in traditional fishing grounds or sensitive habitat of wild fish and federally protected species while excluding commercial and recreational fishing vessels from extended areas surrounding these aquaculture operations.³¹² The rules allowed up to 64 million pounds of fish to be farmed annually, driving down the price of wild-caught fish.³¹³ The agency put off any robust analysis of offshore aquaculture's potential socioeconomic and environmental impacts to future individual permits.³¹⁴ Among other deficiencies, the agency inadequately analyzed likely impacts of fish escapes, only requiring after-the-fact self-reporting of “major” escapes over a certain percentage; in effect, the rules would have allowed more than eight million fish to escape per year unreported.³¹⁵

C. NMFS' Application of MSA "Fishing" Authority

The statutory authority claim for NMFS' permitting scheme—a massive, unprecedented system for an entirely new and novel form of industrial activity—was predicated on one word: “harvesting,” plucked out of the MSA's definition of “fishing,” which 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 [above].³¹⁶

NMFS made no argument that the “catching or “taking” definitional prongs of fishing had anything to do with aquaculture, just “harvesting.” Crucially, the fishing authority of the MSA is the sine qua non touchstone of the agency's statutory authority, from which the entire scheme—FMPs, catch yields, permits, and everything else—flows, as explained in Part II.

The MSA does not define “harvesting.” So, NMFS went to a dictionary definition and found a potential definition that includes “the act or process of harvesting a crop.”³¹⁷ Then, using a second, different dictionary, NMFS found

a potential definition of “crop” that includes “the yield of some other farm produce.”³¹⁸ Then, equating seafood and farm produce, and based solely on these cherry-picked, extra-statutory potential definitions, NMFS thus surmised it had a “sound basis for concluding that ‘fishing’ includes the catch, take or harvest of cultured stocks, and thus aquaculture activities are within the scope” of the MSA.³¹⁹

D. The Litigation

Exactly one month after NMFS issued the FMP and its implementing regulations, in February 2016, a coalition of national and local conservation, commercial fishing, and recreational fishing organizations filed suit in the U.S. District Court for the Eastern District of Louisiana.³²⁰ The broad plaintiff coalition included the Gulf Fishermens Association, Gulf Restoration Network, Gulf of Mexico Reef Fish Shareholders' Alliance, Charter Fisherman's Association, Destin Charter Boat Association, Clearwater Marine Association, Alabama Charter Fishing Association, Fish for America USA, Inc., Florida Wildlife Federation, Recirculating Farms Coalition, Food & Water Watch, Inc., and Center for Food Safety.³²¹

The 94-page detailed complaint brought seven claims. The plaintiffs first argued that the entire regulatory scheme was ultra vires, beyond NMFS' statutory authority under the MSA because aquaculture is not fishing.³²² This claim became the focal point of the judicial review, as discussed below. However, in the alternative and assuming, arguendo, that NMFS did have authority to create the new permitting scheme, the plaintiffs also raised numerous other arguments under several environmental statutes.

Even if NMFS could regulate aquaculture under the MSA, its permitting scheme still violated that Act in several ways. The MSA has 10 key national substantive standards³²³ that must be met for every FMP, and the plaintiffs argued that the Gulf Aquaculture FMP failed several. For example, National Standard 1 provides that all FMPs “shall prevent overfishing while achieving, on a continuing basis, the optimum yield (OY) from each fishery,”³²⁴ but both the concepts of overfishing and maximum sustainable yield were nonsensical to aquaculture, as even NMFS admitted (and the district court later noted).³²⁵ There is no way to “overfish” a fish farm and hence no need for a sustainable yield of it; *all* the fish are harvested.

Further, because the purposes of the MSA include preventing overfishing and ensuring conservation, National Standard 5 requires that all FMPs not have economic

310. *Id.* §622.107.

311. *Id.* §622.101.

312. *Id.* §§622.103, 622.104.

313. *Id.* §622.107.

314. *Id.* §622.105(a).

315. 81 Fed. Reg. 1762, at 1782 (Jan. 13, 2016) (allowing for escapes of up to 10% of the fish from “all approved aquaculture systems combined” to go unreported, which, based on the Aquaculture FMP's ideal number of operations, largest cage, and highest density estimates, translates to more than eight million escapes in pounds per year).

316. 16 U.S.C. §1802(16).

317. 81 Fed. Reg. 1762, at 1768.

318. *Id.*

319. *Id.*

320. Complaint, *Gulf Fishermens Ass'n v. National Marine Fisheries Serv.*, No. 2:16-cv-1271-JTM-KWR (E.D. La. filed Feb. 12, 2016).

321. *Id.*

322. *Id.* ¶¶ 194-201.

323. See 16 U.S.C. §§1853(a)(1), 1851(a)(1)-(10).

324. *Id.* §1851(a)(1); 50 C.F.R. §600.310(a).

325. *Gulf Fishermens Ass'n v. National Marine Fisheries Serv.*, 341 F. Supp. 3d 632, 640 (E.D. La. 2018).

allocation as their sole purpose.³²⁶ The Aquaculture FMP violated this because its purpose was to foster a commercial aquaculture industry in the Gulf.³²⁷ The plaintiffs also argued for several further MSA violations: violation of National Standard 8 (failure to account for adverse impacts to fishing communities)³²⁸; violation of National Standard 9 (failure to minimize bycatch)³²⁹; failure to protect essential fish habitat³³⁰; and violations of the MSA's procedural safeguards, due to the manner of the FMP's adoption.³³¹

The plaintiffs also argued that the regulations, record of decision, and accompanying EIS violated NEPA in multiple ways.³³² First, NMFS violated NEPA's alternatives mandate because it had an overly narrow purpose and insufficient alternatives analyzed.³³³ Second, NMFS improperly punted down the road any analysis of the aquaculture's site-specific impacts, deferring this to the individual permitting stage (and even there, it was unclear what would happen and what types of assessments would occur, as site-specific NEPA analyses were not required).³³⁴ Third and relatedly, NMFS failed NEPA's general "hard look" mandate for numerous environmental and intertwined socioeconomic direct, indirect, and cumulative impacts, such as fish escapes and impacts to local commercial and recreational fishing industries.³³⁵

Finally, the plaintiffs argued that NMFS violated the ESA,³³⁶ because the agency's two-page "analysis" of potential impacts to the Gulf's many endangered species—as with NEPA—kicked the can of analysis down the road to later individual permits, which, in addition to being later in time, would not have the proper scope of the entire regulatory system (nor its cumulative effects). The plain-

tiffs contended that this was contrary to law and that the agency should have engaged in formal §7 consultation on the potential impacts to Gulf species and their habitat at the rulemaking stage.³³⁷ For all these reasons, the plaintiffs asked the court to declare the FMP and its regulations unlawful, and to vacate them.³³⁸

E. The District Court's Decision

After cross-motions for summary judgment and an oral argument, in September 2018, the district court granted the plaintiffs' motion, holding that the MSA does not authorize the permitting of aquaculture facilities, and thus the agency exceeded its statutory authority.³³⁹ In so doing, the court applied the familiar two-step framework from *Chevron, U.S.A., Inc. v. Natural Resources Defense Council, Inc.*³⁴⁰ to analyze agency action. Pursuant to that standard, courts first ask if Congress has "directly spoken to the precise question at issue."³⁴¹ If Congress' intent is clear, "that is the end of the matter."³⁴² If on the other hand the court concludes that the statute is ambiguous with regards to the specific issue, it asks whether or not the agency action is based on a permissible or reasonable construction of the statute.³⁴³

The court began with the MSA's plain text to analyze congressional intent.³⁴⁴ Commerce contended that the term "harvesting" in the Act's definition of "fishing" gave it the authority to regulate aquaculture, as "harvesting" means the "act or process of gathering a crop."³⁴⁵ With aquaculture, it is a "crop of fish." Commerce argued that because the Act does not directly address the precise question at issue and nothing in the Act prohibits its promulgation of these regulations, then the *Chevron* step one analysis ends, and the court was to defer to the agency's interpretation under step two.³⁴⁶

The court rejected this approach. Instead, it held that the Act's definition of "harvesting" should be read in conjunction with neighboring terms "catching" and "taking" that together make up the "fishing" definition.³⁴⁷ Catching and taking describe traditional fishing activities, the capture of wild fish, and thus harvesting should be similarly read.³⁴⁸ The court rejected the defendants' argument that harvesting should be given the separate and apart agricultural definition of the "act or process of gathering crop"—and 'crop'—'the yield of some other farm produce.'³⁴⁹

326. 16 U.S.C. §1851(5); 50 C.F.R. §600.330(a).

327. Opening Summary Judgment Motion at 21-24, *Gulf Fishermens Ass'n*, No. 2:16-cv-1271-JTM-KWR, ECF 80-2.

328. 16 U.S.C. §1851(a)(8); 50 C.F.R. §600.345(a). See Opening Summary Judgment Motion at 24-25, *Gulf Fishermens Ass'n*, No. 2:16-cv-1271-JTM-KWR, ECF 80-2.

329. 16 U.S.C. §1851(a)(9); 50 C.F.R. §600.350(a). See Opening Summary Judgment Motion at 24-25, *Gulf Fishermens Ass'n*, No. 2:16-cv-1271-JTM-KWR, ECF 80-2.

330. 16 U.S.C. §1853(a)(7). See Opening Summary Judgment Motion at 26-27, *Gulf Fishermens Ass'n*, No. 2:16-cv-1271-JTM-KWR, ECF 80-2.

331. See Opening Summary Judgment Motion at 27-28, *Gulf Fishermens Ass'n*, No. 2:16-cv-1271-JTM-KWR, ECF 80-2.

332. Complaint ¶¶ 220-234, *Gulf Fishermens Ass'n*, No. 2:16-cv-1271-JTM-KWR, ECF No. 1.

333. See Opening Summary Judgment Motion at 30-31, *Gulf Fishermens Ass'n*, No. 2:16-cv-1271-JTM-KWR, ECF 80-2; 42 U.S.C. §4332(2)(C)(iii), (E); 40 C.F.R. §1502.14(a). An agency's alternatives analysis is, in turn, a function of the "purpose and need" of the action under review. *Id.* §1502.13 (agency must "specify the underlying purpose and need to which [it] is responding in proposing the alternatives").

334. See Opening Summary Judgment Motion at 33-34, *Gulf Fishermens Ass'n*, No. 2:16-cv-1271-JTM-KWR, ECF 80-2; 40 C.F.R. §§1508.7, 1508.8, 1508.25; Kern v. Bureau of Land Mgmt., 284 F.3d 1062, 1072, 32 ELR 20571 (9th Cir. 2002) ("An agency may not avoid an obligation to analyze in an EIS environmental consequences that foreseeably arise from an [action] merely by saying that the consequences are unclear or will be analyzed later. . .").

335. See Opening Summary Judgment Motion at 34-41, *Gulf Fishermens Ass'n*, No. 2:16-cv-1271-JTM-KWR, ECF 80-2; O'Reilly v. U.S. Army Corps of Eng'rs, 477 F.3d 225, 234-35, 37 ELR 20021 (5th Cir. 2007); 40 C.F.R. §1508.7 (definition of "cumulative effects").

336. Complaint ¶¶ 243-259, *Gulf Fishermens Ass'n*, No. 2:16-cv-1271-JTM-KWR, ECF No. 1.

337. See Opening Summary Judgment Motion at 41-48, *Gulf Fishermens Ass'n*, No. 2:16-cv-1271-JTM-KWR, ECF 80-2.

338. See *id.* at 48-50.

339. *Gulf Fishermens Ass'n v. National Marine Fisheries Serv.*, 341 F. Supp. 3d 632, 635-37 (E.D. La. 2018).

340. 467 U.S. 837, 14 ELR 20507 (1984).

341. *Id.* at 842.

342. *Id.* at 843.

343. *Id.* at 843-44.

344. *Gulf Fishermens Ass'n*, 341 F. Supp. 3d at 637-38.

345. *Id.* at 638.

346. *Id.*

347. *Id.* at 638-39.

348. *Id.* at 639.

349. *Id.* at 638 (wise to apply the maxim "where a word is capable of many meanings in order to avoid the giving of unintended breadth to the Acts of Congress") (quoting *Jarecki v. G.D. Searle & Co.*, 367 U.S. 303, 307 (1961)).

The court next analyzed the MSA's overall statutory scheme.³⁵⁰ Beginning with the findings and purpose provisions, the court held them inapposite to aquaculture.³⁵¹ The Act hinges on best managing and conserving fishery resources "'found' off the coast[s]," for "species which dwell" off the coasts, language inapplicable to fish implanted in the Gulf waters in aquaculture facilities.³⁵² In contrast, "[n]owhere in the [MSA's] findings and purpose does Congress mention aquaculture or the management of fish as crops."³⁵³ However, the court noted that Congress did mention aquaculture in three discrete provisions immaterial to the agency's fishing authority, which showed Congress was aware of aquaculture, but did not include management of it in the agency's fishing authority.³⁵⁴

The court also relied on important ways in which the Act as a whole is "nonsensical" as applied to aquaculture.³⁵⁵ It applies to fishing "vessels," not cages or pens.³⁵⁶ Another critical component of all FMPs is the requirement that they have measures necessary to prevent overfishing, a term "inapplicable to the concept of fish farming."³⁵⁷ The Act also requires that all plans assess the maximum sustainable yield, "yet another concept that is nonsensical in the regulation of aquaculture."³⁵⁸ The court noted that Commerce itself acknowledged in the record that "[m]any [MSA] legal requirements do not fit well or are difficult to satisfy with respect to aquaculture."³⁵⁹

The court next turned to the Act's legislative history, noting that the term "harvesting" is "repeatedly used in regards to traditional fishing of wild fish."³⁶⁰ As such, the "ordinary, contemporary, common meaning" of harvesting as used in the MSA at the time of its enactment was with regards to conventional fishing activities, not aquaculture.³⁶¹ Rather than try to rebut this, Commerce relied on later legislative activity, for a separate statute,³⁶² or for

legislative bills that did not pass, but the court did not find this persuasive.³⁶³

As for case law, the district court found "unavailing" Commerce's reliance on a 2012 District of Hawaii case, *KAHEA v. National Marine Fisheries Service*, which approved a one-year fishing permit issued by NMFS to grow and then harvest albacore jack fish in a mesh cage towed continuously behind a vessel.³⁶⁴ The Ninth Circuit, in an unpublished memorandum disposition, affirmed.³⁶⁵ While the court in *KAHEA* had held NMFS' reliance on its "fishing" authority reasonable, it had "given short thrift to step one of *Chevron*."³⁶⁶ Further, the issue there—a single permit, for a nonstationary vessel—was "easily distinguished from the issue before this Court—an entirely new regulatory scheme permitting aquaculture facilities throughout the Gulf."³⁶⁷ Finally, the court in *KAHEA* had itself cabined its decision, noting that the permit it issued "did not create a rule that aquaculture is fishing."³⁶⁸ For all these reasons, the reasoning in *KAHEA* was "not binding, applicable, or persuasive."³⁶⁹

Based on all of these factors, the court held that the term "harvesting" was intended by Congress to refer to traditional fishing activities in the ocean, not aquaculture.³⁷⁰ The analysis could end at *Chevron*'s step one, because the intent of Congress was clear and unambiguous.³⁷¹

Finally, and importantly as a matter of administrative law beyond interpreting the MSA, the court rejected Commerce's contention that, because the Act does not expressly address the precise question, the court should automatically proceed to *Chevron* step two.³⁷² Instead, courts must exhaust all tools of statutory construction at step one and, "[w]here traditional canons of construction resolve ambiguity, '*Chevron* leaves the stage.'³⁷³ Here, based on all of the above factors—even though the MSA did not expressly say "fishing does not mean aquaculture"—the answer was still unambiguous.

Because the court ruled for the plaintiffs on their ultra vires claim, it saw no need to reach the additional argu-

350. *Gulf Fishermens Ass'n*, 341 F. Supp. 3d at 639 (citing and quoting Chamber of Com. of the U.S. v. U.S. Dep't of Lab., 885 F.3d 360, 372 (5th Cir. 2018) ("words of a statute must be read in their context and with a view to their place in the overall statutory scheme")).

351. *Id.*

352. *Id.* (citing 16 U.S.C. §1801(a)(1), (b)(1)).

353. *Id.*

354. *Id.* at 639 & n.32.

355. Courts "do not . . . construe statutory phrases in isolation; [they] read statutes as a whole." *United States v. Morton*, 467 U.S. 822, 828 (1984); ANTONIN SCALIA & BRYAN A. GARNER, *READING LAW: THE INTERPRETATION OF LEGAL TEXTS* 168 (2012) ("Properly applied, [the whole text canon] typically establishes that only one of the possible meanings that a word or phrase can bear is compatible with the use of the same word or phrase elsewhere in the statute; or that one of the possible meanings would cause the provision to clash with another portion of the statute.").

356. *Gulf Fishermens Ass'n*, 341 F. Supp. 3d at 639.

357. *Id.*

358. *Id.*

359. *Id.* at 640 (quoting record documents).

360. *Id.* at 640 & n.36.

361. *Id.* at 640 (quoting *Perrin v. United States*, 444 U.S. 37, 42 (1979)).

362. This included reliance on the National Aquaculture Act of 1980, discussed in Part II *supra*. *Gulf Fishermens Ass'n*, 341 F. Supp. 3d at 641 ("While the [National Aquaculture Act] and proposed bill may evince a national policy of promoting aquaculture, they do not indicate that Congress intended the MSA to give NMFS authority to regulate it.").

363. *Id.* at 640-41 (quoting *Consumer Prod. Safety Comm'n v. GTE Sylvania, Inc.*, 447 U.S. 102, 118 (1980) ("[E]ven when it would otherwise be useful, subsequent legislative history will rarely override a reasonable interpretation of a statute that can be gleaned from its language and legislative history prior to its enactment.")).

364. *Id.* at 641; *KAHEA v. Nat'l Marine Fisheries Serv.*, No. CIV. 11-00474 SOM, 2012 WL 1537442 (D. Haw. Apr. 27, 2012).

365. *KAHEA v. National Marine Fisheries Serv.*, 544 F. App'x 675 (9th Cir. 2013).

366. *Gulf Fishermens Ass'n*, 341 F. Supp. 3d at 641.

367. *Id.*

368. *Id.* (quoting *KAHEA*, 2012 WL 1537442, at *11).

369. *Id.*

370. *Id.* at 641-42.

371. *Id.* at 642 ("There is no ambiguity in the term 'harvesting' such that the [agency] was authorized to fill a gap therein."); *id.* (quoting *Chamber of Com. of the U.S. v. U.S. Dep't of Lab.*, 885 F.3d 360, 369 (5th Cir. 2018) (Ambiguity "is a creature not of definitional possibilities but of statutory context.")).

372. *Id.* at 638 (citing and quoting *Texas v. United States*, 497 F.3d 491, 513 (5th Cir. 2007) ("To suggest, as the [agency] effectively does, that *Chevron* step two is implicated at any time a statute does not expressly negate the existence of a claimed administrative power . . . is both flatly unfaithful to the principles of administrative law . . . and refuted by precedent.")).

373. *Id.* (quoting *Epic Sys. Corp. v. Lewis*, 138 S. Ct. 1612, 1630 (2018)).

ments under the MSA, NEPA, and the ESA. Accordingly, the court held that the agency acted outside its authority and vacated the regulations.³⁷⁴

F. The Appellate Decision

Commerce appealed, mostly renewing the arguments they made in the district court, namely that the Act was ambiguous on the point and that its interpretation was reasonable. A three-judge panel of the Fifth Circuit heard oral argument in January 2020 and issued their decision in August 2020, affirming the district court by a 2-1 vote.³⁷⁵ The majority, comprising Judge Stuart Kyle Duncan and Judge Patrick Higginbotham, in an opinion authored by Judge Duncan, agreed with Judge Jane M. Triche-Milazzo that the Aquaculture FMP and regulations were ultra vires.³⁷⁶ Judge Stephen A. Higginson dissented.³⁷⁷

1. The Majority

The majority was blunt with its decision—and its remedy advice for aquaculturists—from the outset:

We consider whether a federal agency may create an “aquaculture,” or fish farming, regime in the Gulf of Mexico pursuant to the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (“Magnuson-Stevens Act” or “Act”). *The answer is no. The Act neither says nor suggests that the agency may regulate aquaculture.* The agency interprets this silence as an invitation, but our precedent says the opposite: Congress does not delegate authority merely by not withholding it. Undaunted, the agency seeks authority in the Act’s definition of “fishing”—the “catching, taking, or harvesting of fish.” “Harvesting,” we are told, implies gathering crops, and in aquaculture the fish are the crop. That is a slippery basis for empowering an agency to create an entire industry the statute does not even mention. We will not bite. *If anyone is to expand the forty-year-old Magnuson-Stevens Act to reach aquaculture for the first time, it must be Congress.*³⁷⁸

[The appellate decision is also a fun one to read for readers that enjoy fishing puns. “We will not bite” was the first of many, at least six, by the authors’ count.]³⁷⁹

374. *Id.* at 642; 5 U.S.C. §706(2)(C) (courts shall hold unlawful and set aside agency action that is, inter alia, in excess of statutory authority).

375. *Gulf Fishermens Ass’n v. National Marine Fisheries Serv.*, 968 F.3d 454, 50 ELR 20182 (5th Cir. 2020).

376. *Id.* at 455-69.

377. *Id.* at 469-71.

378. *Id.* at 456 (emphases added) (internal citations omitted).

379. *Id.* at 460 (“As far as aquaculture, the [MSA] is a textual dead zone”); *id.* at 462 (“Once again, this is the argument that presumes power given if not excluded. We have resisted that siren song before.”); *id.* at 463 (“Unable to land support for its interpretation in the words of the Act, the agency goes angling for ambiguity.”); *id.* at 466 (“From one word—‘harvesting’—the agency would conjure up authority over aquaculture that Congress knew how to give, but never gave. That does not hold water.”); *id.* at 467 (“But try applying this idea to aquaculture, and your line will become hopelessly snarled.”).

Specifically, the majority agreed with the lower court that the case could be resolved at *Chevron* step one, because the MSA “unambiguously precludes the agency from creating an aquaculture regime.”³⁸⁰ Proceeding with the text first, the majority rejected Commerce’s “gap filling” argument—that although the MSA did not speak directly to the topic, Congress gave the agency the power to fill that gap because the MSA does not expressly foreclose aquaculture regulation either—as a “nothing-equals-something” argument that “gets *Chevron* backwards.”³⁸¹ Invoking the “elephant in a mousehole” interpretive canon, the majority characterized Commerce’s argument as “all elephant and no mousehole,”³⁸² asking the court to “believe Congress authorized [Commerce] to create and regulate an elaborate industry the statute does not even mention.”³⁸³ The panel could not “suspend [their] disbelief that high.”³⁸⁴

Next, the majority addressed Commerce’s “harvesting” argument, holding that the district court correctly rejected it, explaining that “that is not how to read statutes” and that “the agency puts far more weight on ‘harvesting’ in §1802(16) than it can bear.”³⁸⁵ The court agreed with the appellees that harvesting’s appropriate definition must draw meaning from the adjacent terms, catching and taking, because “one dictionary definition does not override a term’s surrounding context.”³⁸⁶ Finally, the majority noted that “Congress knew what aquaculture was and how to confer authority to regulate it”—citing other “discrete and immaterial” statutory provisions that mention aquaculture—which further supports that it did not intend to provide that authority sub silencio through the MSA’s fishing authority.³⁸⁷

The broader statutory scheme “reinforced” the ultra vires conclusion.³⁸⁸ The district court was “correct” in concluding that there were multiple ways in which the Act is “nonsensical” as applied to aquaculture, that “some of the Act’s core requirements stop making sense.”³⁸⁹ Aquaculture facilities cannot be “overfished,” which “effectively erases” key provisions centered on preventing overfishing.³⁹⁰

380. *Id.* at 460.

381. *Id.* at 461 (“Instead of identifying any intent to delegate authority here, the agency can claim only that Congress did not withhold the power the agency now wishes to wield. Once again, this is the argument that presumes power given if not excluded. We have resisted that siren song before, and we again decline to be seduced.”) (citation omitted).

382. *Whitman v. American Trucking Ass’n*, 531 U.S. 457, 468, 31 ELR 20512 (2001); *Thomas v. Bryant*, 919 F.3d 298, 306 (5th Cir. 2019) (“What is more, giving so much significance to ‘the’ runs counter to another point Justice Scalia made about statutory interpretation: that Congress ‘does not . . . hide elephants in mouseholes.’”).

383. *Gulf Fishermens Ass’n*, 968 F.3d at 462.

384. *Id.*

385. *Id.*

386. *Id.* at 463 (citing the associated word canon (*noscitur a sociis*)). See generally SCALIA & GARNER, *supra* note 355, at 195 (explaining that “the canon especially holds that ‘words grouped in a list should be given related meanings’”).

387. *Gulf Fishermens Ass’n*, 968 F.3d at 465-66.

388. *Id.* at 466. See also SCALIA & GARNER, *supra* note 355, at 167 (whole-text canon).

389. *Gulf Fishermens Ass’n*, 968 F.3d at 466 (“We will not defer to an agency interpretation that is ‘inconsistent with the design and structure of the statute as a whole.’” (quoting *Utility Air Regul. Grp. v. Environmental Prot. Agency*, 573 U.S. 302, 321, 14 ELR 20132 (2014))).

390. *Id.* at 467.

The majority concluded by citing the agency's own acknowledgements of poor fit—"[m]any of the principles and concepts that guide wild stock management under the [Act] are either of little utility or not generally applicable to the management of aquaculture operations"³⁹¹—and then quoting and endorsing the district court's reaction to them: "Contrary to the NMFS's position, this Court does not view the incompatibility of the requirements of the [MSA] with aquaculture operations as an unfortunate happenstance, but rather, as a clear indication that Congress did not intend for the [Act] to grant NMFS the authority to regulate aquaculture."³⁹²

2. The Dissent

Judge Higginson filed a short dissent.³⁹³ He would have upheld the regulations based on Congress' "expansive grant of authority" to NMFS to manage all "fishery resources, without distinguishing between methods of fishing or types of fish."³⁹⁴ He noted that "fishing" has always involved "ingenious varieties of lines, pots, cages, nets and enclosures" such as lobster traps.³⁹⁵ Without directly addressing the "harvesting" definitional question, he concluded that both views on the authority question were "plausible," but neither was "unambiguously correct."³⁹⁶ Thus, at *Chevron* step two he would have deferred to the agency's "reasonable interpretation" because aquaculture "fits within the Act's broad definitions of fishery resources and fishing" and broad mandate to manage and conserve "all fish."³⁹⁷

IV. The Aftermath

A. Fallout and the Current Legal Landscape

The conclusion of the *Gulf Fishermens* litigation, while important, certainly did not end the controversy surrounding aquaculture in the EEZ, though it changed the trajectory. At the same time the appeal proceeded apace, the pro-EEZ aquaculture oars remained in perpetual motion. By January 2020, the time of the Fifth Circuit appellate argument, undoubtedly the writing was on the wall of the case's likely outcome, affirming the district court.

EEZ aquaculture proponents took the court's guidance and went back to Congress for new law,³⁹⁸ but at the same time, even without Congress, the "*damn the torpedoes, full speed ahead*" approach continued, or even accelerated. That led to a battle now engaged on multiple fronts. The Gulf Aquaculture FMP and regulations had been the prototype plan, the channel from which aquaculture's EEZ commer-

cial future was to flow; now, the *Gulf Fishermens* decision dam has split efforts off into multiple tributaries.

B. The Trump Administration Executive Order

First, even before the June decision was issued in the case, on May 7, 2020, the Trump Administration issued an Executive Order, Promoting American Seafood Competitiveness and Economic Growth. This Executive Order sought to expand the offshore aquaculture industry in the United States—and specifically in the EEZ—and to streamline permitting under the guise of addressing the then-COVID pandemic-related food insecurity.³⁹⁹ The Order states as its purpose strengthening the economy, ensuring food security, providing safe and sustainable seafood, supporting workers, promoting predictable federal actions, and removing regulatory burdens to fish farming.⁴⁰⁰ [Of course, many of these purported social benefits of expanded aquaculture, as juxtaposed against the track record of aquaculture elsewhere, are addressed in Part I.] The Order echoed in many ways the National Aquaculture Act of 1980's cheerleading language, including with a national aquaculture development plan, recommendations, and reports required annually.⁴⁰¹

The Executive Order specifically required three actions relevant to offshore finfish aquaculture in the EEZ. First, despite the Fifth Circuit's decision in *Gulf Fishermens*, it designated Commerce, acting through its subagency NMFS, as the lead agency for aquaculture projects in federal waters.⁴⁰² Specifically, it charged NMFS with the duty to navigate projects through federal environmental review and authorization processes, and to record all individual agency decisions in one record of decision.⁴⁰³

Second, it mandated that Commerce identify "aquaculture opportunity areas," which are geographic areas containing locations suitable for commercial aquaculture.⁴⁰⁴ Within the first year, the Order required the Secretary to identify at least two aquaculture opportunity areas, then complete a programmatic EIS for each within the two years following their identification.⁴⁰⁵ And finally, the Order required that within 90 days the Corps develop and propose for public comment an NWP authorizing structures for offshore finfish aquaculture in marine and coastal waters out to the limit of the territorial sea, and in ocean waters beyond the territorial sea within the EEZ.⁴⁰⁶

Of course, like all executive orders, the 2020 aquaculture Executive Order had no substantive authority beyond that already granted to federal agencies; that is, such orders cannot provide any new substantive or procedural author-

391. *Id.* at 468.

392. *Id.*

393. *Id.* at 469-71.

394. *Id.* at 469.

395. *Id.*

396. *Id.* at 470.

397. *Id.* at 471.

398. AQUAA Act, S. 4723, 116th Cong. (2020).

399. Promoting American Seafood Competitiveness and Economic Growth, Exec. Order No. 13921, 85 Fed. Reg. 28471 (May 12, 2020).

400. *Id.*

401. *Id.* (compare Part II *supra*).

402. *Id.*

403. *Id.*

404. *Id.*

405. *Id.*

406. *Id.*

ity for an agency, since it is not legislation.⁴⁰⁷ And the Order acknowledged as much in the standard language.⁴⁰⁸ Although untimely, both agencies, NMFS and the Corps, have now complied with these mandates.

C. NWP 56 Approval and Litigation

Next, the Corps issued NWP 56 in January 2021 authorizing industrial finfish aquaculture structures in federal waters.⁴⁰⁹ This decision marks the first time the Corps has issued an NWP for industrial finfish aquaculture development in U.S. waters on the OCS.

Specifically, NWP 56 allows aquaculture operations to install cages, net pens, anchors, floats, buoys, and other similar structures in marine and estuarine waters overlaying the OCS.⁴¹⁰ The permit also authorizes “integrated multi-trophic” aquaculture structures for facilities that also have bivalve shellfish aquaculture and/or seaweed aquaculture in addition to finfish.⁴¹¹ Fifteen out of 16 Corps districts encompassing marine waters have adopted NWP 56, including all districts in California, Jacksonville, Portland, and Seattle.⁴¹²

NWP 56’s sparse environmental analysis heavily relies on Corps district engineers to keep adverse environmental impacts below a minimal threshold. For example, the Corps did not complete programmatic ESA consultation prior to issuing NWP 56, but instead required district engineers to do so when prospective permittees submit preconstruction notices.⁴¹³ And the Corps included only vague, general conditions in its NWP 56 decision document, which apply to all 16 NWPs issued in January 2021,⁴¹⁴ relying on district engineers to enact regional conditions and mitigate impacts.⁴¹⁵

In June 2022, a coalition of marine conservation organizations, trade groups, and the Quinault Indian Nation filed a notice of intent to sue the Corps for its failure to consider impacts to threatened and endangered species under the ESA when it issued NWP 56.⁴¹⁶ And in Novem-

ber 2022, the same coalition filed a lawsuit in federal court challenging the permit decision on multiple grounds.⁴¹⁷

First, the plaintiffs argued that NWP 56 exceeds the Corps’ statutory authority under the OCSLA because Congress has not granted rights to engage in aquaculture on the OCS. Federal authority over the OCS stems in part from the Property Clause of the U.S. Constitution, which vests Congress with plenary power over all federal lands.⁴¹⁸ Because the OCS is federal property, a federal agency’s authority to dispose of OCS lands and resources can arise only by Congress’ express delegation.

Pursuant to this constitutional authority, Congress enacted the OCSLA, but that law only authorized the Secretary of the Interior to grant leases for limited, expressly stated purposes such as oil, gas, and mineral resource purposes.⁴¹⁹ The RHA permits acknowledge they do not convey a property right,⁴²⁰ yet the Corps approved the aquaculture permit on the OCS without any such authorization from Congress. As such, plaintiffs argue that the NWP is beyond the Corps’ authority and should be vacated.⁴²¹ Though different statutory schemes are implicated, this ultra vires argument has strong echoes of the successful ultra vires MSA argument in the *Gulf Fishermens* case.

Even if the Corps has authority, the plaintiffs have several arguments regarding the substantive and procedural adequacy of the Corps’ action and its failure to consider the adverse impacts of it. Plaintiffs argue that the Corps violated its own regulations in issuing NWP 56, because the facilities far exceed the RHA requirement for NWPs to “cause only minimal individual and cumulative environmental impacts.”⁴²² Plaintiffs also claim that the Corps violated NEPA in its finding of no significant impact (FONSI) because the Corps failed to assess the impacts of industrial aquaculture, improperly deferred assessment to a district level, and failed to adequately support its mitigation measures.⁴²³ Plaintiffs also argue that the Corps violated the ESA by failing to complete programmatic consultation, and instead punting this responsibility to permittees and district engineers.⁴²⁴ And finally, plaintiffs argued that the Corps failed to consult on impacts to essential fish habitat under the MSA.⁴²⁵ Again, many of these “failure to take a hard look” arguments under core environmental laws echo similar arguments from the *Gulf Fishermens* litigation.

407. *Doe #1 v. Trump*, 957 F.3d 1050, 1062 (9th Cir. 2020) (citing *Youngstown Sheet & Tube Co. v. Sawyer*, 343 U.S. 579, 587 (1952) (“[T]he President’s power to see that the laws are faithfully executed refutes the idea that he is to be a lawmaker.”)).

408. Exec. Order No. 13921 §12, 85 Fed. Reg. 28471, 28476-77 (May 12, 2020).

409. U.S. ARMY CORPS OF ENGINEERS, DECISION DOCUMENT: NATIONWIDE PERMIT 56, at 1 (2021) [DECISION DOCUMENT NWP 56]; *see also* 86 Fed. Reg. 2744 (Jan. 13, 2021).

410. DECISION DOCUMENT NWP 56, *supra* note 409, at 1.

411. *Id.*

412. Complaint, *Don’t Cage Our Oceans et al. v. U.S. Army Corps of Eng’rs*, No. 22-1627 (W.D. Wash. filed Nov. 14, 2022), ECF No. 1, Exs. C-T.

413. 86 Fed. Reg. at 2773.

414. *Id.* at 2867-75.

415. *Id.* at 2874-76.

416. Letter from Jennifer Loda & Meredith Stevenson, Staff Attorneys, Center for Food Safety, to Scott A. Spellmon, Chief, U.S. Army Corps of Engineers et al. (June 22, 2022), Re: 60 Day Notice of Intent to Sue: Violations of the Endangered Species Act for Issuance of Nationwide Permit 56, https://www.centerforfoodsafety.org/files/final-nwp-56-60-day-notice-of-intent-to-sue-under-the-esa-1_42455.pdf.

417. *Supra* note 412.

418. *See Kleppe v. New Mexico*, 426 U.S. 529, 539, 6 ELR 20545 (1976) (“This Court has repeatedly observed that [t]he power over the public land thus entrusted to Congress is without limitations.”).

419. 43 U.S.C. §1337. More recently, Congress amended it to also include renewable energy purposes, following a controversy over an offshore wind farm. *Id.* §1337(p)(1)(C); *see also* Alliance to Protect Nantucket Sound v. U.S. Dep’t of the Army, 398 F.3d 105, 35 ELR 20040 (1st Cir. 2005).

420. 33 C.F.R. §320.4(g)(6).

421. *Supra* note 412.

422. 33 C.F.R. §322.2(f); *see also* Complaint ¶¶ 218-228, *supra* note 412.

423. *See* DECISION DOCUMENT NWP 56, *supra* note 409, at 83; *see also* Compl. ¶¶ 229-238, *supra* note 412.

424. Compl. ¶¶ 239-245, *supra* note 412.

425. Compl. ¶¶ 246-250, *supra* note 412.

D. Aquaculture Opportunity Areas

On August 20, 2020, NMFS announced the designation of federal waters in the Gulf of Mexico and southern California regions as aquaculture opportunity areas, each of which may accommodate approximately three to five commercial aquaculture operations.⁴²⁶ The agency followed up by releasing atlases for each region in November 2021, revealing significant overlap between these areas and endangered species critical habitat and marine protected areas.⁴²⁷ NMFS then issued scoping notices for programmatic EISs under NEPA for both areas in May 2022.⁴²⁸ Conservation, fishing, and Indigenous organizations all filed comments, exhausting numerous adverse impacts and legal issues, including (again) the question of NMFS' authority to designate aquaculture opportunity areas following the Fifth Circuit's decision in *Gulf Fishermens*.

As of this writing, NMFS has yet to finalize the EISs. Nor are the agency documents particularly crystal-clear with regards to the underlying authority pursuant to which the agency purports to act. As noted above, NEPA alone is procedural, not substantive, and needs an underlying substantive agency authority.⁴²⁹ And as noted above, the Executive Order calling for the creation of the opportunity areas cannot create new agency authority.⁴³⁰ The only source left is the same one the Fifth Circuit held insufficient to create an aquaculture industry in the EEZ: the MSA.

E. Pacific Islands Region Aquaculture Management Program

In May 2021, NMFS issued a draft programmatic EIS for a proposed aquaculture management program that would allow for amendment of all five fishery ecosystem plans in the Pacific Islands Region to include industrial finfish aquaculture in federal ocean waters surrounding American Samoa, the Marianas Archipelago, the Hawaii Archipelago, and the Pacific Remote Island Areas, totaling half of the United States' EEZ.⁴³¹ (This differs from *Gulf Fishermens* only because there Commerce sought to create a plan solely for aquaculture, but in the Pacific Islands, Commerce seeks to amend existing plans to include aquaculture.)

426. Press Release, NMFS, NOAA Announces Regions for First Two Aquaculture Opportunity Areas Under Executive Order on Seafood (Aug. 20, 2020).

427. See RILEY ET AL., *supra* note 44; see MORRIS ET AL., *supra* note 274.

428. Notice of Intent to Prepare a Programmatic Environmental Impact Statement for Identification of One or More Aquaculture Opportunity Area(s) in Southern California, 87 Fed. Reg. 31210 (May 23, 2022); Notice of Intent to Prepare a Programmatic Environmental Impact Statement for Identification of Aquaculture Opportunity Areas in Federal Waters of the Gulf of Mexico and to Conduct Public Scoping Meetings, 87 Fed. Reg. 33124 (June 1, 2022).

429. See Part II.

430. *Doe #1 v. Trump*, 957 F.3d 1050, 1062 (9th Cir. 2020) (citing *Youngstown Sheet & Tube Co. v. Sawyer*, 343 U.S. 579, 587 (1952) (“[T]he President’s power to see that the laws are faithfully executed refutes the idea that he is to be a lawmaker.”)).

431. PIR DPEIS, *supra* note 56.

Commerce again seeks to authorize this program using “fishing” authority in the MSA.⁴³² Just as in *Gulf Fishermens*, NMFS claims authority here because “landings or possession of fish in the EEZ for the PIR [Pacific Islands Region] from the commercial marine aquaculture production of any species managed under an FEP [fishery ecosystem plan] constitutes ‘fishing’ as defined in the [MSA].”⁴³³ And yet again, Commerce reads the word “harvesting” in the definition of “fishing” outside of its statutory context to mean the “harvesting” of farmed fish as a crop.⁴³⁴ NMFS also asserts its authority using the MSA’s purpose to conserve and manage U.S. fisheries to “prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.”⁴³⁵

Numerous commenters told Commerce that it lacks authority to regulate aquaculture, per the Fifth Circuit’s decision. But in August 2022, in its final programmatic EIS, Commerce stated it intends to ignore the *Gulf Fishermens* decision because Fifth Circuit precedent does not control in the Ninth Circuit.⁴³⁶ Commerce also pointed to other sections on authority in the final programmatic EIS, which state that Commerce draws its authority from the National Aquaculture Act and several other federal actions (the 2020 Executive Order, NOAA’s 2011 Marine Aquaculture Policy, and the 2016 Marine Aquaculture Strategic Plan).⁴³⁷ But as discussed in Part II, the National Aquaculture Act does nothing but state a federal policy to encourage aquaculture, and agencies cannot draw authority solely from executive orders or guidance documents. As of April 2023, Commerce has yet to issue the amended FMPs.

F. Individual Project Approvals and Litigation

Finally, since the vacating of the Gulf plan, EEZ aquaculture proponents have taken to forcing a game of “whack-a-mole,” seeking approval for individual pilot projects since they cannot (yet at least) establish an entire industry. Namely, in spring 2020, agencies published several notices of proposals to issue individual permits to aquaculture operations in federal waters and scoping notices. For example, the Corps issued a proposal to issue the first ever RHA §10 permit to an offshore shellfish facility, Avalon Aquafarms, in federal waters 3.3 miles offshore near Huntington Beach, California.⁴³⁸ And a few months later, NMFS issued a notice of intent to prepare an EIS for Pacific Ocean Aquafarms, a finfish aquaculture facility in federal waters approximately four nautical miles off the San Diego coast.⁴³⁹

432. *Id.* at 21.

433. *Id.*

434. *Id.*

435. 16 U.S.C. §1851(a)(1).

436. PIR FINAL PEIS, *supra* note 226, at 312-13.

437. *Id.*

438. U.S. Army Corps of Engineers, Public Notice, Application for Permit: Avalon Ocean Farm (Aquaculture) 1 (Mar. 23, 2020), https://www.spl.usace.army.mil/Portals/17/docs/publicnotices/SPL-2020-00039-TS%20Avalon%20Ocean%20Farm_PN.pdf.

439. Notice of Intent, Pacific Ocean AquaFarms Environmental Impact Statement, 85 Fed. Reg. 55667 (Sept. 9, 2020).

The first NPDES permit issued to an aquaculture operation in federal ocean waters went to Vellella Epsilon in the Gulf of Mexico in October 2020.⁴⁴⁰ This NPDES permit allows Ocean Era, Inc. to place a 17-meter by seven-meter net pen cage in the Gulf to raise approximately 80,000 pounds of almaco jack over approximately 12 months and to discharge up to 27,000 pounds of feed per month.⁴⁴¹ EPA branded Vellella Epsilon a “pilot project,” despite its projected output totaling more than the average catch in Florida waters in recent years. Due to its size, EPA underwent only voluntary NEPA review, issued a FONSI under NEPA, and failed to complete ESA consultation.⁴⁴²

Because of the lack of water quality criteria for federal waters, as noted in Part II, EPA heavily relied on its ODC evaluation to ensure Vellella Epsilon meets the CWA standard.⁴⁴³ For NPDES permits in federal ocean waters, EPA must find that—despite discharges including escaped fish, pathogens, nutrients, copper, and pharmaceuticals—the NPDES permit will not result in “unreasonable degradation of the marine environment.”⁴⁴⁴ EPA, in turn, concluded that the size and short-term duration of the project would ensure no unreasonable degradation from these discharges.⁴⁴⁵ But despite its failure to qualify as a CAAP subject to NEPA, EPA still completed voluntary NEPA review.

Environmental organizations promptly challenged the NPDES permit before the Environmental Appeals Board, claiming EPA violated the CWA, the ESA, and NEPA.⁴⁴⁶ On review, the Board largely affirmed the Agency but remanded the permit to EPA on one claim, to clarify its determination that Vellella Epsilon will not result in unreasonable degradation to the marine environment.⁴⁴⁷ EPA had made two different statements: one that permitted discharges will not cause unreasonable degradation, and another that unreasonable degradation is “not likely” to occur. Since EPA needed to make the former determination, the Board requested clarity on this determination, but found for EPA on all other claims.

First, the Board found that EPA’s permit conditions, mitigation measures, monitoring requirements, and discussion of discharges in the EA sufficiently supported EPA’s determination, considering the project’s “pilot size.”⁴⁴⁸ Second, the Board confirmed EPA had conducted voluntary NEPA review, since Vellella Epsilon fell 20,000 pounds short of a CAAP, and that petitioners had not properly raised that issue. And finally, the Board determined that EPA adequately considered impacts to federally listed spe-

cies, including excess food release, fish escapes, the project’s potential to act as a fish attraction (or aggregating) device, the effects of harmful algal blooms, entanglement, and vessel strikes.

The *In re Ocean Era, Inc.* decision sheds light on the weak standards for aquaculture in the EEZ, as discussed in Part II. For example, the Board accepted mitigation measures in lieu of evaluations under the mandatory ODC factors for each pollutant EPA allows in its NPDES permit. And the Board accepted EPA’s assertion that it may omit relevant factors in voluntary NEPA review for aquaculture operations that do not qualify as CAAPs.

After EPA re-approved the permit, in September 2022, two separate lawsuits were filed challenging it on multiple grounds. On September 12, 2022, a conservation organization filed a petition for review in the U.S. Court of Appeals for the Second Circuit, challenging the permit.⁴⁴⁹ On September 29, 2022, seven other environmental organizations filed a petition in the U.S. Court of Appeals for the District of Columbia (D.C.) Circuit, challenging it.⁴⁵⁰ These cases have subsequently been consolidated and this litigation remains ongoing.

V. Lessons Learned and Conclusion

With aquaculture’s past, current, and future seascape now successfully circumnavigated, it is time to furl the sails and dock into port. But our journey is not complete without mapping some “lessons learned” landmarks for the broader debate over the future of our oceans to come. Events to this point reveal some insight. And this is not the first wave of an industrial food system paradigm shift: it is also necessary to ask what lessons can be drawn from industrial *agri-*culture for industrial *aquaculture*.

First, when it comes to a new technological development that proponents claim will solve systemic, environmental problems and beget change for the public good, the public, stakeholders, and policymakers would do well to scrutinize with a critical eye, and separate myth from reality. Past experience teaches that the reality of such technologies is often a far cry from that promised.

One need not look any farther than our commodity farm fields: 30 years ago, proponents of GE crops promised agricultural biotechnology would help solve all number of problems, including solving world hunger, increasing nutrition, increasing yields, lessening reliance on pesticides, and, more recently, helping combat climate change. Yet, after three decades and billions of dollars in research and development, none of these claims have come to pass. Contrary to the hype, there are no commercial GE crops

440. U.S. EPA, NPDES Permit No. FL0A00001, Ocean Era, Inc. (2020).

441. U.S. EPA, NPDES PERMIT FACT SHEET: OCEAN ERA, INC.-VELELLA EPSILON 1 (2020).

442. See U.S. EPA, FINDING OF NO SIGNIFICANT IMPACT: OCEAN ERA, INC.-VELELLA EPSILON NATIONAL POLLUTANT DISCHARGE SYSTEM ELIMINATION PERMIT (2020); see U.S. EPA & U.S. ARMY CORPS OF ENGINEERS, FINAL BIOLOGICAL EVALUATION: OCEAN ERA, INC.-VELELLA EPSILON (2020).

443. U.S. EPA, FINAL OCEAN DISCHARGE CRITERIA EVALUATION: OCEAN ERA, INC.-VELELLA EPSILON (2020).

444. 33 U.S.C. §1343(a).

445. U.S. EPA, *supra* note 443, at 48.

446. U.S. EPA, NPDES Permit No. FL0A00001, Ocean Era, Inc. (2020).

447. *In re Ocean Era, Inc.*, 18 E.A.D. 678 (EAB 2022).

448. *Id.* at 709-11.

449. *Friends of Animals v. Environmental Prot. Agency*, No. 22-1992 (2d Cir. filed Sept. 12, 2022).

450. *Food & Water Watch v. Environmental Prot. Agency*, No. 22-1253 (D.C. Cir. filed Sept. 29, 2022); see also Press Release, Center for Food Safety, Coalition Challenges Permit Allowing Wastewater From First-Ever Industrial Aquaculture Facility in Federal Waters (Oct. 12, 2022), <https://www.centerforfoodsafety.org/press-releases/6738/coalition-challenges-permit-allowing-wastewater-from-first-ever-industrial-aquaculture-facility-in-federal-waters>.

that increase yields, help feed the world, help fight climate chaos, or provide any other public good benefit.⁴⁵¹

Instead, it is almost exclusively a pesticide-promoting technology: the commercial reality is that GE crops are overwhelmingly produced by pesticide companies who engineer plants to be resistant to their toxic pesticides⁴⁵² in order to sell more of them.⁴⁵³ Monsanto's "Roundup Ready" GE commodity crops, engineered to be resistant to glyphosate, transformed glyphosate from a minor agricultural pesticide to by far the most intensively and extensively sprayed weed killer in the country, with 280 million pounds applied to nearly 300 million acres of farmland annually.⁴⁵⁴

Based on past precedent and what we know so far about industrial offshore aquaculture's focus and approach—large, carnivorous, expensive fish that require gutting forage fisheries to feed them, with the resulting fish less healthful than wild counterparts—it will be no panacea to the global fisheries crisis nor help fight world hunger.⁴⁵⁵

Second, not only will creating a new industry of aquaculture in federal waters not solve existing human or ecological crises, it is foreseeable that its adoption will also create new adverse consequences or worsen existing ones.

While the promises of agricultural biotechnology have not come to pass, the now well-established externalized impacts of modern industrial crop regimes are widespread and dire. To briefly summarize the major categories: the great majority of corn, soybeans, cotton, canola, and sugar beets grown in the United States are GE herbicide-resistant varieties that have dramatically increased use of these weed-killing chemicals and the overall pesticide output into our environment, that remain on our food as well as leach into the soil and water.⁴⁵⁶ Pesticide-resistant seeds and their companion pesticides are sold to farmers together as a patented crop system.

451. See, e.g., George Kimbrell, *Cutting Edge Issues in 21st Century Animal Food Labeling*, 27 *DRAKE J. AGRIC. L.* 179, 235-36 & nn.388-90 (2022) (and footnotes therein) (providing overview); George A. Kimbrell & Aurora L. Paulsen, *The Constitutionality of State-Mandated Labeling for Genetically Engineered Foods: A Definitive Defense*, 39 *VT. L. REV.* 342, 344 & 342-58 (2014) (and footnotes therein) (discussing the myth versus the reality for GE crops in detail).

452. Most of these are herbicides, a subclass of pesticides, focused on weed control. We use "pesticides" for simplicity.

453. See, e.g., Kimbrell, *supra* note 451, 235-36 & nn.388-90 (and footnotes therein) (providing overview); Kimbrell & Paulsen, *supra* note 451, at 344 & 342-58 (and footnotes therein) (discussing the myth versus the reality for GE crops in detail).

454. BIOLOGICAL AND ECONOMIC ANALYSIS DIVISION, U.S. EPA, *GLYPHOSATE: RESPONSE TO COMMENTS, USAGE, AND BENEFITS* 13 (2019) (EPA-HQ-OPP-2009-0361-2342).

455. See Part I *supra*. On the other hand, other forms of regenerative aquaculture, as discussed in Part I, may well be part of the solution to both. Regardless of whether it be transgenic crops or industrial aquaculture, the "we must produce more" rationale fundamentally misconceives the problem. The United Nations General Comment on the Right to Food concluded that "the roots of the problem of hunger and malnutrition are not lack of food but lack of access to available food." Hunger today results from institutional, not biological, constraints.

456. See William Neuman & Andrew Pollack, *Farmers Cope With Roundup-Resistant Weeds*, *N.Y. TIMES* (May 4, 2010), <http://www.nytimes.com/2010/05/04/business/energy-environment/04weed.html> ("Today, Roundup Ready crops account for about 90 percent of the soybeans and 70 percent of the corn and cotton grown in the United States.").

Because of the adoption of this system, it is estimated that GE corn, soybeans, and cotton alone have led to a 527 million-pound increase in herbicide use over the first 16 years of their cultivation, from 1996 to 2011.⁴⁵⁷ Reliance on these pesticide-promoting GE crop systems has caused a number of harms, including widespread pollution of our waterways and ecosystems,⁴⁵⁸ injury to beneficial insects such as pollinators,⁴⁵⁹ and harm to soil health.⁴⁶⁰ This dramatic increase in poisons has caused all number of harms, from contributing to the extinction crisis,⁴⁶¹ such as the dramatic collapse of monarch butterflies,⁴⁶² to cancer risks to farmworkers and their families.⁴⁶³ In summer 2022, a federal court vacated EPA's cancer "safety" determination for glyphosate as lacking substantial evidence in support.⁴⁶⁴

Pesticide-resistant GE crop systems also foster rapid emergence of "superweeds" immune to the GE crop's companion herbicide(s). Weeds resistant to glyphosate, virtually unknown through the mid-1990s, evolved in epidemic

457. Charles M. Benbrook, *Impacts of Genetically Engineered Crops on Pesticide Use in the U.S.—The First Sixteen Years*, 24 *ENV'T SCI. EUR.* 1, 3 (2012), available at <https://enveurope.springeropen.com/articles/10.1186/2190-4715-24-24>.

458. Feng-Chih Chang et al., *Occurrence and Fate of the Herbicide Glyphosate and Its Degradate Aminomethylphosphonic Acid in the Atmosphere*, 30 *ENV'T TOXICOLOGY & CHEMISTRY* 548, 548-50 (2011), available at <http://goo.gl/bZZTve>; Richard H. Coupe et al., *Fate and Transport of Glyphosate and Aminomethylphosphonic Acid in Surface Waters of Agricultural Basins*, 68 *PEST MGMT. SCI.* 16, 16-17 (2012), available at <http://goo.gl/WsvHO2>.

459. Richard Conniff, *Tracking the Causes of Sharp Decline of the Monarch Butterfly*, *YALE ENV'T* 360 (Apr. 1, 2013), <http://goo.gl/EBCU33>; John M. Pleasants & Karen S. Oberhauser, *Milkweed Loss in Agricultural Fields Because of Herbicide Use: Effect on the Monarch Butterfly Population*, 6 *INSECT CONSERVATION & DIVERSITY* 135 (2013), available at <http://home.cc.umanitoba.ca/~frist/PLNT4600/biodiversity/icad196.pdf>.

460. Robert J. Kremer, *Soil and Environmental Health After Twenty Years of Intensive Use of Glyphosate*, 6 *ADVANCES PLANTS AGRIC. RSCH.* 00224 (2017).

461. Center for Food Safety, *About Extinction Crisis Program*, <https://www.centerforfoodsafety.org/issues/6473/extinction-crisis/about-567> (last visited Mar. 4, 2023).

462. Glyphosate sprayed over the top of Roundup Ready crop systems has nearly eradicated the common milkweed from farm fields in the Midwest, thereby contributing to the dramatic, quarter-century decline in monarch butterflies that critically depend on milkweed for survival; monarchs have consequently been driven so near to extinction that in December 2020 FWS found that their listing under the ESA was "warranted" and that they will be listed in coming years, only precluded by more immediate species currently. *Petition to Protect the Monarch Butterfly Under the Endangered Species Act* (Aug. 26, 2014), https://www.biologicaldiversity.org/species/invertebrates/pdfs/Monarch_ESA_Petition.pdf; 79 Fed. Reg. 78775 (Dec. 31, 2014) (finding listing may be warranted); 85 Fed. Reg. 81813 (Dec. 17, 2020) (finding listing is warranted but precluded; to be listed by 2024).

463. The World Health Organization's International Agency for Research on Cancer concluded that glyphosate is "probably carcinogenic to humans based in part on epidemiology studies showing increased risk of the cancer non-Hodgkin lymphoma among farmers who used glyphosate formulations." Press Release, World Health Organization International Agency for Research on Cancer, IARC Monographs Volume 112: Evaluation of Five Organophosphate Insecticides and Herbicides (Mar. 20, 2015), <http://goo.gl/KRhWnX>. In three lawsuits against Monsanto, juries ruled that use of Roundup and other glyphosate formulations contributed to the development of non-Hodgkin lymphoma in California users of these products. Ludwig Burger & Tina Bellon, *Bayer to Pay Up to \$10.9 Billion to Settle Bulk of Roundup Weedkiller Cancer Lawsuits*, *REUTERS* (June 24, 2020), <https://www.reuters.com/article/us-bayerlitigation-settlement/bayer-to-pay-up-to-10-9-billion-to-settle-bulk-of-roundupweedkiller-cancer-lawsuits-idUSKBN23V2NP>.

464. *Natural Res. Def. Council v. Environmental Prot. Agency*, 38 F.4th 34, 52 ELR 20070 (9th Cir. 2022) (holding the registration of the pesticide glyphosate (Roundup) violated FIFRA because of the failure to assess adequately farmworker cancer risks, and violated the ESA for failure to consider harm to endangered species).

fashion with the massive use of glyphosate accompanying widespread planting of Roundup Ready crops, and now infest at least 120 million acres—nearly 40% of the nation’s cultivated cropland.⁴⁶⁵ Efforts to control these resistant weeds involve spraying increasingly toxic pesticides/herbicides and soil-eroding tillage operations, imposing huge costs on farmers and the environment.⁴⁶⁶

Glyphosate-resistant weeds have also driven the more recent widespread introduction of a second generation of GE crops, resistant to additional toxic herbicides like dicamba or 2,4-D as well as to glyphosate.⁴⁶⁷ The number of discrete herbicide-resistance traits ratchets up as the overuse of weedkillers characteristic of these crop systems selects for further weed resistance. These GE crop systems facilitate the use of cocktails of multiple different herbicides, sprayed at increased frequency and greater volume than has ever been possible before.

Use of dicamba, for example, has skyrocketed since widespread introduction of dicamba-resistant soybeans and cotton in 2017.⁴⁶⁸ Notorious for its volatility, dicamba has caused rampant drift damage to all manner of crops across millions of acres, resulting in huge economic losses to farmers.⁴⁶⁹ In 2020, a federal court vacated EPA’s approval of dicamba’s use on dicamba-resistant commodity crops because of the Agency’s failure to account for these dicamba drift harms, which “has torn apart the social fabric of many farming communities.”⁴⁷⁰

Finally, GE crops also cause substantial harms via transgenic contamination, which occurs when a GE plant disperses its pollen to cross-pollinate a crop or wild plant of the same or closely related species through wind, insect pollinators, or when it disperses its seed to propagate itself in a new area. Time and time again, experimental and commercialized GE plants have shown their ability to escape confinement and contaminate conventional crops and wild relatives, or to colonize wild places.⁴⁷¹ GE contamination is a living pollution that can propagate itself via gene flow. Transgenic contamination of conventional or organic crops has cost U.S. farmers billions of dollars in market losses,

as food companies, grain traders, and export markets have rejected contaminated supplies.⁴⁷²

To give just a few examples⁴⁷³: Field trials of an experimental, GE herbicide-resistant rice known as Liberty-Link601 led to contamination of 30% of U.S. long-grain rice supplies in 2006 and 2007, resulting in massive export market rejection of contaminated shipments, and huge losses estimated at up to \$1.3 billion to 11,000 American rice farmers and others in the rice food chain. More recently, a GE corn known as MIR 162 developed by Syngenta contaminated U.S. corn exports, causing China to reject one million tons and wreaking havoc on the U.S. corn trade, leading to a \$1.5 billion-class action settlement.⁴⁷⁴ Repeated GE contamination incidents in other U.S. crops have cost farmers literally billions⁴⁷⁵ over the past decade in rejected sales,⁴⁷⁶ lost exports,⁴⁷⁷ and closed agricultural markets, with new episodes⁴⁷⁸ “cropping” up regularly.⁴⁷⁹

Accordingly, one does not have to squint very hard to spy the parallels to a future industrial aquaculture regime and its adverse impacts, discussed in Part I. From transgenic seed stock contamination to farmed fish escapes, harming native stocks and traditional fishing and tribal communities. Or toxic chemical and drug inputs spreading beyond farmland to poison native ecosystems, land or ocean, and harm species, terrestrial or aquatic. Industrial conditions require chemical inputs, and such reliance and overuse will lead to pest-developing resistance, which will, in turn, lead to more and more toxic-required inputs, creating a vicious cycle.

465. Kent Fraser, *Glyphosate Resistant Weeds—Intensifying*, STRATUS AG RSCH. (Jan. 25, 2013), <http://www.stratusresearch.com/newsroom/glyphosate-resistant-weeds-intensifying/>; Jackie Pucci, *The War Against Weeds Evolves in 2018*, CROPLIFE (Mar. 20, 2018), <https://www.croplife.com/crop-inputs/the-war-against-weeds-evolves-in-2018/>.

466. David A. Mortensen et al., *Navigating a Critical Juncture for Sustainable Weed Management*, 62 BIOSCIENCE 75 (2012), available at <http://goo.gl/RxZVM2>; Scott Kilman, *Superweed Outbreak Triggers Arms Race*, WALL ST. J. (June 4, 2010), <https://www.wsj.com/articles/SB1000142405274870402530457528439077746822>.

467. Mortensen et al., *supra* note 466; Brandon Keim, *New Generation of GM Crops Put Agriculture in a “Crisis Situation,”* WIRED (Sept. 25, 2014), <http://goo.gl/ejbTLF>.

468. *Nat’l Fam. Farm Coal. v. Env’t Prot. Agency*, 960 F.3d 1120, 1127, 50 ELR 20139 (9th Cir. 2020).

469. *Id.* at 1124, 1135.

470. *Id.* at 1143.

471. Carey Gillam, *U.S. Organic Food Industry Fears GMO Contamination*, REUTERS (Mar. 12, 2008), <https://www.reuters.com/article/us-biotech-crops-contamination-idUSN1216250820080312>.

472. Michelle Marvier & Rene C. Van Acker, *Can Crop Transgenes Be Kept on a Leash?*, 3 FRONTIERS ECOLOGY & ENV’T 99, 100-01 (2005), available at <https://www.jstor.org/stable/3868516>; Andrew Harris & David Beasley, *Bayer Will Pay \$750 Million to Settle Gene-Modified Rice Suits*, BLOOMBERG (July 2, 2011), <https://www.bloomberg.com/news/articles/2011-07-01/bayer-to-pay-750-million-to-end-lawsuits-over-genetically-modified-rice>; Kathleen L. Hewlett & Gundula S.E. Azeez, *The Economic Impacts of GM Contamination Incidents on the Organic Sector*, Presentation at the 16th IFOAM Organic World Congress (June 16-20, 2008), <http://goo.gl/jf2F5E>; Stuart Smyth et al., *Liabilities and Economics of Transgenic Crops*, 20 NATURE BIOTECH. 537 (2002), available at <https://www.nature.com/articles/nbt0602-537>.

473. U.S. GOVERNMENT ACCOUNTABILITY OFFICE, *GENETICALLY ENGINEERED CROPS* (2008), <https://www.gao.gov/assets/gao-09-60.pdf> (Government Accountability Office report giving contamination incident examples); Andrew Pollack, *Lax Oversight Found in Tests of Gene-Altered Crops*, N.Y. TIMES (Jan. 3, 2006), <https://www.nytimes.com/2006/01/03/science/lax-oversight-found-in-tests-of-genealtered-crops.html>. Harris & Beasley, *supra* note 472.

474. Nick McCann, *Syngenta Agrees to Pay \$1.5B Over Modified Corn Seeds*, COURTHOUSE NEWS SERV. (Mar. 13, 2018), <https://www.courthousenews.com/syngenta-agrees-to-pay-1-5b-over-modified-corn-seeds/>.

475. Harris & Beasley, *supra* note 472.

476. Gillam, *supra* note 471.

477. Jesse Newman, *China’s Hard Line on Biotech Burns U.S. Hay*, WALL ST. J. (Dec. 15, 2014), <https://www.wsj.com/articles/u-s-hay-exports-to-china-shrivel-up-1418598477>.

478. Tom Polansek, *China Rejections of GMO U.S. Corn Cost Up to \$2.8 Billion: Group*, REUTERS (Apr. 16, 2014), <https://www.reuters.com/article/us-syngenta-corn-costs-idUSBREA3F20P20140416>.

479. Steven Mufson, *Unapproved Genetically Modified Wheat From Monsanto Found in Oregon Field*, WASH. POST (May 30, 2013), https://www.washingtonpost.com/business/economy/unapproved-genetically-modified-wheat-from-monsanto-found-in-oregon-field/2013/05/30/93fe7abe-c95e-11e2-8da7-d274bc611a47_story.html.

But there are other parallels as well: the externalized wastes from industrial “fish CAFOs” will harm ocean aquatic ecosystems,⁴⁸⁰ just as livestock CAFOs do now on land—the cumulative wastes of thousands of unnaturally (and immorally) confined animals seeping into groundwater from lagoon pits the size of football fields, poisoning water cycles.⁴⁸¹ Or from the intentional over-spraying of the CAFO manure in non-agronomic (non-useful) ways to get rid of it, creating unregulated runoff into surface waters.⁴⁸²

Even the “robbing Peter to pay Paul” aspect of industrial aquaculture seems to have an echo in industrial agriculture. As with depleting forage fisheries to raise lucrative farmed fish at a net negative protein ratio,⁴⁸³ the vast majority of the GE corn and other commodity crops produced in U.S. farm fields do *not* go to feed people, but instead are used as animal feed for CAFOs, a Farm Bill-subsidized input propping up those industrial facilities, without which they could not function,⁴⁸⁴ or for other industrial uses, such as biofuels. Both are examples of claimed public good activities actually causing new problems, of moving problems, not solving them.

Third, there is a dramatic socioeconomic cost when a formerly public good is suddenly privatized. Consider seeds, the sine qua non of farming. Since time immemorial, the dawn of agriculture, farmers saved their crop seeds and replanted them. For centuries, farmers and plant breeders fostered a rich diversity of crop varieties through seed experimentation. The idea of seeds being private goods, being intellectual property, was so anathema as recently as a century ago that the U.S. Department of Agriculture annually gave away more than one billion packages of seeds to U.S. farmers; it was a full third of the agency’s total budget.⁴⁸⁵

But in the past few decades, the United States has led a radical change, to commercialization, consolidation, and control of seed ownership. In the 1980 landmark case *Diamond v. Chakrabarty*, the U.S. Supreme Court ruled by a 5-4 margin that living organisms could be patented.⁴⁸⁶ That decision paved the way for the 1985 case *Ex parte Hibberd* holding that sexually reproducing plants are patent-

able under the Patent Act, providing stronger protection and greater profit potential for seed companies.⁴⁸⁷ Then, in 2001, another 5-4 Supreme Court decision in *J.E.M. Ag Supply v. Pioneer Hi-Bred International* upheld the granting of utility patents, which do not have seed-saving or research exemptions, for plants.⁴⁸⁸

These decisions opened the door to expansive intellectual property rights in GE organisms and crops. As a consequence, firms raced to patent genetic resources and plant-breeding technologies and to purchase existing seed companies; the agricultural biotechnology industry emerged through the rapid acquisition of existing seed firms by chemical and pesticide companies such as Monsanto, DuPont, Syngenta, and Dow.⁴⁸⁹ Dozens of mergers and acquisitions followed; at least 200 independent seed companies were bought out and consolidated from 1996 to 2009.⁴⁹⁰ Consolidation has subsequently increased, to the point that four corporations now control more than 60% of all seeds globally.⁴⁹¹

Accordingly, the modern intellectual property regime for seeds—the recent radical conversion of a quintessential public good and right to a private commodity with the full bundle of property rights reserved—has been a major driver of our current industrial agriculture paradigm, causing, among other things, seed industry consolidation,⁴⁹² rising seed prices,⁴⁹³ the narrowing of farmers’ seed options and loss of the right to choose what they grow,⁴⁹⁴ the suffocation of independent scientific inquiry,⁴⁹⁵ and the prosecution of thousands of America’s farmers for alleged patent infringement for those that tried to continue to save their seeds.⁴⁹⁶

480. See *supra* Part I.

481. ROLF U. HALDEN & KELLOGG J. SCHWAB, ENVIRONMENTAL IMPACT OF INDUSTRIAL FARM ANIMAL PRODUCTION (Pew Commission on Industrial Farm Animal Production 2008), <https://law.lclark.edu/live/files/6699-environmental-impact-of-industrial-farm-animal>; e.g., Community Ass’n for Restoration of the Env’t, Inc. v. Cow Palace, LLC, 80 F. Supp. 3d 1180, 45 ELR 20008 (E.D. Wash. 2015) (applying the Resource Conservation and Recovery Act to CAFO dairy runoff from lagoon seepage and non-agronomic spraying as imminent and substantial endangerment of solid and hazardous waste).

482. HALDEN & SCHWAB, *supra* note 481, at 13.

483. See *supra* Part I.

484. U.S. FOOD & DRUG ADMIN., GMO CROPS, ANIMAL FOOD, AND BEYOND (Aug. 3, 2022), <https://www.fda.gov/food/agricultural-biotechnology/gmo-crops-animal-food-and-beyond#:~:text=While%20a%20lot%20of%20GMO,%2C%20and%20poultry%2C%20like%20chickens>.

485. David Bennett, *U.S. Seed Law History: A Primer*, FARM PROGRESS (Mar. 2, 2006), <https://www.farmprogress.com/us-seed-law-history-primer>; see also CENTER FOR FOOD SAFETY & SAVE OUR SEEDS, SEED GIANTS VS. U.S. FARMERS (2013), http://www.centerforfoodsafety.org/files/seed-giants_final_04424.pdf (Executive Summary).

486. 447 U.S. 303 (1980).

487. 227 U.S.P.Q. 443 (B.P.A.I. 1985). Previously, such plants were only protected under the 1970 Plant Variety Protection Act, which provided temporary exclusivity, but exempted farmers, who could then save seed and replant, and plant researchers, who could use protected varieties to breed improved plants. *J.E.M. Ag Supply, Inc. v. Pioneer Hi-Bred Int’l, Inc.*, 534 U.S. 124, 140 (2001); see also *Asgrow Seed Co. v. Winterboer*, 513 U.S. 179 (1995); 7 U.S.C. §2544.

488. See *J.E.M. Ag Supply*, 534 U.S. at 127.

489. Philip H. Howard, *Visualizing Consolidation in the Global Seed Industry: 1996-2008*, 1 SUSTAINABILITY 1266 (2009).

490. KRISTINA HUBBARD, NATIONAL FAMILY FARM COALITION, OUT OF HAND: FARMERS FACE THE CONSEQUENCES OF A CONSOLIDATED SEED INDUSTRY 4 (2009), <https://www.beginningfarmers.org/article-visualizing-consolidation-in-the-global-seed-industry-1996-2008-by-phil-howard/>.

491. *Global Seed Industry Changes Since 2013*, PHILIP H. HOWARD (Dec. 31, 2018), <https://philhoward.net/2018/12/31/global-seed-industry-changes-since-2013/>.

492. *Id.*

493. CHARLES BENBROOK, THE ORGANIC CENTER, THE MAGNITUDE AND IMPACTS OF THE BIOTECH AND ORGANIC SEED PRICE PREMIUM 1-2, 5-7 (2009), <https://khalacenter.org/archive/publicseedinitiative/images/seed-pricepremium.pdf>.

494. HUBBARD, *supra* note 490, at 25-38.

495. Emily Waltz, *Under Wraps*, 27 NATURE BIOTECH 880, 880-82 (2009); Andrew Pollack, *Crop Scientists Say Biotechnology Seed Companies Are Thwarting Research*, N.Y. TIMES (Feb. 19, 2009), <http://goo.gl/Nz7tWu>.

496. CENTER FOR FOOD SAFETY & SAVE OUR SEEDS, *supra* note 485 (explaining campaign to persecute farmers for alleged seed saving patent infringement); CENTER FOR FOOD SAFETY, MONSANTO VS. U.S. FARMERS (2005), <http://www.centerforfoodsafety.org/files/cfsm Monsanto vs farmer report 11305.pdf> (same); see also CENTER FOR FOOD SAFETY, MONSANTO VS. U.S. FARMERS 2012 UPDATE (2012), http://www.centerforfoodsafety.org/files/monsanto-v-us-farmer-2012-update-final_98931.pdf (same). See also, e.g., *Monsanto Co. v. David*, 516 F.3d 1009 (Fed. Cir. 2008); *Monsanto Co. v. Scruggs*,

As with the control of seeds through patents, genetic engineering, and contracts of adhesion with farmers, industrial aquaculture portends taking federal ocean waters, long a commons regulated for the benefit of all, and divvying it up into privatized and restricted aquaculture “zones.”⁴⁹⁷ In the Gulf of Mexico, had the courts not struck down the aquaculture management plan, under its regulations, swaths of the Gulf surrounding the permitted operations would have been permitted for aquaculture development exclusively, prohibiting traditional fishing.⁴⁹⁸ The new proposals for the Pacific waters promise more of the same.⁴⁹⁹

But the oceans are a commons belonging to everyone (*res communes*), for commerce and recreation.⁵⁰⁰ The resources there have always been open to all for the taking. Never before have these commons or their resources been privatized: while fishermen enjoy rights of access to fishing grounds and the right to capture, for the most part, these rights are not geographically exclusive but held in common with all other fishermen.

There is also the question of the public trust doctrine and its application, the venerable common-law doctrine that protects public rights in trust resources and prevents governments or private individuals from privatizing or adversely affecting those rights.⁵⁰¹ The doctrine traditionally focused on protecting public access to navigable waters for fishing and commerce purposes,⁵⁰² but evolved over time into a broader theory of resource management⁵⁰³ to, among other things, preserve public beach access, impose use restrictions on water rights, and protect wildlife. Aquaculture is, “in essence, an effort to privatize the classic common pool resources of fisheries.”⁵⁰⁴ An ocean net pen operation is given exclusive right to monopolize public

ocean resources for private use, the definition of a public trust violation. Further, in so doing, it interferes with core, traditional public trust activities like fishing and navigation. It is an open legal question whether the public trust doctrine applies to federal waters, as the doctrine thus far has largely been recognized by the courts as an aspect of state common law, but scholars have argued in favor of it and, in particular, its application to the EEZ.⁵⁰⁵

Basic property concepts teach that unregulated commons can result in tragedy, but the solution is not privatization but improved regulation.⁵⁰⁶ Should the federal waters become a patchwork of privately owned zones, no doubt just as with seeds, the ramifications for fishing communities will be profound and consolidate power in the hands of few at the expense of many.

Fourth, a failure to enact modern laws to address modern challenges creates even more problems. Federal environmental laws across the board are badly out of date, all now a half-century old, dating back to the 1960s and 1970s. Congress enacted NEPA, our national environmental charter, in 1970.⁵⁰⁷ The ESA date of enactment is 1973.⁵⁰⁸ The CWA, 1972.⁵⁰⁹ FIFRA, 1972.⁵¹⁰ The MSA, 1976.⁵¹¹ And so forth. Sure, there have been selected updates, but for the most part, the core provisions of these laws are decades old. Policymakers have not passed laws to address the challenges of modern industrial agriculture, or even climate change, to use two compelling examples. Instead, regulators (and government watchdogs) are left to squeeze blood from old statutory stones, trying to fit square pegs in round holes.

It looks very much at the moment like aquaculture will not break this pattern. While some states like California have shown what a responsible oversight regime could look like,⁵¹² Congress has not acted (and the bills it has considered have not come close to a level that could be consid-

459 F.3d 1328, 1328-35 (Fed. Cir. 2006); *Monsanto Co. v. McFarling*, 363 F.3d 1336, 1340 (Fed. Cir. 2004); *Monsanto Co. v. Ralph*, 382 F.3d 1374 (Fed. Cir. 2004); *Monsanto Co. v. Strickland*, 604 F. Supp. 2d 805 (D.S.C. 2009); *Monsanto Co. v. Parr*, 545 F. Supp. 2d 836 (N.D. Ind. 2008); *Monsanto Co. v. Trantham*, 156 F. Supp. 2d 855 (W.D. Tenn. 2001).

497. See *supra* Part IV.D.

498. See *supra* Part III.B.

499. See *supra* note 56.

500. See also Michael C. Blumm & Lucas Ritchie, *The Pioneer Spirit and the Public Trust: The American Rule of Capture and State Ownership of Wildlife*, 35 ENV'T L. 673, 677-79 (2005) (explaining various categories of property under Roman law and distinguishing between *res publicae* (things owned by the state), *res communes* (things owned in common, like air, rivers, and the sea), and *res nullius* (things owned by no one and thus “capable of individual appropriation”).

501. See, e.g., Joseph L. Sax, *The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention*, 68 MICH. L. REV. 471, 489 (1970); Mark Dowie, *Salmon and the Caesar: Will a Doctrine From the Roman Empire Sink Ocean Aquaculture?*, LEGAL AFFS., Sept./Oct. 2004, at 3, available at https://www.legalaffairs.org/issues/September-October-2004/terms_of_art_sep0ct04.msp (describing the public trust doctrine as “one of the biggest obstacles faced by the Bush Administration in its plan to promote ocean aquaculture”).

502. Charles F. Wilkinson, *The Headwaters of the Public Trust: Some Thoughts on the Source and Scope of the Traditional Doctrine*, 19 ENV'T L. 425, 431-32 (1989).

503. See Carol M. Rose, *Joseph Sax and the Idea of the Public Trust*, 25 ECOLOGY L.Q. 351 (1998) (attributing the expansion of the doctrine into other areas of natural resource management to an article written by Prof. Joseph L. Sax, *supra* note 501).

504. William W. Buzbee, *Recognizing the Regulatory Commons: A Theory of Regulatory Gaps*, 89 IOWA L. REV. 1, 8 (2003).

505. Babcock, *supra* note 141, at 53-76 (presenting arguments about why the public trust doctrine should apply to the EEZ federal waters); Tim Eichenberg & Barbara Vestal, *Improving the Legal Framework for Marine Aquaculture: The Role of Water Quality Laws and the Public Trust Doctrine*, 2 TERRITORIAL SEA. J. 339, 347 (1992); Joshua Fortenbery, *The Public Trust Doctrine Adrift in Federal Waters: Fishery Management in the Exclusive Economic Zone Off Alaska*, 5 SEATTLE J. ENV'T L. 227 (2015); see, e.g., DONALD C. BAUR ET AL., OCEAN AND COASTAL LAW AND POLICY 58 (2008) (“Looking back to its origins, there are sound reasons for applying the Public Trust Doctrine in the federal EEZ.”).

506. Amy Sinden, *The Tragedy of the Commons and the Myth of a Private Property Solution*, 78 U. COLO. L. REV. 533 (2007), available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=895724.

507. NEPA.gov, *Home Page*, <https://ceq.doe.gov/index.html> (last visited Mar. 4, 2023).

508. U.S. EPA, *Summary of the Endangered Species Act*, <https://www.epa.gov/laws-regulations/summary-endangered-species-act> (last updated Sept. 12, 2022).

509. U.S. EPA, *History of the Clean Water Act*, <https://www.epa.gov/laws-regulations/history-clean-water-act> (last updated July 6, 2022).

510. CONGRESSIONAL RESEARCH SERVICE, RL31921, PESTICIDE LAW: A SUMMARY OF THE STATUTES (2012), <https://crsreports.congress.gov/product/pdf/RL/RL31921/19>.

511. NOAA Fisheries, *Laws & Policies: Magnuson-Stevens Act*, <https://www.fisheries.noaa.gov/topic/laws-policies/magnuson-stevens-act> (last visited Mar. 4, 2023).

512. See Lora Shinn, *Something Fishy: The Trouble With Atlantic Salmon in the Pacific Northwest*, NRDC (Jan. 3, 2018), <https://www.nrdc.org/stories/something-fishy-trouble-atlantic-salmon-pacific-northwest>.

ered responsible oversight). Instead, efforts are continuing under statutes never intended for that purpose like the MSA⁵¹³ or even from the 19th century, like the RHA of 1899.⁵¹⁴ Finally, especially in light of the lack of proactive laws, the role of litigation as backdoor, stopgap regulation is even more pronounced.

And so, is the future of the oceans doubling down on the tragedy of industrial agriculture? In 30 years, will the EEZ look like a watery version of an Iowa cornfield or a

North Carolina pig CAFO? Large monocultures of species, bereft of biodiversity; produced contrary to natural laws, crowded together contrary to natural behaviors; privately owned by vertically integrated corporations, focused on maximizing short-term profits, and externalizing environmental costs? Those that do not learn from history are doomed to repeat it, as the saying goes. Tough to say whether the aquaculture tide is flooding in or ebbing out; time will tell.

513. *See supra* Part III.

514. *See supra* Parts II and IV.