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MARINE BIODIVERSITY: CHALLENGES, TRENDS, AND A NEW TREATY

BY

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Marine biodiversity is an important component of global biodiversity, which is under threat from a variety of anthropogenic stressors—some of the most important of which include overfishing, pollution, invasive species, climate change, and ocean acidification. After summarizing the scientific evidence that global marine biodiversity is declining, this article examines the two primary legal approaches to protecting marine biodiversity: area-based management, including marine protected areas; and species-specific protections. While, in general, place-based legal protections can offer the most holistic approach to protecting marine biodiversity, especially when warming oceans are inducing species shifts, this article argues that both the United States and the global community should increase protections for individual species at the same time. Species-based protections are especially critical for highly migratory species like bluefin tuna.

I. INTRODUCTION

Marine biodiversity is an important component of global biodiversity, especially in terms of "deep diversity"—that is, fundamentally distinct forms of life differentiated not as individual species but instead as completely different *phyla*. Phyla are the second level of taxonomic classification after kingdoms and hence represent fundamentally different forms of life—in the ocean, for example, important phyla include mollusks (snails, shellfish), echinoderms (sea urchins, sea stars), cnidarians (jellyfish, anemones), and arthropods (crabs, lobsters).[1] By the numbers, "35 animal phyla are found in the sea, 14 of which are exclusively marine, whereas only 11 are terrestrial and only one exclusively so."[2]

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[1] *Marine Phyla*, MARINE EDUCATION SOCIETY OF AUSTRALASIA (viewed Feb. 20, 2023), http://www.mesa.edu.au/phyla/.

[2] Enric Sala & Nancy Knowlton, *Global Marine Biodiversity Trends*, 31 ANN. REV. ENVTL. RESOURCES 93, 94 (2006) (citations omitted).

Nevertheless, attempts to protect marine biodiversity through law face several challenges. The first is basic scientific understanding of what exactly the law is trying to protect.[3] The ocean is both vast and deep, and much of it is difficult to access and observe—especially in terms of continuous and long-term observations of ecosystem function. As a result, most of our information about remote ocean ecosystems, such as those on hydrothermal vents or scattered across the deep ocean floor, comes through semi-random snapshots and sampling from submersibles. While scientific knowledge about the ocean and the species and ecosystems it contains is constantly improving, comprehensive understanding about marine biodiversity and the impacts humans can have on that biodiversity lags far behind what scientists and managers know about terrestrial ecosystems and species.

Even so, scientists know enough to assess trends—and, as Part I will develop in more detail, the trend lines are not good. While commercial fishing, ocean pollution, and habitat destruction provided the first reasons for worrying about anthropogenic impacts on marine biodiversity, noise pollution has also become a concern, and climate change (ocean warming) and ocean acidification not increasingly disrupt species distributions, marine food webs, and marine ecosystem viability.

Various national and international regimes recognize the importance of protecting marine biodiversity. The current emphasis is place-based protections, in the form marine protected areas (MPAs), including marine reserves. Part II reviews this approach to marine biodiversity protection, including the newest treaty, still in negotiation, to protect biodiversity in areas of the ocean outside of national control.

Commercial fishing, however, remains a major impediment to more targeted, species-specific protection. Moreover, there has been a general reluctance to protect marine species other than charismatic marine species such as marine mammals and sea turtles. To demonstrate this reluctance, Part III offers the thoroughly endangered bluefin tuna as a case study.

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[3] Gloria Pallares, *The most important facts we don't know about the ocean*, Landscape News (Sept. 10, 2019), https://news.globallandscapesforum.org/38647/the-most-important-facts-we-dont-know-about-oceans/.

This article concludes that, while place-based habitat protections remain an important tool, they do not adequately protect particular marine species that are critically endangered. While marine species' range shifts in response to ocean warming and ocean acidification make reliance on marine protected areas (MPAs) increasingly problematic regardless, MPAs are particularly inadequate solutions for highly migratory pelagic species like bluefin tuna.

II. TRENDS IN MARINE BIODIVERSITY: WHAT DO WE KNOW?

Far less is known about the marine realm, including the extent of and changes to marine biodiversity, than is known about terrestrial ecosystems and species.[4] Somewhat perversely, moreover, "major changes in marine biodiversity over deep time" are better understood than "the dramatic changes in marine ecosystems that have occurred in historic times," thanks to a good fossil record but poorly documented historic baselines in most places.[5] Complicating the picture even more is the fact that a number of stressors threaten marine biodiversity.[6]

Nevertheless, severe reductions of biodiversity are occurring in many parts of the ocean, and the resulting "jellyfish seas" are profound evidence that trends in marine biodiversity are not good.[7] In 2005, for example, the Millennium Ecosystem Assessment (MEA) described in detail the cumulative existing degradation of coastal ecosystems, emphasizing that these systems "are now undergoing more rapid change than at any time in their history" through a complexity of physical, chemical, and biological/ecological changes.[8] It concluded that "[t]hese impacts, together with chronic degradation resulting from land-based and marine pollution, have caused significant ecological changes and an overall decline in many ecosystem services."[9]

[4] Sala & Knowlton, *supra* note 2, at 94 (citations omitted)
[5] *Id.* at 94 (fossil record), 97 (lack of local data) ((citations omitted).
[6] Robin Kundis Craig, *Marine Biodiversity, Climate Change, and Governance of the Oceans*, 4 DIVERSITY 224, 225 (2012), doi:10.3390/d4020224.
[7] C.L. Dybas, "Jellyfish 'Blooms' Could Be Sign of Ailing Seas," WASHINGTON POST, May 6, 2002, at A09.
[8] MILLENNIUM ECOSYSTEM ASSESSMENT, ECOSYSTEMS AND HUMAN WELL-BEING: CURRENT STATE AND TRENDS 516 (2005).
[9] *Id.*

This part updates the Millennium Ecosystem Assessment and summarizes what is currently known about marine biodiversity, in terms both of numerical estimates of that diversity and trends over time.

A. Numerical Estimates of Marine Biodiversity

According to scientists, "[t]here are approximately 300,000 described marine species, which represent about 15% of all described species."[10] However, the estimate of the number of marine species is plagued by several sources of uncertainty and the true number is probably much higher. For example, "taxa that have been considered to be the same may actually be different," and "failure to recognize these cryptic or sibling species has probably resulted in a 10-fold underestimate of marine biodiversity in many groups."[11] Moreover, many discovered species have not yet been described because of the relatively low numbers of taxonomists.[12] To give some sense of the magnitude of the uncertainty, before the Census of Marine Life concluded its work in 2010, estimates for the number of marine species ranged from 178,000 to over 10 million[13]—and that's only for multicellular eukaryotes.[14] "[M]icrobial diversity may be enormous."[15]

The Census of Marine Life provided a better picture of marine biodiversity. Over ten years, the Census deployed "2,700 scientists from over 80 nations" to "delineat[e] a comprehensive baseline of Planet Earth's marine biodiversity for the first time ever."[16] "[A]t the outset of the Census, oceanographers estimated that only 5 percent of the ocean had been systematically explored for life."[17] By the end of the decade's research, Census scientists reported "an unanticipated riot of species," raising the estimate for the number of known marine species from 230,000 to nearly 250,000—and "the Census still could not reliably estimate the total number of

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[10] *Id*. at 95 (citations omitted).
[11] *Id*. at 95-96 (citations omitted).
[12] *Id*. at 96. (citations omitted).
[13] *Id*. (citations omitted).
[14] *Id*. (citations omitted).
[15] *Id*. at 97.
[16] Craig, *Marine Biodiversity*, supra note 6, at 224.
[17] J.H. Ausubel, D.T. Crist, & P.E. Waggoner, First Census of Marine Life 2010: Highlights of a Decade of Discovery 6 (2010).

species, the kinds of life, known and unknown, in the ocean."[18] Equally important, the Census "found living creatures everywhere it looked, even where heat would melt lead, seawater froze to ice, and light and oxygen were absent. It expanded known habitats and ranges in which life is known to exist. It found that in marine habitats, extreme is normal."[19]

However, the Census scientists also "found signs of decline in both species and the sizes of individuals—declines that had occurred fairly quickly, sometimes within a human generation. Perhaps most importantly, it found that phytoplankton, the basis of marine food webs and the source of approximately 50% of the world's atmospheric oxygen, have declined since 1899."[20] Later refinements and modeling indicate that, "compared to 1950, the ocean has 40% less phytoplankton, small algae that are the basis of the ocean food web, and that human impacts are degrading coral reefs as well as increasing the risk of marine populations going extinct."[21]

Impacts to coral reef ecosystems are critical to future marine biodiversity because, in terms of ecosystems, coral reefs and the deep sea are "the biggest repositories of marine biodiversity"—coral reefs because of the high concentration of species, the deep sea "because of its enormous area."[22] Otherwise, studies of spatial patterns of global marine biodiversity prior to pervasive climate change impacts revealed three major gradients of species richness: higher diversity at tropical latitudes declining as one moved toward the poles; "decreasing diversity as one moves west to east in the tropical Pacific and Atlantic"; and decreasing diversity with depth.[23] High levels of endemic species are found around isolated islands.[24] However, there remain significant gaps in the scientific understanding of marine community diversity at any scale. The Large Marine Ecosystems (LME) project identified 64 distinct nearshore ecoregions globally; however, each

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[18] *Id*. at 3.
[19] *Id*.
[20] Craig, *Marine Biodiversity*, supra note 6, at 225 (citing Ausubel, Crist, & Waggoner, *supra* note 17, at 3, 6, 31).
[21] *The Census of Marine Life*, Smithsonian Ocean (April 2018), https://ocean.si.edu/ecosystems/census-marine-life/census-marine-life-overview.
[22] Sala & Knowlton, *supra* note 2, at 96 (citations omitted).
[23] *Id*. (citations omitted).
[24] *Id*. (citations omitted).

LME is huge and encompasses a range of smaller-scale ecosystems, and as a result "they do not provide a detailed picture of biological distinctness."[25]

B. Human Impacts on Marine Species and Ecosystems

Of course, marine ecosystems and species change over time. Over evolutionary timescales, for example, "[t]he number of marine taxa, particularly large complex forms, increased dramatically with the onset of the Cambrian explosion," about 540 million years ago, and continued to increase, albeit punctuated with mass extinction events.[26] In addition, "the number of marine ecosystems and ways of making a living has increased from the primordial pre-Cambrian ocean," including the "marine Mesozoic revolution" after the Permian mass extinction event, when 98% of all species went extinct.[27]

At more human timescales, "[m]arine biodiversity naturally changes locally at scales of years to centuries," a phenomenon known as ecological succession, which typically begins with a disturbance of some kind.[28] Large-scale disturbances tend to reduce local biodiversity, but small-scale disturbances can enhance biodiversity at the local scale by creating "patchy" habitat.[29] However, absent human impacts, marine ecosystems tend to recover from even large disturbances.[30]

But, of course, there *are* human impacts. Indeed, "human activities are without doubt now the strongest driver of change in marine biodiversity at all levels of organization. . . ."[31] In terms of species impacts, "Humans have directly caused the global extinction of more than 20 described marine species, including seabirds, marine mammals, fishes, invertebrates, and algae."[32] Europeans hunted the Steller's sea cow to extinction within 27 years of discovering it; eliminating

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[25] *Id*. at 97 (citations omitted).
[26] *Id*. at 98 (citation omitted).
[27] *Id*. (citations omitted).
[28] *Id*. at 98-99.
[29] *Id*. at 99 (citations omitted).
[30] *Id*. (citations omitted).
[31] *Id*. at 100. For a more comprehensive overview of anthropogenic stressors to marine biodiversity, see Robin Kundis Craig, *Marine Biodiversity, Climate Change, and Governance of the Oceans*, 4 DIVERSITY 224, 226-28 (2012).
[32] Sal & Knowlton, *supra* note 2 at 102.

the Caribbean monk seal, in contrast, took about four and a half centuries.[33] More disturbingly, "[m]any species may have disappeared unnoticed"; statistical methods for estimating loss, for example, estimate that about 1% of coral reef species had perished by the early 21st century.[34] Local and regional extinctions are even more common, such as the loss of the gray whale from the Atlantic Ocean and nine of 14 species of kelp from the Mediterranean Sea.[35]

Human activities can also impact larger ecological function, with long-term and synergistic effects. Ecological extinction occurs when a species becomes "so rare that it no longer fulfills its natural ecosystem function" and is an early sign of threats to biodiversity because it "occurs long before species completely disappear."[36] Overfishing, especially historical overfishing, is a primary cause of ecological extinction—and one that traces forward to contemporary collapses of marine ecosystems around the globe.[37] As a group of eminent marine biologists concluded in 2001, "Overfishing and ecological extinction predate and precondition modern ecological investigations and the collapse of marine ecosystems in recent times, raising the possibility that many more marine ecosystems may be vulnerable to collapse in the near future."[38] They also painted a vivid picture of an ocean full of ghost species:

> There are dozens of places in the Caribbean named after large sea turtles whose adult populations now number in the tens of thousands rather than the tens of millions of a few centuries ago. Whales, manatees, dugongs, sea cows, monk seals, crocodiles, codfish, jewfish, swordfish, sharks, and rays are other large marine vertebrates that are now functionally or entirely extinct in most coastal ecosystems. Place names for oysters, pearls, and conches conjure up other ecological ghosts of marine invertebrates that were once so abundant as to pose hazards to navigation, but are witnessed now only by massive garbage heaps of empty shells.
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> Such ghosts represent a far more profound problem for ecological understanding and management than currently realized. Evidence from retrospective records strongly suggests that major structural

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[33] *Id*.
[34] *Id*. (citation omitted).
[35] *Id*. (citations omitted).
[36] *Id*. (citations omitted).
[37] Jeremy B.C. Jackson et al., *Historical Overfishing and the Recent Collapse of Coastal Ecosystems*, 293 SCIENCE 629, 629 (2001), DOI: 10.1126/science.1059199.
[38] *Id*.

> and functional changes due to overfishing occurred worldwide in coastal marine ecosystems over many centuries.[39]

Other studies suggest that humans have probably been effecting significant changes in marine ecosystems—at least coastal ecosystems—through hunting and fishing since prehistoric times.[40] The exact number of ecological extinctions in the ocean remains difficult to estimate, but the IUCN Red List of Threatened Species provides a decent (and probably conservative) proxy.[41] As of February 2023, 1329 marine species on the Red List are vulnerable, endangered, or critically endangered, while another 527 marine species are "near threatened."[42] Thus, roughly 1850 marine species are ecologically extinct or are approaching ecological extinction.

Population declines precede ecological extinction, and the best source of data regarding population declines among marine species is commercial catch data in wild fisheries.[43] Global wild fisheries catch "has been declining since the 1990s."[44] The best source of information about wild fisheries globally is the U.N. Food & Agriculture Organization's (FAO's) biennial report, *The State of World Fisheries and Aquaculture*. In its 2022 report, the FAO concludes that "[f]ishery resources continue to decline due to overfishing, pollution, poor management and other factors . . . ."[45] More specifically, "the fraction of fishery stocks within biologically sustainable levels decreased to 64.6 percent in 2019, that is 1.2 percent lower than in 2017. This fraction was 90 percent in 1974. In contrast, the percentage of stocks fished at biologically unsustainable levels has been increasing since the late 1970s, from 10 percent in 1974 to 35.4 percent in 2019."[46]

Beyond direct impacts from hunting and fishing, humans also indirectly affect marine biodiversity, and these indirect impacts have become cumulatively more important to marine

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[39] *Id*. (citations omitted).
[40] *See generally* Jon M. Erlandson & Torben C. Rick, *Archeology Meets Marine Ecology: The Antiquity of Maritime Cultures and Human Impacts on Marine Fisheries and Ecosystems*, 2 ANNUAL REVIEW OF MARINE SCIENCE 231 [PINCITE] (2010) (tracing such prehistoric impacts in the Channel Islands, California, and Polynesia).
[41] Sala & Knowlton, *supra* note 2, at 103.
[42] Search of the IUCN Red List database, https://www.iucnredlist.org/search, conducted February 5, 2023.
[43] *Id*. (citation omitted).
[44] *Id*. (citation omitted).
[45] U.N. FOOD & AGRICULTURE ORGANIZATION, THE STATE OF WORLD FISHERIES AND AQUACULTURE: TOWARDS BLUE Transformation xvi (2022) (hereinafter 2022 FAO REPORT].
[46] *Id*. at 46.

biodiversity. Until recently, "human impacts on water quality (toxic pollutants, nutrients, carbon, acidity)" were the most important indirect stressors.[47] However, human activities can also favor certain more adaptable species, such as seagulls, or facilitate highly invasive species,[48] such as through ships' ballast water.[49] "Although the arrival of new species may be seen as an increase in species richness, the consequences for the local biodiversity are generally negative, sometimes catastrophically so."[50] The Mediterranean Sea and San Francisco Bay provide apt examples of how new arrivals and invasive species can devastate local biodiversity.[51]

Temperature increases from climate change and ocean acidification have now become at least as important as any other indirect human stressor on the ocean, and complexly so.[52] According to the *Impacts, Adaptation and Vulnerability* (Working Group II) report of the Intergovernmental Panel on Climate Change's (IPCC's) Sixth Assessment Report,[53] human-induced climate change is causing heat extremes in the ocean (generally known as ocean heat waves), warm water coral reef bleaching and mortality, ocean acidification, and rising sea levels.[54] Climate change is causing substantial and increasingly irreversible damage to coastal and ocean ecosystems, and "[a]pproximately half the species assessed globally have moved polewards."[55] Increasing heat has caused mass mortality events in the ocean and led to the loss of kelp forests.[56] "Ocean warming and ocean acidification have adversely affected food production from shellfish aquaculture and fisheries in some oceanic regions . . . ."[57] Moreover, ocean "acidification decreases abundance and richness of calcifying species (*high confidence*)," and the "[s]ynergistic effects of

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47 Sala & Knowlton, *supra* note 2, at 103 (citations omitted).
48 *Id*. at 104.
49 *Id*. at 105. "It is estimated that as many as 3000 alien species are transported daily in ballast water, although only a few survive the trip and/or establish themselves in a new environment." *Id*. (citation omitted).
50 *Id*. at 104-05.
51 *Id*. at 105.
52 Sala & Knowlton, *supra* note 2, at 103-04 (citations omitted). For an overview of how climate change affects marine biodiversity, see Robin Kundis Craig, *Marine Biodiversity, Climate Change, and Governance of the Oceans*, 4 Diversity 224, 228-30 (2012).
53 Intergovernmental Panel on Climate Change, Climate Change 2022: Impacts, Adaptation and Vulnerability (2022) [hereinafter 2022 IPCC Adaptation Report].
54 *Id*. at 9.
55 *Id*.
56 *Id*.
57 *Id*.

warming and acidification will promote shifts towards macroalgal dominance in some ecosystems (*medium confidence*) and lead to reorganisation of communities (*medium confidence*)."[58]

Probably most pervasively, marine heat waves increasingly undermine marine biodiversity:

> Marine heatwaves (MHWs) are extended periods of unusually warm ocean temperatures relative to the typical temperatures for that location and time of year. Due to climate change, the number of days with MHWs has increased by 54% over the past century. These MHWs cause mortalities in a wide variety of marine species, from corals to kelp to seagrasses to fish to seabirds, and have consequent effects on ecosystems and industries like aquaculture and fisheries.[59]

Moreover, "MHWs attributable to climate change . . . can cause fatal disease outbreaks or mass mortality among some key foundational species (*high confidence*) and contribute to ecological phase shifts (*medium confidence*)."[60]

The IPCC projects some impacts to marine biodiversity with great confidence. As noted, for example, coral reefs are critical to marine biodiversity—but they are also the most vulnerable marine ecosystems to climate change:

> Warm-water coral reef ecosystems house one-quarter of the marine biodiversity and provide services in the form of food, income and shoreline protection to coastal communities around the world. These ecosystems are threatened by climate-induced and non-climate drivers, especially ocean warming, MHWs, ocean acidification, SLR [sea level rise], tropical cyclones, fisheries/overharvesting, land-based pollution, disease spread and destructive shoreline practices . . . . Warm-water coral reefs face near-term threats to their survival.[61]

However, coral reefs are not alone; "kelp and other seaweeds in most regions are undergoing mass mortalities from high temperature extremes and range shifts from warming (*very high confidence*)."[62] The IPCC notes that "kelp ecosystems are expected to decline and undergo

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[58] *Id*. at 418.
[59] *Id*. at 416 FAQ 3.2.
[60] *Id*. at 415, 418.
[61] *Id*. at 410 (citations omitted).
[62] *Id*. at 418.

changes in community structure in the future due to warming and increasing frequency and intensity of MHWs (*high confidence*)."[63] The third marine ecosystem already undergoing profound change is the Arctic:

> The profound climatic and environmental changes projected for the Arctic region by 2100 . . . are also anticipated to alter the composition of apex assemblages like marine mammals . . . . Under both RCP2.6 and 8.5 scenarios the most vulnerable marine mammal species will be the North Pacific right whale (*Eubalaena japonica*, listed as an endangered species; IUCN, 2020) and the grey whale (*Eschrichtius robustus*, which has critically endangered subpopulations; IUCN, 2020). The extinction of the most-vulnerable species will disproportionately eliminate unique and important evolutionary lineages as well as functional diversity, with consequent impacts throughout the entire marine ecosystem . . . .[64]

In short, anthropogenic stressors are almost certainly directly and indirectly reducing marine biodiversity, even if marine biologists cannot precisely document all of the species, ecosystem functions, and ecosystems that have already been lost or irreparably damaged. "Fishing, habitat destruction, pollution, and other human activities can deplete populations to such a level that most genetic variability is lost," and fishing also acts as a selection pressure that favors smaller and less fecund fish.[65] Moreover, commercial fishing's efficiency at removing top predators "can reduce species richness and biomass by orders of magnitude and cause a decline in structural diversity" within the relevant ecosystem, as when the removal of sea otters through hunting in Alaska allowed sea urchins to multiply and decimate the entire kelp ecosystem.[66] The Black Sea devolved to a jellyfish sea as a result of overfishing of species at the top of the food chain.[67]

Nutrient pollution and climate change tend to affect biodiversity from the opposite direction, reducing lower-trophic species—and hence the start of the food web—first.[68] Nutrient

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[63] *Id*. at 420.
[64] *Id*. at 441.
[65] Sala & Knowlton, *supra* note 2, at 105 (citations omitted).
[66] *Id*. at 106.
[67] *Id*. at 107 (citations omitted).
[68] *Id*. at 107, 108. However, some fisheries, such as for sardines, anchovies, baleen whales, and shellfish like oysters, can similarly destroy diverse ecosystems from the bottom up. *Id*. at 108.

pollution often leads to hypoxic zones, resulting in the "large-scale loss of biodiversity at the ecosystem level, where diverse and structurally complex benthic and pelagic communities are turned into simpler microbial communities."[69]

Climate change impacts to marine biodiversity are more pervasive, and "[g]lobal projections anticipate a likely future reorganisation of marine life of variable magnitude, contingent on emission scenario."[70] In addition, "Climate-change-driven changes in ocean characteristics and the frequency and intensity of extreme events . . . increase the risk of persistent, rapid and abrupt ecosystem change (*very high confidence*), often referred to as ecosystem collapses or regime shifts."[71]

Unhelpfully, overfishing, marine pollution, biological invasions, and global warming "typically act in synergy and produce changes in biodiversity that are more pervasive than those caused by single disturbances."[72] For these and other reasons, predicting the exact future trajectory of marine biodiversity remains fraught with uncertainty. As the IPCC explained:

> biodiversity observations remain sparse, and statistical and modelling tools can provide conflicting diversity information because correlative approaches assume that the modern-day relationship between marine species distribution and environmental conditions remains the same into the future, whereas mechanistic models permit marine species to respond dynamically to changing environmental forcing. Moreover, existing global projections of future biodiversity disproportionately focus on the effects sea surface temperature, typically overlooking other factors such as ocean acidification, deoxygenation and nutrient availability, and often failing to account for natural adaptation.[73]

Nevertheless, the net result appears to be that humans are homogenizing the ocean, greatly reducing its biodiversity at a global scale,[74] with no end in sight.

[69] *Id*. at 108.
[70] 2022 IPCC ADAPTATION REPORT, *supra* note 53, at 441.
[71] *Id*. at 442.
[72] Sala & Knowlton, *supra* note 2, at 110.
[73] 2022 IPCC ADAPTATION REPORT, *supra* note 53, at 441.
[74] *Id*. at 110, 113.

III. Legally Protecting Marine Biodiversity through Area-Based Protections: MPAs and a New Treaty

A. *Use of Marine Protected Areas, and Marine Reserves*

1. Overview

Given the complexities of marine ecosystems, marine protected areas (MPAs)—especially marine reserves—have become preferred means for protecting marine biodiversity both domestically and internationally.[75] "MPAs are management designations with various levels of protection designed to protect and preserve natural resources and ecological systems. They can safeguard a wide range of habitats and species."[76] Marine reserves are a subset of MPAs legally established to be "no take," generally meaning that no hunting or fishing is allowed.[77] As a result, "MPA classifications range from "no-take" areas to small "no-access" areas that prohibit all consumptive human uses to large "multiple-use" areas that permit a wide range of economic, social, and conservation activities."[78]

The International Union for the Conservation of Nature (IUCN) provides one widely-accepted set of criteria and guidelines for MPAs.[79] It distinguishes MPAs from fishery management areas and other area-based management tools on the principle that, "whatever form the MPAs take, the primary focus is the conservation of biodiversity."[80] It also emphasizes that commercial and industrial activities in MPAs should be minimized:

> If fishing or other extractive activities are compatible with an MPA's objective(s) and are permitted within the MPA, they must have a low ecological impact, be sustainable, be well managed as part of an integrated approach to management, and fit within the definition and category of an IUCN protected area. Any industrial

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[75] Linwood H. Pendleton, Gabby N. Ahmadia, Howard I. Browman, Ruth H. Thurstan, David M. Kaplan, & Valerio Bartolino, *Debating the Effectiveness of Maine Protected Areas*, 75 ICES J. Marine Sci. 1156, 1156 (2018).
[76] *Marine Protected Areas*, California Sea Grant (viewed Feb. 19, 2023), https://caseagrant.ucsd.edu/our-work/resources/marine-protected-areas.
[77] *Id*.
[78] Randall S. Abate, *Marine Protected Areas as a Mechanism to Promote Marine Mammal Conservation: International and Comparative Law Lessons for the United States*, 88 Or. L. Rev. 255, 259-60 (2009) (citations omitted).
[79] Jon Day, Nigel Dudley, Marc Hockings, Glen Holmes, Dan Laffoley, Sue Stolton, Sue Wells & Lauren Wenzel, IUCN, *Guidelines for applying the IUCN protected area management categories to marine protected areas* (2d ed. 2019).
[80] *Id*. at 8.

> activities and infrastructural developments (e.g. mining, industrial fishing, oil and gas extraction) are not compatible with MPAs and should be excluded from such areas if they are to be considered as MPAs.[81]

The IUCN describes seven categories of MPAs, ranging from strictly protected areas usable as reference sites that almost completely limit human access and use to areas protected specifically because of their distinct human interactions and/or cultural significance.[82] Thus, even when MPAs share a common goal of protecting marine biodiversity, they "differ in many ways, including the objectives for which they were created, the ecological and human contexts in which they are situated, the degree to which they involve stakeholders, and how well their management and enforcement is resourced."[83]

Using the IUCN's definitions of MPAs, the Marine Conservation Institute keeps track of MPAs globally through its Marine Protection Atlas.[84] As of late February 2023, the Atlas identifies 16,848 MPAs globally and categorizes them in terms of protection from fishing.[85] Notably, only 1,015 of these MPAs, or slightly over 6%, are fully or highly protected from fishing. Moreover, most (over 11,000) are very small, encompassing less than 10 square kilometers[86] (approximately 3.86 square miles or 2470 acres).

MPAs can do a very good job of protecting and enhancing biodiversity if the legal protections they provide are strong and enforced. In the Mediterranean Sea, for example, marine reserves tend to support healthy predator-dominated ecosystems "characterized by high fish biomass and benthic communities dominated by non-canopy algae."[87] In contrast, poorly enforced marine reserves, marine protected areas that allowed fishing, and open fishing parts of the

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[81] *Id*.
[82] *Id*. at 9-10, tbl. 1.
[83] Linwood H. Pendleton, Gabby N. Ahmadia, Howard I. Browman, Ruth H. Thurstan, David M. Kaplan, & Valerio Bartolino, *Debating the Effectiveness of Maine Protected Areas*, 75 ICES J. MARINE SCI. 1156, 1157 (2018).
[84] Marine Conservation Institute, *Marine Protection Atlas* (viewed Feb. 20, 2023), https://mpatlas.org/zones.
[85] *Id*.
[86] *Id*.
[87] Eric Sala et al., *The Structure of Mediterranean Rocky Reef Ecosystems across Environmental and Human Gradients, and Conservation Implications*, 7 PLoS ONE 1, 5 (2012).

Mediterranean had lower fish biomass, more extensive algae cover, and, in the worst areas, barrens.[88] More generally, marine biologists conclude that:

> The potential ecological benefits of strongly protected MPAs (those that prohibit commercial activity and allow only light fishing) and fully protected MPAs that prohibit fishing are well documented. Strongly protected MPAs increase fish biomass and diversity. MPAs can also promote the dispersal of larvae and adults of target and non-target species to areas outside their borders, potentially benefiting both fisheries and biodiversity outside the MPA, although the extent to which this occurs and whether there is any net fisheries benefit, are unknown for most MPAs.[89]

However, as noted, these fully or highly protective MPAs are rare (although some of them are very large).[90]

It is important to remember, however, that MPAs work best to restrict human activities that have direct impacts on marine biodiversity, like fishing. As MPA managers are discovering around the world, even the most legally restrictive MPAs offer little protection against the direct effects of climate change and ocean acidification, because they can provide no barrier to generally increasing temperature, MHVs, or decreasing ocean pH. For example, "there has been massive coral bleaching and death in iconic MPAs, including in the Great Barrier Reef Marine Park and Chagos MPA, revealing the limits of MPAs to protect against all main threats."[91] Under certain circumstances, however, they can make specific ecosystems more resilient to climate change precisely by removing more direct anthropogenic stressors.[92]

2. Area-Based Marine Protections under the United Nations Convention on Biological Diversity

As one group of researchers noted in 2018, "[i]ncreasing the size and number of marine protected areas (MPAs) is widely seen as a way to meet ambitious biodiversity and sustainable development goals."[93] More specifically, MPAs:

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[88] *Id*. at 5-6.
[89] Pendelton et al., *supra* note 83, at 1157 (citations omitted).
[90] Marine Protection Atlas, *supra* note 84.
[91] Pendelton et al., *supra* note 83, at 1156-57.
[92] *Id*. at 1156 and sources cited therein.
[93] Pendelton et al., *supra* note 83, at 1156.

> have been embraced by high level international bodies as being important for achieving biodiversity goals (e.g. the Convention on Biodiversity's Aichi Targets), as a key tool for meeting Sustainable Development Goals (U.N. Oceans Conference Voluntary Commitments), and to protect the natural heritage of humankind (UNESCO's World Heritage Program).[94]

This part will focus on the United Nations Convention on Biological Diversity ("CBD" or "Biodiversity Convention"), the most general global treaty for protecting biodiversity.

The CBD opened for signature in 1992 at the Rio Earth Summit[95] and "entered into force on 29 December 1993, which was 90 days after the 30th ratification."[96] The Convention has three primary objectives:

> 1. The conservation of biological diversity
>
> 2. The sustainable use of the components of biological diversity
>
> 3. The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.[97]

As of February 2023, 196 nations are parties to the treaty, making it nearly universally binding; only the United States and the Holy See have not ratified or acceded to it, although the United States signed it in June 1993.[98]

Marine biodiversity has been of concern to the parties since the first Conference of the Parties (COP) in 1994.[99] COP 2 resulted in the Jakarta Mandate on Marine and Coastal Biological Diversity as well as several workplans.[100] COPs 4 through 6 focused on coral reef bleaching and the resulting biodiversity loss, but COP 7 added attention to MPAs, marine aquaculture, and high seas biodiversity.[101]

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[94] *Id.*
[95] *The Convention on Biological Diversity*, UNITED NATIONS ENVIRONMENT PROGRAMME (as updated Dec. 16, 2022), https://www.cbd.int/convention/.
[96] *History of the Convention*, UNITED NATIONS ENVIRONMENT PROGRAMME (as updated Feb. 7, 2023), https://www.cbd.int/history/.
[97] *Background*, UNITED NATIONS ENVIRONMENT PROGRAMME (April 5, 2022), https://www.cbd.int/marine/background.shtml.
[98] *List of Parties*, UNITED NATIONS ENVIRONMENT PROGRAMME (viewed Feb. 19, 2023), https://www.cbd.int/information/parties.shtml.
[99] *Marine and Coastal: COP Decisions*, UNITED NATIONS ENVIRONMENT PROGRAMME (Feb. 17, 2022), https://www.cbd.int/marine/decisions.shtml.
[100] *Id.*
[101] *Id.*

COP 8 extended these new emphases:

> The conservation and sustainable use of high-seas biodiversity, specifically deep seabed genetic resources beyond the limits of national jurisdiction, was taken up at COP 8 (decision VIII/21), when Parties noted that hydrothermal vent, cold seep, seamount, coldwater coral and sponge reef ecosystems contain genetic resources of great interest for their biodiversity value and for scientific research as well as for present and future sustainable development and commercial applications, and recognized an urgent need to enhance scientific research and cooperation.”[102]

COP 8 also “recognized the importance of integrated marine and coastal area management (IMCAM),” “expressed its deep concern over the range of threats to marine ecosystems and biodiversity beyond national jurisdiction, and recognized that marine protected areas are an essential tool to help achieve conservation and sustainable use of biodiversity in these areas.”[103] At COP 9, in turn, “the Parties requested the Executive Secretary to compile and synthesize scientific information on the potential impacts on marine biodiversity of both direct human-induced ocean fertilization to sequester CO_2 and ocean acidification” and “adopted scientific criteria for identifying ecologically or biologically significant marine areas in need of protection and scientific guidance for designing representative networks of marine protected areas.”[104]

Thus, it is fair to say that an early interest in coral reefs led the parties to the Biodiversity Convention to a more general interest in MPAs. This interest became an actual biodiversity target In 2010 at COP 10 in Japan, when the parties adopted the Aichi Biodiversity Targets.[105] Four of these targets were particularly relevant to marine biodiversity. First, in Target 6, the parties acknowledged the biodiversity impacts of overfishing, establishing a goal that:

> By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species

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[102] *Id.*
[103] *Id.*
[104] *Id.*
[105] *Strategic Plan for Biodiversity 2011-2020, including Aichi Biodiversity Targets*, United Nations Environment Programme (Jan. 21, 2020), https://www.cbd.int/sp/ (emphasis added).

> and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.[106]

Second, in Target 8, the parties acknowledged the potentially devastating role of nutrient pollution, seeking that "[b]y 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity."[107] Third, in Target 10, the parties maintained their earliest focus on coral reefs, setting a goal that '[b]y 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning."[108]

Notably, many protections for coral reefs and against fishing can come through MPAs and especially marine reserves. However, COP 10 addressed MPAs more specifically in Target 11, where the parties set as a goal that:

> By 2020, at least 17 per cent of terrestrial and inland water, *and 10 per cent of coastal and marine areas*, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascapes.[109]

COP 11 began to make progress toward the prioritization of areas for MPAs through the first reports on ecologically or biologically significant marine areas (EBSAs).

> An EBSA is an area of the ocean that has special importance in terms of its ecological and/or biological characteristics, for example, as essential habitats, food sources or breeding grounds for particular species. These areas can include seabed habitats from the coastline to deep ocean trenches, and can be located at a variety of depths in the water column from the surface to the abyss.[110]

The parties at COP 11 also became concerned about marine noise pollution, marine litter, the impacts of climate change on coral reefs, and the impacts of fisheries on marine biodiversity

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[106] United Nations Environment Programme, *Strategic Plan for Biodiversity 2011-2020 and the Aichi Targets* 2 (2010), *available at* https://www.cbd.int/doc/strategic-plan/2011-2020/Aichi-Targets-EN.pdf.
[107] *Id.*
[108] *Id.*
[109] *Id.*
[110] *Marine and Coastal: Ecologically or Biologically Significant Marine Areas (EBSAs)*, United Nations Environment Programme (Feb. 16, 2022), https://www.cbd.int/marine/EBSAs.shtml.

more generally.[111] At COP 12, the parties accepted a second set of EBSA reports, addressed underwater noise pollution and ocean acidification, and adopted priority actions to enhance protections for coral reefs to achieve Aichi Target 10, "includ[ing] reducing land-based pollution, promoting sustainable fisheries and *improving the design of marine protected area networks for coral reefs*, implementing poverty-reduction programmes for reef-dependent coastal communities, and developing socioeconomic incentives for coral reef conservation."[112] More EBSA reports greeted the parties at COP 13.[113] The parties improved the EBSA classification process at COP 14, in 2018.[114]

So what has the CBD accomplished with respect to marine biodiversity? As of 2022, over 300 EBSAs around the world have been identified and described based on seven internationally agreed-upon scientific criteria.[115] These EBSAs provide the relevant national governments as well as the international community critical information regarding where they should focus and prioritize marine biodiversity conservation efforts, including MPAs and marine reserves.

However, the parties failed to achieve *any* of the Aichi Biodiversity Targets by 2020.[116] With respect to Target 6, "Although there has been progress in some regions, the proportion of overfished marine stocks has increased in the last decade to a third of the total, and many non-target species are threatened because of unsustainable levels of bycatch."[117] Nutrient pollution remains a significant threat, and "[m]ore than 60% of the world's coral reefs are under threat, especially because of overfishing and destructive practices . . ."[118] Finally, with a new goal of protecting 30 percent of the global ocean in "fully and highly protected areas" by 2030, as of 2023

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[111] *Marine and Coastal: COP Decisions*, United Nations Environment Programme (Feb. 17, 2022), https://www.cbd.int/marine/decisions.shtml.
[112] *Id.* (emphasis added).
[113] *Id.*
[114] *Id.* COP 15 was disrupted by the COVID-19 pandemic and concluded only in December 2022.
[115] *Marine and Coastal: COP Decisions*, United Nations Environment Programme (Feb. 17, 2022), https://www.cbd.int/marine/decisions.shtml.
[116] Patrick Greenfield, *World fails to meet a single target to stop destruction of nature—UN report*, The Guardian (Sept. 15, 2020, 09:15 EDT), https://www.theguardian.com/environment/2020/sep/15/every-global-target-to-stem-destruction-of-nature-by-2020-missed-un-report-aoe#:
[117] *Id.*
[118] *Id.*

only "2.9% of the ocean is fully or highly protected from fishing impacts," and only 8.2 percent of the ocean is covered by any form of biodiversity-based (IUCN-complying) MPA.[119]

3. United States

While the United States is not a party to the Biodiversity Convention, it also pursued the goal of protecting 10% of the ocean in MPAs by 2020.[120] Moreover, unlike the international community at large, the United States met that goal. "As of June 2020, 26% of U.S. waters (including the Great Lakes) are in some type of MPA, and 3% of U.S. waters are in the most highly protected category of MPAs ('no take' MPAs that prohibit extractive uses)."[121]

However, the largest no-take MPAs in the United States protect only two Pacific Ocean coral reef ecosystems: "Nearly all the highly protected MPAs in the U.S. are located in two large MPAs in the remote Pacific Ocean–Papahānaumokuākea Marine National Monument and Pacific Remote Islands Marine National Monument. Less than 0.1% of U.S. waters outside of these sites are in highly protected MPAs."[122] Outside of these two marine national monuments, marine reserves in the United States are scattered along the West and Alaska coasts, with additional sprinklings in Florida and the far Northeast.[123]

In terms of protecting the nation's full range of marine biodiversity, moreover, the United States' system of MPAs does a fair—but not exemplary—job:

> the current collection of federal and state MPAs in the U.S. is moderately representative of the nation's key eco-regions, ecosystems, and taxa. In 2015 and 2020, NOAA's National MPA Center conducted preliminary assessments of the degree of representativeness in the nation's portfolio of MPAs. These analyses found that all of the 19 marine ecoregions in the U.S. contained at least one and often many MPAs. The relative number and sizes of these MPAs vary widely within and among ecoregions, as do their levels of protection, management

[119] *The Marine Protection Atlas*, MARINE CONSERVATION INSTITUTE (viewed Feb. 19, 2023), https://mpatlas.org/.
[120] National Marine Protected Areas Center, *Marine Protected Areas 2020: Building Effective Conservation Networks* 1 (2020).
[121] *Id.* at 2.
[122] *Id.*
[123] *Id.*

> approaches, and likely conservation impacts on those ecosystem features.[124]

As is true internationally, moreover, the United States' collection of MPAs favors certain kinds of marine ecosystems, such that state and federal MPAs protect "80% of shallow tropical corals, 83% of mangroves, 63% of seagrasses, and 54% of deep corals . . .."[125] For both biodiversity and economic reasons, the United States' coral reefs have received the lion's share, historically, of legal attention,[126] while other ecosystems important to marine biodiversity, such as kelp forests, still receive little legal protection outside of California.

Nor, with two state exceptions, is the United States' collection of MPAs truly a biodiversity-maintaining *system*.

> Ecological connectivity is only beginning to be a factor in the design and adaptive management of MPAs and MPA networks in U.S. waters. To date, the states of California and Hawai'i have created the nation's first MPA networks that take connectivity into account in the location of sites. In contrast, most other U.S. MPAs were established over several decades by many different programs, each with distinct conservation goals and management approaches. MPA establishment processes have historically focused on individual sites of local significance, rather than on connected networks of ecologically linked sites.[127]

Instead of a national system, "[t]he state of California's portfolio of MPAs is the nation's only example of an intentionally designed, ecologically connected, cohesive, regional network of MPAs. This network design involved significant stakeholder input and relied on models and studies of ocean circulation, larval dispersal, optimal size and spacing distances, and projected impacts on commercial and recreational fisheries."[128] Under the 1999 state Marine Life Protection

[124] *Id.* at 5.
[125] *Id.*
[126] *See, e.g.*, Robin Kundis Craig, *Coral Reefs, Fishing, and Tourism: Tensions in U.S. Law and Policy Reform*, 27 STAN. ENVTL. L.J. 3 (2008); Robin Kundis Craig, *Taking Steps Toward Marine Wilderness Protection? Fishing and Coral Reff Marine Reserves in Florida and Hawaii*, 34 MCGEORGE L. REV. 155 [PINCITE] (2003) (both tracing legal efforts in the United States to protect coral reefs).
[127] Nation Marine Protected Areas Center, *supra* note 120, at 6.
[128] *Id.* at 6, "Case Study."

Act,[129] California used a form of MSP to network 124 marine reserves and other MPAs established on the basis of science and stakeholder input and subject to both monitoring and adaptive management.[130] In so doing, it created a model for the nation in terms of marine biodiversity legal protection, where MPAs cover 16 percent of state waters and "[a]bout 9% of the state's MPAs are non-take marine reserves."[131]

B. The New BBNJ Treaty

As noted, the parties to the Biodiversity Convention became increasingly interested in biodiversity in the open ocean—the area beyond national jurisdiction. Under international law, national jurisdiction over ocean waters stops 200 nautical miles from shore, beyond which is the high seas. Marine conservation in these "high seas" has traditionally depended on regional treaties, especially with regard to regulation of fishing.[132]

The United Nations is currently finishing a draft of a new treaty to allow for area-based marine biodiversity protection on the high seas. In 2017, the United Nations General Assembly called for an international conference to draft a new treaty to govern marine biodiversity in international waters, which will operate as a new protocol to the United Nations Convention on the Law of the Sea, the international "constitution" for the ocean.[133] Formally, this new treaty is called the *Agreement under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction*,[134] but it is more colloquially known as the BBNJ (Biodiversity Beyond National

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[129] Marine Life Protection Act, CAL. FISH & GAME CODE §§ 2850-2863. For more information about the implementation of the Marine Life Protection Act, see generally: Britta Phillips, Comment, *Southern California's Recent Adoption of the Marine Life Protection Act to Create Marine Protected Areas*, 2 ARIZ. J. ENVTL. L. & POL'Y 1053 (2011); Deborah A. Sivas & Margaret R. Caldwell, *A New Vision for California Ocean Governance: Comprehensive Ecosystem-Based Maine Zoning*, 27 STAN. ENVTL. L.J. 209 (2008).

[130] *Marine Protected Areas*, California Sea Grant (viewed Feb. 19, 2023), https://caseagrant.ucsd.edu/our-work/resources/marine-protected-areas.

[131] *Id.*

[132] *Regional Seas Programme*, United Nations Environment Programme (viewed Feb. 19, 2023), https://www.unep.org/explore-topics/oceans-seas/what-we-do/regional-seas-programme.

[133] *Intergovernmental Conference on an international legally binding instrument under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction*, UNITED NATIONS (viewed Feb. 19, 2023), https://www.un.org/bbnj/.

[134] *Id.*

Jurisdiction) treaty. Negotiations began in 2018, and the fifth session, delayed by the COVID-19 pandemic, takes places February 20 to March 3, 2023, in New York City.[135]

The draft treaty[136] going into the fifth round of negotiation acknowledges the need for a "comprehensive global regime to better address the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction" and the desire for parties "to act as stewards of the ocean in areas beyond national jurisdiction on behalf of present and future generations."[137] It applies to both the high seas and the areas of seabed beyond national jurisdiction[138] (and seeks "to ensure the [long-term] conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction through effective implementation of the relevant provisions of the Convention and further international cooperation and coordination."[139]

Although the exact language of many of the treaty's core principles is still being negotiated, the parties have settled on an ecosystem-based precautionary approach based on the best available knowledge[140] (including indigenous and local knowledge) "that builds ecosystem resilience to the adverse effects of climate change and ocean acidification and restores ecosystem integrity."[141] Within that overall goal and subject to an overarching duty to cooperate for conservation,[142] the BBNJ Treaty addresses four specific topics: (1) exploitation and sharing of marine genetic resources;[143] (2) use of area-based protections/marine protected areas on the high seas or on the seabed;[144] (3) environmental impact assessments for activities on the high seas or on the seabed;[145] and (4) capacity building and technology transfer.[146]

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135 *Id*.
136 United Nations General Assembly, Further refreshed draft text of an agreement under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction (Dec. 12, 2022), available at https://documents-dds-ny.un.org/doc/UNDOC/GEN/N22/467/94/PDF/N2246794.pdf?OpenElement.
137 *Id*., Preamble.
138 *Id*. arts. 1(4), 3(1).
139 *Id*. art 2; bracketed text is still being negotiated.
140 The status of indigenous knowledge is still being negotiated.
141 *Id*. art. 5.
142 *Id*. art 6.
143 *Id*. Part II.
144 *Id*. Part III.
145 *Id*. Part IV.
146 *Id*. Part V.

While many of the proposed BBNJ's provisions are both fascinating and controversial, for purposes of this article the area-based protections are the most important. The December 2022 draft defines "area-based management tool" to be "a tool, including a marine protected area, for a geographically defined area through which one or several sectors or activities are managed with the aim of achieving particular conservation and sustainable use objectives in accordance with this Agreement."[147] Part III of the treaty seeks to "[c]onserve and sustainably use areas requiring protection," to "[s]trengthen cooperation and coordination in the use of area-based management tools, including marine protected areas," to "[p]rotect, preserve, restore, and maintain biodiversity and ecosystems," to enhance food security and protection of cultural values, and to support developing nations.[148] To establish an area-based management tool, including an MPA, in the high seas, individual or collective parties submit a proposal to the Secretariat based on the best available science and, "where available, traditional knowledge of Indigenous Peoples and local communities . . . ."[149] Proposals must include 10 elements:

> (a) A geographic or spatial description of the area that is the subject of the proposal by reference to one or more of the indicative criteria specified in annex I;
>
> (b) Information on any of the criteria specified in annex I, as well as any criteria that may be further developed and revised in accordance with paragraph 5 of this article, applied in identifying the area;
>
> (c) Human activities in the area, including uses by Indigenous Peoples and local communities, and their possible impact, if any;
>
> (d) A description of the state of the marine environment and biodiversity in the identified area;
>
> (e) A description of the conservation and, where appropriate, sustainable use objectives that are to be applied to the area;
>
> (f) A draft management plan encompassing the proposed measures, and outlining proposed monitoring, research and review activities to achieve the specified objectives;
>
> (g) The duration of the proposed area and measures, if any;

[147] *Id*. art. 1(3).
[148] *Id*. art. 14.
[149] *Id*. art. 17(1), 17(3).

> (h) Information on any consultations undertaken with States, including adjacent coastal States and/or relevant global, regional, subregional and sectoral bodies, if any;
>
> (i) Information on area-based management tools, including marine protected areas implemented under relevant legal instruments and frameworks and relevant global, regional, subregional and sectoral bodies; and
>
> (j) Relevant scientific input and, where available, traditional knowledge of Indigenous Peoples and local communities.[150]

There are 23 Annex I criteria that can justify area-based management, ranging from "uniqueness" and "rarity" to the area's importance to species or biodiversity, its vulnerability, fragility or sensitivity, or its importance to humans.[151]

Once submitted, the proposal becomes public and is sent for preliminary review to the Scientific and Technical Body.[152] The Secretariat also consults with affected nations and other potentially affected entities, such treaty bodies, Indigenous Peoples, and local communities.[153] Moreover, "Consultations on proposals submitted under article 17 shall be inclusive, transparent and open to all relevant stakeholders, including States and global, regional, subregional and sectoral bodies, as well as civil society, the scientific community, Indigenous Peoples and local communities."[154] The Conference of the Parties makes the final decision on whether to establish the area-based management tool.[155] It must also adopt emergency measures; specifically, it

> shall adopt an area-based management tool, including a marine protected area, in areas beyond national jurisdiction to be applied on an emergency basis, if necessary, where an activity, or when a natural phenomenon or human-caused disaster has, or is likely to have, a significant adverse impact on marine biological diversity of areas beyond national jurisdiction, to ensure that the adverse impact is not exacerbated.[156]

[150] *Id*. art. 17(4).
[151] *Id*. Annex I.
[152] *Id*. art 17 bis.
[153] *Id*. art. 18(2).
[154] *Id*. art. 18(1).
[155] *Id*. art . 19.
[156] *Id*. art. 20 ante.

Either way, parties become obligated to act consistently with the decisions made—although they can enact more stringent protections if they want.[157] Both the parties and the Scientific and Technical Body monitor the area-based management tool's implementation.[158]

The proposed BBNJ thus would extend the increasing global concern for marine biodiversity and global endorsement of MPAs to the high seas. From this perspective, it would be the culmination of over three decades of international effort to protect marine biodiversity.

Nevertheless, it is important to remember that much of the open ocean is low in biodiversity.[159] Thus, the BBNJ is most likely to promote marine biodiversity by protecting deep-sea ecosystems from deep seabed mining,[160] with occasional use for protecting unusual open ocean ecosystems, such as the Sargasso Sea in the Atlantic Ocean.[161]

IV. The Underused Approaches to Protecting Marine Biodiversity: Species Protections for Marine Species that are not Marine Animals

As helpful as MPAs can be for protecting marine biodiversity, they cannot be the only tools deployed. Leaving climate change and ocean acidification to the side,[162] the need for other legal biodiversity tools remains *even if* no-take marine reserves become fully integrated into fisheries management. As the Biodiversity Convention's many COPs have recognized, threats to marine biodiversity are many, and many forms of pollution, in particular, need to be addressed through legal tools other than area-based management.[163]

However, even when the focus stays on species and ecosystems, area-based management will be insufficient for some species. For example, "[b]ecause of overfishing most large predatory

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[157] *Id.* art. 20(1), (2).
[158] *Id.* art. 21.
[159] *Ecosystems of Oceans and Freshwater: Biological Diversity and Water*, STUDY.COM (viewed Feb. 19, 2023), https://study.com/academy/lesson/ecosystems-of-oceans-and-freshwater-biological-diversity-and-water.html.
[160] *See, e.g.*, K.A. Miller et al., Challenging the Need for Deep Seabed Mining From the Perspective of Metal Demand, Biodiversity, Ecosystems Services, and Benefit Sharing, 8 FRONTIERS MARINE SCI. art. 706161 (July 2021) (describing the potential impacts of deep seabed mining on marine biodiversity).
[161] *What Is the Sargasso Sea?*, NATIONAL OCEAN SERVICE (as updated Jan. 4, 2021), https://oceanservice.noaa.gov/facts/sargassosea.html.
[162] For a more comprehensive discussion of immediate ways to immediately protect the ocean from climate change and ocean acidification, see Robin Kundis Craig, *Re-Valuing the Ocean in Law: Exploiting the Panarchy Paradox of a Complex System Approach*, 41 STAN. ENVTL. L.J. 61-78 (2022).
[163] *Id.* at 72-78.

fish species have had their abundance reduced to 10% or less of historical levels, with some sensitive species of sharks reduced to about 1% of their carrying capacity."[164] For many of these species, MPAs provide little conservation assistance because the species are large and highly migratory pelagic species. Instead, the species itself needs to be protected—a form of legal protection that can also help to limit overfishing, as well. After surveying the primary legal tools for species-specific protection, this Part presents two case studies of regarding this last gap in marine biodiversity protection.

A. Early Protections for Marine Mammals

Marine mammals, as charismatic megafauna, have long enjoyed special legal protections—protections implemented to halt the direct impacts on specific species from hunting and whaling. One early example is the North Pacific Fur Seal Treaty of 1911, also known as the North Pacific Sealing Convention of 1911. As one historian recounted, "By the year 1911 the North Pacific fur seal was little more than a reminder of the greed and rapacity of man. The magnificent American herd on the Pribilof Islands had been reduced in numbers from approximately 4,000,000 in 1867 to rapidly dwindling 100,000."[165] Sealing in United States territory created tensions among the United States, Great Britain, Russia, and Japan, and in July 1911 they entered the treaty, which "prohibited pelagic sealing by citizens or subjects of the signatory nations, leaving to the respective governments owning seal rookeries the right to deal independently with land killing."[166] The treaty also enacted a profit-sharing scheme under which all the nations involved were better off if the fur seal herds thrived.[167]

The treaty was an immediate success:

> Within one year after the cessation of this practice the Pribilof herd had shown a noticeable increase, particularly in females. By 1932, the 100,000 or so of 1911 had increased to 1,219,000. Yet in that same year, under the government monopoly now existing, 49,336

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[164] Sala & Knowlton, *supra* note 2, at 103; *see also* SMITHSONIAN INSTITUTION, *supra* note 21 (listing the same 10% figure for large apex predators).
[165] Thomas A. Bailey, *North Pacific Sealing Treaty of 1911*, 4 PAC. HISTORICAL REV. 1, 1 (1935).
[166] *Id.* at 11.
[167] *Id.* at 11-12.

> superfluous males were killed and their skins sold, net-ting a handsome profit. In fact, from 1918 to 1930, after deducting the annual payments to Canada and Japan, the United States government received a total revenue of $4,477,000 from the seal herd.[168]

The Fur Seal Treaty thus demonstrated that controlling an international free-for-all in marine mammal hunting could be good both for the species and for economics.

More comprehensive is the International Convention for the Regulation of Whaling (IWC)[169] came into force in 1948, and in 1949 Congress passed the Whaling Convention Act[170] to implement it in the United States. Currently, 88 nations are parties to the IWC.[171] As the treaty name suggests, the IWC originally sought to *regulate* whaling globally, but in 1986 the parties adopted a global moratorium on whaling because whale stocks were being overexploited.[172] Although the parties originally intended the moratorium to be temporary, it has remained in place.[173] Nevertheless, many whale species remain in trouble. For example, according to the IUCN's "Red List"—a global compendium of scientific assessments of species' statuses—blue whale[174] and sei whales,[175] two of the largest hunted baleen whales, are still endangered. Perhaps worst off is the North Atlantic right whale, the target of New England whalers at the time of *Moby Dick*, which remains critically endangered.[176]

However, other whale species have rebounded. For example, the Eastern North Pacific (California) gray whale population is one of the great success stories. With hunting eliminated, this population's numbers began to increase. By the early 1990s, this population of gray whales had recovered to near its original numbers. The IUCN considers the gray whale to be a species of

[168] *Id*. at 13.
[169] Dec. 2, 1946, 161 U.N.T.S. 72, 62 Stat. 1716 (Nov. 10, 1948).
[170] 16 U.S.C. §§ 916 *et seq*.
[171] *International Whaling Commission*, National Oceanic & Atmosphere Administration (viewed Feb. 20, 2023), https://www.fisheries.noaa.gov/international-affairs/international-whaling-commission.
[172] *Id.*
[173] *Id.*
[174] *Blue Whale*, IUCN RED LIST (viewed Feb. 20, 2023), https://www.iucnredlist.org/species/2477/156923585.
[175] *Sei Whale*, IUCN RED LIST (viewed Feb. 20, 2023), https://www.iucnredlist.org/species/2475/130482064.
[176] *North Atlantic Right Whale*, IUCN Red List (viewed Feb. 20, 2023), https://www.iucnredlist.org/species/41712/178589687.

"least concern."[177] Humpback whales are also in the IUCN's "least concern" category,[178] while fin whales are recovering but still considered "vulnerable."[179]

In the United States, the legacy of special legal protections for marine mammals lives on in the Marine Mammal Protection Act ("MMPA").[180] In this legislation, Congress found that "certain species and population stocks of marine mammals are, or may be, in danger of extinction or depletion as a result of man's activities," that "such species and population stocks should not be permitted to diminish beyond the point at which they cease to be a significant functioning element in the ecosystem of which they are a part," and that "there is inadequate knowledge of the ecology and population dynamics of such marine mammals and of the factors which bear upon their ability to reproduce themselves successfully."[181] In the terms of this article, therefore, the MMPA seeks to prevent the ecological extinction of marine mammals in the face of limited scientific knowledge.

For purposes of the Act, a "marine mammal" is:

> any mammal which (A) is morphologically adapted to the marine environment (including sea otters and members of the orders Sirenia, Pinnipedia and Cetacea), or (B) primarily inhabits the marine environment (such as the polar bear); and, for the purposes of this chapter, includes any part of any such marine mammal, including its raw, dressed, or dyed fur or skin.[182]

Moreover, consistent with the lack of scientific knowledge, the MMPA enacts a general "moratorium on the taking and importation of marine mammals and marine mammal products, . . . during which time no permit may be issued for the taking of any marine mammal and no marine mammal or marine mammal product may be imported into the United States . . . ."[183] The moratorium is subject to exceptions that require permits, such as for scientific research or

[177] *Gray Whale*, IUCN Red List (viewed Feb. 20, 2023), https://www.iucnredlist.org/species/8097/50353881.
[178] *Humpback Whale*, IUCN Red List (viewed Feb. 20, 2023), https://www.iucnredlist.org/species/13006/50362794.
[179] *Fin Whale*, IUCN Red List (viewed Fed. 20, 2023), https://www.iucnredlist.org/species/2478/50349982
[180] 16 U.S.C. §§ 1361–1362, 1371-1389, 1401-1407, 1411-1418, 1421-1421h, 1423-1423h.
[181] *Id.* § 1361(1)-(3).
[182] *Id.* § 1362(2).
[183] *Id.* § 1371(a).

incidental take in the course of commercial fishing.[184] NOAA Fisheries issues yearly stock assessment reports, through which it tracks 259 stocks of marine mammals.[185]

B. More General Legal Tools for Marine Species Protection

While species-specific legal instruments are helpful in certain biodiversity-threatening situations like overhunting, both the international community and the United States have also opted for more flexible legal regimes that allow species to be listed for various levels of protection as needed. Internationally, for example, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)[186] protects species threatened through international trade. The parties to CITES list species into one of three Appendices. "Appendix I shall include all species threatened with extinction which are or may be affected by trade. Trade in specimens of these species must be subject to particularly strict regulation in order not to endanger further their survival and must only be authorized in exceptional circumstances."[187] In turn,

> Appendix II shall include:
>
> (a) all species which although not necessarily now threatened with extinction may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival; and
>
> (b) other species which must be subject to regulation in order that trade in specimens of certain species referred to in sub-paragraph (a) of this paragraph may be brought under effective control.[188]

Finally, "Appendix III shall include all species which any Party identifies as being subject to regulation within its jurisdiction for the purpose of preventing or restricting exploitation, and as needing the cooperation of other parties in the control of trade."[189] Parties to CITES cannot allow

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[184] *Id.* § 1371(a)(1), (2).
[185] *Marine Mammal Stock Assessment Reports*, NOAA FISHERIES (viewed Feb. 20, 2023), https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports. The full list of marine mammals that NOAA Fisheries tracks, including their biodiversity status, is available at: *Species Directory: Marine Mammals*, NOAA Fisheries (viewed Feb. 20, 2023), https://www.fisheries.noaa.gov/species-directory/marine-mammals.
[186] March 3, 1973, T.I.A.S. No. 8249, 27 U.S.T. 1087 (in force July 1, 1975).
[187] *Id.* art. 2(1).
[188] *Id.* art 2(2).
[189] *Id.* art. 2(3).

or participate in trade in listed species contrary to the convention,[190] which requires a system for issuing export permits and monitoring imports and limits trade in Appendix I species to noncommercial uses.[191]

As of February 2023, the CITES Appendices list over 38,700 species and subspecies, 32,364 of which are plants and 37,435 of which are listed under Appendix II.[192] "There are currently almost 2,400 marine species listed in CITES Appendices, accounting for less than 10 percent of all CITES-listed species and around 40 percent of CITES-listed animal species."[193] Most of the included marine species are charismatic—all seven species of sea turtle, seahorses, all beaked whales, almost all great whales, six fur seal species, all dolphins, most porpoises, and some large sharks.[194] Sharks and rays have more recently received increasing protections under CITES.[195]

The United States implements CITES, as well as its own endangered species protections, through the federal Endangered Species Act ("ESA"). The ESA's dual national and international focus is evident in Congress's statement of the statute's purposes, which are "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take steps as may be appropriate to achieve the purposes of [certain] treaties and conventions * * *."[196] Specifically, Congress listed six treaties, conventions, and groups of treaties and conventions that it intended the ESA to implement or help to implement:

> (A) migratory bird treaties with Canada and Mexico;
>
> (B) the Migratory and Endangered Bird Treaty with Japan;

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[190] *Id.* art. 2(4).
[191] *E.g.*, *id.* at. 3 (detailing the requirements for trading in Appendix I species).
[192] *The CITES Species*, CITES (viewed Feb. 20, 2023), https://cites.org/eng/disc/species.php.
[193] 2022 FAO Report, *supra* note 45, at 184.
[194] *Convention on International Trade in Endangered Species of Flora and Fauna*, NOAA Fisheries (viewed Feb. 20, 2023), https://www.fisheries.noaa.gov/national/international-affairs/convention-international-trade-endangered-species-wild-fauna-and.
[195] 2022 FAO Report, *supra* note 45, at 186.
[196] 16 U.S.C. § 1531(b).

(C) the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere;

(D) the International Convention for the Northwest Atlantic Fisheries;

(E) the International Convention for the High Seas Fisheries of the North Pacific Ocean; [and]

(F) the Convention on International Trade in Endangered Species of Wild Fauna and Flora[.][197]

Under the ESA, the U.S. Fish & Wildlife Service (terrestrial and aquatic species and the National Marine Fisheries Service (marine and anadromous species) list species as either endangered or threatened species on the basis of the best science available.[198] Once a species is listed, no entity subject to the United States' jurisdiction can take members of the species or trade them in commerce.[199] Moreover, the federal government must ensure that neither its own actions nor the activities that it permits, licenses, or funds jeopardize the species' continued existence or harm its critical habitat.[200]

"NOAA Fisheries has jurisdiction over 163 endangered and threatened marine species (79 endangered; 84 threatened), including 65 foreign species (39 endangered; 26 threatened)."[201] In addition, the Queen conch was proposed for listing in 2022,[202] and 17 other marine species are awaiting decision.[203]

C. Protecting the Bluefin Tuna

"Bluefin tuna" actually refers to three species of fish: Atlantic bluefin tuna (*Thunnus thynnus*); the Southern bluefin tuna (*Thunnus maccoyii*); and the Pacific bluefin tuna (*Thunnus*

[197] 16 U.S.C. § 1531(a)(4).
[198] *Id.* § 1533.
[199] *Id.* § 1538(a).
[200] *Id.* § 1536(a)(2).
[201] *Species Directory: ESA Threatened and Endangered*, NOAA FISHERIES (viewed Feb. 20, 2023), https://www.fisheries.noaa.gov/species-directory/threatened-endangered?oq=&field_species_categories_vocab=All&field_region_vocab=All&items_per_page=350.
[202] National Oceanic & Atmospheric Administration, Endangered and Threatened Wildlife and Plants: Proposed Rule to List the Queen Conch as Threatened Under the Endangered Species Act (ESA), 87 Fed. Reg. 55,200 (Sept 8, 2022).
[203] *Species Directory: ESA Threatened and Endangered*, NOAA FISHERIES (viewed Feb. 20, 2023), https://www.fisheries.noaa.gov/species-directory/threatened-endangered?oq=&field_species_categories_vocab=All&field_region_vocab=All&items_per_page=350.

orientalis).[204] They represent a quintessential conflict between biodiversity protection and human gustatory desires:

> As top predators with few natural enemies, bluefin tuna once enjoyed long lifespans in thriving oceans. However, over the past 80 years, overfishing led to an estimated 80% to 90% population reduction. Consumers seek out this highly prized delicacy in the form of sushi and sashimi, resulting in enormous payouts for tuna fisheries, with a single bluefin tuna selling for over three million dollars.[205]

All three species of tuna are vulnerable to exploitation because they grow slowly and are unable to reproduce until they are four to eight years old.[206]

By any standard, bluefin tuna deserve legal protection. The Atlantic bluefin tuna is the species of "least concern," according to the IUCN.[207] However, it was considered "endangered" in 2011, and trend status data are unavailable.[208] It ranges across the North Atlantic and into the South Atlantic and the Gulf of Mexico.[209] Substantial uncertainty surrounds its 2021 assessment, because "[t]here has been considerable uncertainty associated with assessments of the Eastern Atlantic and Mediterranean Sea stock of Atlantic Bluefin Tuna due to issues with the catch per unit effort data, misreporting of catch during the late 1990s and 2000s, a lack of understanding of stock-recruit relationships and potential recruitment levels. Overfishing occurred during the late 1990s and 2000s . . ."[210] Moreover, "The eastern stock of Atlantic Bluefin Tuna is fished by many nations, and achieving consensus on management measures, especially allocation issues, is extremely difficult, which greatly increases management response time. Data deficiencies remain,"

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[204] 2022 FAO REPORT, *supra* note 45, at 52; *Bluefin Tuna: Endangered Species or Gourmet Food*?, TULANE UNIVERSITY LAW SCHOOL (Apr. 9, 2021), https://online.law.tulane.edu/blog/bluefin-tuna-endangered-species-or-gourmet-food.
[205] *Bluefin Tuna*, *supra* note 204.
[206] *Id.*
[207] *Atlantic Bluefin Tuna*, IUCN RED LIST (viewed Feb. 20, 2023), https://www.iucnredlist.org/species/21860/46913402.
[208] B.B. Collette, A, Boustany, W. Fox, J. Graves, M. Juan Jorda, & V. Restrepo, Thunnus thynnus, THE IUCN RED LIST OF THREATENED SPECIES 2021: e.T21860A46913402, at 2 (2021), https://dx.doi.org/10.2305/IUCN.UK.2021-2.RLTS.T21860A46913402.en
[209] *Id.* at 4.
[210] *Id.* at 7.

potentially compromising the assessment.[211] Moreover, because the western population of Atlantic bluefin tuna breeds in the Gulf of Mexico, it is distinctly vulnerable to climate change:

> The warm ambient temperatures on their breeding grounds in the Gulf of Mexico potentially present a distinct threat to these large, endothermic fish, and this potential threat will increase with increasing water temperatures due to global warming. Substantial breeding habitat loss for both adult and larval Atlantic Bluefin Tuna is thus predicted for the main spawning grounds in the northern Gulf of Mexico as water temperatures continue to warm.[212]

Petitions have been submitted to list the Atlantic bluefin tuna under both CITES and the United States ESA, to no avail.[213] The failure of additional protections, especially in light of climate change threats, could be particularly problematic for the western population. As the IUCN noted in 2021, "while the larger, eastern population of Atlantic bluefin tuna, which originates in the Mediterranean, has increased by at least 22% over the last four decades, the species' smaller native western Atlantic population, which spawns in the Gulf of Mexico, has declined by more than half in the same period."[214]

The Pacific bluefin tuna's numbers are actively decreasing, and the IUCN categorizes it, as of January 2021, as "near threatened."[215] This species has vacillated among IUCN classifications, moving from "least concern" in 2011 down to "vulnerable" in 2014 before bouncing back to "near threatened" in 2021.[216] It ranges across the North Pacific and in select parts of the South Pacific, including around New Zealand.[217] Fishing is by far the largest threat to the Pacific bluefin tuna; it "is a high-value species in the global fresh-fish markets, particularly in the

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[211] *Id.* at 10.
[212] *Id.*
[213] *Id.*
[214] *Tuna species recovering despite growing pressures on marine life—IUCN Red List*, IUCN (Sept. 4, 2021), https://www.iucn.org/news/species/202109/tuna-species-recovering-despite-growing-pressures-marine-life-iucn-red-list.
[215] *Pacific Bluefin Tuna*, IUCN RED LIST (viewed Feb. 20, 2023), https://www.iucnredlist.org/species/170341/170087840.
[216] B.B. Collette, A. Boustany, W. Fox, J. Graves, M. Juan Jorda, & V. Restrepo, Thunnus orientalis, THE IUCN RED LIST OF THREATENED SPECIES 2021: e.T170341A170087840, at 2 (2021), https://dx.doi.org/10.2305/IUCN.UK.2021-2.RLTS.T170341A170087840.en.
[217] *Id.* at 3.

sashimi and sushi markets of Japan, and aquaculture production is being intensively studied in Japan. It is the most expensive fish in the world."[218] However, this species has also recently been successfully aquacultured, and "aquaculture production has now spread to Mexico, where the total production may now exceed wild catch."[219] Thus, the continued need for wild catch of Pacific bluefin tuna is questionable, especially given that the species "remains severely depleted at less than 5% of its original biomass."[220]

The IUCN considers the Southern bluefin tuna to be endangered.[221] While this status is actually an improvement from its "critically endangered" assessments in 1996 and 2011,[222] it remains in trouble. This species ranges across the very southern parts of the Pacific, Indian, and Atlantic Oceans, skirting the edges of the Southern Ocean surrounding Antarctica.[223] The species is overfished, with an extremely low biomass compared to historic levels, and fisheries management is complicated by the fact that Australian fishers catch immature juveniles to grow up in cages.[224] Indeed, the caging problem is significant enough that the Commission for the Conservation of Southern Bluefin Tuna has recommended "the use of stereoscopic cameras to accurately estimate the amount of caged fish in farming operations, but this recommendation has not yet been realized."[225]

Bluefin tuna are also particularly emblematic of the limits of MPAs as biodiversity conservation tools. With ranges that cross entire oceans, these tuna benefit little from small MPAs unless the MPAs protect their known breeding grounds. However, the relatively new practice of catching juvenile tuna in the Mediterranean and off Australia and caging them to grow to

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[218] *Id.* at 6.
[219] *Id.*
[220] *Tuna species recovering despite growing pressures on marine life—IUCN Red List*, IUCN (Sept. 4, 2021), https://www.iucn.org/news/species/202109/tuna-species-recovering-despite-growing-pressures-marine-life-iucn-red-list.
[221] *Southern Bluefin Tuna*, IUCN Red List (viewed Feb. 20, 2023), https://www.iucnredlist.org/species/21858/170082633.
[222] B.B. Collette, A. Boustany, W. Fox, J. Graves, M. Juan Jorda, & V. Restrepo, Thunnus maccoyii, The IUCN Red List of Threatened Species 2021: e.T21858A170082633, at 2 (2021), https://dx.doi.org/10.2305/IUCN.UK.2021-2.RLTS.T21858A170082633.en.
[223] *Id.* at 3.
[224] *Id.* at 6.
[225] *Id.*

marketable size undermines even a breeding-ground-focused MPA strategy, because these captured juveniles never get a chance to breed. As a result, both the international community and the United States should consider listing Bluefin tuna for individual species protections as endangered species and under CITES Appendix I, despite their commercial value as food.

V. Conclusion

Protecting marine biodiversity often feels like an uphill battle, especially in light of the recently magnifying impacts on marine species and ecosystems from climate change and ocean acidification. Nevertheless, it is important for the global community and the United States to remember that *other* threats to marine biodiversity still exist, and that the continued existence of these other stressors often make the impacts of climate change worse.

Therefore, while the world continues to work toward reducing carbon dioxide emissions—the ultimate "fix" to both climate change impacts and ocean acidification—it should more enthusiastically deploy *all* of the legal tools in the marine biodiversity toolbox. Carefully located, designed, and enforced MPAs that limit exploitation of marine resources remain an important biodiversity tool, and the global consensus to protect 30% of the ocean in MPAs by 2030 is an ambitious but desirable goal.

Nevertheless, commitment to that area-based strategy should not prevent increased deployment of "no take" protections for individual species like bluefin tuna. Bluefin tuna, and other highly migratory species, need to be protected from capture *wherever* they are found. While fisheries management appears to be improving, "less bad" fishing does not change the fact that many of these apex marine species remain severely depleted, approaching ecological extinction and warping marine ecosystem function. Only a complete ban on fishing for these species gives them their best chance to recover to something approaching their historical biomass and ecological function despite a rapidly changing ocean.