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CORAL REEF CASE STUDY: COMPARING CURRENT INTERNATIONAL AND DOMESTIC CORAL REEF LAWS AND DIVING INTO THE LEGAL INPLICATIONS OF COUNTRIES FAILING TO ADEQUATELY PROTECT AND CONSERVE THESE ECOSYSTEMS AS CLIMATE CHANGE WORSENS

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CORAL REEF CASE STUDY: COMPARING CURRENT INTERNATIONAL AND DOMESTIC CORAL REEF LAWS AND DIVING INTO THE LEGAL IMPLICATIONS OF COUNTRIES FAILING TO ADEQUATELY PROTECT AND CONSERVE THESE ECOSYSTEMS AS CLIMATE CHANGE WORSENS

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Scientists predict that 90% of the world's coral reefs will disappear by 2050 due to climate change induced by human activity. If society continues being laissez-faire about how human impacts are affecting coral reefs, declines in ocean health and ecosystem services are projected to cost the global economy $428 billion per year by 2050. Although countries understand the general sense of urgency when taking action to protect coral reef ecosystems, countries have taken different approaches in how to effectively legislate and regulate these delicate areas. When looking to international law, there have been dozens of multilateral agreements and conventions established over the past fifty years, but none of them have prevented or curbed the impact climate change has had on coral reef ecosystems enough to reverse the effect. Environmental non-profits, as well as individuals, have realized the importance of these ecosystems to everyday life. Some have tried to sue their own governments in order to spark action by bringing due process claims for failing to protect citizens from the harmful effects of increased greenhouse gas emissions and for federal agencies failing to upkeep water quality standards. Others have petitioned for more endangered species of coral reefs to be listed under the Endangered Species Act (ESA). And several suggest expanding the public trust doctrine to include a stable climate for future generations.

This paper concludes by providing insight into the future outlook of coral reef ecosystems with the advancement of new technologies and proposes creating a new, international treaty that encompasses and addresses every threat to coral reefs in one document. The proposed treaty would seek to have countries collaborate with each other to regulate the multitude of activities that threaten coral reefs, including climate change, by establishing more effective, domestic programs with enforcement and financial mechanisms in place.

I. BACKGROUND

A. WHAT IS A CORAL REEF?

Coral reefs are made up of polyps. A coral reef consists of hundreds to hundreds of thousands of individual polyps functioning together as one system.[1] These are known as colonial organisms.[2] Each polyp has a stomach that opens at one end.[3] The opening, known as the mouth, is surrounded by tentacles which are often used as defense and hunting mechanisms.[4] Additionally, these polyps secrete a substance made up of calcium carbonate that eventually hardens and builds upon each other to develop the reef structure.[5] The coral polyps themselves are colorless, but reefs obtain their color from the tiny creatures living inside the polyps—algae called zooxanthellae.[6] The relationship between the coral and the algae is symbiotic.[7] The coral provides shelter, access to sunlight, and other qualities necessary for photosynthesis, while the algae share the nutrients produced by photosynthesis with the coral.[8] According to the National Oceanic and Atmospheric Administration (NOAA), as much as 90% of the nutrients that algae produce are transferred to their coral hosts.[9] Corals can be found all over the world throughout the oceans at varying temperatures, latitudes, and depths.[10] However, there are some factors and environments that make it more optimal for corals to grow.[11] For example, corals need salt

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1 *Corals Tutorial*, NAT'L OCEAN SERV., NOAA, U.S. DEP'T OF COM., https://oceanservice.noaa.gov/education/tutorial_corals/welcome.html.

2 *Id.*

3 *Id.*

4 *Id.*

5 *Coral Reefs*, LIVE SCI., https://www.livescience.com/topics/coral-reefs.

6 Rachel Ross, *What are Coral Reefs?*, LIVE SCI. (Sept. 24, 2018), https://www.livescience.com/40276-coral-reefs.html.

7 *Id.*

8 *Id.*

9 *Corals Tutorial*, *supra* note 1.

10 *Coral Reef Systems*, SCRIPPS INSTITUTION OF OCEANOGRAPHY, https://scripps.ucsd.edu/projects/coralreefsystems/about-coral-reefs/biology-of-corals/ (last visited Dec. 1, 2019).

11 *Id.*

water to survive, so areas where there is freshwater runoff or where rivers are merging into the ocean are not ideal.[12] Other factors influencing coral distributions within the oceans include: availability of food, the existence of species that help control algae, and availability of hard-bottom substrate (usually found closer to the shore).[13] "Shallow coral reefs show prime growth rates in warmer water ranging from 70–85 degrees Fahrenheit."[14] "Reef-building corals also generally grow best at depths shallower than 230 feet."[15] "The most prolific reefs occupy depths of 60–90 feet . . . ."[16]

B. WHAT DO CORAL REEFS PROVIDE?

> "Coral reefs are the ecosystems richest in biological diversity and are considered a focal point of interaction between marine ecology and coastal socioeconomics."[17]

At a high level, coral reefs provide two kinds of benefits: economic benefits, which are tangible and immediate, and ecosystem services, which are often harder to realize because they can be direct or indirect.[18] "An ecosystem service is any positive benefit that wildlife or ecosystems provide to people."[19] "Worldwide, coral reefs have a net present value of almost $800 billion, and every year, they generate $30 billion in net economic benefits."[20]

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12 *Id.*
13 *Id.*
14 *Id.*
15 *Id.*
16 *Id.*
17 RADOSLAV S. DIMITROV, SCIENCE & INTERNATIONAL ENVIRONMENTAL POLICY: REGIMES AND NONREGIMES IN GLOBAL GOVERNANCE 131 (Rowman & Littlefield 2006).
18 J.C. Sylvan, *How to Protect a Coral Reef: The Public Trust Doctrine and the Law of the Sea*, 7 SUSTAINABLE DEV. L. & POL'Y 32, 32 (2006).
19 *Ecosystem Services*, NAT'L WILDLIFE FED., https://www.nwf.org/Educational-Resources/Wildlife-Guide/Understanding-Conservation/Ecosystem-Services (last visited Nov. 23, 2020).
20 Sylvan, *supra* note 18.

Coral reefs are one of the most bio diverse ecosystems on the planet and yet only cover 1/10th of 1% of the ocean floor.[21] "Coral reefs support more than 800 hard coral species and more than 4,000 species of fish."[22] Not only this but, reefs are an essential breeding ground for many species.[23] Coral reef structures not only provide support for animals but also for beaches by providing coastal protection.[24] Due to their rough and complex structures, coral reefs can break much of the wave energy that would normally cause beach erosion.[25] By serving as a buffer to shorelines from currents, waves, and storms, reefs help to prevent erosion, property damage, and loss of life.[26] With today's increasingly severe tropical storms, reefs prevent as much as $4 billion in flood damages globally every year, according to a recent study in the journal *Nature Communications*.[27] Coastlines are often very dynamic and ever-changing, but ones protected by reefs are typically more stable.[28]

As previously mentioned, there is an abundant variety and supply of fish that rely on reefs for protection and food.[29] These fish are a significant food source for over a billion people globally.[30] Nearly half of federally managed fisheries in the U.S. rely on coral reef systems during their life cycle.[31] NOAA's National Marine Service suggests that the annual commercial value of U.S. fisheries from coral reefs is over $100 million.[32] "Globally, fisheries benefits account for $5.7 billion of the total $29.8 billion global net benefit

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21 *Value of Corals*, SCRIPPS INSTITUTION OF OCEANOGRAPHY, https://scripps.ucsd.edu/projects/coralreefsystems/about-coral-reefs/value-of-corals/ (last visited Dec. 1, 2019).

22 *Id.*

23 *Id.*

24 *Id.*

25 *Id.*

26 *Id.*

27 Michael W. Beck et al., *The Global Flood Protection Savings Provided by Coral Reefs*, NATURE COMM. 1, 3 (June 12, 2018), https://www.nature.com/articles/s41467-018-04568-z.

28 *Value of Corals*, *supra* note 21.

29 *Id.*

30 *Id*.

31 *Id.*

32 *Id.*

provided by coral reefs."[33] Additionally, coral reef ecosystems produce chemical compounds used for defense of the organisms living within the reef.[34]

Bioprospecting, the search for plant and animal species from which medicinal drugs and other commercially valuable compounds can be obtained,[35] is relatively new in the coral reef environment.[36] But already, organisms found in coral ecosystems are important sources of new medicines being developed to "induce and ease labor and to treat cancer, arthritis, asthma, ulcers, bacterial infections, heart disease, viruses, and other diseases, as well as sources of nutritional supplements, enzymes, and cosmetics."[37]

Coral reefs are extremely valuable to tourism and recreational sectors.[38] Millions of scuba divers and snorkelers travel to coral reefs to experience the plethora of sea life surrounding them every year.[39] Many reefs are just off the coast of smaller, lesser developed islands that depend on visitors to stimulate their economies and to help them ensure their local livelihood.[40] Through diving tours, recreational fishing trips, hotels, restaurants, and other businesses located near reef ecosystems, local economies are able to flourish.[41] It is estimated that the "total global value of coral-reef based recreation and tourism [is] $9.6 billion of the total global net benefit of coral reefs."[42]

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33 *Id.*

34 *Id.*

35 *Bioprospecting*, UN DEV. PROGRAMME (Mar. 15, 2016), https://www.sdfinance.undp.org/content/sdfinance/en/home/solutions/bioprospecting.html (last visited Nov. 23, 2020).

36 *Value of Corals*, *supra* note 21.

37 *Id.*

38 *Id.*

39 *Id.*

40 *Coral Reef Conservation is Key to Small Islands*, WORLD WIDE FUND FOR NATURE (Jan. 10, 2005), http://wwf.panda.org/?17756/coral-reef-conservation-is-key-to-small-islands.

41 *Value of Corals*, *supra* note 21.

42 *Id.*

C. ISSUES FACING CORAL REEFS

"Climate change is the greatest global threat to coral reef ecosystems."[43] If we continue doing nothing about how our human impacts are affecting oceans and coral reefs, declines in ocean health and ecosystem services are projected "to cost the global economy $428 billion per year by 2050, and $1.979 trillion per year by 2100."[44] The speed and intensity of the future risks and impacts on these delicate ecosystems depend critically on future greenhouse gas emissions.[45] Society today must also combat the effects of climate change lingering from the past decades of emissions.[46] In 2007, the Intergovernmental Panel on Climate Change (IPCC) stated that the evidence is now "unequivocal" that the earth's atmosphere and oceans are warming.[47] They concluded that these changes are primarily due to greenhouse gases.[48] The more these emissions can be curbed, the healthier our reef systems will be.[49]

Coral reefs are threatened by three major climate change-induced stressors: warming, acidification, and loss of oxygen.[50] Rising sea temperatures brought on by climate change have become the greatest danger to coral reefs, according to NOAA.[51] As the ocean is warming, marine heat waves are becoming more frequent and intense.[52] If an organism is immobile or is unable to adapt to

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43 *How Does Climate Change Affect Coral Reefs?,* NOAA NAT'L OCEAN SERV., https://oceanservice.noaa.gov/facts/coralreef-climate.html (last visited Nov. 23, 2020).

44 IPCC, THE OCEAN AND CRYOSPHERE IN A CHANGING CLIMATE: SUMMARY FOR POLICYMAKERS, 1-49 (Sept. 24, 2019), https://report.ipcc.ch/srocc/pdf/SROCC_FinalDraft_FullReport.pdf.

45 *Id.*

46 *Id.*

47 *Id.* at SM1-4.

48 *Id.* at 2-16.

49 *Id.* at 1-49.

50 *How Does Climate Change Affect Coral Reefs?*, *supra* note 43.

51 *See generally* IPCC*, supra* note 44.

52 *Id.* at 1-23.

warmer water, they are put at risk.[53] This impacts coral reef and fish populations by causing disease and death.[54] These disease outbreaks are likely to become more frequent as the oceans warm.[55]

Ocean acidification occurs when there is a rise in ocean temperature due to carbon dioxide being absorbed into the ocean from the atmosphere.[56] Carbon dioxide that has been taken up by the ocean reacts with water molecules to increase the acidity of seawater, therefore, decreasing the pH.[57] This makes the water more corrosive for marine organisms that build their shells and structures out of mineral carbonates, like corals.[58] Gradually, this leads to the reduction of calcification rates in reef-building and reef-associated organisms.[59] Coral bleaching is an environmental stress response to this phenomenon that causes coral polyps to expel the algae whose photosynthesis provides the nutrients corals need to build reef structures.[60] "This type of heat stress affected 70% of the world's coral reefs between 2014 and 2017."[61] Between 2016 and 2017, according to NASA, "half of the Great Barrier Reef died in bleaching events set off by high sea temperatures".[62] Bleaching

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[53] *See* Ivan Nagelkerken, *How Will Marine Life Adapt to Warmer Oceans?*, WORLD ECON. F. (Oct. 29, 2015), https://www.weforum.org/agenda/2015/10/how-will-marine-life-adapt-to-warmer-oceans/ (last visited Nov. 23, 2020).

[54] *See generally id.*

[55] *See generally id.*

[56] *See generally id.*

[57] *See id.*

[58] *See generally id.*

[59] Heron et al., *Impacts of Climate Change on World Heritage Coral Reefs: A First Global Scientific Assessment.* UNESCO WORLD HERITAGE CENTRE (June 23, 2017), https://whc.unesco.org/en/news/1676/ (last visited Nov. 23, 2020).

[60] *See What Is Coral Bleaching?*, NOAA NAT'L OCEAN SERV. (last updated Nov. 5, 2020), https://oceanservice.noaa.gov/facts/coral_bleach.html (last visited Nov. 23, 2020).

[61] Donavyn Coffey, *What Is Coral Bleaching?*, LIVE SCI. (Jan. 31, 2019), https://www.livescience.com/64647-coral-bleaching.html.

[62] *Id.*

events have become more frequent in recent decades.[63] The most recent global scientific assessment of the status of coral reef ecosystems occurred in 2008 and estimated that "the world has effectively lost 19% of the original area of coral reefs; 15% are seriously threatened with loss within the next 10–20 years; and 20% are under threat of loss in 20–40 years."[64] Seemingly insignificant temperature spikes of only 1.8 to 3.6 degrees Fahrenheit can trigger coral bleaching events that affect miles and miles of coral reef.[65] Mass bleaching happens gradually because as water temperature rises above the coral's comfort zone, algae begin to leave and corals begin to essentially starve to death.[66] This bleached coral is still alive but without the symbiotic relationship of algae providing the corals energy, these structures are much more vulnerable.[67] This process transforms once vibrantly colored, life sustaining coral into a bright white, barren skeleton.[68] It is possible for corals to recover from bleaching.[69] For instance, if conditions return to normal, and continue to stay that way, corals can reobtain algae necessary for survival.[70] However, when prolonged periods of warmer temperatures occur coral "can struggle to regrow, reproduce and resist disease."[71] "Coral communities typically take 15 to 25 years to recover from mass bleaching."[72] There is a limited capacity for corals to adapt to climate change and current global targets of carbon

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63 *See* Clive Wilkinson, *Status of Coral Reefs of the World: 2008*, GLOBAL CORAL REEF MONITORING NETWORK (2008), at 1.

64 *Id.* at 5.

65 Coffey, *supra* note 61.

66 Wilkinson, *supra* note 63.

67 *Id.*

68 *Id.*

69 *Coral Bleaching,* AUSTRL. MARINE CONSERVATION SOC'Y, https://www.marineconservation.org.au/coral-bleaching/ (last visited Nov. 23, 2020).

70 *Id.*

71 *Id.*

72 *Achieving Paris Goals Key to Survival of Coral Reefs,* UN CLIMATE CHANGE (July 6, 2018), https://unfccc.int/news/achieving-paris-goals-key-to-survival-of-coral-reefs (last visited Dec. 30, 2020).

emission reductions are insufficient for coral reef protection.[73] Therefore, lower emission targets should be pursued.[74]

Ocean warming also reduces the amount of oxygen oceans can hold.[75] This in turn stratifies the water column and less oxygen is able to be transported to deeper depths where it is necessary to sustain life.[76] According to *National Geographic*, 70% of Earth's oxygen production comes from marine phytoplankton.[77] With marine plant species dying out, this number is set to decrease.[78]

These significant climate-change stressors occur alongside other human-driven impacts, like unsustainable fishing practices and pollution that drastically impact our reef ecosystems.[79] Overfishing can lead to the depletion of key reef species worldwide.[80] Certain impacts of fishing on reefs vary from overexploitation of fish for food; removal of a species impacting multiple trophic levels, by-catch; and physical damage to reef environments.[81] Pollution from land sources, such as runoff from agricultural sector, deforestation, storm water, impervious surfaces,

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[73] *See* Mebrahtu Ateweberhan et al., *Climate Change Impacts on Coral Reefs: Synergies with Local Effects, Possibilities for Acclimation, and Management Implications*, NAT'L CTR FOR BIOTECHNOLOGY INFO. (June 28, 2013), https://www.ncbi.nlm.nih.gov/pubmed/23816307.

[74] *Id.*

[75] Chris Mooney, *Global Warming Could Deplete the Oceans' Oxygen – With Severe Consequences,* WASH. POST (Apr. 28, 2016, 11:28AM), https://www.washingtonpost.com/news/energy-environment/wp/2016/04/28/global-warming-could-deplete-the-oceans-oxygen-levels-with-severe-consequences/.

[76] *See id.*

[77] *Save the Plankton, Breathe Freely*, NAT'L GEOGRAPHIC, https://www.nationalgeographic.org/activity/save-the-plankton-breathe-freely/ (last visited Nov. 23, 2020).

[78] *Id.*

[79] IPCC, *supra* note 44, at 49.

[80] *How Does Climate Change Affect Coral Reefs?*, *supra* note 43.

[81] *Threats to Coral Reefs*, SCRIPPS INSTITUTION OF OCEANOGRAPHY, https://sioweb.ucsd.edu/projects/coralreefsystems/about-coral-reefs/corals-in-crisis/ (last visited Dec. 1, 2019).

coastal development, and other construction, has negative effects on the coral reef ecosystem as well.[82]

D. WHY DOES IT MATTER?

As previously discussed, coral reefs are important because they provide economic benefits as well as ecosystem services that benefit and support the global population. Ocean health depends on coral reef health because reefs create shelter and create essential nutrients for larger communities of fish and other sea life.[83] Approximately 25% of all ocean species depend on coral reefs.[84] Coral reefs are estimated to provide the U.S. $30 billion in, not only economic value, but also social and cultural value.[85] Several million people in the U.S. live near a coral reef and benefit from it—whether that be from coastal protection or by the reef serving as source of food.[86] Current projections "indicate that climate-related loss of reef ecosystem services will cost the U.S. $500 billion per year or more by 2100."[87]

> According to a United Nations report, the world's coral reefs are at the epicenter of climate change impacts and species loss.[88] If the world warms another 0.9 degrees Fahrenheit, coral reefs are projected to diminish by 70%-90%.[89]

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82 *Id.*

83 *Coral Reefs, supra* note 5.

84 *Corals and Coral Reefs*, SMITHSONIAN (Apr. 2018), https://ocean.si.edu/ocean-life/invertebrates/corals-and-coral-reefs (last visited Nov. 23, 2020).

85 *Id.*

86 *Importance of Coral Reefs*, NAT'L OCEAN SERV., NOAA, U.S. DEP'T OF COM., https://oceanservice.noaa.gov/education/tutorial_corals/coral07_importance.html (last visited Nov. 23, 2020).

87 Heron et al., *supra* note 59.

88 Univ. of S. Cal., *Hope for Coral Recovery May Depend on Good Parenting*, SCI. DAILY (Sept. 16, 2019), https://www.sciencedaily.com/releases/2019/09/190916081500.htm.

89 *Id.*

There are predictions that 90% of the world's coral reefs will disappear by 2050 due to climate change induced by human activity.[90] "A gain of 1.8 degrees Fahrenheit, the report says, means 99% of the world's coral will be in jeopardy."[91] Current plans for decreasing global carbon dioxide emissions are not taking effect at a rate fast enough to save reefs.[92]

II. ANALYSIS OF CURRENT LAWS AND POLICIES PROTECTING CORAL REEFS

A. INTERNATIONAL LAW

Coral reefs are found in most oceans around the world, and the protection of the coral organisms that inhabit these reefs is vital to protecting the health of our oceans. Due to the global importance of coral reefs, the international community has committed on numerous occasions to coordinate policy responses to the ongoing changes affecting coral reef ecosystems. The current makeup of international instruments pertaining to coral reefs has developed incrementally since the 1960s, with commitments tied to almost every anthropogenic driver of change in coral reef ecosystems.[93] In 2016, the United Nations Environment Programme (UNEP) joined together with the International Coral Reef Initiative (ICRI) to conduct an analysis of policies and governance mechanisms related to the protection of coral reefs.[94] This idea, Resolution 2/12 Sustainable Coral Reef Management, was passed by the United

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[90] *Protecting Corals,* LOST CITIES: EXPLORE THE VIBRANT WORLD OF CORALS, http://lostcities.org/#/story/protecting-corals (last visited Nov. 23, 2020).

[91] Univ. of S. Cal., *supra* note 88.

[92] *See id.*

[93] R. Karasik et al., *Analysis of Policies Related to the Protection of Coral Reefs-Analysis of Global and Regional Policy Instruments and Governance Mechanisms Related to the Protection and Sustainable Management of Coral Reefs*, UN ENV'T PROGRAMME, ICRI, DUKE NICHOLAS INST. FOR ENV'T POL'Y SOLUTIONS (2019), https://www.icriforum.org/wp-content/uploads/2020/05/Coral_Policy%20(1).pdf.

[94] *Id.* at 7.

Nations Environment Assembly to "reiterate[] the need for international cooperation for the protection of coral reef ecosystems."[95] These organizations found that there are at least 232 international instruments considered to directly or indirectly support conservation of coral reefs, and attempt to address common stressors in these ecosystems.[96] This body of coral reef-related instruments includes 150 global instruments—twenty-nine are legally binding instruments, whereas the rest are non-binding and voluntary.[97] Within these instruments, there are thirty-three policy commitments made to address climate change impacts on coral reefs, specifically focusing on cutting greenhouse gas emissions.[98] Some of the international instruments most relevant to coral reef ecosystems that are frequently cited in scientific literature include: the United Nations Convention on the Law of the Sea (UNCLOS) 1982, the Convention on the International Trade in Endangered Species (CITES), the Ramsar Convention, the Convention on Biological Diversity (CBD) 1992, and the UNESCO World Heritage Convention 1972.[99] Other partnerships, without binding effect, such as the ICRI have been instrumental in pushing coral reef conservation policies forward as well.[100] We will now look at these instruments in more detail.

1. *United Nations Convention on the Law of the Sea (UNCLOS)*

Arguably, the most important milestone for international policy related to conservation of coral reef ecosystems was the adoption in 1982 of UNCLOS.[101] In 1994, this convention and following articles and annexes created a comprehensive, legal framework for all activities in the oceans and established the rights and obligations of

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95 *Id.*
96 *Id.* at ix.
97 *Id.*
98 *Id.* at 19.
99 *Id.* at 14.
100 *Id.*
101 UN Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 297 [hereinafter UNCLOS].

states within the different maritime zones.[102] UNCLOS shifted the legal assumption that the ocean was an inexhaustible commodity, and instead treated oceans as a vulnerable resource.[103] Due to the ecology of reefs, most reefs are found within coastal states' jurisdiction because reefs depend on photosynthesis and are located in areas where light is able to penetrate; and these states exercise sovereignty over their natural resources.[104] This entitles them to conserve or to exploit these ecosystems. UNCLOS established a new maritime zone beyond the territorial sea known as the exclusive economic zone (EEZ).[105] This zone can extend up to a limit of 200 nautical miles from beginning to the end of the territorial sea.[106] In the EEZ, coastal States have

> sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or nonliving, of the waters superjacent to the sea-bed and of the sea-bed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents and winds.[107]

UNCLOS cautions states against undertaking actions that jeopardize the marine environment of their neighbors, but absent proof of trans boundary damage, no state can challenge the policies or practices of its neighbors.[108] The state decides the degree to which it will enforce these limits.[109] Under the maritime zones established under UNCLOS, the world's warm-water coral reefs fall under national jurisdiction.[110] Approximately 85% of the world's warm-water coral reefs are estimated to be under the jurisdiction of twenty five countries: Australia, Bahamas, China, Cuba, Egypt, Eritrea,

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102 Sylvan, *supra* note 18, at 34.
103 *Id.*
104 *Id.*
105 *See* UNCLOS, *supra* note 101.
106 *See id.*
107 *Id.* at art. 56(a).
108 Sylvan, *supra* note 18, at 34.
109 *Id.*
110 R. Karasik et al., *supra* note 93, at 49.

Federated States of Micronesia, Fiji, France, India, Indonesia, Kiribati, Madagascar, Malaysia, Maldives, Marshall Islands, Mozambique, Papua New Guinea, Philippines, Saudi Arabia, Seychelles, Solomon Islands, Tanzania, United Kingdom, and the U.S.[111] These quasi-trustees have sovereign rights for their own conservation and sustainable management; for this reason, international coral reef instruments following UNCLOS mostly focus on action that should be taken by states.[112] About 16% of all enforcement commitments within the current international instruments that were included in the analysis are found in "UNCLOS, which requires States to adopt and enforce rules relating to the conservation and utilization of the living resources in the EEZ."[113]

2. *The CITES Convention*

"One of the most significant conventions concerning coral reefs is the Convention on International Trade in Endangered Species of Wild Fauna (CITES)."[114] The convention's objectives are to "protect wildlife against such overexploitation and to prevent international trade from threatening species with extinction."[115] CITES is "in fact the only international legal mechanism with a mandate to protect species from overexploitation due to international trade."[116] This treaty is legally binding on the parties, and places obligations on both exporting and importing parties.[117] The treaty requires that each signatory nation establish a CITES Management Authority who mainly issues permits.[118] It also

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[111] *Id.* at 17.

[112] *Id.* at 18.

[113] *Id.* at 26.

[114] Kristin Kushlan, *Coral Reefs: The Failure to Regulate at the International Level*, U.C. DAVIS ENVTL. L. & POL'Y J. VOL. 33:2 , 318, 329–40 (2009).

[115] *Id.* at 329.

[116] *Id.*

[117] *Id.* at 329, 336.

[118] *How CITES Works*, CONVENTION ON INT'L TRADE IN ENDANGERED SPECIES OF WILD FAUNA & FLORA, https://cites.org/eng/disc/how.php (last visited Nov. 24, 2020).

requires a CITES Scientific Authority to monitor biological sustainability of trade.[119] However, CITES is generally not self-executing and cannot be fully implemented until states at the domestic level have adopted legislation allowing them to implement and enforce all aspects of the Convention.[120] Of the countries addressed later on, Australia and the U.S. have both enacted proper legislation.[121] The first coral species listed by CITES were black corals in 1981.[122] Since then, CITES has listed over 2,000 species of hard coral and several non-reef-building corals.[123]

3. *The Ramsar Convention*

The Convention on Wetlands of International Importance (the Ramsar Convention) was signed in Ramsar, Iran, in 1971.[124] It is an intergovernmental treaty that provides a framework for national action and international cooperation for the conservation and wise use of wetlands.[125] Coral reef ecosystems fall within the definition of wetland under this treaty and reefs are generally protected (subject to some limitations).[126] The mission statement set out at the convention signing was "[t]he conservation and wise use of wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable

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[119] *See id.*

[120] *National Laws for Implementing the Convention*, CITES, https://cites.org/legislation (last visited Nov. 24, 2020).

[121] *See generally* Status of Legislative Progress for Implementing CITES, CONVENTION ON INT'L TRADE IN ENDANGERED SPECIES OF WILD FAUNA & FLORA (last updated Apr. 2019), https://cites.org/sites/default/files/projects/NLP/Legislative%20status%20table%20April%202019.pdf (last visited Nov. 24, 2020).

[122] *Coral*, U.S. FISH & WILDLIFE SERV. INT'L AFF., https://www.fws.gov/international/animals/coral.html (last visited Nov. 24, 2020).

[123] *See id.*

[124] *About the Convention on Wetlands*, RAMSAR CONVENTION ON WETLANDS, https://www.ramsar.org/about-the-convention-on-wetlands-0 (last visited Nov. 24, 2020).

[125] *Id.*

[126] *Id.*

development throughout the world."[127] There are 170 Contracting Parties to the Convention, with 2,413 wetland sites, designated for inclusion in the Ramsar List of Wetlands of International Importance.[128]

The Ramsar Convention encourages the designation of sites containing wetlands that are important for conserving biological diversity.[129] After these sites are designated, they ". . . are added to the Convention's List of Wetlands of International Importance and become known as Ramsar sites."[130] Parties then must agree to establish and oversee a management framework aimed at conserving the wetland and ensuring its "wise use."[131] "Wise use under the Convention is broadly defined as maintaining the ecological character of a wetland."[132]

In total, there are approximately 850 Ramsar Sites that host coral formations.[133] However, only one coral reef in the U.S. is currently protected by this treaty—the Palmyra Atoll National Wildlife Refuge.[134] Ten reefs in Australia are designated as a

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[127] *The Convention on Wetlands and its Mission*, RAMSAR CONVENTION ON WETLANDS, https://www.ramsar.org/about/the-convention-on-wetlands-and-its-mission (last visited Nov. 24, 2020).

[128] *The List of Wetlands of International Importance*, RAMSAR CONVENTION ON WETLANDS (Dec. 11, 2020), https://www.ramsar.org/sites/default/files/documents/library/sitelist.pdf (last visited Jan. 5, 2021).

[129] *The Ramsar Convention on Wetlands*, AUSTRALIAN GOV'T DEP'T OF ENV'T & ENERGY, https://www.environment.gov.au/water/wetlands/ramsar (last visited Nov. 24, 2020).

[130] *Id.*

[131] *Id.*

[132] *Id.*

[133] *Coral Reefs: Critical Wetlands in Severe Danger,* RAMSAR CONVENTION ON WETLANDS (June 1–9, 2015), https://www.ramsar.org/sites/default/files/documents/library/cop12_doc25_corals_fact_sheet_e.pdf.

[134] *Ramsar Sites Information Service*, RAMSAR, https://rsis.ramsar.org/ris-

Wetland of International Importance,[135] seven of which are designated as threatened by climate change.[136] In the last decade, the Regional Wetland Action Plans have recognized the lack of integration of wetland management into climate change policies, but nothing of substantial nature has transpired.[137]

At the 12th Meeting of the Conference of the Parties (COP) to the Convention on Wetlands in 2015, the parties discussed a more holistic approach to promoting more resilient coral reef systems and what that might encompass.[138] Ideas formed around zoning human activities surrounding reefs include management of activities on land, preservation of key habitat corridors, and integrating local coral reef users and stakeholders into management actions.[139] At the 13th Meeting of the COP in 2018, climate change priorities are listed including managing wetlands in a changing climate, in terms of dealing with the hydrological processes that maintain the values of many of the sites designated under the Ramsar Convention, and conducting an economic valuation of ecosystem services to inform climate change adaptation and provide targeted funding for the management of these Ramsar Sites affected by climate change.[140]

4. *Convention on Biological Diversity (CBD)*

The Convention on Biological Diversity is an international convention that addresses imminent problems facing coral reef

search/?f%5B0%5D=regionCountry_en_ss%3AAustralia&f%5B1%5D=wetlandTypes_en_ss%3AMarine%20or%20coastal%20wetlands&f%5B2%5D=wetlandTypes_en_ss%3AC%3A%20Coral%20reefs&pagetab=1 (last visited Nov. 24, 2020).

135 *Id.*

136 *Id*.

137 *See generally About the Convention on Wetlands*, *supra* note 124.

138 *Coral Reefs: Critical Wetlands in Severe Danger*, *supra* note 133.

139 *Id.*

140 *Australia's National Report to the 13th Conference of the Contracting Parties to the Ramsar Convention,* (Oct. 21–29, 2018), AUSTRL. GOV'T DEP'T OF AGRIC., WATER & THE ENV'T, https://www.environment.gov.au/water/wetlands/publications/australias-national-report-13th-conference-contracting-parties-ramsar-convention.

ecosystems.[141] The Convention recognizes that, over the past decade, coral bleaching has increased substantially and continues to threaten marine biodiversity.[142] "In 1998, . . . the [Convention] drew attention to an extensive, severe coral bleaching episode occurring that year as a result of abnormally high water temperatures."[143] After identifying this occurrence as a possible consequence of climate change, the Convention requested the Subsidiary Body on Scientific, Technical and Technological Advice to analyze this phenomenon and provide pertinent information to the next meeting of the parties.[144] At the next meeting, the Conference decided to integrate coral reefs into a pre-existing program to develop and implement a specific work plan focusing on coral bleaching, in cooperation with the United Nations Framework Convention on Climate Change and other relevant bodies including CITES, RAMSAR, ICRI, and UNESCO.[145] The Conference again recognized that there is evidence that climate change is a primary cause of coral bleaching and is sufficient enough to warrant taking remedial measures.[146] After recognizing climate change was a pressing issue, specific work plans on coral bleaching and physical degradation and destruction of coral reefs were adopted.[147]

"In 2015, the 193 member states of the United Nations confirmed their commitment to conserve at least 10 percent of coastal and marine areas by 2020, incorporating a target established

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[141] *See generally The Convention on Biological Diversity*, CONVENTION ON BIOLOGICAL DIVERSITY (Oct. 12, 2020), https://www.cbd.int/convention/ (last visited Dec. 30, 2020).

[142] *Coral*, CONVENTION ON BIOLOGICAL DIVERSITY (Dec. 14, 2007), https://www.cbd.int/marine/coral.shtml (last visited Dec. 30, 2020).

[143] *Id.*

[144] *COP 4 Decision IV/5 Conservation and Sustainable Use of Marine and Coastal Biological Diversity, Including a Programme of Work,* CONVENTION ON BIOLOGICAL DIVERSITY, https://www.cbd.int/decision/cop/?id=7128 (last visited Dec. 1, 2019).

[145] *COP 5 Decision V/3 Progress Report on the Implementation of the Programme of Work on Marine and Coastal Biological Diversity (Implementation of IV/5)*, CONVENTION ON BIOLOGICAL DIVERSITY, https://www.cbd.int/decision/cop/?id=7145 (last visited Dec. 31, 2020).

[146] *See id.*

[147] *See id.*

under the Convention on Biological Diversity into the U.N.'s 2030 Agenda for Sustainable Development."[148] These areas are known as marine protected areas (MPAs), which are defined as any protected area of "clearly defined geographical space, recognized, dedicated, and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values."[149] MPAs have been shown to maintain biodiversity, furnish "ecological benefits" to adjoining ecosystems, and stabilize ecosystems.[150] MPAs also "serve as important climate reference points for scientists."[151] Although establishing an MPA or a reserve will not eliminate ocean acidification or global warming, it may be able to assist in ecosystem resilience to these overarching stressors.[152]

The current work plan being implemented acknowledges the urgent need to manage coral reefs for resistance and resilience to instances of high sea temperatures and coral bleaching, and recovery from these events through "(1) management actions and strategies to support reef resilience, rehabilitation[,] and recovery; . . . (2) information gathering; . . . (3) capacity-building; . . . (4) policy development/implementation; . . . [and] (5) financing."[153]

5. *United Nations Educational, Scientific and Cultural Organization (UNESCO)*

UNESCO is a specialized agency of the United Nations whose purpose is to contribute to advancing international collaboration to expand universal respect for human rights, justice, and the rule of

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[148] *Marine Protected Areas Beyond National Jurisdiction*, THE PEW CHARITABLE TRUSTS 1, 2 (Mar. 2016), https://www.pewtrusts.org/-/media/assets/2016/03/high-seas-mpa-policy-brief.pdf.

[149] *Id.* at 1.

[150] *Id.* at 2.

[151] *Id.*

[152] *Id.*

[153] *COP 7 Decision VII/5 Marine and Coastal Biological Diversity,* CONVENTION ON BIOLOGICAL DIVERSITY, https://www.cbd.int/decision/cop/?id=7742 (last visited Nov. 24, 2020).

law.[154] UNECSCO has 193 Member States and eleven associate members.[155] Each country that is a Member State is entitled to one vote. The Conference meets every two years and is attended by Member States along with "observers for non-Member States, intergovernmental organizations[,] and non-governmental organizations."[156]

UNESCO pursues its goals through five major areas: education, culture, natural sciences, social and human sciences, and communication and information.[157] Because the reach of this organization is so extensive, we will look at the work UNESCO has done with the natural sciences (oceans, coral reefs) and focus specifically on its work securing the world's cultural and natural heritage through World Heritage Sites.[158]

UNESCO has had a track record of protecting coral reef ecosystems. The UNESCO World Heritage Convention of 1972 recognized "the ways in which people interact with nature, and the fundamental need to preserve the balance between the two."[159] World Heritage Sites are a magnet for international cooperation and may have the potential of receiving funding for heritage conservation projects.[160] Sites on the World Heritage List benefit from an implementation of a sweeping management plan that establishes adequate preservation measures, monitoring mechanisms, and an increase in public awareness of these areas.[161]

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[154] *See generally UNESCO in Brief- Mission and Mandate,* UNESCO, https://en.unesco.org/about-us/introducing-unesco (last visited Nov. 24, 2020).

[155] *Member States List*, UNESCO, https://en.unesco.org/countries (last visited Nov. 24, 2020).

[156] *Governance*, UNESCO, https://en.unesco.org/about-us/governance (last visited Jan. 5, 2021).

[157] *See What We Do,* UNESCO, https://en.unesco.org/themes/science-sustainable-future (last visited Nov. 24, 2020).

[158] *See generally id.*

[159] *The World Heritage Convention*, UNESCO, https://whc.unesco.org/en/convention/ (last visited Nov. 24, 2020).

[160] *Id.*

[161] *Id.*

Recently in 2017, UNESCO's World Heritage Centre published the first ever worldwide scientific assessment analyzing the effects climate change has had on UNESCO World Heritage coral reefs.[162] Of the twenty-nine World Heritage-listed coral reef sites, "[fifteen] were exposed to repeated severe heat stress during the 2014–2017 global bleaching event."[163] Recurrent bleaching was apparent on over half of the sites.[164] The assessment uncovered that twenty-five of the twenty-nine World Heritage reefs are "projected to severely bleach twice-per-decade by 2040 under a business-as-usual [carbon dioxide] emissions scenario."[165] The assessment concluded that limiting global average temperature increase to 1.5 degrees Celsius above pre-industrial levels, a goal set out in the Paris Agreement, is an imperative action to secure coral reef protection.[166] Conserving World Heritage-listed coral reef properties requires on-site management of these ecosystems and national and regional enabling legislation to restore resilience and minimize local human stressors, like emissions, while climate stabilization occurs.[167]

In 2018, following this global assessment, UNESCO members created an initiative to address ways to "strengthen coral reef adaptation to climate change."[168] The initiative seeks to implement an effective strategy for climate change resilience in five coral reefs on UNESCO's World Heritage List: "the Rock Islands Southern Lagoon (Palau), the Lagoons of New Caledonia (France), the Belize Barrier Reef Reserve System (Belize), the Ningaloo Coast, and the

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[162] Scott F. Heron et al., *Impacts of Climate Change on World Heritage Coral Reefs: Update to the First Global Scientific Assessment,* UNESCO WORLD HERITAGE CENTRE 1, 1 (2018), https://unesdoc.unesco.org/ark:/48223/pf0000265625/PDF/265625eng.pdf.multi.

[163] *Id.*

[164] *Id.*

[165] *Id.*

[166] *Id.* at 3.

[167] *Id.* at 4.

[168] *UNESCO Calls for Concerted Action to Strengthen the Resilience of Coral Reefs*, UNESCO (July 8, 2019), https://en.unesco.org/news/unesco-calls-concerted-action-strengthen-resilience-coral-reefs (last visited Nov. 24, 2020).

Great Barrier Reef (Australia)."[169] The four-year initiative is supplied with a $9 million budget.[170] In July 2019, UNESCO members met to take stock of the initiative again because it is necessary to take swift action to reverse the impact of rising sea temperatures.[171] The UNESCO Director-General suggested that UNESCO was "the most appropriate platform to accelerate this effort" and suggested this effort must be done on a global scale to be effective.[172] "The evaluation recognizes the importance of the United Nations Decade of Ocean Sciences for Sustainable Development, which will begin in 2021 and be coordinated by UNESCO through the Intergovernmental Oceanographic Commission (IOC)."[173] The IOC has also announced plans to use Remote Sensing technologies to gather data for the mapping and greater understanding of coral reef communities.[174]

6. *International Coral Reef Initiative*

The International Coral Reef Initiative (ICRI) was founded in 1994 by eight governments including Australia and the U.S.[175] It was initially announced at the First Conference to the Parties on the Convention of Biological Diversity.[176] The mission of this informal network is to "identify and promote needed action without directly engaging in policymaking" and to be "an open forum for like-minded political actors to discuss coral reef issues, share information, promote research, identify priorities, and facilitate policy action."[177] ICRI views themselves as an advocacy group because they do not "develop, fund, or implement coral reef

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169 *Id.*
170 *Id.*
171 *Id.*
172 *Id.*
173 *Id.*
174 *OTGA/INIOAS: Remote Sensing of Coral Reefs,* IOC-UNESCO (Oct. 20–23, 2019), http://ioc-unesco.org/index.php?option=com_oe&task=viewEventRecord&eventID=2474 (last visited Nov. 24, 2020).
175 *About Us*, INT'L CORAL REEF INITIATIVE, https://www.icriforum.org/about/ (last visited Nov. 24, 2020).
176 *Id.*
177 Kushlan*, supra* note 114, at 327.

policy."[178] ICRI identifies areas of policy needed at both the local and national levels.[179] Members believe an informal structure allows ICRI to become "more effective in influencing national governments and relevant international institutions when it is viewed as a flexible mechanism instead of a competing agency."[180]

Today, ICRI consists of "governments, international development banks, non-governmental organizations, scientists, and corporate actors from the private sector who meet annually for nonbinding discussions."[181] ICRI's discussions and gatherings have involved representatives from up to eighty governments and some of the aforementioned international organizations, such as UNEP and IOC-UNESCO.[182] ICRI meets every four years and consists of a diverse group of professionals including natural scientists; resource managers and users; economists; conservationists; and educators who yearn to promote coral reef science, management, and conservation.[183] ICRI's research and strategies have been taken into consideration by policymakers and binding conventions.[184] Unlike governmental bodies and conventions whose focus is not streamlined, this body is solely focused on coral reef preservation and has become a steward in this area.[185] For example, "the work of ICRI is regularly acknowledged in [UN] documents, highlighting" ICRI's "important cooperation, collaboration and advocacy role within the international arena."[186] This includes United Nations General Assembly resolutions, UNEP Governing Council decisions, and documents from Multilateral Environmental Agreements such as the CBD or the Ramsar Convention.[187] Today, the ICRI focuses

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178 *Id.* at 327.
179 *Id.* at 327–28.
180 *Id.* at 328.
181 *Id.* at 327.
182 *Id.*
183 *Id.*
184 *Id.*
185 *See generally* INT'L CORAL REEF INITIATIVE, *supra* note 175.
186 *Id.*
187 *ICRI, Coral Reefs and the UN*, INT'L CORAL REEF INITIATIVE, https://www.icriforum.org/icri-coral-reefs-and-the-un/ (last visited Jan. 5, 2021).

on generating scientific data about coral reefs.[188] The ICRI established Global Coral Reef Monitoring Network (GCRMN) to provide the information needed for further discussions related to protection of the world's coral reefs.[189] Additionally, ICRI created the International Coral Reef Action Network (ICRAN) "whose mandate is to assist in capacity building for reef management in developing countries."[190]

7. *Analysis and Concerns to Addressing Climate Change Impacts through International Means*

There are many difficulties that hinder the success of policy action or the adoption of a new convention to protect coral reef ecosystems from the threat of climate change. As we have seen, many countries and organizations have expressed their concerns over the state of the world's coral reefs in various international forums and conferences. However, these "discussions in such institutional settings have not led to collective[,] remedial policy action."[191] Current efforts such as CITES, CBD, and other treaties address some of the threats coral reefs are facing like the exportation of coral or the reduction of greenhouse gases, however, "there is no single convention or international organization that attempts to protect all of the world's coral reefs at an international level" from every human stressor.[192] This may be in part because people do not view coral reef conservation as a global issue but rather a domestic or even localized one even though everyone on this planet has a stake in the health of all of the world's coral reefs.[193]

Some environmentalists "believe that an international coral reef treaty [may] be ineffective or unable" to address the myriad of issues threatening the world's coral reefs because of the variety and locality

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188 *See generally Our Networks*, INT'L CORAL REEF INITIATIVE, https://www.icriforum.org/groups/our-networks (last visited Nov. 24, 2020).

189 *Id.*

190 Kushlan, *supra* note 114, at 329.

191 *Id.*

192 *Id.* at 330.

193 *See generally* R. Karasik et al., *supra* note 93.

of issues.[194] Many of the threats to coral reefs, while common to all reefs, vary greatly by location, both ecologically and socially.[195] Due to the particularity of local issues facing coral reefs, numerous conservation groups believe that coral reef conservation efforts must be a "bottom-up process driven by local communities."[196] Even if that were the process, the need for local regulation does not necessarily lead to the creation of an international program or policy.[197] On the bright side, ICRI's approach does "focus on local actions and often there is no mention at these conferences of global or regional policy measures" while global conventions force commitments on states and localities for enforcement of their creation of regulation.[198] As previously noted, the breadth of international coral reef-related instruments is vast, but the commitments placed on the Member-States privy to said instrument are often vague, general, and voluntary.[199] For example, some commitments are focused on marine ecosystems at-large or on the economic sectors of human activity that may drive changes in coral reef ecosystems, rather than focusing on protecting coral reef ecosystems themselves from climate change. States have the primary responsibility for achieving 75% of the commitments laid out in the body of international reef-related instruments.[200] In addition, the coordination among "the 232 international reef-related policy instruments and the 591 commitments they contain presents" a challenge for those governments trying to implement locally-appropriate processes and responses for achieving set goals.[201] Another issue relating to regionalized commitments is that while these states work to translate these commitments into localized initiatives, the intensity of the drivers of change and the estimated

194 Kushlan, *supra* note 114, at 330.
195 *Id.*
196 *Id.*
197 *Id.*
198 *Id.* at 331.
199 R. Karasik et al., *supra* note 93, at ix.
200 *Id.*
201 *Id.* at xi.

rates of change in coral reef ecosystems have only increased.[202] It is a constant moving target.

Within the aforementioned analysis conducted by UNEP and ICRI assessing gaps in the design of international instruments set out to address policies related to the protection of coral reefs, many pointed to lacking governance mechanisms.[203] "Of the 591 reef-related commitments, only 13[%] were linked to references of enforcement mechanisms. Of these, one sixth were commitments [found] in the [UNCLOS] treaty."[204] These commitments "require states to adopt and enforce the measures needed to deliver the commitments in the instrument, and in some cases the global, legal instruments require states to report to the conferences of the parties to monitor progress."[205] Even with these measures in place, there are few and far between enforcement mechanisms that result in penalties referenced in the body of international reef-related instruments for failing to adopt appropriate measures or for failure to report back.[206] Therefore, there is not an incentive to comply with commitments, other than a moral incentive, especially if coming up with a process to meet the goal of the commitment results in economic harm.[207]

Financial mechanisms in order to help fund the costs of compliance and meeting of the commitments are often lacking in these instruments as well.[208] This presents a unique "challenge for the many low-income and lower-middle-income states with responsibility for delivering reef-related commitments."[209] "Of the 591 reef-related commitments, [approximately] 25[%] make reference to financing provisions or mechanisms."[210] Of these, only a handful "actually describe the establishment or enhancement of

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202 *Id.* at vii.
203 *Id.* at x.
204 *Id.*
205 *Id.*
206 *Id.*
207 *Id.*
208 *Id.*
209 *Id.*
210 *Id.*

financial mechanisms."[211] Most commitments with financial provisions could be considered general calls to developed states and development finance institutions asking to provide additional financing to support developing states who are trying to fulfill commitments.[212] The other 75% of commitments expect states to come up with the funding themselves.

Although international efforts have been instrumental in raising awareness of the issues facing coral reefs and importance of protecting these delicate ecosystems, the 591 international instruments relating to coral reefs do not seem to be doing enough. Instead, rather than establishing a treaty or convention that addresses the multitude of stressors affecting reefs, the current international instruments are tackling global issues in a piecemeal manner. This does not seem to be effective. As previously identified, these international instruments all place a heavy burden on states to fulfill commitments because of the various issues pertaining to different coral reefs all over the world. Current and efficiently enforced legislation and implementation have to be done at the domestic level, whether that be at the state or local level even if an international treaty of this sort was to be established.

B. DOMESTIC LAWS

The U.S. and Australia have two different, domestic approaches to conserving and managing coral reefs. This paper will specifically look at how the U.S. protects the Florida Reef and how Australia conserves the Great Barrier Reef. The Florida coral reef system is the third largest in the world and contains "nearly 1,400 species of plants and animals and over 500 species of fish."[213] The Great Barrier Reef is the world's longest and largest coral reef complex

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211 *Id.*

212 *Id.* at x–xi.

213 John Vidal, *How Did Half of the Great Florida Coral Reef System Disappear?*, THE GUARDIAN (Dec. 27, 2017, 5:30 PM), https://www.theguardian.com/environment/2017/dec/27/how-did-half-of-the-great-florida-coral-reef-system-disappear-climate-bleaching (last visited Dec. 30, 2020).

containing over 2,900 individual reefs.[214] It includes around 300 species of hard coral, and around 10% of the world's total fish species.[215] In addition to the domestic legislation and action discussed, both countries are also parties to the above-mentioned international treaties, conventions, and initiatives (UNCLOS, CITES, Ramsar, CBD, UNESCO, and ICRI).

C. UNITED STATES, FLORIDA REEF

Prior to the 1990's not much was done to specifically target coral reef protection. This is not to say that major environmental legislation, such as the National Environmental Protection Act (NEPA), the Clean Water Act (CWA), Magnuson-Stevens Fishery Conservation and Management Act (MSA), and the Coastal Zone Management Act (CZMA), did not do anything to protect coral reefs. They do encompass provisions that take coral reefs into consideration, but these acts did not target coral reefs as area of significant concern. However, the "world's first recorded widespread coral bleaching" event took place in the late 90s, which raised the necessary awareness to spark action to conserve coral reef ecosystems.[216]

1. *Executive Order*

In 1998, President Bill Clinton signed Executive Order 13089, entitled "Coral Reef Protection,"[217] which called "for all federal agencies whose activities may affect coral reef ecosystems to: identify such actions; use their programs and authorities to protect and enhance coral reef ecosystems; and ensure that any actions they authorize, fund, or carry out will not degrade the condition of coral

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[214] *Great Barrier Reef Facts*, GREAT BARRIER REEF, http://www.greatbarrierreef.org/about-the-reef/great-barrier-reef-facts/ (last visited Dec. 11, 2020).

[215] *Id.*

[216] Vidal, *supra* note 213.

[217] Exec. Order No. 13089, 63 F.R. 32701 (1998), https://www.govinfo.gov/content/pkg/FR-1998-06-16/pdf/98-16161.pdf.

reef ecosystems."[218] The Executive Order also established a Coral Reef Task Force (CRTF) to develop and implement "coordinated efforts to map and monitor U.S. coral reefs; research the causes of, and solutions to coral reef decline; . . . mitigate coral reef degradation . . . and implement strategies to promote conservation and sustainable use of coral reefs internationally."[219] The CRTF is leading a Coral and Climate Adaptation Planning (CCAP) project in partnership with the Environmental Protection Agency (EPA), National Oceanic and Atmospheric Administration (NOAA), and the Department of the Interior (DOI).[220] The project "aims to develop guidance and tools for improving adaptation to changing environmental conditions in coral reef management."[221] "Climate change is not only affecting coral reefs directly [through coral bleaching], but it is also affecting inputs of other stressors such as land-based pollution."[222] The goal of the project is to develop knowledge and tools "that will help coral reef managers achieve successful adaptation planning and implementation."[223]

2. *Under the Environmental Protection Agency (EPA)*

a. Clean Water Act (CWA)

The "EPA protects coral reefs by implementing Clean Water Act programs that protect water quality in watersheds and coastal zones of coral reef areas" by monitoring current conditions of U.S. coral reefs, conducting research into the causes of coral reef deterioration, and developing ways for coral reefs to adapt to

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[218] *What EPA is Doing to Protect Coral Reefs*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/coral-reefs/what-epa-doing-protect-coral-reefs (last visited Dec. 11, 2020).

[219] *About*, U.S. CORAL REEF TASK FORCE, https://www.coralreef.gov/about/ (last visited Dec. 11, 2020).

[220] *EPA Research about Coral Reefs*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/coral-reefs/epa-research-about-coral-reefs#Biological-Criteria (last visited Dec. 11, 2020).

[221] *Id.*

[222] *Id.*

[223] *Id.*

warming ocean temperatures.[224] Many of these programs are operated in combination with other federal agencies and states.[225]

Through the CWA, the EPA attempts to "reduce land-based sources of pollution that degrade coastal waters and coral reefs that live in them. Improving coral reef health by addressing local stressors will enhance their natural resilience."[226] There are many sections under the CWA that help address human impacts to coral reefs, but we will focus on the most pertinent. Under Section 106 of the CWA, the "EPA provides assistance to states . . . and interstate agencies . . . to establish and implement ongoing water pollution control programs."[227] Section 319 allows states to receive grant money that supports activities in order to assess specific nonpoint source implementation projects.[228] Section 402 works with states to improve the environmental protections provided by National Pollutant Discharge Elimination System permits.[229] Section 403 lays out criteria to ensure that dredging and ocean disposal is conducted in a way that does not adversely impact reefs.[230] Section 404 works with the U.S. Army Corps of Engineers (USACE) to minimize impacts to coral reefs from discharges of dredged or fill material and to provide compensatory mitigation for unavoidable

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[224] *What EPA is Doing to Protect Coral Reefs, supra* note 218.

[225] *Id*.

[226] *Id.*

[227] *Water Pollution Control (Section 106) Grants*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/water-pollution-control-section-106-grants (last visited Dec. 11, 2020).

[228] *319 Grant Program for States and Territories*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/nps/319-grant-program-states-and-territories (last visited Dec. 11, 2020).

[229] *Clean Water Act, Section 402: National Pollutant Discharge Elimination System*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/cwa-404/clean-water-act-section-402-national-pollutant-discharge-elimination-system (last visited Dec. 11, 2020).

[230] *Clean Water Act Section 403: Ocean Discharge Criteria,* U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/cwa-404/clean-water-act-section-403-ocean-discharge-criteria (last visited Dec. 11, 2020).

impacts.[231] The EPA also helps states adopt water quality standards to increase protection of corals by supporting development of biological assessment methods and biological criteria for states.[232] Additionally, the EPA consults with NOAA to ensure that updated criteria are fully protective of Endangered Species Act (ESA) listed coral species and their critical habitats.[233]

3. *Under National Oceanic and Atmospheric Administration (NOAA)*

a. Magnuson-Stevens Fishery Conservation and Management Act (MSA)[234]

The MSA "is the primary law governing marine fisheries management in U.S. federal waters."[235] It became law in 1976 and "fosters long-term biological and economic sustainability" of U. S. fisheries.[236] The MSA extended U.S. jurisdiction out to 200 nautical miles and created eight regional fishery management councils.[237] The act's objectives are to reduce overfishing, rebuild overfished stocks, and to solidify a sustainable seafood supply.[238]

Although the main focus of this act is the protection of fisheries, this interconnects with protecting coral reefs because of these codependent relationships between species and reef ecosystems. The MSA actually authorizes the drafting of a Fishery Management

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[231] *Overview of Clean Water Act Section 404*, U.S. ENVTL. PROT. AGENCY, https://www.epa.gov/cwa-404/overview-clean-water-act-section-404 (last visited Dec. 11, 2020).

[232] *What EPA is Doing to Protect Coral Reefs*, *supra* note 218.

[233] *Id.*

[234] Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. § 1801 (1972), NOAA FISHERIES, https://www.fisheries.noaa.gov/resource/document/magnuson-stevens-fishery-conservation-and-management-act.

[235] *Id.*

[236] *Magnuson-Stevens Act*, NOAA FISHERIES, https://www.fisheries.noaa.gov/topic/laws-policies#magnuson-stevens-act (last visited Dec. 12, 2020).

[237] *Id.*

[238] *Id.*

Plan for Coral and Coral Reefs of the Gulf of Mexico and South Atlantic to preserve "all corals on the seabed in U.S. federal waters (of the Gulf) from harvest, sale, and destruction from fishing related activities."[239] Additionally, the MSA Reauthorization Act of 2006 included international provisions in order to assist international fisheries management organizations.[240] Collaboration with the international community could really improve management practices of fisheries, as well as reefs.

b. Coral Reef Conservation Act of 2000 (CRCA)[241]

The CRCA created NOAA's "Coral Reef Conservation Program (CRCP) and established a number of mandates for NOAA aimed at the preservation . . . and restoration of coral reef ecosystems."[242] The Act requires CRCP to establish a National Coral Reef Action Strategy (NAS) and to provide funding to state and local projects assisting in implementing the strategy.[243] The Act also contains criteria for awarding these grants and places timelines for review, often soliciting input from MSA "fishery management councils and affected National Marine Sanctuaries."[244] "The CRCA provides authority for NOAA to implement a national program to conserve coral reef ecosystems."[245] Through the program, NOAA "conducts activities, such as mapping, monitoring," research, enhancing public awareness, assisting states in removing marine debris from reefs, and "conducting cooperative management" of

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[239] Sylvan, *supra* note 18.

[240] Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, 16 U.S.C. §§ 1801 et seq. (2007), https://www.congress.gov/bill/109th-congress/house-bill/5946.

[241] Coral Reef Conservation Act of 2000, 16 U.S.C. §§ 6401 et seq. (2000), https://www.coris.noaa.gov/activities/actionstrategy/08_cons_act.pdf.

[242] *Coral Reef Conservation Act*, NOAA (Sept. 20, 2012), https://coast.noaa.gov/data/Documents/OceanLawSearch/CoralReefConservationAct.pdf.

[243] *Id.*

[244] *Id.*

[245] *Id.*

reefs.[246] The Act "authorizes NOAA to enter into cooperative agreements with" NGOs for specific purposes and, in the event of a coral reef emergency, "to provide emergency grant money to state and local governments."[247] In Florida, the Department of Environmental Protection helps in coordinating efforts to implement the CRCP.[248] The CRCP leads the Southeast Florida Coral Reef Initiative, which contributes to conserving coral reefs.[249]

On August 1, 2019, the Restoring Resilient Reefs Act of 2019 was introduced by Senator Marco Rubio (FL) to "reauthorize the Coral Reef Conservation Act of 2000 and to establish the United States Coral Reef Task Force."[250] The House of Representatives also introduced a matching bill that was introduced by Representative Darren Soto (FL) on August 1, 2019.[251] The Act's objective was to protect and restore the condition of the U.S. coral reef ecosystems combating the rise of ocean temperatures, ocean acidification, coral bleaching, and invasive species.[252] Florida Governor Ron DeSantis supported the bill stating, "Florida depends on coral reefs. Not only are they essential to the health of our marine ecosystem, they are vital to coastal resiliency, stand as the first line of defense against storm surge in Southeast Florida and play a key role in our tourism economy."[253] Even though it seems there has

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246 *Id.*

247 *Id.*

248 *Coral Reef Conservation Program*, FLA. DEP'T OF ENVTL. PROT., https://floridadep.gov/rcp/coral (last visited Dec. 12, 2020).

249 *Id.*

250 Restoring Resilient Reefs Act of 2019, S. 2429, 116th Cong. (2019), https://www.congress.gov/bill/116th-congress/senate-bill/2429?q=%7B%22search%22%3A%5B%22Restoring+Resilient+Reefs+Act+of+2019%22%5D%7D&s=1&r=2.

251 Restoring Resilient Reefs Act of 2019, H.R. 4160, 116th Cong. (2019), https://www.congress.gov/bill/116th-congress/house-bill/4160/text?q=%7B%22search%22%3A%5B%22H.R.+4160%3A+Restoring+Resilient+Reefs+Act+of+2019%22%5D%7D&r=1&s=1.

252 *Id.*

253 Alex Harris, *Florida's Coral Reefs are in Trouble. Here's a New $160 Million Plan to Save Them,* MIAMI HERALD (Aug. 2, 2019, 12:47 PM), https://www.miamiherald.com/news/local/environment/article233412922.html.

been overwhelming support of the reauthorization of CRCA in 2019, reauthorization "has been pending in Congress since 2004, although NOAA's authority under the statute" has continued.[254]

c. National Coral Reef Monitoring Program (NCRMP)

NOAA established this program to focus on coral reef monitoring efforts with partners across the U.S.[255] NCRMP establishes a framework for conducting observations of biological and climatic indicators in the U.S.[256] The goals of the program are to develop consistent standard operating procedures others can follow and implement to improve monitoring efforts, establish partnerships with federal and state partners, collect "scientifically sound, geographically comprehensive biological" and climate data in U.S. coral reef areas, and to "provide periodic assessments of the status" of U.S. coral reef ecosystems.[257]

Scientists look at certain indicators when analyzing climate trends. These include changes in water temperature, chemistry of the reef structures to analyze ocean acidification, and growth and erosion rates of coral.[258] This extensive analysis helps to provide a comprehensive view of climate change impacts on coral reef ecosystems and help identify areas of weakness. The data may also provide insight for resiliency efforts.[259] Above all, this data can be used to inform policy makers of the most current science and can aid them in drafting more effective climate change legislation.

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254 *Coral Reef Conservation Act, supra* note 242.

255 *NOAA's National Coral Reef Monitoring Program*, NOAA CORAL REEF INFO. SYS., https://www.coris.noaa.gov/monitoring/ (last visited Dec. 12, 2020).

256 *Id.*

257 *Id.*

258 *National Coral Reef Monitoring Program: Monitoring Climate-Driven Impacts*, NOAA CORAL REEF INFO. SYS., https://www.coris.noaa.gov/monitoring/climate.html (last visited Dec. 12, 2020).

259 *Id.*

d. Coral Reef Early Warning System (CREWS)

Through CREWS, NOAA "is working to establish an integrated regional network of climate and biological monitoring stations to strengthen the [Caribbean] region's early warning mechanism."[260] Because climate change is intensifying, increasing ocean acidification and coral bleaching of coral reefs, it is imperative to monitor the parameters that impact these ecosystems in order to improve climate risk planning and management.[261] These stations collect data that allow for the "development of climate models and ecological forecasting in coral reef ecosystems."[262] Currently, these are only being stationed in the Caribbean, but with the continued successful collection of data from these monitoring systems and the spread of technology, these have the potential to be deployed worldwide.

e. Marine Protected Areas (MPA)

The National MPA Center was established following the Executive Order referenced earlier in Executive Order 13158. The order directs the Department of Commerce through NOAA, the Department of the Interior through the U.S. Fish and Wildlife Service, and other federal agencies to work closely with states, fishery management councils, and groups with an interest in marine resource conservation to develop a comprehensive National System of MPAs.[263] Executive Order 13158 defined an MPA as "any area of the marine environment that has been reserved by federal, state, tribal, territorial, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources

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[260] *Coral Reef Early Warning System (CREWS),* CARIBBEAN CMTY. CLIMATE CHANGE CTR., https://www.caribbeanclimate.bz/caribbean-climate-chage-tools/coral-reef-early-warning-system-crews/ (last visited Dec. 12, 2020).

[261] *See id.*

[262] *Id.*

[263] Exec. Order No. 13158, 65 F.R. 34910 (2000), https://nmsmarineprotectedareas.blob.core.windows.net/marineprotectedareas-prod/media/archive/pdf/eo/execordermpa.pdf.

therein."[264] MPAs "provide important recognition to a limited number of ocean habitats that are under assault."[265] They "coordinate the work of federal agencies with overlapping jurisdiction in the sanctuary areas, providing more integrated protection."[266]

MPAs are designated by levels of protection, such as National Marine Sanctuaries, which U.S. coral reef ecosystems currently fall under.[267] A national marine sanctuary is "a specific designation created in federal legislation . . . to ensure conservation and management for areas of special national significance."[268]

The MPA Center is located within NOAA's National Ocean Service and is a division of the Office of National Marine Sanctuaries.[269] The MPA Center is currently working on building resilience to climate change impacts.[270] Their efforts have attempted to foster coordination among the MPA programs at the federal and state level to address stewardship when dealing with climate change issues impacting reefs.[271] The Center points out the major impacts

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[264] *Id.*

[265] Mary Gray Davidson, *Protecting Coral Reefs: The Principal National and International Legal Instruments*, 26 HARV. ENVTL. L. REV. 499, 510–23 (2002), Westlaw.

[266] *Id.*

[267] *Marine Protected Areas Building Resilience To Climate Change Impacts*, NAT'L MARINE PROTECTED AREAS CTR., https://nmsmarineprotectedareas.blob.core.windows.net/marineprotectedareas-prod/media/archive/pdf/helpful-resources/mpas_climate_change_march_2013.pdf (last visited Dec. 12, 2020).

[268] HAROLD F. UPTON & EUGENE H. BUCK, CONG. RES. SERV., RL32154, MARINE PROTECTED AREAS: AN OVERVIEW (2010), https://fas.org/sgp/crs/misc/RL32154.pdf.

[269] *National MPA Center*, NAT'L MARINE PROTECTED AREAS CTR., https://marineprotectedareas.noaa.gov/aboutmpas/mpacenter/ (last visited Dec. 12, 2020).

[270] *Marine Protected Areas in a Changing Climate,* NAT'L MARINE PROTECTED AREAS CTR., https://marineprotectedareas.noaa.gov/sciencestewardship/climatechangeimpacts/ (last visited Dec. 12, 2020).

[271] *Id.*

climate change will have on MPAs, including increased water temperature leading to ocean acidification and changing habitats.[272] Climate change requires a more concerted effort to restore, preserve, and protect the ecological integrity and resilience of ocean and coastal ecosystems, so they can withstand the additional stress of climate change.[273] MPAs help address climate change through the permanent legal and management infrastructure in place to protect their resources.[274] MPAs also serve as carbon sinks—over half of the global biological carbon is stored in living marine organisms—that help mitigate climate change impacts.[275] As sea temperatures rise, these MPAs can create a safe haven for shifting species and habitats because other stressors like pollution are less prevalent in these areas.[276] MPAs also serve as control areas for monitoring and collecting data to learn about emerging threats to coral reefs that, when shared, can be beneficial for other reef systems.[277] Although the designation of MPAs, particularly marine sanctuaries, is a positive step in recognizing the negative human impact on the oceans, it alone is insufficient to ensure the preservation of the marine environment.[278]

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[272] *Id.*

[273] *See Guide for Considering Climate Change in Coastal Conservation*, NOAA, U.S. DEP'T OF COM., https://coast.noaa.gov/data/digitalcoast/pdf/considering-climate-change.pdf.

[274] *See* Sylvan, *supra* note 18.

[275] *See Ocean Plankton Reducing Greenhouse Gases By Using More Carbon Dioxide*, SCI. DAILY (Nov. 18, 2007), https://www.sciencedaily.com/releases/2007/11/071117121016.htm.

[276] Davidson, *supra* note 265.

[277] *Id.*

[278] *Id.*

f. Florida Keys National Marine Sanctuary

Florida is the only state in the U.S. to have extensive shallow coral reef formations near its coasts.[279] Millions of people visit the Florida Keys every year to explore the coral reefs and are estimated to have an asset value of $7.6 billion.[280] The Florida Keys National Marine Sanctuary was created under federal law to ensure the continued protection of this reef system.[281] In fact, the Sanctuary protects 2,900 square nautical miles of waters off the Florida coast.[282] Approximately 60% of the protected area falls within state waters, but the State of Florida consented to allowing the sanctuary to be effective in the area of overlap.[283] This creates a unique partnership between NOAA and the State of Florida under a co-trustee agreement.[284] NOAA mainly partners with the Florida Department of Environmental Protection (DEP).[285] The Florida Fish and Wildlife Conservation Commission also assists with enforcement of sanctuary regulations in partnership with NOAA's

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[279] *Petition To List 83 Coral Species Under The Endangered Species Act Before The Secretary of Commerce,* CTR. FOR BIOLOGICAL DIVERSITY (Oct. 20, 2009), https://www.biologicaldiversity.org/campaigns/coral_conservation/pdfs/Coral_petition_10-20-09.pdf.

[280] *A National Coral Reef Action Strategy Report to Congress on Implementation of the Coral Reef Conservation Act of 2000 and the National Action Plan to Conserve Coral Reefs in 2002-2003*, U.S. DEP'T OF COM., NOAA, https://ocean.floridamarine.org/efh_coral/pdfs/action_reef_final.pdf.

[281] *Florida Keys National Marine Sanctuary Administration and Legislation*, NAT'L OCEAN SERV. FLA. KEYS NAT'L MARINE SANCTUARY, https://floridakeys.noaa.gov/legislation.html?s=about (last visited Dec. 12, 2020).

[282] *History of Florida Keys National Marine Sanctuary*, NAT'L OCEAN SERV. FLA. KEYS NAT'L MARINE SANCTUARY, https://floridakeys.noaa.gov/history.html?s=about (last visited Dec. 12, 2020).

[283] *Florida Keys National Marine Sanctuary Administration and Legislation, supra* note 281.

[284] *Id.*

[285] *Id.*

Office of Law Enforcement.[286] Not only does the sanctuary work with other agencies to protect Florida's coral reef ecosystem but additionally with universities and non-governmental organizations.[287]

Some of these federal and state agency relationships are fostered by legislation that created the sanctuary in the first place.[288] These include the National Marine Sanctuaries Act of 1972 and the Florida Keys National Marine Sanctuary and Protection Act.[289] The National Marine Sanctuary Act authorizes the Department of Commerce "to designate and protect areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or esthetic qualities as national marine sanctuaries."[290] The Florida Keys National Marine Sanctuary and Protection Act designated the sanctuary "to be managed as a national marine sanctuary under the National Marine Sanctuary Act."[291]

In August 2019, NOAA and the U.S. Fish and Wildlife Service published a Draft Environmental Impact Statement (DEIS) for the Sanctuary, establishing a restoration blueprint.[292] NOAA prepared the DEIS in order to comply with the National Environmental Protection Act (NEPA), which, broadly speaking, requires federal agencies to create an impact statement for certain actions that significantly affect the quality of the human environment.[293] This blueprint proposes to expand the Sanctuary boundary, update sanctuary and marine zone regulations, modify and establish new

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286 *Id.*
287 *Id.*
288 *Id.*
289 *Id.*
290 *Id.*
291 *Id.*
292 *Draft Environmental. Impact Statement for Florida Keys National Marine Sanctuary: A Restoration Blueprint*, NOAA, FLA. KEYS NAT'L MARINE SANCTUARY (Aug. 2019), https://nmsfloridakeys.blob.core.windows.net/floridakeys-prod/media/blueprint/deis-fknms-restoration-blueprint.pdf.
293 *Id.*

marine zones, and revise the sanctuary's nonregulatory management plan.[294] The purpose of this proposal is to modernize the outdated regulations and marine zones that were established in the 1990s and to continue to meet the purposes and policies of the National Marine Sanctuaries Act.[295] If allowed, this blueprint would be a good first step in achieving the most up to date, scientifically-sound, and efficient management practices.

g. National Marine Fisheries Service (NMFS)

NOAA's NMFS, along with the U.S. Fish and Wildlife Service, is in charge of the protection and conservation of endangered and threatened marine species under the Endangered Species Act (ESA).[296] However, NOAA is solely responsible for listing endangered and threatened corals. Listing a coral as endangered means that it is illegal for any person under U.S. jurisdiction to *take* that species of coral.[297] "Taking" includes harassing, harming, wounding, collecting, importing, exporting, transporting or selling.[298] NOAA also has the duty of designating critical habitats, monitoring, developing recovery plans, providing grants to states for species conservation, entering into agreements with other nations to encourage conservation of species, and investigating ESA violations.[299]

The NMFS has listed seven species of coral in the southeast part of the U.S. (this case study focuses on Florida, the Southeast region) as threatened: the Boulder Star Coral, Elkhorn Coral, Lobed Star Coral, Mountainous Star Coral, Pillar Coral, Rough Cactus Coral,

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294 *Id.*

295 *Id.*

296 *Endangered Species Conservation*, NOAA FISHERIES, https://www.fisheries.noaa.gov/topic/endangered-species-conservation (last visited Dec. 12, 2020).

297 *Id.*

298 *Protective Regulations for Threatened Species Under the Endangered Species Act: Section 4(d)*, NOAA FISHERIES, https://www.fisheries.noaa.gov/national/endangered-species-conservation/protective-regulations-threatened-species-under-endangered.

299 *Endangered Species Conservation, supra* note 296.

and Staghorn Coral.[300] However, even though designating a species of coral as endangered or threatened may help alleviate some human made stressors like takings, if we continue with the status quo these corals will still be harmed by warming sea temperatures as a result of climate change.

h. Coastal Zone Management Act (CZMA)

The CZMA was passed by U.S. Congress in 1972, and is administered by NOAA.[301] Its overall goal is to protect, restore and/or enhance the resources of the nation's coastal zone.[302] The CZMA puts into action three national programs: the National Coastal Zone Management Program, the National Estuarine Research Reserve System, and the Coastal and Estuarine Land Conservation Program (CELCP).[303] The National Coastal Zone Management Program attempts to deal with issues through state and coastal management programs, the reserve areas act as laboratories to help us understand human impacts on coastal areas, and CELCP provides funds to state and local governments to purchase threatened coastal and estuarine lands or obtain conservation easements.[304]

Section 303 of the CZMA "declares that it is national policy to . . . encourage and assist the states to exercise effectively their responsibilities in the coastal zone through the development of management programs to achieve wise use of the land and water

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[300] *Species Directory: ESA Threatened & Endangered*, NOAA FISHERIES, https://www.fisheries.noaa.gov/species-directory/threatened-endangered?species_title=&field_species_categories_vocab_target_id=1000000069&field_species_status_value=All&field_region_vocab_target_id=1000001121 (last visited Dec. 12, 2020).

[301] Coastal Zone Management Act 16 U.S.C. § 1451 (1972). [18.2.1(a)].

[302] *Id.*

[303] *See generally id.*

[304] *Coastal Zone Management Act*, THE OFF. FOR COASTAL MGMT., NOAA, https://coast.noaa.gov/czm/act/ (last visited Dec. 12, 2020).

resources of the coastal zone" and should provide for the "protections of . . . coral reefs . . . within the coastal zone."[305]

CZMA sets up a national framework for states to manage coastal resources.[306] If a state chooses "to develop a coastal zone management program and the program is approved, the state or territory (1) becomes eligible for several federal grants and (2) can perform reviews of federal agency actions in coastal areas."[307] For instance, the State of Florida created the Florida Coastal Management Program (FCMP) to implement statewide coastal management programs.[308] It was approved by NOAA in 1981 with the Florida Department of Environmental Protection (DEP) serving as the lead agency.[309] The Program is based on a network of nine agencies implementing statutes that protect and enhance the state's natural, cultural, and economic coastal resources.[310] "The program's goal is to coordinate local, state, and federal agency activities using existing laws to ensure that Florida's coast is just as valuable to future generations . . . ."[311] The coastal zone in Florida encompasses the entire state but is divided into two tiers.[312] Only coastal cities and counties that include or are contiguous to state water bodies are eligible to receive coastal management funds.[313] Every five years, FCMP undergoes an assessment that allows its state agencies to brainstorm new projects to help continue to improve coastal management; these state agencies can then submit these ideas for

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[305] Coastal Zone Management Act, *supra* note 301.

[306] *Coastal Zone Management Act (CZMA): Overview and Issues for Congress*, CONG. RES. SERV. (2019), https://fas.org/sgp/crs/misc/R45460.pdf.

[307] *Id.*

[308] *Florida Coastal Management Program*, FLA. DEP'T OF ENVTL. PROT., https://floridadep.gov/rcp/fcmp (last visited Dec. 12, 2020).

[309] *Coastal Zone Management Programs*, NOAA OFFICE FOR COASTAL MGMT., https://coast.noaa.gov/czm/mystate/ (last visited Dec. 12, 2020).

[310] *Coastal Zone Management Programs, supra* note 309.

[311] *Id.*

[312] *Florida Coastal Management Program, supra* note 308.

[313] Coastal Zone Management Act, *supra* note 301.

funding through the CZMA.[314] Previous efforts of the FCMP helped Aquatic Preserves from across the state implement their management plan, and another project allowed local communities opportunities to enhance coastal resilience planning, making these areas more prepared for future climate change threats.[315]

Additionally, the Florida DEP is authorized under the Florida Coral Reef Protection Act (CRPA) of 2009 as the states lead trustee for coral reef resources and can delegate reef protection authority to other state or local government agencies.[316] The Department may fine those who damage coral reefs from $150 to $1000 per square meter.[317] Florida has also enacted state laws to protect coral reefs. House Bill 53/SB 232 became effective July 1, 2018 and established the Southeast Florida Coral Reef Conservation Area, which consists of the sovereignty submerged lands and states waters off certain counties in Florida.[318] The bill was created due to growing concern of environmental changes resulting from human activities impacting coral reefs.[319] The bill allows the state to bring in federal money to

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[314] *The Coastal Zone Enhancement Program*, NOAA OFFICE FOR COASTAL MGMT., https://coast.noaa.gov/czm/enhancement/.

[315] *Final Evaluation Findings: Florida Coastal Management Program September 2007 to July 2015,* NOAA OFFICE FOR COASTAL MGMT. (Apr. 2016), https://coast.noaa.gov/data/czm/media/Florida-CMP.pdf.

[316] *Florida's Coral Reef Protection Act*, FLA. DEP'T OF ENVTL. PROT. (2016), https://floridadep.gov/sites/default/files/coral-reef-protection-052016.pdf.

[317] *Id.*

[318] H.B. 53 Ch. 2018-30, 120th Leg. Reg. Sess. (Fla. 2018), http://laws.flrules.org/2018/30.

[319] *Fla. House of Rep. Final Bill Analysis H.B. 53*, FLA. HOUSE OF REP., (Mar. 22, 2018) https://www.myfloridahouse.gov/Sections/Documents/loaddoc.aspx?FileName=h0053z1.NRPL.DOCX&DocumentType=Analysis&BillNumber=0053&Session=2018.

monitor these reefs due to the coral disease epidemic that began in 2014 and coral bleaching events that have ravaged Florida's reefs.[320]

The U.S. finally has come to recognize the value of coral reefs and has created legislation and mechanisms in attempt to protect these ecosystems to some extent.

4. *Analysis and Concerns*

Even though it seems that progress has been made in this area, many countries around the world do not think the U.S. has done enough; instead, the U.S. has fallen behind when it comes to environmental policy.[321] A prime example is the U.S. withdrawing from the Paris Agreement.[322] Not just this decision, but the current Administration and numerous politicians in Washington have raised concerns about whether or not climate change exists. This doubt, in regard to the science behind global warming, hinders effective legislation passing through Congress and becoming a law that could better protect coral reef ecosystems.

The U.S. has created various, multi-faceted laws that touch upon conserving coral reef ecosystems over the years, but until mass coral bleaching events began to occur, coral reefs were not the focus of legislation. The drastic impact of the events on coral reefs sparked the need for protection. Therefore, one could argue Executive Order 13089 should have been executed years or even decades earlier, when scientists pointed to warming trends in oceans, rather than taking a reactive approach to such vulnerable and delicate ecosystems that millions of species depend on daily.

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[320] Dan Sweeney, *South Florida Coral Reef Conservation Bill Heads to Gov. Scott*, SUNSENTINEL (Feb. 7, 2018, 4:35 PM) https://www.sun-sentinel.com/news/florida/fl-reg-coral-reef-conservation-rick-scott-bills-20180206-story.html (last visited Dec. 16, 2020).

[321] *See Paris Agreement Only Chance for Coral Reef Survival*, IUCN (Sept. 22, 2017), https://www.iucn.org/news/secretariat/201709/paris-agreement-only-chance-coral-reef-survival-–-iucn (last visited Dec. 16, 2020).

[322] *See id.*

Fragmentation of coral reef conservation law and policy is an issue with domestic and international policy.[323] "Success of coral reef conservation depends on a unified authority with jurisdiction extending . . . over a wide range of . . . coastal issues" relating to reefs.[324] An effective approach to coral reef protection must look at the bigger picture and address the full gambit of risks facing that particular coral reef ecosystem, including climate change, pollution, taking of species, and overfishing, rather than splitting each issue out and delegating it to a specific agency. Similarly, Florida laws protecting coral reefs and species focus mainly on the prevention of human contact, such as taking coral, rather than tackling overarching threats of climate change; the continued decline of corals in Florida waters is indication of the inadequacy of these laws.[325]

Many different bodies have authority to protect the Florida Reef through a variety of means. Although cooperative federalism between the federal, state, and local levels seems like the quintessential way to enforce a policy, it is often a hindrance to conservation. Divided authority often encompasses conflicting conservation goals for coral reef ecosystems and may undermine any opportunity for their sustainable use.[326] The U.S. Congress, Florida State Legislature, federal agencies, and state agencies have similar goals but achieve these goals in different ways through task forces, implementation of acts, monitoring programs, MPAs, and passing legislation. An example in the MPA context relates to this fragmentation of jurisdiction and authority issue. Even when reefs are officially "protected," a mandate to regulate on behalf of a species, an area, a process, or a habitat may not guarantee protection in an area subject to fractured jurisdiction or authority.[327] As the number of MPAs in the U.S. continues to grow, coastal states will have to choose which rules will govern reef conservation through the states coastal management program, therefore, increasing inconsistency in conservation implementation.

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323 *See generally* Sylvan, *supra* note 18.
324 *Id.* at 34.
325 *See Florida's Coral Reef Protection Act*, *supra* note 316.
326 *See id.*
327 *See generally id.*

There is a lack of funding designated to conserving coral reefs. Other governments designate and invest much more capital into protecting their own reefs. Funding for many of the state implemented initiatives comes from grants received from the federal government, but it would be helpful if there was another source of funding from a private foundation focused on climate change impacts on coral reefs.

Another issue arises when local communities that depend on reefs for food have a strong incentive not to establish MPAs or marine reserves in areas that are most productive regardless of whether they are fragile ecosystems because they want to make a profit.[328] The U.S. at large often has conflicting interests between what is economically sound and what is environmentally sound. Additionally, the U.S. needs to obtain "greater control over human activities located away from coral reefs that contribute to reef degradation."[329] This includes human behavior contributing to global climate change.[330]

In order to safeguard coral reef systems in the U.S., it is paramount that the U.S. drafts legislation or establish an agreement that tackles the multitude of human-made problems affecting coral reefs to better prepare for the future impact of climate change. Additionally, it is important that we streamline and designate specific authority in a jurisdiction to avoid conflicting interests and confusion.

D. AUSTRALIA, GREAT BARRIER REEF (GBR)

Australia is conscientious about the importance of conserving biodiverse reefs and the threats facing them. The GBR is a critical, natural asset that provides $6.4 billion a year to Queensland and Australian economies.[331] The GBR also supports over 64,000 jobs

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328 *See generally* Sylvan, *supra* note 18.

329 Davidson, *supra* note 265.

330 *Id.*

331 *Reef Facts*, AUSTL. GOV'T GREAT BARRIER REEF MARINE PARK AUTH., http://www.gbrmpa.gov.au/the-reef/reef-facts (last visited Dec. 16, 2020).

in the area.[332] Each year, the Australian and Queensland governments jointly invest approximately $200 million in the GBR's health.[333] This investment was especially necessary after the 2016 coral bleaching events where the northern third of the GBR experienced an unprecedented loss of corals.[334] A study showed that "29% of the 3,863 reefs comprising the [GBR] lost [approximately] two-thirds . . . of their corals, transforming the ability of these reefs to sustain full ecological functioning."[335] The Australian government and the Queensland government have worked together to implement important reef-legislation over the years.

1. *Australian Government (Commonwealth)*

a. Great Barrier Reef Marine Park Act of 1975 (GBRMP Act)

The main piece of legislation that has encouraged protection of the GBR has been the Great Barrier Reef Marine Park Act of 1975.[336] As contained in this Act, the Commonwealth is responsible for the management of the Great Barrier Reef Marine Park

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[332] Camila Domonoske, *Australia Investing $377 Million To Protect Great Barrier Reef*, NPR (Apr. 30, 2018, 12:13 PM), https://www.npr.org/sections/thetwo-way/2018/04/30/607037119/australia-investing-377-million-to-protect-great-barrier-reef.

[333] *Managing and Protecting the Great Barrier Reef*, AUSTL. GOV'T DEP'T OF ENV'T & ENERGY, https://www.environment.gov.au/marine/gbr/protecting-the-reef (last visited Dec. 16, 2020).

[334] Hayley Halpin, *Great Barrier Reef Corals Experiencing 'Catastrophic Die-Off' as Result of Global Warming* (Apr. 19, 2018, 4:20PM), https://www.thejournal.ie/great-barrier-reef-corals-global-warming-3966571-Apr2018/.

[335] *Id.*

[336] *Great Barrier Reef Marine Park Act of 1975*, AUSTL. GOV'T FED. REG. OF LEGIS., https://www.legislation.gov.au/Details/C2018C00076.

(GBRMP), within the Great Barrier Reef Region.[337] The GBRMP extends over 1,430 miles along the Queensland coastline and generally spans over Queensland State coastal waters to the low-water mark.[338]

The Act provides for the establishment, control, care, and development of the GBRMP, and establishes the Great Barrier Reef Marine Park Authority (GBRMP Authority). The GBRMP Authority provides for zoning plans, creates management plans, regulates use of permitted and prohibited activities within the Park, and facilitates a collaborative approach to management of the Great Barrier Reef World Heritage sites in collaboration with the Queensland government.[339] An example of this beneficial cooperation is the relationship between the Queensland Great Barrier Reef Coast Marine Park and the GBRMP.[340] "The Queensland Great Barrier Reef Coast Marine Park and the Queensland island national parks form part of the Great Barrier Reef World Heritage Area."[341] Queensland is in charge of managing the Great Barrier Reef Coast Marine Park, established under the *Marine Parks Act 2004*.[342] The Queensland Great Barrier Reef Coast Marine Park covers the area between low and high water marks and many waters within the limits of the State of Queensland.[343] The GBRMP Authority creates zones of different protection in attempt to provide for greater cooperation between managers and users.[344]

One benefit of forming a specific body to effectively manage the GBR is that the zoning "of integrated and multiple-use management, allow[s] for sustainable utilization of the reef by a

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337 *See generally* Great Barrier Reef Intergovernmental Agreement 2015, AUSTL. GOV'T DEP'T OF ENV'T & ENERGY, https://www.environment.gov.au/system/files/pages/7a85531d-9086-4c22-bdca-282491321e46/files/gbr-iga-2015.pdf.

338 *Id.* at 4.

339 *See id.* at 5–7.

340 *Id.*

341 *Id.* at 5.

342 *Id.* at 4.

343 *Id.*

344 *See Managing and Protecting the Great Barrier Reef*, *supra* note 333.

wide range of users with numerous and often conflicting needs."[345] The most effective MPAs (such as the GBRMP) generally have certain things in common.[346] For instance, several zones can and generally should exist within a single MPA, contributing to the strength of MPAs in protecting the biodiversity of a location, rather than trying to address each individual human impact separately.[347]

The GBRMP Authority has taken the position that climate change is the greatest threat to the GBR and that actions taken now will matter in the future.[348] They encourage immediate action to decrease greenhouse gas emissions in order to limit the negative impacts climate change has on the reef ecosystems.[349]

b. Environment Protection and Biodiversity Conservation Act of 1999 (EPBC Act)

The EPBC Act, protects nationally significant matters including the Great Barrier Reef World and National Heritage areas in accordance with UNESCO.[350] The Commonwealth government is responsible for regulating activities that have "a significant impact on matters of 'national environmental significance' as defined by the Act, and on the environment within Commonwealth land and waters."[351] At-large, this Act is wide in scope and covers World Heritage sites, Ramsar wetlands, threatened species, biodiversity

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[345] *Marine Protected Areas of the World*, WORLD RESOURCES INST., https://www.wri.org/resource/marine-protected-areas-world (last visited Dec. 20, 2020).

[346] *Id.*

[347] Elizabeth A. Fulton et al., *Modelling Marine Protected Areas: Insights and Hurdles*, THE ROYAL SOC'Y PUB. (Nov. 5, 2015), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4614735/.

[348] *Position Statement Climate Change*, AUSTL. GOV'T GREAT BARRIER REEF MARINE PARK AUTHORITY, https://elibrary.gbrmpa.gov.au/jspui/bitstream/11017/3460/5/v1-Climate-Change-Position-Statement-for-eLibrary.pdf.

[349] *Id.*

[350] Environment Protection and Biodiversity Conservation Act 1999, AUSTL. GOV'T FED. REG. OF LEGIS., https://www.legislation.gov.au/Details/C2019C00275.

[351] *Id.*

protection, the GBRMP, bilateral agreements, conservation agreements, and environmental assessments.[352]

Prior to this Act, the GBRMP Act was not completely integrated with the national environmental law.[353] The EPBC Act made more comprehensive investigation powers available for purposes of the GBRMP Act, so that a single investigation system applies to the marine park.[354] Now, "marine park users now have a duty to take reasonable steps to prevent or minimize environmental harm" and if they breach this duty there can be fines, other civil, and even criminal penalties.[355] Negligence of being unaware of the marine park, zones, and restrictions of uses is not an excuse under the law, unless it is an honest and reasonable mistake.[356]

2. *Queensland Government*

The Queensland government is responsible for natural resource management; land use planning; and regulation of activities on the islands, coasts, and hinterlands adjacent to the Great Barrier Reef World Heritage Area.[357] Because most of the GBR is located in Queensland, the Queensland government has passed its own legislation to protect the GBR. The most important pieces of legislation are discussed below.

a. Coastal Protection and Management Act 1995

The Coastal Protection and Management Act provides for the protection, conservation, and management of the coastal zone,

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352 *Id.*

353 *Safeguarding the Great Barrier Reef Marine Park*, AUSTL. GOV'T DEP'T OF THE ENV'T & ENERGY, https://www.environment.gov.au/epbc/publications/factsheet-safeguarding-great-barrier-reef-marine-park (last visited Dec. 29, 2020).

354 *See id.*

355 *Id.*

356 *Id.*

357 *See Managing and Protecting the Great Barrier Reef*, *supra* note 333.

including its resources and biological diversity; ensures land use, development decisions, and safeguards life and property from the threat of coastal hazards; and encourages the enhancement of knowledge of coastal resources and the effect of human activities on the coastal zone.[358]

b. Marine Parks Act 2004

The Marine Park Act helps establish marine parks, zones, zoning plans, management plans, cooperative implementation of international responsibilities, and intergovernmental agreements, a coordinated approach with other environment conservation legislation, monitoring mechanisms, and the "Commonwealth and the State have agreed that, in conserving marine parks, the State is to maintain, as far as practicable, legislation in line with the Commonwealth Act."[359] The coordinated effort between the Commonwealth and the State to protect the marine parks like the GBR is vital to the success of these efforts. The GBRMP Authority and the Queensland Parks and Wildlife Service operate a joint Field Management Program for the marine national parks. The program helps protect and maintain "well-functioning marine and island ecosystems that support economic, traditional[,] and recreational uses of the Great Barrier Reef . . . ."[360]

3. *Great Barrier Reef Intergovernmental Agreement*

This Agreement was signed in 2009 by the Prime Minister and Queensland Premier as an update to a former agreement known as

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[358] Coastal Protection and Management Act 1995, QUEENSL. GOV'T, https://www.legislation.qld.gov.au/view/whole/html/inforce/current/act-1995-041.

[359] Marine Parks Act 2004, QUEENSL. GOV'T, https://www.legislation.qld.gov.au/view/whole/html/inforce/current/act-2004-031.

[360] *Managing Marine Parks*, QUEENSL. GOV'T, https://www.qld.gov.au/environment/coasts-waterways/marine-parks/managing (last visited Dec. 29, 2020).

the Emerald Agreement of 1979.[361] It is meant to provide a framework for the Australian and Queensland governments to work together to better protect the GBR.[362] Within the Agreement, the governments identify major pressures to the reef including climate change impacts, water quality concerns, and coastal development issues that were not foreseen in the earlier agreement.[363] Both governments recognize these concerns cannot be effectively addressed by either government alone.[364]

The reauthorized 2015 Agreement reflects the shared vision in the Reef 2050 Plan.[365] The most updated plan was released in July 2018 and renews the intergovernmental commitment to protecting the GBR World Heritage Area under UNESCO and outlines concrete management measures to ensure the reef is preserved now and for future generations.[366] The Agreement articulates objectives, respective jurisdictions, and accountabilities.[367] After the unprecedented, climate-driven mass coral bleaching events in 2016 and 2017, the Plan puts a stronger focus on climate change as a key pressure to the GBR.[368] In fact, the Plan cites linkages to international efforts and domestic plans and strategies to mitigate and adapt to climate change, such as the Paris Agreement and the Queensland Climate Transition Strategy.[369] The Strategy sets a goal

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361 *Great Barrier Reef Intergovernmental Agreement*, AUSTL. GOV'T DEP'T OF AGRIC., WATER & THE ENV'T, https://www.environment.gov.au/marine/gbr/protecting-the-reef/intergovernmental-agreement.

362 *Id.*

363 *Id.*

364 *Id.*

365 *Id.*

366 Reef 2050 Long-Term Sustainability Plan, COMMONWEALTH OF AUSTL. (2018) https://www.environment.gov.au/system/files/resources/35e55187-b76e-4aaf-a2fa-376a65c89810/files/reef-2050-long-term-sustainability-plan-2018.pdf.

367 *See id.*

368 *Id.*

369 *Id.*

for Queensland to achieve zero net emissions by 2050.[370] Other highlights include aligning water quality targets with the Reef 2050 Water Quality Improvement Plan 2017-2022 and setting out a structure to oversee the implementation of management in a way that engages industry, the science community and the Australian people.[371] Revisions to the plan will be informed by the Outlook Report that the Australian government publishes every year.[372] The most recent of which is the Great Barrier Reef Outlook Report 2019.[373] This comprehensive risk assessment of 45 threats (including climate change) to the GBR ecosystem and states that without additional local, national, and global action on the greatest of these threats the overall outlook will remain very poor.[374]

4. *Reef Trust*

The Reef Trust is being carried out by the Australian government, in collaboration with the Queensland government, and the GBRMP Authority.[375] Together, "the Australian government has committed over $700 million . . . to provide innovative, targeted investment focused on improving water quality, restoring coral reef ecosystem health," and enhancing species protection in the GBR region.[376] However, the Australian government is not the only party putting funds in the trust; the Reef Trust is able to consolidate investment from the philanthropic and investment sectors as well. The Reef Trust includes governance and enforcement mechanisms

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370 *Pathways to a Clean Growth Economy Queensland Climate Transition Strategy*, DEP'T OF ENV'T & HERITAGE PROTECTION, QUEENSL. GOV'T, https://www.qld.gov.au/__data/assets/pdf_file/0026/67283/qld-climate-transition-strategy.pdf.

371 Reef 2050 Long-Term Sustainability Plan, *supra* note 366.

372 *Id.* at 366.

373 *See generally Great Barrier Reef Outlook Report 2019: In Brief*, AUSTRL. GOV'T GREAT BARRIER REEF MARINE PARK AUTHORITY, http://www.gbrmpa.gov.au/our-work/outlook-report-2019/outlook-report-2019-in-brief.

374 *Id.*

375 *The Reef Trust*, AUSTRL. GOV'T DEP'T OF AGRIC., WATER & THE ENV'T, http://www.environment.gov.au/marine/gbr/reef-trust (last visited Dec. 23, 2020).

376 *Id.*

to make sure funds are directed towards prioritized projects and efforts.[377] Scientists and other experts provide input to assist in deciding which projects will receive funding.[378] These projects are released in phases and funding is released continuously throughout the application and assessment processes.[379] The Reef Trust also helps in facilitating the *Reef 2050 Plan*, by focusing on known critical areas for investment, such as improving water quality and habitats along the Great Barrier Reef.[380]

5. *Analysis and Concerns*

Australia has been a leader on many issues in the environmental realm but must do more to confront the degradation of the GBR and other environmental challenges facing Australia and the world.[381] The World Wildlife Fund polled Australian attitudes regarding ocean ecosystems and protecting the Great Barrier Reef.[382] "Nine out of ten agree[d] that" more needs to be done to "protect . . . oceans and marine life."[383] In fact, protecting the GBR is the most important environmental issue for Australians, 94% found it important.[384] 59% of Australians described the GBR as having environmental value to them (habitat, global, and economic

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[377] *Id.*

[378] *The Reef Trust*, AUSTRL. GOV'T DEP'T OF AGRIC., WATER & THE ENV'T, https://www.environment.gov.au/marine/gbr/reef-trust (last visited Dec. 23, 2020).

[379] *Id.*

[380] Reef 2050 Long-Term Sustainability Plan, *supra* note 366.

[381] David Suzuki, *Australia's Environmental Leadership Needed Now More Than Ever,* HUFF POST (July 18, 2015, 7:56 AM), https://www.huffingtonpost.com.au/david-suzuki/australia-inspired-me-to-tackle-climate-change_b_7980512.html (last visited Dec. 23, 2020).

[382] Australian Attitudes to Nature 2017 Report Prepared for WWF-Australia, WWF, ROY MORGAN RES. (2018), https://webcache.googleusercontent.com/search?q=cache:WHmJMcx8a1sJ:https://www.wwf.org.au/ArticleDocuments/353/pub-backyard-barometer-australian-attitudes-to-nature-05jun18.pdf.aspx+&cd=2&hl=en&ct=clnk&gl=us&client=safari.

[383] *Id.*

[384] *Id.*

value).[385] 89% of Australians think that the Great Barrier Reef is the most important natural place to be protected.[386] "Coral bleaching followed by climate change are [perceived] to be the two greatest threats to the Great Barrier Reef" amongst the general population.[387]

This study goes to show that Australians value the GBR and recognize the significance of its deterioration being primarily due to climate change. It also shows that Australians want to do more to protect the GBR from climate change impacts.

With this being said, Australia has taken major strides in creating effective policies that address the issues facing coral reefs, instituting reporting schemes, securing funding, and establishing cooperative agreements amongst multiple actors. Although Australia's reef-related policies are not perfect, their strategy approaches protection of the GBR as a whole by focusing on the importance and value the GBR provides; addressing climate change impacts; and other human made impacts like water quality concerns, coastal development, and species protection. The U.S. could learn from this all-encompassing approach.

There are some issues that prevent more effective legislation from being passed to safeguard the GBR. One of the most prominent being the highly politically motivated Australian Parliament.[388] Some members of Parliament have questioned whether climate change is man-made, and others deny it entirely.[389] Some members preach that it is possible to turn things around for the reef without

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385 *Id.*

386 *Id.*

387 *Id.*

388 *See* Jon Brodie & Alana Grech, '*This Situation Brings Me to Despair': Two Reef Scientists Share Their Climate Grief*, YALE CLIMATE CONNECTIONS (Oct. 3, 2019), https://www.yaleclimateconnections.org/2019/10/this-situation-brings-me-to-despair-two-reef-scientists-share-their-climate-grief/?fbclid=IwAR1P7IKvrZF0iXdTpKFRhxDPulapl86kTHfW2u7Fw3eRHm_nkKsjMaojQc4 (last visited Dec. 25, 2020).

389 *See id.*

tackling global warming.[390] Another example exemplifying distrust in science is the Senate of the Australian Parliament voting in favor of inquiring whether farming and poor water quality actually harms the GBR as Queensland introduced new environmental laws to protect the GBR.[391] There has been some push back from the certain parties seeking land management changes, and campaigns against further state regulation that would actually benefit the GBR.[392] Additionally, some North Queensland politicians have undermined the science that informs their own policies by advocating for a national watchdog to verify scientific papers because of certain politicians' doubts about climate change.[393]

Another roadblock is that the Commonwealth of Australia, Queensland government, and GBRMP Authority attempt to raise awareness about the importance of reducing GHG emissions to help protect the GBR, but actual CO_2 emissions have increased "in almost every sector of Australia's economy."[394] Australia is one of the world's top twenty polluting countries.[395] Australia's greatest contribution to global warming is through coal being exported and

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[390] *See* David Ritter, *Australia's Politicians Have Betrayed the Great Barrier Reef and Only the People Can Save It*, THE GUARDIAN (Apr. 9, 2017, 5:02 PM), https://www.theguardian.com/environment/2017/apr/10/australias-politicians-have-betrayed-the-great-barrier-reef-and-only-the-people-can-save-it (last visited Dec. 25, 2020).

[391] Paul Karp, *Senate Inquiry Into Great Barrier Reef Seen as Bid to Discredit Queensland Laws*, THE GUARDIAN (Sept. 27, 2019, 5:42 PM), https://www.theguardian.com/environment/2019/sep/17/senate-inquiry-into-great-barrier-reef-seen-as-bid-to-discredit-queensland-laws (last visited Dec. 25, 2020).

[392] *Id.*

[393] Brodie & Grech, *supra* note 388.

[394] Adam Morton & Lisa Cox, *How Does Scott Morrison's Climate Declaration at the United Nations Stack Up?*, THE GUARDIAN (Sept. 26, 2019, 5:06 PM), https://www.theguardian.com/environment/2019/sep/26/how-does-scott-morrisons-climate-declaration-at-the-united-nations-stack-up (last visited Dec. 25, 2020).

[395] *Each Country's Share of CO2 Emissions,* UNION OF CONCERNED SCIENTISTS (July 16, 2008), https://www.ucsusa.org/resources/each-countrys-share-co2-emissions (last visited Dec. 25, 2020).

burned.[396] Some suggest closing down the coal mining industry, while ensuring new green jobs for all affected workers and communities, but this becomes difficult when financial institutions continue to invest in fossil fuel projects that endanger the reef.[397]

For Australia to create more effective policy choices, politicians must cross the aisle and acknowledge climate change is real. As a society, Australians must decrease greenhouse gas emissions.

E. LEGAL IMPLICATIONS

If the world follows the same trajectory, climate change will continue to produce a range of harmful effects, including ocean acidification. This is expected to worsen and further have a disastrous impact on reefs. As we have seen, the international community, the U.S., and Australia have all taken a variety of actions to protect coral reef ecosystems from these stressors, but what is the remedy if actors feel governments acting alone or together are not doing enough to conserve coral reef ecosystems for future generations? Although this has not been challenged specifically, some have argued that private litigation could be used to combat climate change.[398] Others suggest expanding the public trust doctrine to protect our climate system.[399]

1. *Juliana v. United States*

The plaintiffs challenged the policies and acts of the Executive branch, including the President of the U.S. and many federal agencies.[400] They challenged a multitude of decisions the defendants have made in regard to regulating CO_2 emissions, granting fossil fuel extraction permits, tax breaks for the fossil fuel industry, construction of pipelines, and authorization of marine coal

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396 *See generally* Suzuki, *supra* note 381.

397 Ritter, *supra* note 390.

398 JOHN SPRANKLING & RAYMOND R. COLETTA, PROPERTY A CONTEMPORARY APPROACH, 909–916 (West Academic Publishing, 3d ed. 2018).

399 *Id.*

400 Juliana v. United States, 217 F. Supp. 3d 1224 (Or. 2016).

projects.[401] They assert that the defendant's actions have "substantially caused the planet to warm and the oceans to rise."[402] The main questions the Court must answer are "whether defendants are responsible for some of the harm created by climate change," whether there is even a claim the plaintiffs may bring to challenge climate change policy in court, and whether the Court can force the defendants to change their current policies.[403]

a. Due Process; Fundamental Rights

The plaintiffs attempted to bring a due process claim alleging that the defendants have directly caused atmospheric CO_2 to rise to levels that dangerously interfere with a stable climate system; the defendants are knowingly endangering health and welfare by approving fossil fuel development and the defendants, after knowingly creating this situation, are continuing to enhance the danger by allowing fossil fuel production and consumption.[404] The court is required to uphold a challenged governmental action if it "implements a rational means of achieving a legitimate governmental end."[405] However, if the government action infringes on a fundamental right, the court applies strict scrutiny and will only allow an infringement if it is narrowly tailored and serves a compelling state interest.[406]

Fundamental rights include those that are enumerated somewhere in the Constitution and rights and liberties that are either (1) "deeply rooted in this Nation's history and tradition" or (2) fundamental to our "scheme of ordered liberty."[407] This means that new fundamental rights may be formed but the courts must exercise "reasoned judgment" when deciding to do so.[408] Some environmentalist believe that the right to a climate system is

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401 *See id.* at 1234.
402 *Id.*
403 *Id.*
404 *Id.* at 1248.
405 Kim v. United States, 121 F.3d 1269, 1273 (9th Cir. 1997).
406 *Id.*
407 McDonald v. City of Chicago, 561 U.S 742, 767 (2010).
408 SPRANKLING & COLETTA, *supra* note 398.

fundamental to sustaining human life and that it should be protected as such.[409] The court determined that the plaintiffs properly alleged infringement of a fundamental right.[410]

b. Public Trust Doctrine

The Public Trust Doctrine is rooted in ancient Roman law.[411] The doctrine "requires the sovereign, or state, to hold in trust designated resources for the benefit of the people."[412] This means that no government can legitimately abdicate its core sovereign powers, for example the government's police powers.[413] The doctrine "recognizes the public right to many natural resources, including 'the air, running water, the sea and its shore.'"[414] The trust bars the sovereign from "depriving a future legislature of the natural resources necessary to provide for the well-being and survival of its citizens."[415] It traditionally applied to commerce and fishing in navigable waters, but the doctrine's uses have been expanded by the courts overtime.[416] For example, in *Marks v. Whitney*, the California Supreme Court broadened the definition of public trust to include

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409 *Id.*

410 *Id.*

411 *Public Trust Doctrine*, WATER EDUC. FOUND., https://www.watereducation.org/aquapedia/public-trust-doctrine (last visited Dec. 30, 2020).

412 *Id.*

413 SPRANKLING & COLETTA, *supra* note 398.

414 *Public Trust Doctrine, supra* note 411.

415 CHRISTINE A KLEIN ET AL., NATURAL RESOURCES LAW: A PLACE-BASED BOOK OF PROBLEMS AND CASES (Wolters Kluwer 2018), https://books.google.com/books?id=JvdJDwAAQBAJ&pg=PA735&lpg=PA735&dq="depriving+a+future+legislature+of+the+natural+resources+necessary+to+provide+for+the+well+being+and+survival+of+its+citizens."&source=bl&ots=wXHNHXwcaQ&sig=ACfU3U0CmDVXT0TFEUp4cnxObQ8WuNKGIA&hl=en&sa=X&ved=2ahUKEwjR4LSV8_btAhWlslkKHS9zBjUQ6AEwAHoECAMQAg#v=onepage&q="depriving%20a%20future%20legislature%20of%20the%20natural%20resources%20necessary%20to%20provide%20for%20the%20well%20being%20and%20survival%20of%20its%20citizens."&f=false.

416 *Public Trust Doctrine, supra* note 411.

"fish, wildlife, habitat[,] and recreation" because "'public trust uses are sufficiently flexible to encompass changing public needs.'"[417]

The Juliana lawsuit is part of a wave of environmental cases asserting that state and national governments have abdicated their responsibilities under the doctrine because the defendants have violated their duties to current and future trustees by failing to protect the atmosphere water, seas, seashores, and wildlife.[418] The plaintiff's injuries relate to the effects of ocean acidification and rising ocean temperatures and, therefore, they have adequately alleged harm to public trust assets.[419] The Court ultimately denied the Defendants' motion to dismiss and the lawsuit is ongoing.[420]

Tying this argument into the legitimacy of protecting coral reefs would turn upon "whether the State has exercised its police power in conformity with the federal laws and Constitution."[421] One view maintains that the legislature is the most appropriate body to decide what is in the interest of the public.[422] In fact, the Florida legislature decided to include the public trust doctrine in the state's constitution.[423] Another approach relates to the public interest argument being used as a defense against takings claims by private parties contesting conservation restrictions on private land.[424] Some have argued that because coral reefs in the U.S. are limited in scope and fixed in location they could be reduced to private ownership and the public trust would then create a pseudo-easement on the land.[425] However, "'the individual States have the authority to define the limits of the lands held in public trust and to recognize private rights in such lands as they see fit.'"[426]

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417 *Id.*
418 SPRANKLING & COLETTA, *supra* note 398.
419 *Id.*
420 *Id.*
421 *See* Douglas v. Seacoast Products, Inc., 431 U.S. 265, 284–285 (1977).
422 Sylvan, *supra* note 18 at 34.
423 *Id.*
424 *See id.*
425 *See id.*
426 *See id.*

If two legitimate public property rights, like recreational fishing and coral reef conservation, are in conflict, typically, the courts are left to decide.[427] Referenced previously, courts have amended the purposes of the doctrine throughout the years, adding conservation, but without creating a hierarchy among them.[428] Marine living resources that "should be conserved and managed for the benefit of the state, its people, and future generations" were added to the Constitution of Florida.[429] "This seems to suggest that the vitality of the ecosystem in general is paramount to any particular use . . ." of the ecosystem.[430] With this discussion, Courts in the future may appropriately expand the doctrine to protect a stable climate system for the interest of the public, in turn better protecting reefs from climate change threats.

2. *Other Pertinent Lawsuits and Actions*

a. Center of Biological Diversity (Center)

The Center is a non-profit, environmental organization dedicated to the protection of species and their habitats through "science, policy, and environmental law."[431] The Center is "concerned with the conservation of endangered species, including coral species, and the effective implementation of the ESA."[432]

In 2009, the Center of Biological Diversity petitioned to list 83 coral species under the ESA.[433] The National Marine Fisheries Service (NMFS) under NOAA had jurisdiction over this petition.[434] The NMFS was required to determine whether the petition presented substantial scientific or commercial information indicating that the

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427 *See id.*

428 *Public Trust Doctrine, supra* note 411.

429 FLA. CONST., art. X, § 16(a).

430 Sylvan, *supra* note 18.

431 *Petition To List 83 Coral Species Under The Endangered Species Act Before The Secretary of Commerce, supra* note 279.

432 *Id.*

433 *Id.*

434 *Id.*

petition may be warranted.[435] The science supporting the petition indicated that climate change and ocean acidification greatly threatened the survival of the 83 coral species at issue.[436] In fact the species were threatened "with extinction before the mid-century due to the increasing frequency of mass bleaching events at harmful[] intervals and the projected dissolution of corals due to ocean acidification."[437] Both Congress and the Supreme Court have obliged NOAA to prioritize species survival and recovery "whatever the cost."[438] Due to their vital importance, imperiled corals identified in this petition were believed to warrant immediate protection under the ESA.[439] A handful of the petitioned corals were located in Florida and Australia.[440] In 2014, because of this petition, twenty species of coral (five species located in Florida) are now "protected as 'threatened' under the [ESA] because global warming" and ocean acidification are driving them towards extinction.[441] This level of "protection under the [ESA] will provide these corals with habitat protections, recovery planning, and prohibition of federal actions that could jeopardize the corals."[442]

Additionally, in August 2019, the Center also filed a lawsuit against the NMFS in order to protect twelve endangered coral species ("five species of Florida and Caribbean corals and seven

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435 16 U.S.C. § 1533(b)(3)(A).

436 *Petition To List 83 Coral Species Under The Endangered Species Act Before The Secretary of Commerce, supra* note 279.

437 *Id.*

438 *See* TVA v. Hill, 437 U.S. 153, 154 (1978).

439 *Petition To List 83 Coral Species Under The Endangered Species Act Before The Secretary of Commerce, supra* note 279.

440 *Id.*

441 Shaye Wolf, *20 Corals Protected Under Endangered Species Act Because of Global Warming, Ocean Acidification*, CTR. FOR BIOLOGICAL DIVERSITY (Aug. 27, 2014), https://www.biologicaldiversity.org/news/press_releases/2014/corals-08-27-2014.html.

442 *Id.*

species of Pacific corals").[443] The Center recognized the safeguards needed to protect the Florida Reef and reefs surrounding the Pacific Islands from mass extinction due to climate change, pollution, and overfishing.[444] The plaintiffs argued that the corals all received ESA protection in 2014 (as previously mentioned), but they did not receive the critical habitat protection the law requires, and they need this level of protection in order to not become extinct.[445] In a press release, an attorney at the Center stated: "You can't save these vanishing corals without protecting their most important habitat. It's time for the Trump administration to stop dragging its feet and give these corals the help they desperately need."[446] No further action has been taken by the D.C. District Court where the lawsuit was filed.

b. Center of Biological Diversity v. EPA, et. seq.

In November 2018, the Center filed a complaint against the EPA for declaratory and injunctive relief.[447] The complaint alleges that Oregon's coastal waters are experiencing a water quality problem due to ocean acidification which has stripped the seawater of calcium carbonate, in turn, making it difficult for marine organisms to build shells (or build reefs).[448] Consequently, shellfish production has declined and scientists have linked this to ocean acidification.[449]

The Clean Water Act requires each state to identify any water bodies that fail to meet the state's water quality standards and list

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[443] Emily Jeffers, *Safeguards Needed Around Florida, Pacific Islands to Prevent Mass Extinction*, CTR FOR BIOLOGICAL DIVERSITY (Aug. 21, 2019), https://biologicaldiversity.org/w/news/press-releases/lawsuit-filed-protect-habitat-12-endangered-coral-species-2019-08-21/ (last visited Dec. 30, 2020).

[444] *Id.*

[445] *Id.*

[446] *Id.*

[447] Ctr. for Biological Diversity v. United States E.P.A., 2018 WL 6521805 (Or.) (Trial Pleading), Westlaw.

[448] *See id.*

[449] *See id.*

those bodies as "impaired" waters.[450] The state has to submit this list to the EPA and the EPA is required to approve or disapprove of it within thirty days.[451] Within the list submitted, the state must identify the pollutant causing the impairment, when known, and then develop a plan to improve water quality for the impaired water body based on the severity of the pollution and the sensitivity of the water's use.[452] The Oregon Department of Environmental Quality (DEQ) "failed to include any marine waters impaired due to ocean acidification on its 2012 [303(d)] list."[453] The state submitted its impaired waters list to the EPA and it was partially approved and partially disapproved. The EPA partially disapproved the list due to DEQ's failure to list 332 impaired water bodies.[454] Accordingly, the plaintiff sought a declaration that the EPA's failure to identify impaired waters in Oregon within thirty days of the EPA's disapproval of Oregon's 2012 303(d) list violated the EPA's mandatory duty under Section 303 of the Clean Water Act, 33 U.S.C. § 1313(d)(2), and constitutes an agency action unlawfully withheld or unreasonably delayed under the Administrative Procedure Act, 5 U.S.C. § 706(1).[455] The plaintiff also sought an order requiring the EPA to promptly identify and finalize its rulemaking to add additional impaired waters, including those due to ocean acidification, to Oregon's 2012 303(d) list.[456] In March 2019, this action was dismissed.

Although there have not been any lawsuits suing the government for lack of action in regard to protecting coral reefs from climate change impacts, we can learn from the cases, petitions, and complaints that have attempted to conserve coral reefs in a vague sense. The *Juliana* case is a first step at establishing a stable climate as a fundamental right; this claim was not thrown out and that speaks volumes to the importance of a functioning planet now and in the

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450 33 U.S.C. § 1313(d) (2018).

451 33 U.S.C. § 1313(d)(2) (2018); 40 C.F.R. § 130.7(d)(2) (2018).

452 40 C.F.R. § 130.7(b)(4) (2018).

453 Ctr. for Biological Diversity v. United States E.P.A., 2018 WL 6521805 (Or.), Westlaw.

454 *Id.*

455 *Id.*

456 *Id.*

future. The due process argument could likewise be used in a case where a plaintiff is suing the government for lack of action in protecting coral reefs because the government is aware of the value reefs provide and the onset harm humans have caused to these ecosystems. The public trust doctrine was expanded to include conservation uses and this could pertain to the government not being allowed to deprive future generations of the natural resources (food supply, habitats, and protection that coastal reefs provide) necessary to provide for the well-being and survival. Petitioning for more coral reefs species to be placed on the ESA list has also benefitted corals, but at the same time has also been somewhat ineffective. This is because of the time it took from the original petition to the actual listing (five years) and then it was not actually enforced and now has triggered further litigation. It also looked like there was hope for claims brought against the EPA for violating the CWA and for procedural issues, but the case was later dismissed. It would have been interesting to see if the EPA finalized a rule adding waters that have been impacted by ocean acidification to the impaired water's list, inducing more protection of these areas. If this had been the case, coral reefs impacted by ocean acidification and the waters surrounding these ecosystems may have been able to get more protection under the CWA. This is likely to come up again as climate change persists.

III. LOOKING FORWARD

The complex nature of coral reef ecosystems makes protection and conservation of these areas, both on the international level and domestic level, extremely challenging. But with every challenge, innovation occurs, and society finds solutions. The University of Southern California, James Cook University, and the Australian Institute of Marine Science are working together to study coral's ability to shuffle their symbionts, the algae colonies inside their cells, as an adaptation mechanism to potentially gain an advantage in a changing environment.[457] Researchers have found that adult coral can pass along this ability to shuffle their symbionts to their offspring, allowing them to have a head start in establishing an

[457] Univ. of S. Cal., *supra* note 88.

energy supply.[458] Although this breakthrough shows that corals may be more adaptable, they still need time to be able to adapt.[459]

Recent scientific reviews on the future of coral reefs suggest that corals may not be able to adapt quickly enough to avoid major reef ecosystem loss on a global scale as a result of numerous stressors.[460] Some believe that increasing efforts to reduce these threats is pertinent but it might be "too little and/or too late" and direct intervention is required.[461] One group has done just that. The Coral Restoration Foundation in Florida is rebuilding thousands of square acres of the reef by cutting coral microfragments, strengthening the fragments in a laboratory and replanting them in the ocean.[462] This is known as assisted evolution.[463] Divers plant small corals in underwater nurseries on rows of artificial trees that mimic a coral reef structure and nourish themselves until they are ready to be replanted.[464] By collecting microfragments and placing them in genetic banks under water and in labs, scientists are able to analyze variations of genotypes for restoration and climate resilience.[465] The scientists have also experimented with medical pastes that can be injected into the reefs to contain the spread of disease.[466] The scientists recognize this is not a long-term solution that is going to take the place of mitigating climate change.[467] The process is extremely time consuming and labor intensive, but it will help ward off total devastation to the Florida Reef system in the

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458 *See supra* text accompanying note 88.

459 *See supra* text accompanying note 88.

460 Madeleine J. H. van Oppen, *Building Coral Reef Resilience Through Assisted Evolution,* NAT'L CTR. FOR BIOTECHNOLOGY INFO. (2015), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4345611/.

461 *Id.*

462 Evan Halper, *Racing to Save Florida's Coral From Climate Change, Scientists Turn to a Once–Unthinkable Strategy: "Assisted Evolution,"* LA TIMES (July 9, 2018, 3:00 AM), https://www.latimes.com/science/sciencenow/la-na-pol-coral-climate-change-20180709-htmlstory.html (last visited Dec. 29, 2020).

463 *Id.*

464 *Id.*

465 *Id.*

466 *Id.*

467 *Id.*

meantime while governments solve the root problem: climate change.[468] NOAA has already commended the Foundation's efforts and acknowledge the positive difference it is making.[469] Their goal is to scale up their processes so that they can be effective at restoring reefs all over the world, like the Great Barrier Reef.[470] Introducing genetically superior corals has the potential to enable reefs to persist in the future.[471] However, there are risks involved regarding ecological consequences that must be analyzed before this process is scaled globally.[472]

As science advances, more innovative solutions to mitigating climate change impacts on coral reefs, like the ones discussed, will hopefully come to fruition and benefit more of society.

IV. POLICY SUGGESTION & CONCLUSION

Regulatory mechanisms currently in place are inadequate to protect coral reefs from climate change impacts. Many domestic policies described above have overlapping purposes but leave many gaps in the protection of coral reefs. While a few domestic laws in the U.S. and Australia have been to some degree effective, coral reefs ultimately must require protection at the international level. Coral reef ecosystems worldwide have similar overriding problems facing them, but they are affected differently depending on the location of a particular coral reef.

Looking toward the future, we need an initiative that must be international in scope and localized in implementation. I propose an all-encompassing, international treaty focused solely on coral reef protection~~,~~ that would be modelled after the successful pieces of the domestic policies and international instruments previously discussed. These include: increasing the number of MPAs, creating something similar to the Reef Trust in Australia in order to help smaller countries comply with commitments in the treaty, and

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468 *Id.*
469 *Id.*
470 *Id.*
471 van Oppen, *supra* note 460.
472 *Id.*

perhaps even implementing a CZMA scheme in all coastal areas around the globe. This treaty needs to focus on making the protection of coral reefs an international priority by addressing the multitude of factors leading to the demise of coral reefs, including, but not limited to, increased greenhouse gas emissions, overfishing, takings, pollution, etc., while also encouraging and helping local communities to participate on the smaller scale. The treaty must establish enforceable standards and guidelines for how countries are to implement regulation of activities harming the reefs and to develop sustainable development tactics. It is also necessary for the treaty to address how countries can afford to comply, by offering financial assistance, creating a trust with private donors, or coordinating efforts with non-profits focused on reef conservation.

If a new treaty is not feasible, another avenue that could protect reefs more effectively is reworking or adding to the current structures in place. An example could be adding more reef species to CITES. The signatories of CITES are required to report on the trade of each species and this could help the international community better estimate how much overharvesting is actually occurring to better assess the harm. MPAs can be highly effective tools for protecting biodiversity when the areas are large such as the GBR and the Florida Keys National Marine Sanctuary. Therefore, it would be beneficial to expand and designate more areas as MPAs in order to better monitor, collect data, and improve management practices. UNESCO could also designate more threatened reefs as World Heritage Sites. However, this might not be enough because UNESCO has previously warned that 25 of the 29 coral reefs on the list already are at risk for devastating back-to-back bleaching events by 2040.[473] They also warn that 29 of the reefs, which include the reef in Florida and the Great Barrier Reef in Australia, will no longer host functioning ecosystems by 2100 if climate change is not confronted.[474] In essence, any of these actions will incrementally help reefs, but if we do not address the bigger picture, decreasing greenhouse gas emissions, these smaller actions might not be enough to save these ecosystems in the long run. It would be more

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[473] Halper, *supra* note 462.

[474] *See supra* text accompanying note 462.

advantageous for society to have an innovative treaty proactively tackling all the issues facing coral reefs in one document.

Coral reef survival is at a tipping point as climate change worsens. The protection of these delicate ecosystems is a global issue and more coordinated efforts must be taken by local, state, and international actors to preserve their existence for future generations.