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February 7, 2019

The Hon. Jared Huffman
Chair, Subcommittee on Water, Oceans, and Wildlife
Committee on Natural Resources
U.S. House of Representatives
1324 Longworth House Office Building
Washington, DC 20515

The Hon. Tom McClintock
Ranking Member, Subcommittee on Water, Oceans, and Wildlife
Committee on Natural Resources
U.S. House of Representatives
1329 Longworth House Office Building
Washington, DC 20515

Re: Subcommittee Hearing on Healthy Oceans and Healthy Economies: The State of Our Oceans In the 21st Century

Dear Chairman Huffman and Ranking Member McClintock,

Thank you for the opportunity to provide input in regards to today's hearing. We commend the Subcommittee's leadership in addressing oceans and climate change, and urge continued focus and action on this critical issue as we move further into the 116th Congress.

Ocean Conservancy creates science-based solutions for a healthy ocean and the wildlife and communities that depend on it. Climate change is one of the most pressing challenges for our ocean, and Ocean Conservancy has been deeply engaged in supporting solutions at the local, national, and global levels. Our work ranges from supporting ocean acidification funding and research, to fisheries management adaptation and modelling, to addressing ocean policy in venues like the International Maritime Organization and Arctic Council. The ocean is a system at risk, struggling to keep pace with rising temperatures, pollution, and the absorption of greenhouse gases. It is increasingly clear that urgent action is required to preserve the essential functioning of both the ocean and climate systems, and that saving one can't happen without saving the other. Congress must act on climate change. The science is clear, solutions are available here and now, and the ocean must be at the heart of climate action.

Why climate change matters to ocean and coastal communities

The ocean and America's coastal communities are on the frontlines of climate change impacts. Thirty-nine million people live near the coast in the United States. They, and the ocean they depend on, are experiencing major risk from extreme weather events, sea level rise, high water temperatures, low dissolved oxygen levels, and ocean and coastal acidification. Extreme events associated with the ocean are projected to become more common and severe as these conditions intensify and intersect. All of this

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is putting jobs and resources at risk, including America's multi-billion dollar seafood and ocean and coastal recreation industries, and trillion dollar coastal property market. In addition, the recent Fourth National Climate Assessment (NCA4) report found that the impacts of climate change along our coasts are actively worsening social inequality (NCA4, Chapter 1). American lives, livelihoods, and culture are at risk.

Below are just a few examples of how climate change is dramatically affecting ocean and coastal communities and economies:

Sea level rise

Repeated tidal flooding, coupled with sea level rise and heavy precipitation events, are already significantly harming America's public infrastructure and trillion-dollar coastal property market. Global average sea level has risen by about 7-8 inches since 1900, with almost half this rise occurring since 1993 as oceans have warmed and land-based ice has melted. Sea level rise, driven by expansion of warming seawater and melting of glaciers, now causes regular flooding in coastal communities around our country—euphemistically called "sunny day flooding" or "king tides." 50 million housing units are within 1/8 of a mile of the coast, and projections suggest that between $66 and $106 billion of real estate value may be underwater by 2050 (NCA4, Chapter 8). Moreover, 60,000 miles of roads and bridges are located along the coast (NCA4, Chapter 12), and many if not most of these will need to be repaired or relocated. These costs will become an increasing economic liability for municipalities and programs like the National Flood Insurance Program, which may become insolvent when properties become unsellable (NCA4, Chapter 8).

Around the country, costs of forced adaptation are already mounting. In Florida, there are already 120,000 properties at risk from frequent tidal flooding (NCA4, Chapter 19). Sea level around Florida is 8 inches higher than it was in 1950, and the state is planning over $4 billion in sea level rise solutions (SeaLevelRise.org). Cities like Miami are installing pumps to remove floodwaters from coastal streets. Some communities are considering leaving the coastal zone altogether: the Biloxi-Choctaw tribe in Louisiana has a $48 million grant from the federal government to develop a relocation plan (NCA4, Chapter 15). In California alone, the cost to elevate ports to withstand 6 feet of sea level rise could be $12 billion (NCA4, Chapter 8). The nation's largest naval base, in Norfolk Virginia, is at major risk from sea level rise, a fact acknowledged by the Department of Defense (January 2019 Report of Effects of a Changing Climate to the Department of Defense).

Fisheries

U.S. commercial and recreational fisheries generate $212 billion in sales impacts each year (Fisheries Economics of the United States Report, 2016) and are a critical economic driver for thousands of coastal communities. But ocean warming, acidification, and oxygen loss are rapidly altering the abundance, productivity, and distribution of fish stocks. These impacts on fish are resulting in a cascade of management and sustainability challenges, which impact fishermen and fishing communities.

In ocean waters, species distributions are shifting at an estimated 70 kilometers per decade (Poloczanska et al., 2013), with most species moving poleward or to deeper waters as the oceans warm (NCA4, Chapter 9). Scientists expect 10-50 percent decline in fish from warmer regions by 2085 (NCA4, Chapter 9), while catch could increase elsewhere. Warm water has already contributed to overfishing of the iconic Atlantic cod in the Gulf of Maine, and negatively affected the allowable catch of Pacific cod in the Gulf of Alaska and the Bering Sea. American lobster has experienced a major range shift, with its center of abundance having moved 3 degrees north in latitude from Long Island to Maine. The Gulf of Maine has warmed faster than 99 percent of the rest of the global ocean in the last century; by 2050 lobster populations could be cut by more than half with continued warming (La Bris et al., 2018). As stocks move, research suggests fisheries have only been able to shift 10-30 percent as much as their target species, likely due to economic and regulatory constraints (Pinsky and Fogarty, 2012). Changing ocean conditions will also affect the productivity of fish stocks by influencing habitat suitability, interactions between predators and prey, and the life history parameters of fish such as growth and recruitment (Karp et al. 2018). These changes in productivity make it more difficult to define and achieve management targets (Karp et al. 2018).

With changing abundance and distribution of fish stocks, changes in fishing patterns follow, and commercial, recreational, and subsistence fishermen are on the front lines. A survey of commercial fishermen in the Northeast found that the majority attributed changes they saw to climate change and 65 percent believed that climate change would ultimately force them out of their fishery (Center for American Progress, 2014). Climate change is also already affecting U.S. fishery management as species shift their distributions and productivity is altered. Among the pressing issues are jurisdictional and boundary conflicts for managing stocks, coordination and allocation issues among and across states and regions, the need to manage new and emerging fisheries, and increased costs for fishermen to pursue fisheries over longer distances. Taken together, these issues make fisheries harvests less secure and complicate management of both fisheries and protected species. Recognizing the urgency of these issues, the National Oceanic and Atmospheric Administration (NOAA), the Regional Fishery Management Councils, and others are working to refine the science, assess fish and community vulnerabilities, incorporate insights into planning and decision-making, and develop a more climate-ready fishery management system (for example, see Link et al. NOAA Fisheries, 2015).

Arctic

The potential impacts from climate change and acidification in the U.S. Arctic warrant particular attention. The Arctic region is warming at twice the rate of the rest of the planet. This warming is already causing significant effects in Alaska, America's only Arctic state, some of which ripple through the rest of the United States. Alaska marine ecosystems and coastal communities are inextricably linked and, together, they are threatened by climate change. Coastal communities are being forced to relocate as homes and other infrastructure erode into the ocean. Warming is also disrupting subsistence that has existed in coastal communities for millennia, including making hunting more dangerous and less predictable, which contributes to the loss of food security and cultural continuity.

Warming is causing the loss of sea ice. The 2018 sea ice minimum was tied for the sixth lowest on record, and NASA scientists estimate that approximately 21,000 square miles of ice—an area the size of Maryland and New Jersey—has been lost for each year since the late 1970s (Earth Observatory 2018). The loss of sea ice is disrupting marine ecosystems and contributing to erosion and other impacts. It is also opening the region to other industrial activities—like oil and gas exploration and development and commercial fishing—in addition to increasing vessel traffic. These changes, in turn, are having profound impacts on maritime transportation in the Arctic. Vessel traffic in the Arctic has already grown significantly, and is poised to increase rapidly in coming years as the ice-free season lengthens. As vessel traffic increases, so too does the potential for significant impacts to residents of the region and to the marine ecosystem.

Warming ocean conditions are also affecting commercial, recreational, and subsistence fisheries in Alaska. Pacific cod populations in the Gulf of Alaska have diminished by more than 80%, and that loss has been attributed to a "warm blob" of ocean water in the Pacific. Pacific cod has also seen a significant decline in the Bering Sea. The reduction in cod had dramatic impacts of the Pacific cod fishery, which has been worth as much as $50 million per year in the past. The warm blob has also been linked to sea bird die-offs, whale strandings, and algal blooms (Seattle Times, 2017). Arctic waters are particularly susceptible to ocean acidification because they are colder and because freshwater inputs from melting glaciers make them less saline. Acidification will have dramatic effects on Arctic marine ecosystems by disrupting the base of a fragile food web.

Why climate change matters to ocean ecosystems

The ocean is our largest single buffer against climate change. It is the Earth's largest heat and carbon sink: it has absorbed 93 percent of the excess heat generated by industrial-era carbon dioxide emissions, and it captures nearly 30 percent of the carbon dioxide released into the atmosphere every year. Recent headlines have highlighted new research that suggests the ocean is storing even more heat than previously estimated (Cheng et al. 2019). Ocean surface waters have warmed 0.7 degrees Celsius since 1990. Dissolved oxygen in the ocean is falling because warmer water holds less oxygen and decreased circulation is causing oceans to become increasingly stratified; these impacts have already been detected as far as 1000 feet below the surface. By 2050, 86 percent of the ocean will see temperature and ocean acidification conditions that modern ecosystems and species have never experienced (NCA4, Chapter 9). Each new scientific assessment confirms that the pace and scale of change is greater than scientists previously thought.

Below are just a few examples of how these changes are dramatically affecting the functioning of ocean ecosystems:

Mass disruption of ocean ecosystems and food webs
The NCA4 report found that changing ocean conditions and increasing temperatures are already causing the loss of important habitats and changing food webs and species distributions, an effect that will only increase as warming, acidification, and oxygen loss continue.

In one dramatic example, just last week a new study from Cornell University documented that sea star wasting syndrome, a climate-change driven disease, has virtually extirpated *Pycnopodia helianthoides* (colloquially called the sunflower star) along a 3,000 mile stretch of the West coast (Harvell et al. 2019). This loss is threatening the survival of kelp forest ecosystems. A classic example of a "keystone species", sunflower stars keep purple sea urchin populations in check, which in turn allows giant kelp to grow prolifically, creating the physical structure that harbors all the other species that collectively comprise the kelp forest. Science warns that without *Pycnopodia* – and the other sea stars killed by the wasting

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disease - there could be no kelp forests. And that is what is happening. As sea star abundances have tumbled across the west coast, the abundance of kelp has likewise fallen and these once vibrant habitats have increasingly become barren zones dominated by sea urchins. This is just one example of the types of major trophic cascades ocean scientists are anticipating as a result of climate change.

Ocean Acidification
One of the major drivers of atmospheric climate change, carbon dioxide, is also responsible for driving ocean climate change by causing ocean acidification. Carbon dioxide dissolved in water creates carbonic acid, which changes not only the pH of oceans but also other chemical balances important for marine life. Thirty-year ocean time-series datasets provide direct evidence of this process worldwide (2018 2nd State of the Carbon Cycle Report: Chapter 17).

In the mid-2000s, mass mortality at shellfish hatcheries in the Pacific Northwest alerted the shellfish aquaculture industry to a major systemic problem. Partnering with federal and university researchers, they identified the problem as ocean acidification, caused by fossil fuel emissions absorbed by the Pacific Ocean over the last several decades, upwelled to coastal waters decades earlier than previously predicted (Feely et al., 2008, Science). To protect multi-generational businesses that support an industry employing thousands of people and sustaining the entire Pacific oyster industry, hatchery owners invested in “future proofing” steps such as monitoring seawater intakes, modifying the water chemistry of intake water, and researching the prospects for selective breeding to help safeguard the industry. At the same time, research on other impacts of ocean acidification took off. Since ocean acidification was identified as a threat to marine life, laboratory studies have shown it can alter fish and marine invertebrate reproductive success (e.g., Kroeker et al. 2013), fish and shark behavior (Dixson et al. 2010), and predator-prey relationships. Modeling studies suggest that these effects together have the power to decrease fishery yields of lucrative fisheries such as sea scallops (Cooley et al. 2018), red king and Tanner crabs (Punt et al. 2016), and Puget Sound fisheries (Busch et al. 2013). Surprisingly, preliminary studies suggest that OA worsens the toxicity of harmful algal blooms by increasing domoic acid toxin production (Sun et al. 2011), and it can decrease the flavor and food appeal of northern shrimp (Dupont et al. 2014). It is clear that the full effects of ocean acidification on marine life are still being determined, but we know that it can interact in subtle and difficult to predict ways with other marine drivers like warming, oxygen loss, and nitrogen loading.

Loss of Coral Reefs
Coral reef survival, along with the ecosystem and storm buffering services they provide, are at significant risk from warming and acidifying oceans. In the United States, coral reefs fringe the warm-water coastlines around Florida and Hawaii and territories of Puerto Rico, Guam, American Samoa, and the U.S. Virgin Islands. The past several summers in Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands, widespread coral bleaching occurred. The 2015 event killed approximately half of the coral cover in Western Hawaii (NCA4, Ch. 27). Cold-water-loving coral species also ring the entire coast, from Alaska to Hawaii. Both warm and cold-water reefs provide vital habitat for a wide variety of marine life, many of which are species that sustain economically important fisheries. In addition, reefs in shallow waters also help protect coasts from waves, acting like “speed bumps” that help dissipate wave energy. Erosion of reefs in Florida, U.S. Virgin Islands, and Hawaii from the combined effects of wave action, storms, and acidification is changing the seafloor topography enough

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that changes in wave runup on land can be expected. Losses of $140 billion in recreational revenue alone are projected from loss of coral reefs by 2100 (4th US Climate Assessment, Ch. 9). With forecasts calling for increased flooding threats from hurricanes that carry extra precipitation because of anthropogenic climate change (Patricola and Wehner, 2018), it is essential to maintain these invisible coastal protections that help defend against wave-based flooding.

Solutions: Ocean-based mitigation and adaptation

The ocean, and the coastal communities and economies that depend on it, are an important part of the solutions to climate change. The fundamental solution to ocean warming and acidification is decreasing atmospheric greenhouse gas levels, particularly carbon dioxide, and the ocean can help us to do that. In addition, even if we stopped emitting greenhouse gases today, there would still be years of "momentum" in the system, as existing atmospheric greenhouse gases continue to warm and acidify the ocean. As we work towards reducing our carbon footprint, there are concurrent steps that should be taken to decrease other ocean stressors and to support adaptation to ocean climate change.

The ocean can help us reduce our carbon footprint.

The ocean is more than a victim of climate change. It is a potential solution to the mitigation targets we must achieve to keep global temperatures below 2 degrees Celsius. The ocean provides critical carbon sinks, such as "blue carbon" ecosystems (mangroves, seagrasses, and tidal marshes, which have the added benefit of insulating communities from the effects of sea level rise and storm surges) and other elements of a living ocean. The ocean also provides important opportunities for decarbonization, such as clean energy via offshore renewables like wind and wave power, and reduction in emissions from offshore activities such as shipping and drilling. For example, shipping accounts for about 90% of global trade, and emission of greenhouse gases from shipping represent 2-3% of total global emissions. It is possible to reduce or eliminate these emissions using short-term measures such as design and technology solutions for new ships, adoption of low-carbon fuels, reduction of black carbon emissions, and mandatory speed reductions. These solutions should be addressed with industry in the dialogue as we work to develop a holistic approach to carbon reduction. Regardless of the mitigation mechanisms employed, any mitigation targets should include a specific focus on CO_2, since CO_2 has a significantly greater impact on the ocean by causing ocean acidification.

Ocean communities, industries and ecosystems need resources and support to secure long-term adaptation & resilience.

As noted above, the ocean impacts of climate change present significant and growing risks to coastal communities, economies, and ecosystems. We must invest in making them resilient to the climate change impacts we can't avoid. Functioning fisheries are needed to support populations, and healthy ecosystems are needed to protect coastlines. Protecting coastal and marine ecosystems against the adverse effects of climate change is vital for human and ecosystem adaptation and, in many cases, also contributes to reduction of emissions. Reducing anthropogenic stressors on the oceans, such as overfishing and other unsustainable exploitation of marine resources, habitat degradation, pollution and nutrient runoff, may also enhance the ocean's capacity to absorb the impacts of climate change and

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reduce the acidifying impact of CO2 emissions. We need to ensure the actions we take are designed with a changing climate and the goal of building resilience in mind.

In particular, we recommend focusing on two key approaches to adaptation and resilience:

Work to decrease ocean stressors: Studies show that multiple layered drivers on ocean ecosystems have a greater chance of acting synergistically – that is, exerting more stress on ocean life together than they would singly, or simply added together – than to counteract each other (Harley et al. 2006). This implies that reducing as many ocean drivers as possible, to reduce overall stress on ocean life, is warranted. Actions to reduce ocean stressors should include activities to combat things like oxygen loss, nitrogen pollution, sedimentation, disease, and other types of chemical pollution (Kelly & Caldwell, 2013). Marine resource management has sought to reduce these problems as part of general water quality improvement for decades, with progressive success in doing so (Côté et al. 2017), but the need is even more pressing in the face of climate change. Preventing the expansion of offshore oil and gas activities, especially in sensitive or remote places where the risks of these activities far outweigh any potential benefits, is also an important way to decrease additional ocean stressors. Decreasing marine pollution and other stressors to ecosystems is a "no-regrets" policy approach because of the multiple benefits that accrue—both the immediate value of reducing single stressors, and the likely synergistic effect of the stressors acting together (Côté et al. 2017).

In the Arctic in particular, we can put in place measures and best practices that will both decrease unnecessary ocean stressors and increase safety and protect communities. We can take common-sense steps to prevent maritime accidents from happening, such as implementing targeted vessel routing measures, tightening limitations on discharges into the water, supporting advancements in vessel tracking and communication, and improving nautical charts. We can also improve our ability to respond effectively if an accident does occur by increasing spill response equipment and training in local communities, continuing to fund design and construction of new ice-breaking polar security cutters and supporting seasonal Arctic Shield operations and additional Coast Guard outreach activities in Arctic communities.

Support community adaptation planning: To date, ocean climate change has driven piecemeal adaptation. As more adaptation efforts begin, there is an increasing risk that overlapping, uncoordinated efforts could be at best inefficient and at worst interfere with each other. Around the world, nations are currently planning both mitigation and adaptation actions to address climate change as part of their Nationally Determined Contributions under the Paris Agreement, but little guidance exists to ensure coordination and inclusion of the ocean in these activities. A similar dynamic exists within the U.S., where state and local governments nationwide are at widely different stages and levels of coordination in adopting ocean-smart climate policies.

Resources and support for long-term resilience and adaptation planning are desperately needed. At a minimum, this should include support for regional ocean planning through tools that support coordinated data and management like regional ocean data portals. Comprehensive planning approaches underpin community and ecosystem resilience and ecosystem-based management. States and regional ocean partnerships across the country have found value in comprehensive planning, and

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resources should support the priorities outlined by states. It should also include support for policies and programs, particularly those within NOAA, that support ocean and coastal resilience. This includes priorities such as ocean acidification monitoring and funding, ocean and coastal habitat and coral reef restoration, and fisheries management adaptation. In addition, there is a particular need to increase resilience and adaptation planning in the Arctic. Funding and support is needed for communities that must relocate, and there are opportunities to plan for coming changes and ensure that Alaskan communities, ecosystems, and economies will be resilient in a changing future.

Growing Global Momentum for Ocean-Climate Action

We are seeing energy for coordinated, ocean-focused action on climate change occurring at the local and regional levels, and we are also seeing it at the international level. There is excellent interagency work happening on climate change through the U.S. federal agencies. All of this action has not been matched by action at the federal legislative or executive level. This must change.

Ocean acidification, until recently an issue unknown outside the science community, has been the cause of much regional organizing. In the United States, scientists are joining largely self-organized groups such as the Global OA Observing Network (GOA-ON), the regional Coastal Acidification Networks (CANs) associated with the OOS network. These groups are also engaging regional industry and resource management experts, as well as educators and science communicators. As a result, lessons learned in one region are being transferred to other regions, accelerating the application of adaptive solutions and technology to monitor ocean climate change. This bottom-up energy has recently contributed to the creation of the International OA Alliance, a non-binding network of governments and nongovernmental members dedicated to enhancing ambitions to reduce CO2 emissions, sharing knowledge about ocean acidification, increasing actions to address it, and international capacity building efforts, through programs like the International Ocean Acidification Coordination Centre (OA-ICC), funded by the International Atomic Energy Agency.

Regions across the U.S. are also focusing on oceans and climate change more broadly. The recent Global Climate Action Summit, led by the state of California, is one prominent example where oceans were at the fore of the discussion. Other examples include the work of the Arctic Council and Pacific Coast Collaborative. In the international sphere, there is growing energy to address ocean issues in international climate policy, evidenced by the push to include ocean-focused actions in Nationally Determined Contributions as well as large number of ocean-focused meetings and panels at U.N. climate meetings over the past year.

Conclusion: U.S. Action is Needed Now

The time is right for the United States to consider how it can safeguard ocean resources and ecosystems for now and into the future. Heightening ambitions to cut carbon dioxide is a necessary first step to genuinely address ocean warming and acidification. Considering how climate-focused action, or inaction, impacts the ocean is also a necessary step. Plans for climate adaptation must be coordinated. States and regions are taking steps to do so, which can be learned from, exported, and applied to other areas to accelerate action.

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Congress must debate and move aggressive climate legislation that will ensure communities and ecosystems are spared the most devastating potential impacts from climate change, and are able to successfully adapt to those they can't avoid. That work must start now. But in addition, Congress can and must take action immediately using the tools we already have. This spring Congress will take up appropriations legislation for the next fiscal year. Those bills must prioritize critical funding for the climate research, coastal resilience, and adaptation programs that are already working to tackle our climate challenges.

Ocean climate change is happening now. It will get worse before it gets better. Congress must act now to curb climate change and plan to protect coastal communities as pro-actively as we can from the changes that are coming.

Sincerely,

Janis Searles Jones
CEO
Ocean Conservancy