Statement of Erika Zavaleta, Ph.D.
Howard Hughes Medical Institute Professor of
Ecology and Evolutionary Biology
University of California, Santa Cruz

To the U.S. House Committee on Natural Resources
Subcommittee on Water, Oceans and Wildlife
Legislative Hearing

July 29, 2021

Chairman Huffman, Ranking Member Bentz and Members of the Subcommittee, thank you for the opportunity to be here today to discuss a slate of bills aimed at securing the future of wildlife.

I am a biologist on the faculty of the University of California. As a scientist I have worked for 28 years to understand the roles that wildlife play in supporting natural lands and Indigenous and local communities, and the ways we can conserve wildlife effectively under climate and other rapid environmental changes. In part because of this experience, I was recently appointed to the California Fish and Game Commission, where I help to advise and make key decisions for my home state about biodiversity, endangered species, adapting to climate change, and other critical issues. In this hearing, however, I speak not in my role as Commissioner, but as a scientist concerned with halting what could be irreversible losses of plants and wildlife of value to the people of the United States and the world. I am honored to speak about the promise of several proposed bills to effectively address wildlife conservation, environmental quality and climate challenges.

Saving the world's and the United States' diversity of plants and animals from extinction

The first of three linked issues before us is the threats facing unique species of plants and wildlife around the world that have existed since time immemorial. Plant and wildlife species worldwide are threatened with extinction by habitat loss, invasive species, overexploitation and pollution, and we are losing species 10 to over 100 times faster than natural rates[1]. The world's longest-lasting legacy of environmental impact will be the species we lose to extinction, whose absence will be detectable for millions of years, and which we will never get back once they are gone.

The good news is that we can prevent most if not all extinctions using validated tools, and we have hundreds of success stories to build on. When I was growing up, there were few brown pelicans left in the U.S.; today in central California one cannot stand on the beach for five minutes without seeing squadrons of pelicans fly by. The California condor was extinct in the wild, surviving only in zoo breeding programs for most of the 20th century. Today, it is once again soaring over the Grand Canyon and the Big Sur coast. These successes, and scores of others, were possible because of coordinated action by federal, state and Tribal agencies, conservation organizations and communities. By enabling these entities to address conservation

[1]Ceballos, G., Ehrlich, P. R., Barnosky, A. D., García, A., Pringle, R. M., & Palmer, T. M. (2015). Accelerated modern human–induced species losses: Entering the sixth mass extinction. *Science Advances 1*: e1400253.

priorities and to coordinate their efforts, the bills we are discussing today could catalyze many more such successes.

While preventing extinctions and recovering wildlife are huge undertakings, targeted efforts can make enormous headway. Not all species are equally imperiled, and not all are equally difficult to safeguard and secure. Of the roughly 900 known global extinctions that have taken place since the year 1600, 89% have occurred on islands and in freshwaters, which make up less than 3% of the Earth's surface (Figure 1). Almost two-thirds of the world's present critically endangered and endangered species occur on this same narrow slice of the globe[2]. This is because islands and freshwaters, like rivers and lakes, are both home to disproportionate numbers of unique wildlife and plant species, and disproportionately vulnerable. It means that focus on those most diverse and vulnerable settings can bring about significant progress.

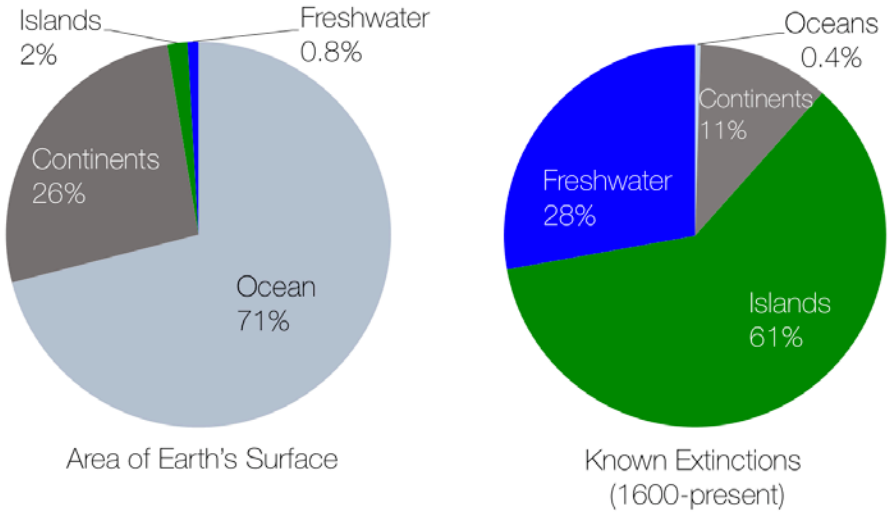

Figure 1. Distribution of Earth's surface across continental, ocean, freshwater and island areas (left) and distribution among those four Earth surface categories of the 890 extinctions known to have occurred from 1600 to 2019 across all taxonomic groups Data: IUCN Red List 2019, Tershy et al. 2015[3].

Moreover, certain threats to wildlife prevail in different settings, which lets us focus with precision on those threats. On islands, more than 85% of all the extinctions in recent centuries were caused, at least in part, by invasive species[2]. Invasive species have also contributed to 41% of freshwater extinctions. Removing invasive species from islands and freshwaters where they imperil native wildlife and plants would have a substantial impact on global extinction risks. We are fortunate also to have organizations in the US focused specifically on these greatest needs, such as Freshwater Life and Island Conservation - entrepreneurial organizations with strong track records not only at protecting wildlife but also at working effectively with agencies and Indigenous and local partners around the world and here at home[4].

The suite of bills today concerning imperiled species are focused on the right cases. They target the most at-risk species and settings, and some of the ones we are most able to protect:

---

[2]Data source: IUCN Red List 2019. 61% of all critically endangered and endangered species on the IUCN Red List occur on islands or in freshwaters.

[3]Tershy, B. R., Shen, K. W., Newton, K. M., Holmes, N. D., & Croll, D. A. (2015). The importance of islands for the protection of biological and linguistic diversity. *Bioscience*, *65*(6), 592-597.

[4] https://fwlife.org/; https://www.islandconservation.org/

- The current version of the Extinction Prevention Act, by directing funds towards the conservation of Pacific Island plants and U.S. freshwater mussels and fishes, would support precisely the freshwater and island settings where imperiled wildlife are most concentrated.
- Among invertebrate wildlife, mollusks are the most imperiled group of wildlife in the world, with more than a tenth of them categorized as Extinct or Critically Endangered on the IUCN Red List. Most of the freshwater mussel species in the United States are imperiled, and they are a focus for protection under the current draft of the Extinction Prevention Act.
- Among vertebrate wildlife, the most imperiled group on Earth are amphibians, nearly a tenth of which are Extinct or Critically Endangered on the International Union for the Conservation of Nature Red List (Figure 2) and approximately 40% of which are in an IUCN threatened category[5]. The Global Amphibian Protection Act, as currently drafted, would help us protect this most imperiled group of salamanders, frogs, toads and newts from extinction.
- At least one in six U.S. butterfly species are at risk of extinction[6]. Some have had their distribution restricted to a single, tiny area - like Edith's Bay Checkerspot Butterfly, whose last significant habitat on Earth flanks San Jose, California's expanding city landfill[7]. Others are more widespread but have crashed in numbers - like the western U.S. population of Monarch butterflies, whose numbers have declined at least 97% in the last two decades[8].

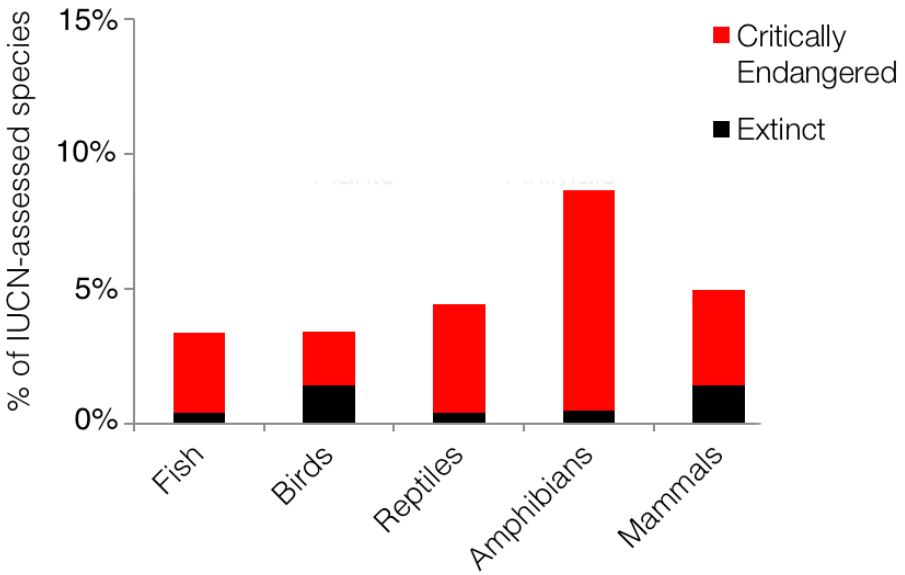

Figure 2. Extinct and Critically Endangered vertebrate wildlife species. Values are expressed as percentages of those species assessed by the International Union for the Conservation of Nature (IUCN) in each displayed group. The IUCN Red List is widely recognized as the world's most authoritative, science-based guide to the status of the world's wildlife and plant species Data: IUCN Red List 2019.

[5] https://www.iucnredlist.org/resources/summary-statistics

[6] Stein, B. A., N. Edelson, L. Anderson, J. Kanter, and J. Stemler. 2018. Reversing America's Wildlife Crisis: Securing the Future of Our Fish and Wildlife. Washington, DC: National Wildlife Federation

[7] US Fish and Wildlife Service (2021). Information for Planning and Consultation. <https://ecos.fws.gov/ipac/> Accessed July 18, 2021.

[8] US Fish and Wildlife Service (2020). Monarch (*Danaus plexippus*) Species Status Assessment Report, v. 2.1 (Sept. 2020). < https://www.fws.gov/savethemonarch/pdfs/Monarch-SSA-report.pdf> Accessed July 18, 2021.

Protecting wildlife and wildlife values before they become rare

A second critical conservation priority is the enormous, unmet need to steward and protect wildlife before it species reach crisis points in our 50 states, Tribal lands and territories. State Wildlife Action Plans and Tribal wildlife efforts address the needs of at least 12,000 species in the United States. Many of them are not yet threatened with extinction, but most are declining in numbers and shrinking in extent. Threats to wildlife across the U.S. include:

- habitat loss, which can be addressed through restoration and management on a range of working and protected lands[9];
- diseases ranging from Sudden Oak Death Syndrome in western trees to chytrid fungus and White-Nose Syndrome ravaging frogs and bats across the continent;
- invasive species, many of which can be effectively removed or controlled, such as the invasive plants threatening numerous butterfly species and invasive fishes threatening native fishes in our lakes and rivers;
- and pollution, which affects everything from freshwater mussels in the Southeastern states to rare plants in California.
- These threats often interact with each other and with climate change. For instance, invasive mosquitoes in Hawaii carry avian malaria, an introduced disease deadly to Hawaii's native birds. Some of these imperiled birds have eked out survival on the high-altitude flanks of Hawaii's volcanoes, but progressive warming lets the mosquitoes expand malaria higher and higher, eroding the birds' last safe haven from disease[10].

The Recovering America's Wildlife Act as currently drafted would transform states' and Tribes' abilities to act, on behalf of both wildlife and the public who enjoy and care about them, to address these threats. The current version of the Recovering America's Wildlife Act (RAWA) amends the Pittman-Robertson Wildlife Restoration Act by expanding funding to states and Tribes for their wildlife conservation efforts at a time when they are stretched to the limit to sustain this work. RAWA expands funding for and partnership opportunities to Tribes, with their tremendous stake in and expert knowledge about wildlife stewardship. This is to be celebrated because wildlife diversity is high on Tribal lands, and its stewardship, despite great successes like the recovery of the Apache trout[11], is chronically underfunded. Finally, RAWA would establish an Innovation Grant program for conservation efforts to spur the kind of entrepreneurship and ingenuity that has propelled biodiversity conservation successes ranging from the recovery of peregrine falcons and bald eagles to the successful prevention of new biological invasions throughout the U.S.

This opportunity is urgent if we are to protect wildlife, and the values they provide to natural systems and people, while they are still secure. Lesser-known species often shore up the systems and species we recognize and rely on. For example, kelp, an unassuming algae growing off our coasts, forms marine nurseries for a tremendous diversity of economically and culturally important fishes, crabs, abalone and seabirds[12]. Lake insects like dragonflies and mayflies form

---

[9] Kremen, C. (2015). Reframing the land-sparing/land-sharing debate for biodiversity conservation. *Annals of the New York Academy of Sciences*, *1355*(1), 52-76.

[10] Liao, W., Atkinson, C. T., LaPointe, D. A., & Samuel, M. D. (2017). Mitigating future avian malaria threats to Hawaiian forest birds from climate change. *PloS one*, *12*(1), e0168880.

[11] Arizona Game and Fish Department, *Apache Trout Recovery: A Wildlife Success Story.* < https://www.azgfd.com/wildlife/speciesofgreatestconservneed/apachetrout/>. Accessed July 26, 2021.

[12] Rogers-Bennett, L., & Catton, C. A. (2019). Marine heat wave and multiple stressors tip bull kelp forest to sea urchin barrens. *Scientific reports*, *9*(1), 1-9.

the base of whole food chains of songbirds, frogs, falcons, hawks and foxes in the mountains of the West[13]. As wildlife disappear from the natural places that people love and call home, those wildlife can no longer contribute to food webs, water quality, pest control, recreation and cultural values in those places. We have the opportunity to sustain thousands of species proactively, before we give up more of their contributions to nature and people.

Finally, it is cost-effective to support existing efforts and expertise held by state agencies and Tribes rather than to reinvent efforts; and it is cost-effective to protect wildlife while the need is to sustain them, rather than to wait until we have to take extraordinary measure to claw them back from the brink of extinction. For both critically endangered wildlife and species of concern, conservation investments ripple through the ecological systems that these wildlife contribute to, multiplying the reach and effects of stewardship and restoration. The Recovering America's Wildlife Act as currently drafted would deliver benefits outsized compared the funds it will provide to allow state wildlife agencies and Tribes, with their place-based expertise and knowledge, to apply it to stewarding our vast wildlife heritage.

Conserving wildlife, land and water in the face of climate change

The United States needs a climate adaptation strategy if we are to successfully steward wildlife, water and landscapes in the coming years. This is because we need to ensure that our efforts are robust to new, emerging conditions. The world is changing rapidly. Since the 1950s, extreme rainfall events have increased markedly in 49 of the 50 US States and Puerto Rico, and heat wave season has increased by nearly two months (Figure 3). Year-round temperatures have increased in most locations, especially at night; Western snowpack has declined at most areas by 20 to over 80%; and our oceans have acidified and expanded, leading to more frequent coastal flooding. As a result, Arctic ice has receded, U.S. wildfires have burned an increasing land area each year, and growing conditions have changed markedly in much of the country[14].

Extreme events like the wildfires, heat emergencies, hurricanes and floods that have taken lives and damaged communities in just the last year have also affected wildlife, lands, waters and our ability to successfully manage them. Wildlife ranging from salmon and songbirds to oaks and pinyon pines have suffered major heat, smoke and drought-related mortality events. Low water and warm water in Western rivers this summer have forced state wildlife agencies to take emergency measures, like trucking fish from California rivers to safe havens in distant hatcheries to survive the hot, dry summer[15]. Longer-term conservation investments also need to reflect climate trends to be effective. Conserving oak trees in California might require replanting burned woodlands with acorns from drought-adapted woodlands farther south[16]. Recovering red-legged frogs calls for anticipating where sea level rise will inundate their freshwater coastal habitats[17],

[13] Epanchin, P. N., Knapp, R. A., & Lawler, S. P. (2010). Nonnative trout impact an alpine-nesting bird by altering aquatic-insect subsidies. *Ecology*, *91*(8), 2406-2415.

[14]Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.). 2018: *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II* U.S. Global Change Research Program, Washington, DC, USA, 1515 pp.

[15]California Department of Fish and Wildlife (2021). CDFW Successfully Relocates 1.1 Million Hatchery Salmon Until Klamath River Drought Conditions Improve. (July 13, 2021). < https://wildlife.ca.gov/News/cdfw-successfully-relocates-11-million-hatchery-salmon-until-klamath-river-drought-conditions-improve> Accessed July 23, 2021.

[16] McLaughlin, B. C., & Zavaleta, E. S. (2012). Predicting species responses to climate change: demography and climate microrefugia in California valley oak (*Quercus lobata*). *Global Change Biology*, *18*(7), 2301-2312.

[17] Moore, S.S., N.E. Seavy, and M. Gerhart. 2013. Scenario planning for climate change adaptation: A guidance for resource managers. Point Blue Conservation Science and California Coastal Conservancy.

and recovering cold-water fish calls for prioritizing rivers and streams that will be able sustain cold flows as warming and drought progress[18]. These are just a few examples to illustrate how climate change and extreme events could undermine our efforts to conserve wildlife and natural lands if we ignore them, or could guide our priorities and actions to adapt effectively to changing conditions if we strategize proactively.

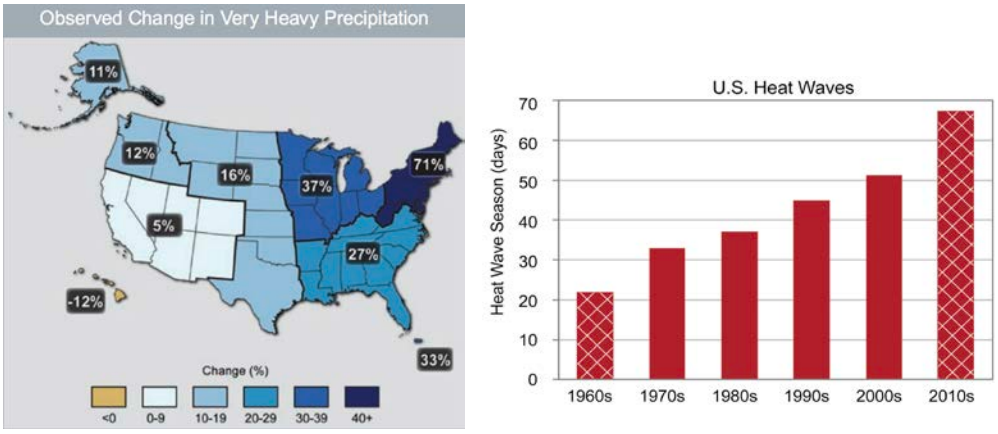

Figure 3. (left): Observed changes in very heavy precipitation,1958-2012. Data show the change in the percent of total annual rainfall falling during the very heaviest events (top 1%). Clear increasing trends make flooding, debris flows and other impacts of heavy rain events more likely, but also make longer dry periods between rain events more likely. Source: U.S. Third National Climate Assessment (2014)[19]. **(right)**: **Observed changes in the length of heat wave season in the United States.** Hatched bars indicate that data do not include some years in the early 1960s and the late 2010s. Source: U.S. Fourth National Climate Assessment (2018)[13].

Moreover, hurricanes, wildfires, floods, heat waves, long-term drought and other extreme events increasing in frequency and severity do not respect jurisdictional boundaries. This means the need for coordinated planning and response among federal, state, Tribal and local governments and communities, and across federal agencies, is especially urgent. The current version of the SAFE Act restores federal cross-agency coordination and planning so that agency responses are aligned and robust to the new and evolving conditions we face. This working group would develop and implement a national, science-based strategy to adapt to changing climate in partnership with state, local, Tribal and other experts and scientists. This would reduce costs by reducing redundancy of efforts across federal agencies. The SAFE Act as currently drafted would also specifically enable agencies to identify and prioritize specific conservation and management strategies to respond to extreme weather and climate change. This work should build on the existing Climate Adaptation Science Center network as a key hub for adaptation expertise. Finally, the draft SAFE Act's emphasis on updating the national fish, wildlife, and plants climate adaptation strategy on a regular basis is important, because as climatic conditions

[18]Oakes, L. E., Cross, M. S., & Zavaleta, E. S. (2021). Rapid assessment to facilitate climate-informed conservation and nature-based solutions. *Conservation Science and Practice*, e472.

[19] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 pp.

continue to change, adaptation plans and strategies need to be reviewed, revised, and updated to take those changing climatic, ecological, and societal conditions into account.

Protecting Ocean Ecosystems and Wild Fisheries from Aquaculture Risks

The best way to protect the oceans; sustain good, ocean-related jobs; and put food on American plates is well-managed wild fisheries. Fortunately we have learned how to manage fisheries, and today 89% of U.S. marine fish stocks are recovered or recovering[20]. Large-scale aquaculture breaks the links between healthy oceans, fisheries related jobs and fish on America's tables. In so doing, it can threaten all three. A precautionary approach to finfish aquaculture would ensure that we protect the fisheries that the U.S. and much of the world depends on for livelihoods and seafood, and our coastal oceans from pollution, habitat loss, and invasion by domestic and genetically engineered fishes with the potential to cause widespread and lasting harm.

Genetically altered finfishes may pose especially severe risks to wild fishes because if they escape, they could introduce domesticated and engineered genes into wild fish populations, dismantling the genetic diversity, place-based adaptations and ability to respond adaptively to change of salmon and other wild fishes. Both genetically engineered and domesticated fishes introduced into the oceans would also compete with and prey upon marine wildlife, disrupting the balance of interactions that allow so many species of marine animals to coexist. Introductions into the wild of genetically engineered fishes and the genes they carry would likely be impossible to reverse. California already has banned transgenic and exotic finfish aquaculture in its state waters[21]. Expanded protection would reduce the risks posed by genetically engineered finfishes to the rest of the Pacific coast.

Conclusion

In summary, we have before us a sweeping set of measures. They would help secure critically endangered wildlife with precise, targeted funding; transform the ability of states, Tribes, U.S. territories, and public and private partners to effectively steward fish, wildlife and plants; climate-proof our wildlife conservation and stewardship efforts; and secure coastal oceans against the incipient threats posed to them by finfish aquaculture. I urge the Committee to support these measures on behalf of the American people, whose varied and deep connections to animals, plants, water and land in the U.S. and abroad make conservation a national priority.

[20] NOAA (2019) Status of Stocks. <fisheries.noaa.gov/national/sustainable-fisheries/status-stocks-2019>. Accessed July 24, 2021. The value of 89% is a weighted average of separate reported values for stocks with known overfishing and overfished status, of which 93% and 81%, respectively, are recovering (harvested below Maximum Sustainable Yield).

[21] AB 504 (2014), https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201320140AB504