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Sea-Level Rise and the Endangered Species Act

Dave Owen*

I. INTRODUCTION

Through no fault of their own, piping plovers have chosen their habitats poorly. Many piping plovers nest on ocean beaches, and all piping plovers spend their winters foraging and sheltering on dry beaches and in the adjacent intertidal zone.¹ Consequently, piping plovers are heavily dependent—for some populations, entirely dependent—on habitats very close to sea level.² Because of widespread coastal development, these habitats have long been under threat, and the threat has recently taken on an added dimension. Rising sea levels, caused in part by greenhouse gas emissions and associated climate change, are beginning to inundate the piping plover's present habitats.³ As its habitats disappear, the piping plover may disappear as well.⁴

The piping plover is not alone in its plight.⁵ The Fish and Wildlife Service and the National Marine Fisheries Service ("FWS" and "NOAA Fisheries," collectively "the Services"), the two federal agencies with primary responsibility for protecting threatened and endangered species, have not compiled any sort of

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* Associate Professor, University of Maine School of Law. I thank Katherine Lybrand, John O'Hara, and Lauren Parker for research assistance, and the staff of the Louisiana Law Review for editorial assistance and for inviting me to participate in this symposium.

1. See U.S. FISH & WILDLIFE SERV., PIPING PLOVER (CHARADRIUS MELODUS) 5-YEAR REVIEW: SUMMARY AND EVALUATION 17, 23–30 (2009), http://www.fws.gov/northeast/endangered/PDF/Piping_Plover_five_year_review_and_summary.pdf (describing the piping plover's range and habitat needs). Populations breeding in the upper Midwest rely on beaches and dunes adjacent to freshwater, but spend their winters along the Gulf Coast. See *id.* at 13. The intertidal zone is the area between the high- and low-tide lines.

2. See *id.* at 29–30.

3. *Id.* at 50–52.

4. See *id.* at 52 ("Sea-level rise poses a significant threat to all piping plover populations during the migration and wintering portion of their life cycle.").

5. See Reed F. Noss, *Between the Devil and the Deep Blue Sea: Florida's Unenviable Position with Respect to Sea Level Rise*, 107 CLIMATIC CHANGE 1, 3 (2011) ("[T]he impacts of sea level rise constitute one of the greatest potential causes of global species extinctions and ecosystem disruption over coming decades and centuries.").

comprehensive list of species imperiled by sea-level rise.⁶ But if they did, the list would likely be quite long. Hawaiian monk seals,⁷ many species of sea turtles,⁸ Louisiana black bears,⁹ black abalones,¹⁰ Atlantic sturgeon,¹¹ and any species unique to the Florida Keys¹² would headline an extensive list of species whose habitats may soon be inundated, infiltrated with saltwater, or compressed between an encroaching ocean and the hard edges of human development.¹³ Most, if not all, of those species were already under threat, whether because of habitat alteration, invasive species, pollution, or some combination of factors.¹⁴ For some, the addition of rising seas may represent a tipping point toward extinction.

This Essay addresses how environmental law is, or is not, responding to that threat. I focus on the Endangered Species Act (“ESA”), which serves as the last line of defense for many species imperiled with extinction. At present, that defense is not

6. With some exceptions, FWS generally holds jurisdiction over terrestrial and freshwater species, and NMFS generally holds jurisdiction over marine and diadromous species.

7. Jason D. Baker et al., *Potential Effects of Sea Level Rise on the Terrestrial Habitats of Endangered and Endemic Megafauna in the Northwestern Hawaiian Islands*, 2 ENDANGERED SPECIES RES. 21 (2006) (describing threats to Hawaiian monk seals and several other species).

8. Lucy A. Hawkes et al., *Climate Change and Marine Turtles*, 7 ENDANGERED SPECIES RES. 137, 138–39 (2009).

9. See Richard F. Keim et al., *Ecological Consequences of Changing Hydrological Conditions in Wetland Forests of Coastal Louisiana*, in COASTAL ENVIRONMENT AND WATER QUALITY 383–96 (Y.J. Xu & V.P. Singh eds., 2006) (identifying sea-level rise as a threat to Louisiana’s coastal forests and black bears as dependent upon those forests).

10. Endangered and Threatened Wildlife and Plants; Endangered Status for Black Abalone, 74 Fed. Reg. 1937, 1939 (Jan. 14, 2009) (identifying sea-level rise as a “medium threat” to the species).

11. See Endangered and Threatened Wildlife and Plants; Final Listing Determinations for Two Distinct Population Segments of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the Southeast, 77 Fed. Reg. 5914, 5972 (Feb. 6, 2012).

12. See Joyce Maschinski et al., *Sinking Ships: Conservation Options for Endemic Taxa Threatened by Sea Level Rise*, 107 CLIMATIC CHANGE 147, 148–50 (2011) (discussing threats to Florida Keys species).

13. Because sea-level rise is a global problem, a full list would include hundreds of species from other countries as well. See, e.g., Christina J. Greenwood & Ishtiaq Uddin Ahmad, *The Tigers of Bangladesh*, U.S. FISH & WILDLIFE SERV., <http://www.fws.gov/endangered/news/bulletin-spring2010/the-tigers-of-bangladesh.html> (2010) (noting that sea-level rise threatens the survival of the world’s largest remaining population of wild tigers).

14. In the course of researching for this Essay, I have not found any documentation of a species imperiled exclusively by sea-level rise. Instead, sea-level rise is always one of several threats.

particularly strong, for sea-level rise presents the Services with a very difficult dilemma. An aggressive regulatory response might help protect species, but the practical and political barriers to aggressive regulation are daunting.¹⁵ Consequently, the Services, though quite willing to acknowledge the gravity of the threat, have studiously eschewed any attempt to invoke their regulatory powers to respond to sea-level rise.¹⁶ Instead, they have used information and persuasion as their primary means of changing the ways that public and private entities manage the coastal zone.¹⁷ That softer approach comports with a widely-shared sense that the future of environmental law lies in collaborative, adaptive, and cooperative alternatives to traditional regulation.¹⁸ And, of course, it acknowledges the political controversies surrounding biodiversity protection and, more generally, regulatory governance. But even if the Services' approach is understandable, its odds of success are rather slim.¹⁹

No innovation in governance will make this dilemma disappear.²⁰ Consequently, while this Essay closes by suggesting several modest reforms, its broader point will strike most readers as a familiar lament. Notwithstanding the deregulatory fashions of our present era, and the understandable desire of environmental thinkers to find some less legalistic way to achieve positive environmental change, a serious response to sea-level rise will necessitate a genuine commitment to environmental regulation. There is really no other choice.

In Part II, this Essay begins by describing the causes and environmental consequences of sea-level rise. Part III then explores the potential application of the ESA to sea-level rise, first surveying the regulatory and non-regulatory tools set forth in the statute, and then considering how they might be implemented. Part IV turns from potential application to actual practices, describing

15. See *infra* Part V.

16. See *infra* Part IV.

17. See *infra* notes 94–102 and accompanying text.

18. See, e.g., Carol A. Casazza Herman et al., *The Breaking the Logjam Project*, 17 N.Y.U. ENVTL. L.J. 1, 1 (2008) (criticizing traditional environmental law as obsolescent); Cass R. Sunstein, *Administrative Substance*, 1991 DUKE L.J. 607, 627 (blaming “rigid, highly bureaucratized ‘command-and-control’ regulation” for “regulatory failure”).

19. See *infra* Part IV.

20. For articles offering creative solutions to the biodiversity threats posed by climate change, see Alejandro E. Camacho, *Assisted Migration: Redefining Nature and Natural Resources Law Under Climate Change*, 27 YALE J. ON REG. 171 (2010); Maschinski et al., *supra* note 12 (evaluating relocation of species as an option). But as both articles acknowledge, the obstacles to successful species relocations are likely to be substantial.

what the Services have actually done to address sea-level rise. Part V explores why there are significant differences between theoretical possibilities and actual practices, and this Essay concludes with suggestions for partial reform.

II. RISING SEAS AND CHANGING HABITATS

Sea levels are rising.²¹ The changes are incremental and uneven; in some areas, land elevations are also rising, which slows or negates the apparent change, and in others, land is subsiding, thereby accelerating the impacts of rising seas.²² But across the globe, average sea levels rose by approximately 1.7 millimeters per year over the past century.²³ Predictions of future sea-level rise vary significantly and have substantial error ranges, though some level of accelerated change is all but certain.²⁴ Several recent studies project as much as four feet of sea-level rise by the end of the twenty-first century and continued change thereafter.²⁵ If substantial portions of the Greenland or Antarctic ice sheets melt, the changes could be much more drastic.²⁶

21. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS 387 (Susan Solomon et al. eds., 2007). See also Stefan Rahmstorf et al., *Recent Climate Observations Compared to Projections*, 316 SCI. 709, 709 (2007) (“Since 1990 the observed sea level has been rising faster than the rise projected by models . . .”).

22. See *Coastal Areas Impacts & Adaptation*, U.S. ENVTL. PROT. AGENCY, <http://www.epa.gov/climatechange/impacts-adaptation/coasts.html#impactssea> (last updated June 14, 2012).

23. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: IMPACTS, ADAPTATIONS AND VULNERABILITY 320 (M.L. Parry et al. eds., 2007), available at <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter6.pdf>.

24. See, e.g., Martin Vermeer & Stefan Rahmstorf, *Global Sea Level Linked to Global Temperature*, 106 PROC. NAT’L ACAD. SCI. 21527, 21531 (2009) (predicting changes three times higher than most recent projections of the Intergovernmental Panel on Climate Change).

25. Endangered and Threatened Wildlife and Plants; Listing of the Miami Blue Butterfly as Endangered Throughout Its Range; Listing of the Cassius Blue, Ceraunus Blue, and Nickerbean Blue Butterflies as Threatened Due to Similarity of Appearance to the Miami Blue Butterfly in Coastal South and Central Florida, 77 Fed. Reg. 20948, 20970 (Apr. 6, 2012) (summarizing recent studies).

26. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 23, at 317 (“Irreversible breakdown of the West Antarctica and/or Greenland ice sheets, if triggered by rising temperatures, would make this long-term rise significantly larger, ultimately questioning the viability of many coastal settlements across the globe.”).

The primary cause of these changes has long been clear.²⁷ Sea levels are rising because average global temperatures are rising, and those rising temperatures cause liquid water to expand and ice to melt.²⁸ Global temperatures are rising largely because of human emissions of greenhouse gases, which increase the capacity of the atmosphere to retain energy radiated upward as heat.²⁹ Those greenhouse gas emissions derive from a wide variety of sources and activities, with fossil fuel combustion contributing the lion's share.³⁰ That fossil fuel combustion, in turn, supports electric power generation, transportation, manufacturing, and domestic heating across much of the world.³¹

Those rising seas threaten biodiversity in several ways. Many coastal areas have gradual topography, and a slight rise in sea levels can inundate many acres of land.³² Areas that were previously subject to the ebb and flow of the tides will become open water; dry sand beaches and coastal wetlands will be flooded; inland freshwater wetlands, forests, or dune habitats will be displaced by more salt-tolerant assemblages; and freshwater streams and aquifers may turn brackish or saline.³³ These habitat shifts will be stressful for species even in undeveloped areas, but where humans have built up the coastal zone, habitat zones cannot migrate landward as sea levels rise. As a result, some habitats will be lost.³⁴ The problem is even more acute for areas with hardly any topographic variation, like southern Florida or southern Louisiana. There, habitat migrations would have to be exceedingly rapid to

27. See, e.g., James G. Titus, *Sea Level Rise, in THE POTENTIAL EFFECTS OF CLIMATE CHANGE ON THE UNITED STATES: REPORT TO CONGRESS 118*, 118–19 (1989) (describing the “greenhouse effect” as a cause of sea-level rise).

28. See INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 21, at 408.

29. See *id.* at 133–36.

30. See *id.* at 136 (quantifying contributions from various sources).

31. See generally U.S. ENVTL. PROT. AGENCY, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS, 1990–2010 (2012), available at <http://epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2012-Main-Text.pdf>.

32. See, e.g., James G. Titus & Charlie Richman, *Maps of Lands Vulnerable to Sea Level Rise: Modeled Elevations along the U.S. Atlantic and Gulf Coasts*, 18 CLIMATE RES. 205, 217–23 (2001) (mapping vulnerable areas in Louisiana, Florida, North Carolina, and the mid-Atlantic coast).

33. See Ann Shellenbarger Jones et al., *Vulnerable Species: The Effects of Sea-Level Rise on Coastal Habitats*, in U.S. CLIMATE CHANGE SCIENCE PROGRAM, COASTAL SENSITIVITY TO SEA-LEVEL RISE: A FOCUS ON THE MID-ATLANTIC REGION 73–83 (2009) (describing habitat impacts).

34. See Noss, *supra* note 5, at 3 (“[H]uman development adjacent to the coasts has destroyed suitable habitat and severed potential dispersal corridors to inland areas that might otherwise accommodate range shifts.”).

keep pace with rising seas.³⁵ In some areas—the Florida Everglades and Keys provide perhaps the starkest examples—there may soon be nowhere that the habitat can go.³⁶ And as habitat goes, so, often, go the species.³⁷

III. LEGAL OPTIONS

To all of this we have, in theory, a legislative response. According to conventional wisdom, the ESA is one of the most powerful environmental laws in the world.³⁸ It combines mandatory procedures with seemingly stringent regulatory prohibitions, creating a formidable set of coercive sticks, and it also empowers the Services to use a variety of incentive- and information-based strategies. This Part addresses how all of these tools might help the Services respond to sea-level rise.

A. Section 4

The ESA's regulatory and nonregulatory protections begin with section 4, which sets forth procedures for listing species as threatened or endangered, designating critical habitat for those species, and drafting recovery plans.³⁹ Section 4 itself does not provide any regulatory protection for species. Other than authorizing recovery plans, which typically are not binding, it simply provides procedures for making species eligible for protection. But outside of a few narrow exceptions, a listing under

35. See *id.*; John C. Ogden et al., *The Use of Conceptual Ecological Models to Guide Ecosystem Restoration in South Florida*, 25 WETLANDS 795, 801 (2005) ("Given that Florida is characterized by very small topographic relief, a conservatively estimated sea-level rise of 0.75 m over the next century will reduce shoreline habitat, overall habitat extent, and mix sediments and salinities altering water composition." (citation omitted)).

36. See generally THE NATURE CONSERVANCY, INITIAL ESTIMATES OF THE ECOLOGICAL AND ECONOMIC CONSEQUENCES OF SEA LEVEL RISE ON THE FLORIDA KEYS THROUGH THE YEAR 2100 (2009) (mapping future scenarios for the Florida Keys, some of which involve nearly complete inundation).

37. See David S. Wilcove et al., *Quantifying Threats to Imperiled Species in the United States*, 48 BIOSCIENCE 607, 609 (1998) (identifying habitat loss as the largest threat to threatened and endangered species).

38. See, e.g., William H. Rodgers, Jr., *Indian Tribes*, in 1 THE ENDANGERED SPECIES ACT AT THIRTY: RENEWING THE CONSERVATION PROMISE 161, 170 (Dale D. Goble et al. eds., 2006) (describing the ESA as "the strongest environmental law in the world").

39. See 16 U.S.C. § 1533 (2006).

section 4 is a condition precedent to any other protection under the Act.⁴⁰

One might expect sea-level rise to affect section 4 implementation in several ways. First, the Services might consider sea-level rise when making their listing decisions.⁴¹ Section 4 lists several factors that the Services must take into account, including “the present or threatened destruction, modification, or curtailment of [the species’] habitat or range.”⁴² That factor clearly encompasses the effects of sea-level rise.⁴³ Second, the Services might adjust or expand their critical habitat designations to encompass inland areas likely to become essential as sea levels rise.⁴⁴ The ESA defines critical habitat as habitat “essential to the conservation of the species,” and if existing habitat will be inundated, then the habitat that remains, or even habitat areas that are not presently suitable for the species, may become essential.⁴⁵ Finally, recovery plans could include a wide variety of provisions designed to allow species to adjust to rising seas.⁴⁶

B. Section 7

While section 4 establishes species’ eligibility for protection, the actual protection comes from elsewhere in the statute, with section 7 playing a central role.⁴⁷ Section 7 prohibits federal

40. Unlisted species may be the beneficiaries, incidentally and sometimes intentionally, of the protection of species listed under the Act, but sections 7 and 9 extend their direct protections only to species actually listed.

41. See J.B. Ruhl, *Climate Change and the Endangered Species Act: Building Bridges to the No-Analog Future*, 88 B.U. L. REV. 1, 33 (2008) (arguing that “[s]ection 4 leaves no room for debate over whether the agency must integrate climate change effects in the listing decision”).

42. 16 U.S.C. § 1533(a)(1)(A).

43. See *supra* notes 32–37 and accompanying text.

44. See Ruhl, *supra* note 41, at 36 (“[T]he provision allowing designation of specific areas outside the geographical area occupied by the species if ‘essential for the conservation of the species’ may be an ideal way for FWS to respond aggressively to ecological reshuffling.”).

45. 16 U.S.C. § 1532(5)(A) (2006). Not all essential areas are to be included; the definition includes only those essential areas “which may require special management considerations or protection.” *Id.* The definition also expressly includes presently unoccupied habitat if it meets the “essential” criterion. See *id.* § 1532(5)(A)(ii).

46. See 16 U.S.C. § 1533(f); Anna T. Moritz et al., *Biodiversity Baking and Boiling: Endangered Species Act Turning Down the Heat*, 44 TULSA L. REV. 205, 222 (2008) (“[T]he section 7 consultation process is the heart of the ESA.”).

47. 16 U.S.C. § 1536 (2006). Many commentators view section 7 as the most influential portion of the ESA. However, in practice, implementation of sections 7 and 9 is closely intertwined, and the influence of the two sections can

agencies from taking actions likely to “jeopardize” the continued existence of listed species or to “result in the destruction or adverse modification” of designated critical habitat.⁴⁸ Section 7 also creates detailed procedural requirements for putting that substantive mandate into effect. If their activities may affect listed species, federal agencies are obligated to “consult” with one of the Services, depending on which agency holds jurisdiction over the affected species. The Services must provide either a concurrence that the proposed project’s effects will not be adverse or, if some adverse effect is possible, a “biological opinion” assessing whether the project is likely to cause jeopardy or adverse modification and prescribing adjustments to reduce or eliminate the adverse impacts.⁴⁹ This consultation process rarely halts projects, but every year it leads to thousands of environmentally protective project changes.⁵⁰

As with section 4, the Services might use section 7 to respond to sea-level rise in several ways. First, and perhaps most ambitiously, the Services might use the section 7 process to address the root causes of climate change.⁵¹ Thus, when federal agencies consider actions that will accelerate greenhouse gas emissions or eliminate greenhouse gas sinks,⁵² the Services might require consultation. Through those consultation processes, the Services might negotiate or impose conditions designed to avoid or mitigate emissions.⁵³

Even if the Services do not take that step, they might invoke sea-level rise as a reason to ratchet up their efforts to address other

be difficult to separate. See Dave Owen, *Critical Habitat and the Challenge of Regulating Small Harms*, 64 FLA. L. REV. 141, 187 & n.292 (2012) (explaining how section 7 consultations almost invariably lead to restrictions designed to avoid “takes” of listed species).

48. 16 U.S.C. § 1536(a)(2). Section 7(a)(1), which requires all federal agencies to take steps to conserve listed species, has proven less influential in practice, and I do not discuss its importance here.

49. 16 U.S.C. § 1536(b), (c) (setting forth the consultation requirements).

50. See Owen, *supra* note 47, at 163–64.

51. See Moritz et al., *supra* note 46, at 207 (“The regulation of greenhouse gas emissions under the ESA through the Section 7 consultation process is legally required and of great practical importance.”). *But see* Ruhl, *supra* note 41, at 46–47 (arguing that the consultation process applies poorly to greenhouse gas sources).

52. A greenhouse gas sink is a landscape feature, like a growing forest, that removes greenhouse gases from the atmosphere.

53. See Moritz et al., *supra* note 46, at 223–29.

threats.⁵⁴ For example, if a species is likely to be threatened by saltwater intrusion, the Services might seek more stringent controls on upstream water withdrawals and pollutant discharges.⁵⁵ The gravity of those other threats may increase as sea-level rise adds a new stressor, creating a likelihood of jeopardy or adverse modification even if the same activities would pose less of a threat in a world without climate change.⁵⁶ Consequently, the Services might reach more jeopardy or adverse modification findings, or they might use the section 7 process to impose more protective conditions in an effort to increase species' capacity to survive despite rising seas.

C. Section 9 (and Sections 7 and 10)

The ESA's other major substantive constraint comes from section 9, which prohibits anyone from "taking" endangered species.⁵⁷ That prohibition appears far-reaching, particularly because the Services interpret the prohibition to include some modifications to habitat.⁵⁸ Nevertheless, exceptions to the prohibition do exist. "Incidental" takes are allowed pursuant to approved "incidental take statements," which the Services issue through the section 7 consultation process, and pursuant to "habitat conservation plans," which are governed by ESA section 10.⁵⁹

54. See generally Robin Kundis Craig, "Stationarity is Dead"—*Long Live Transformation: Five Principles for Climate Change Adaptation Law*, 34 HARV. ENVTL. L. REV. 9, 43–45 (2010) (emphasizing the reduction of nonclimate stressors as a central priority for environmental protection in an era of climate change).

55. See, e.g., Endangered and Threatened Wildlife and Plants; Final Listing Determinations for Two Distinct Population Segments of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the Southeast, 77 Fed. Reg. 5914, 5972 (Feb. 6, 2012) (discussing the relationship between saltwater intrusion and other habitat stressors).

56. See *Natural Res. Def. Council v. Kempthorne*, 506 F. Supp. 2d 322, 367–69 (E.D. Cal. 2007) (rejecting as illegal a biological opinion that failed to consider whether climate change would exacerbate other strains upon the species); Moritz et al., *supra* note 46, at 223 ("[A] finding that allowing the destruction of certain coastal wetlands relied upon by a listed species will not equate to jeopardy because sufficient other wetlands still exist in a nearby preserve utterly fails to protect the species if the preserve will no longer exist in 50 years following another half-meter or more of sea level rise.").

57. 16 U.S.C. § 1538 (2006).

58. See *Babbitt v. Sweet Home Chapter of Cmty. for a Great Or.*, 515 U.S. 687 (1995) (upholding this interpretation).

59. See 16 U.S.C. § 1536(b)(4) (2006); *id.* § 1539(a); J.B. Ruhl, *How to Kill Endangered Species, Legally: The Nuts and Bolts of Endangered Species Act "HCP" Permits for Real Estate Development*, 5 ENVTL. LAW. 345 (1999).

Both incidental take statements and habitat conservation plans require compliance with conditions designed to minimize the impact of the take, and habitat conservation plans can also include measures to compensate for takes.⁶⁰

Like the jeopardy and adverse modification prohibitions, the take prohibition might address sea-level rise in two primary ways. First, a few commentators and activists have argued that at least some actions that emit greenhouse gases, and thus contribute to habitat modifications, are causing prohibited takes and should therefore face liability under section 9.⁶¹ Second, sea-level rise might provide a basis for finding that other incursions upon habitat or threats to species constitute a “take.” For example, amid stable sea levels, a beach-armoring program that degrades some habitat might not create a take because animals may be able to avoid the project area without incurring any harm. But if sea-level rise has left those animals with nowhere else to go, the same activity might be subject to section 9 liability.

D. Non-Regulatory Tools

When lawyers and politicians talk about the ESA, they tend to characterize it as a regulatory “pit bull,” a source of rigid and unyielding prohibitions.⁶² But actual implementation of section 7 and section 9 involves far fewer commands (let alone enforcement actions) and much more negotiation than the “pit bull” characterization would suggest.⁶³ The Services also have a variety of nonregulatory tools, many of which they could employ to address sea-level rise. They can draft recovery plans, which can provide blueprints for species conservation.⁶⁴ They can use federal

60. See 16 U.S.C. § 1536(b)(4)(C)(ii); *id.* § 1539(a) (requiring applicants to “minimize and mitigate” impacts).

61. See, e.g., Moritz et al., *supra* note 46, at 230–31. *But see* Ruhl, *supra* note 41, at 40–42 (concluding that plaintiffs could not show that a specific emissions source was the proximate cause of a take); Owen, *supra* note 47, at 160 (drawing a similar conclusion).

62. See, e.g., Steven P. Quarles, *The Pit Bull Goes to School: The Endangered Species Act at 25: What Works?*, 15 ENVTL. F. 55, 55 (1998).

63. See Owen, *supra* note 47, at 182–85.

64. See Anthony Povilitis & Kierán Suckling, *Addressing Climate Change Threats to Endangered Species in U.S. Recovery Plans*, 24 CONSERVATION BIOLOGY 372, 372 (2010) (“Recovery plans are the central organizing tool for guiding species restoration under the U.S. Endangered Species Act.”). Legal authors have generally been less sanguine in their estimation of the value of recovery plans, at least as they have traditionally been drafted. See, e.g., Federico Cheever, *The Road to Recovery: A New Way of Thinking About the*

money to purchase habitat.⁶⁵ They can manage areas that they already control, like wildlife refuges, to promote resilience in the face of rising seas, perhaps by restoring or creating habitat to compensate for likely losses elsewhere.⁶⁶ They can promote scientific research on the threats posed by sea-level rise and the ways that species might respond. Using that knowledge, they can participate, as informational resources and as advocates rather than as regulators, in state, local, and private decision-making processes.⁶⁷ And finally, they can try to educate the general public about the impacts of sea-level rise.⁶⁸ None of these options figures centrally in the average legal casebook's coverage of the ESA, but all are prominent in the Services' portfolio of tools.

IV. ACTUAL RESPONSES

So, what are the Services actually doing? The answer is not easy to discern. While the Services produce thousands of documents every year, most are not published to the Internet.⁶⁹ Nor do the Services produce summary statistics explaining how, if at all, their implementation approaches are evolving or changing. ESA implementation can therefore seem like a black box, and exposing that box's inner workings would require issuing dozens of Freedom of Information Act requests, reviewing hundreds—

Endangered Species Act, 23 *ECOLOGY L.Q.* 1, 16 & n.64 (1996) (arguing that recovery plans were often vague and usually unenforceable).

65. See, e.g., U.S. FISH & WILDLIFE SERV., FY 2011 COOPERATIVE ENDANGERED SPECIES CONSERVATION FUND PROJECT DESCRIPTIONS ARRANGED BY STATE (2012), available at <http://www.fws.gov/endangered/grants/Sect%206%20FY2011%20Combined%20Award%20Summaries%20Final%208-22.pdf>.

66. See, e.g., *Working with Nature to Prepare for the Change*, U.S. FISH & WILDLIFE SERV., <http://www.fws.gov/southeast/climate/stories/alligatorriver.html> (last updated Sept. 28, 2010) (describing efforts to promote habitat resiliency at the Alligator River National Wildlife Refuge in North Carolina) [hereinafter *Working with Nature*].

67. For example, in a recent research project focused on state water allocation decisions, I discovered that the Services often submitted comments on water right applications. See Dave Owen, *The Mono Lake Case, The Public Trust Doctrine, and the Administrative State*, 45 *U.C. DAVIS L. REV.* 1099, 1118 (2012).

68. See, e.g., *There's Nothing Level About Sea Level*, U.S. FISH & WILDLIFE SERV., <http://www.fws.gov/southeast/climate/profiles/caperomain.html> (last updated Mar. 2, 2011) (educational video) [hereinafter *There's Nothing Level*].

69. Listing decisions and critical habitat-designation documents are published in the Federal Register. Biological opinions and habitat conservation plans are not, however, and many are not published anywhere on the Internet.

perhaps thousands—of documents, and interviewing many agency staff.⁷⁰ For this Essay, I did not take those ambitious steps. My research instead was limited to court cases, Federal Register filings, agency guidance documents and policy statements, and agency websites.

Nevertheless, even that limited set of sources supports some intriguing, albeit tentative, conclusions about how the Services are using the ESA to respond to sea-level rise. The central conclusion is that the Services are committed to responding to sea-level rise, but only by using a subset of the available tools. Their marked preference has been to use their educational powers and persuasive authority rather than any sort of regulatory stick.

A. Section 4 Implementation: Species Listing and Critical Habitat

The most extensive paper trail documenting the Services' responses to sea-level rise comes from implementation of ESA section 4.⁷¹ The Services' proposed and final decisions to list species as threatened or endangered, to remove them from the lists, and to designate or change critical habitat all are published in the Federal Register, as are status reports on unresolved listing petitions. Consequently, an extensive written record documents what the Services are doing to implement section 4 and why.

That record leaves no doubt that the Services now consider sea-level rise to be a threat. For a few species, the Services have referred to sea-level rise as a primary reason for a threatened or endangered listing.⁷² For many others, they have identified it as a contributing threat, both in listing documents and in reviews of the status of species that remain candidates for listing.⁷³ Whether the

70. For an example of this approach, see Owen, *supra* note 47, at 161–63. Even with this more exhaustive methodology, some questions about the efficacy of regulatory approaches remained very difficult, if not impossible, to answer.

71. That evidence is clear partly because listing documents are readily accessible.

72. See, e.g., Endangered and Threatened Wildlife and Plants; Listing of the Miami Blue Butterfly as Endangered Throughout Its Range; Listing of the Cassius Blue, Ceraunus Blue, and Nickerbean Blue Butterflies as Threatened Due to Similarity of Appearance to the Miami Blue Butterfly in Coastal South and Central Florida, 77 Fed. Reg. 20948, 20969–70 (Apr. 6, 2012) (“Climatic changes, including sea level rise, are major threats to south Florida, including the Miami blue and its habitat.”).

73. See, e.g., Endangered and Threatened Wildlife and Plants; Final Listing Determinations for Two Distinct Population Segments of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the Southeast, 77 Fed. Reg. 5914, 5972 (Feb. 6, 2012) (noting that sea-level rise will stress water supplies, leading to potential reductions in freshwater flows and thus impairing water quality);

Services are giving enough emphasis to sea-level rise is a scientific question beyond the scope of this Essay, but they are clearly treating it as a relevant factor. In that way, at least, sea-level rise has changed implementation of the ESA.

Nevertheless, sea-level rise has not affected section 4 implementation quite as much as one might expect. Initially, whatever effects are occurring are only of recent vintage. Through the end of 2011, the Services had actually discussed sea-level rise in 46 listing-related documents.⁷⁴ All but one of those documents date from 2005 or later, and 27 of them—almost 60%—are from 2010 and 2011 alone.⁷⁵ Scientists have understood for decades that the climate is changing and that those changes would accelerate sea-level rise, but only in the last few years have the Services' listing decisions begun to grapple with that reality.⁷⁶

Additionally, the evidence of changed approaches is almost entirely limited to species listings rather than critical habitat designations. One might expect the Services to designate as critical habitat areas that are presently not highly suitable, or perhaps not even occupied, to allow species and their habitats to migrate inland

Endangered and Threatened Wildlife and Plants; Review of Native Species That Are Candidates for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions, 76 Fed. Reg. 66370, 66372, 66412, 66413, 66415, 66417 (Oct. 26, 2011) (identifying sea-level rise as a threat to multiple plant species); Endangered and Threatened Species; Determination of Nine Distinct Population Segments of Loggerhead Sea Turtles as Endangered or Threatened, 76 Fed. Reg. 58868, 58892, 58909, 58917 (Sept. 22, 2011) (discussing sea-level rise as a significant contributing threat). *But see* Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Black-footed Albatross as Endangered or Threatened, 76 Fed. Reg. 62504, 62520–23 (Oct. 7, 2011) (identifying sea-level rise as a threat but not a substantial enough threat to justify listing).

74. I base these numbers on the results of an electronic search for FWS or NMFS Federal Register documents containing the phrase “sea-level rise.” From that overall pool, I eliminated documents that did not pertain to section 4 implementation (for example, filings pertaining to management of national wildlife refuges). The resulting numbers do contain some imprecision; the difference between actually discussing sea-level rise and merely mentioning it—for example, in a paper title, or in a boilerplate summary of climate change impacts—is obviously fuzzy, and another researcher might come to slightly different numbers. Nevertheless, the differences would be subtle. There are only a few additional documents that use the phrase “sea-level rise” without providing what I would describe as discussion.

75. A summary table is on file with the author and with the Louisiana Law Review and is available on request.

76. *See* Titus, *supra* note 27 (describing sea-level rise as a consequence of climate change; report chapter was written in 1989).

as sea levels change.⁷⁷ That approach would fit with the letter and spirit of the law,⁷⁸ in an era of shifting habitats, presently unoccupied areas may become essential if the species is to be conserved. Indeed, the Services themselves, along with many commentators, have endorsed that sort of anticipatory protection.⁷⁹ But to date, the Services have only once turned that rhetorical endorsement into reality. I found one critical habitat designation that encompassed areas likely to be needed as sea levels rise, as well as two earlier filings describing and inviting comments on that proposed approach.⁸⁰ Two other documents emphasized the designation of presently-occupied habitat areas less vulnerable to sea-level rise, though in both cases that habitat might have been designated anyway (the documents are not clear on this point).⁸¹ In a larger—albeit still small—number of documents, the Services

77. See Ruhl, *supra* note 41, at 36 (explaining this potential approach).

78. See 16 U.S.C. § 1531(c)(1) (2006) (“It is further declared to be the policy of Congress that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this chapter.”).

79. See NAT’L FISH, WILDLIFE & PLANTS CLIMATE ADAPTATION STRATEGY, PUBLIC REVIEW DRAFT 3 (2012), available at http://www.wildlifeadaptationstrategy.gov/pdf/public_review_draft.pdf (noting that because “[m]any wildlife refuges and habitats could lose some of their original values . . . there’s a growing need to identify the best candidates for new conservation areas”); see also *id.* at 54–55 (emphasizing the importance of protecting an ample amount of habitat and of protecting habitat corridors).

80. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Pacific Coast Population of the Western Snowy Plover, 77 Fed. Reg. 36728, 36731, 36735 (June 19, 2012) (to be codified at 50 C.F.R. pt. 17) (discussing this approach); Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat and Taxonomic Revision for the Pacific Coast Population of the Western Snowy Plover, 77 Fed. Reg. 2243, 2243 (proposed Jan. 17, 2012) (to be codified at 50 C.F.R. pt. 17) (“We are particularly interested in comments concerning . . . [s]pecific information on our proposed revised designation of back-dune systems and other habitats in an attempt to offset the anticipated effects of sea-level rise associated with climate change.”); Endangered and Threatened Wildlife and Plants; Revised Critical Habitat for the Pacific Coast Population of the Western Snowy Plover, 76 Fed. Reg. 16046, 16049–50 (proposed Mar. 22, 2011) (to be codified at 50 C.F.R. pt. 17).

81. See Endangered and Threatened Wildlife and Plants; Proposed Rulemaking to Revise Critical Habitat for Hawaiian Monk Seals, 76 Fed. Reg. 32026, 32036, 32041–42 (proposed June 2, 2011) (to be codified at 50 C.F.R. pt. 226) (acknowledging sea-level rise as a threat, noting that the critical habitat designation includes areas less vulnerable to sea-level rise, and declining to designate unoccupied habitat); Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Louisiana Black Bear (*Ursus americanus luteolus*), 74 Fed. Reg. 10350, 10356–57 (Mar. 10, 2009) (to be codified at 50 C.F.R. pt. 17) (emphasizing that the designated area includes upland habitat that will remain viable as sea levels rise).

identified sea-level rise as a threat but declined to adjust the critical habitat boundary, usually citing uncertainty about where suitable habitat would eventually emerge.⁸² Consequently, for almost every species affected by sea-level rise, critical habitat designations are unchanged.

B. Section 7 Implementation: Jeopardy and Adverse Modification

The theme of reticent implementation continues with section 7. In theory, the Services might use section 7 to address the root causes of sea-level rise, or, alternatively or additionally, to increase species' resilience in the face of sea-level rise by reducing other threats.⁸³ In practice, however, they have emphatically disavowed the former course of action, and there is little, if any, evidence that they are pursuing the latter.

Beginning in 2007, when the listing of the polar bear first compelled the Services to confront the issue, the Services clearly and repeatedly stated that they saw no role for section 7 in

82. See Endangered and Threatened Wildlife and Plants; Designation of Revised Critical Habitat for the Tidewater Goby, 76 Fed. Reg. 64996, 65001 (proposed Oct. 19, 2011) (to be codified at 50 C.F.R. pt. 17) (“[T]he information currently available on the effects of global climate change is not sufficiently precise to determine what additional areas, if any, may be appropriate to include in the revised critical habitat for this species to address the effects of climate change.”); Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Wintering Population of the Piping Plover (*Charadrius melodus*) in Texas, 74 Fed. Reg. 23476, 23480–81 (May 19, 2009) (“However, the information currently available on the effects of climate change does not make sufficiently accurate estimates of the location and magnitude of the effects, so we are unable to determine what additional areas would be needed, nor where they would be located.”); Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Tidewater Goby (*Eucyclogobius newberryi*), 73 Fed. Reg. 5920, 5926 (Jan. 31, 2008) (“We simply do not have good science at this point that provides local predictions. Therefore, we cannot account for such potential but unknown changes in local climate in our critical habitat designation.”); Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for *Cirsium hydrophilum* var. *hydrophilum* (Suisun thistle) and *Cordylanthus mollis* ssp. *mollis* (soft bird’s-beak), 72 Fed. Reg. 18518, 18519 (Apr. 12, 2007) (responding to a peer reviewer’s comment urging designation of presently unoccupied areas: “Given the speculative nature of such an undertaking, we do not consider the available evidence sufficient to support a finding that any particular unoccupied upland area is essential to the conservation of the subspecies.”).

83. See Moritz et al., *supra* note 46, at 222–30 (arguing that section 7 should apply to greenhouse gas sources); see also Natural Res. Def. Council v. Kempthorne, 506 F. Supp. 2d 322, 367–70 (E.D. Cal. 2007) (rejecting a biological opinion that failed to account for climate change’s potential to exacerbate other stresses).

regulating the root causes of climate change.⁸⁴ As one internal memorandum put it, “[W]here the effect at issue is climate change in the form of increased temperatures, a proposed action that involves the emission of [greenhouse gases] cannot pass the ‘may affect’ test and is not subject to consultation under the ESA and its implementing regulations.”⁸⁵ At least in the Services’ view, that guidance still appears to be the law of the land. For another recent research project, I and my research assistant reviewed several thousand biological opinions, finding not a single consultation triggered by, or even addressing, a federal action’s greenhouse gas emissions.⁸⁶ I am not aware of any evidence, either in the form of individual biological opinions or overarching agency guidance, of a subsequent change in practices.

The evidence is more equivocal about whether the Services are attempting to use section 7 to support climate change adaptation.⁸⁷ If they are, the most likely changes would be adjustments in the type or extent of the protective measures the Services negotiate through the consultation process.⁸⁸ Documenting whether such changes exist is difficult, even if one does have all the relevant biological opinions—and I do not. With only a cold, paper record, one cannot easily judge how protective the various protective measures are, let alone compare those conditions to the conditions imposed before sea-level rise emerged as a threat.⁸⁹ Consequently, I cannot say with certainty whether the Services are using this approach. Nevertheless, if change has occurred, it has been fairly well-hidden. The Services have not published any sort of guidance directing their regional and field offices to adjust section 7

84. See Lawrence Liebesman et al., *The Endangered Species Act and Climate Change*, 39 ENVTL. L. REP. NEWS & ANALYSIS 11173, 11179 (2009) (quoting multiple FWS documents).

85. Memorandum from Office of the Solicitor, U.S. Dept. of Interior, to Director, U.S. Dept. of Interior, 7 (Oct. 3, 2008) (citation omitted), available at http://www.peer.org/docs/doi/08_14_10_interior_solicitor_memo.pdf.

86. See Owen, *supra* note 47, at 169.

87. There is no question about whether the Services are using section 7 to respond to other threats to species. Clearly, they are. See *id.* at 171–72, 187–88. The question instead is whether sea-level rise, or, more generally, climate change, has generated any adjustments in ways the Services address those other threats.

88. As discussed above, section 7 consultations rarely block projects and usually instead lead to conditional approvals. See *id.* at 163–64 (summarizing past studies and providing recent statistics).

89. See *id.* at 171–72 (discussing the types of controls the Services sometimes impose and the challenge of assessing their efficacy). Of course, even if such a comparison did demonstrate that a change had occurred, the change might be due to some other variable rather than to concerns about sea-level rise.

implementation to promote climate change adaptation. And while their broader strategy documents argue that “[r]educing existing stresses on fish, wildlife, and plants can be some of the most effective, and doable, ways to increase resilience to climate change,” those documents say nothing about using the consultation process as a means to that end.⁹⁰ In short, while I cannot say that the Services are *not* adjusting their approaches to section 7 in an effort to promote resilience in the face of sea level rise, I have found no evidence that they are doing so.

C. Section 9

The story of section 9 implementation is quite similar to that of section 7. Initially, the evidence of the Services’ activities is difficult to obtain. Most section 9 implementation occurs not through direct enforcement of the take provision—such enforcement rarely happens—but instead through incidental take statements and habitat conservation plans, neither of which are generally available online.⁹¹ Discerning changes in section 9 implementation therefore would require reviewing many HCPs and biological opinions, neither of which I have gathered, as well as conducting more interviews. But even a more limited review suggests that section 9 is exerting limited influence. As with section 7, the Services have clearly disclaimed any intent to use section 9 to mitigate the causes of climate change.⁹² And they have not issued any regulations, amendments to their HCP handbook, or other guidance or memoranda directing agencies to otherwise

90. See NAT’L FISH, WILDLIFE & PLANTS CLIMATE ADAPTATION STRATEGY, *supra* note 79, at 4; *id.* at 57 (describing strategies for habitat conservation but not mentioning the adverse modification or jeopardy prohibitions or the consultation process).

91. See Barton H. Thompson, Jr., *The Endangered Species Act: A Case Study in Takings & Incentives*, 49 STAN. L. REV. 305, 315 (1997) (noting that direct enforcement of section 9 is rare); Owen, *supra* note 47, at 187 (noting that section 9 plays an important role in consultation processes).

92. See News Release, U.S. Fish & Wildlife Serv., Salazar Retains Conservation Rule for Polar Bears Underlines Need for Comprehensive Energy and Climate Change Legislation (May 8, 2009), available at <http://www.fws.gov/news/NewsReleases/showNews.cfm?newsId=20FB90B6-A188-DB01-04788E08-92D91701>. The news release announced that the Obama Administration would retain a Bush Administration rule that precluded any section 9 liability for greenhouse gas emissions affecting polar bears. Interior Secretary Salazar was quoted as saying, “[T]he Endangered Species Act is not the proper mechanism for controlling our nation’s carbon emissions. Instead, we need a comprehensive energy and climate strategy that curbs climate change and its impacts—including the loss of sea ice.” *Id.*

change their approaches to section 9 implementation to account for sea-level rise.⁹³

D. Nonregulatory Tools

While the Services have been reluctant to exercise their regulatory authority, they have not been inactive in responding to sea-level rise. The Services' websites describe widespread efforts to educate the public about realities of sea-level rise and the biodiversity threats that it poses.⁹⁴ In national wildlife refuges, where the Services already control land, they are planning for adaptation, working on habitat restoration projects designed to increase resilience in the face of sea-level rise, and, in some places, experimenting with carbon sequestration.⁹⁵ They also are developing planning tools that state and local governments and private land managers could use to address sea-level rise. For example, FWS recently released its Sea Level Rise Affecting Marshes Model ("SLAMM"), a web-based tool that allows users to create simulated maps illustrating the effects of sea-level rise.⁹⁶ Ideally, the model should help local governments as they try to keep development away from areas that will likely flood, with the collateral benefit of protecting habitat in those same areas.⁹⁷ Finally, the Services continue to spend grant money on habitat preservation, and they direct some of that money to areas at risk from sea-level rise.⁹⁸

That selective emphasis on education, facilitation, and nonregulatory advocacy appears to reflect a deliberate strategy. In January 2012, the Services published a draft report outlining their

93. See U.S. FISH & WILDLIFE SERV. & NAT'L MARINE FISHERIES SERV., HABITAT CONSERVATION PLANNING AND INCIDENTAL TAKE PERMIT PROCESSING HANDBOOK (1996), available at http://www.nmfs.noaa.gov/pr/pdfs/laws/hcp_handbook.pdf. The handbook does not specifically discuss climate change mitigation or adaptation.

94. See, e.g., *There's Nothing Level*, *supra* note 68.

95. See, e.g., *id.*; *Working with Nature*, *supra* note 66 (describing efforts to promote habitat resiliency at the Alligator River National Wildlife Refuge in North Carolina); Stacy Shelton, *Opportunities to Sequester Carbon by Restoring North Carolina's Pocosins*, U.S. FISH & WILDLIFE SERV., <http://www.fws.gov/southeast/climate/stories/pocosinlakes.html> (last updated Oct. 6, 2010) (describing a habitat restoration and carbon sequestration project).

96. *Sea Level Rise Affecting Marshes Model*, U.S. FISH & WILDLIFE SERV., <http://www.fws.gov/slamm/> (last updated Apr. 23, 2012).

97. For a discussion of how some state and local governments are actually reacting to sea-level rise, see *infra* notes 141–143 and accompanying text.

98. See, e.g., U.S. FISH & WILDLIFE SERV., *supra* note 65.

strategy for climate change adaptation.⁹⁹ The report contains several case studies of the impacts of sea-level rise and leaves no doubt that the Services consider climate change generally, and sea-level rise more specifically, as major challenges that they must address.¹⁰⁰ To respond, the Services offer a menu of options. “[C]ollaborat[ing] among all levels of government,” “supporting adaptive management,” “increasing knowledge,” and “increasing awareness and motivating action” are a few representative examples.¹⁰¹ Some of the goals seem broad enough to encompass regulatory approaches, but the strategy provides no blueprint for turning any of these concepts into specific regulatory constraints. Instead, the Services assert that a central principle of climate adaptation will be to “foster communication and collaboration” rather than prescription.¹⁰² The vision seems to be of the Services as educators and (unpaid) consultants, providing information and analytical tools, facilitating partnerships, and spending a little bit of money, but leaving the thankless work of regulating, if any such work is to be done, to someone else.

V. EXPLAINING THE RELUCTANCE

The Services’ reluctance to invoke their regulatory powers to address sea-level rise, or climate change more generally, may initially surprise some readers. Why, we might ask, wouldn’t the agencies responsible for implementing our most important statute for protecting biodiversity use that statute to address what is emerging as an enormous threat to biodiversity?¹⁰³ As Part III

99. See NAT’L FISH, WILDLIFE & PLANTS CLIMATE ADAPTATION STRATEGY, *supra* note 79. According to the website associated with the report, the FWS, NOAA, and the New York Division of Fish, Wildlife, and Marine Resources chaired the report-writing effort with input from many other entities. See U.S. Fish & Wildlife Service & Nat’l Oceanic & Atmospheric Admin., *About Us*, NAT’L FISH, WILDLIFE & PLANTS CLIMATE ADAPTATION STRATEGY, <http://www.wildlifeadaptationstrategy.gov/about.php> (last visited Sept. 14, 2012). As of this writing, the report remains in draft form.

100. See NAT’L FISH, WILDLIFE & PLANTS CLIMATE ADAPTATION STRATEGY, *supra* note 79, at 7 (identifying sea-level rise as an important effect of climate change), 44 (discussing impacts to piping plovers and agency responses), 57–58 (describing habitat impacts on New Jersey’s Cape May Peninsula), 62 (describing impacts to coastal Delaware), 67–68 (describing threats and response efforts at Elkhorn Slough in California).

101. *Id.* at 3, 5.

102. U.S. Fish & Wildlife Serv. & Nat’l Oceanic & Atmospheric Admin., *Goals*, NAT’L FISH, WILDLIFE & PLANTS CLIMATE ADAPTATION STRATEGY, <http://www.wildlifeadaptationstrategy.gov/goals.php> (last visited June 6, 2012).

103. See Celine Bellard et al., *Impacts of Climate Change on the Future of Biodiversity*, 15 *ECOLOGY LETTERS* 365, 375 (2012) (reviewing the literature on

shows, the problem is not a lack of potential legal tools; if the Services were to pursue aggressive regulatory approaches, they could invoke multiple statutory provisions as authority.¹⁰⁴ Nevertheless, the Services have legal, practical, and political reasons for their reticence. And while those reasons are most salient with respect to climate change mitigation, the challenges of using the ESA as a tool for climate change adaptation are also substantial. To make matters even more difficult, the challenges of mitigation and adaptation—even voluntary, nonregulatory approaches to adaptation—are intertwined.

A. Designating Critical Habitat

The evidence of reticence begins with the Services' reluctance to designate critical habitat that is not presently occupied, but that could become essential as sea levels rise. As Part IV discusses, external commentators have endorsed this practice, and the Services have acknowledged the importance of anticipatory habitat designations. However, they have done almost nothing to put this practice into effect.¹⁰⁵

There are several reasons for the Services' reluctance. First, the Services are correct that predicting where suitable habitat will emerge involves uncertainty. Even if scientists can readily predict sea-level rise, the habitat dynamics triggered by that rise are substantially more complex.¹⁰⁶ The second set of reasons is practical and political rather than scientific. Critical habitat

climate change and biodiversity and concluding that most models "indicate alarming consequences for biodiversity with worst-case scenarios leading to extinction rates that would qualify as the sixth mass extinction in the history of the earth" (citation omitted)). The authors also note that modeled predictions of climate change's impacts on biodiversity vary widely and that such modeling is relatively new, with many unresolved methodological problems.

104. See discussion *supra* Part III.

105. See *supra* notes 77–82 and accompanying text.

106. See INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 23, at 320 ("Climate change and sea-level rise affect sediment transport [which in turn controls the configuration of many coastal habitats] in complex ways and abrupt, non-linear changes may occur as thresholds are crossed." (alteration in original) (citation omitted)); Donald R. Cahoon et al., *Vulnerable Species: The Effects of Sea-Level Rise on Coastal Habitats*, in U.S. CLIMATE CHANGE SCIENCE PROGRAM, COASTAL SENSITIVITY TO SEA-LEVEL RISE: A FOCUS ON THE MID-ATLANTIC REGION 9 (2009) ("Making long-term projections of coastal change is difficult because of the multiple, interacting factors that contribute to that change.").

designations are already one of the Services' greatest headaches.¹⁰⁷ Many designations are triggered by and then provoke litigation, and the Services have sometimes been rather skeptical of the protective value of those designations once they are completed.¹⁰⁸ Under such circumstances, a reluctance to expand the scope of designations is understandable.

Nevertheless, if anticipatory critical habitat designations could protect species to even a limited extent—and prior research demonstrates, notwithstanding the Services' occasional protestations to the contrary, that they could—this reluctance hamstringing the Services' efforts to protect species.¹⁰⁹ A critical habitat designation provides one of the few ways, other than simply purchasing property interests, that the Services could provide some preemptive regulatory protection for habitat that species might eventually need.¹¹⁰ That protection would not be absolute, for section 7 provides no direct protection against nonfederal alteration of critical habitat.¹¹¹ But designations would at least warn landowners of potential future species needs, providing a signal that development of designated areas could create regulatory complexities and should therefore be avoided.¹¹²

107. See Owen, *supra* note 47, at 144–45.

108. See *The Threatened and Endangered Species Recovery Act of 2005: Hearing on H.R. 3824 Before the H. Comm. on Res.*, 109th Cong. 28 (2005) (statement of Craig Manson, Assistant Sec'y of Dep't of Interior).

109. See Owen, *supra* note 47, at 180–81 (describing ways critical habitat designations may influence landowners' and land managers' practices and concluding that the influence on regulators' decision-making, while minor, is real); Kieran Suckling & Martin Taylor, *Critical Habitat and Recovery*, in 1 THE ENDANGERED SPECIES ACT AT THIRTY: RENEWING THE CONSERVATION PROMISE, *supra* note 38, at 75, 80–85 (providing case studies of critical habitat designations leading to species protection).

110. In theory, the loss of such habitat could also jeopardize species' survival, but showing that the habitat will be adversely modified is often easier than supporting a jeopardy determination. See Owen, *supra* note 47, at 155–56.

111. See 16 U.S.C. § 1536(a)(2) (2006) (applying only to federal agency actions).

112. There is some risk that critical habitat designations could also spur landowners to alter their land and make sure that species do not take up residence there. See generally Jonathan Adler, *Money or Nothing: The Adverse Environmental Consequences of Uncompensated Land Use Controls*, 49 B.C. L. REV. 301, 303–04 (2008). That risk would seem particularly acute where the habitat alteration requires no federal funding or authorization because section 7's prohibition on adverse modification then would not apply. However, there is also evidence that even private landowners will try to avoid activities on land designated as critical habitat and that designations may spur local or private land conservation efforts. See Jeffrey E. Zabel & Robert W. Paterson, *The Effects of Critical Habitat Designation on Housing Supply: An Analysis of California Housing Construction Activity*, 46 J. REGIONAL SCI. 67, 90 (2006); Owen, *supra*

Conversely, in the absence of anticipatory designations, areas that might become suitable for future use by species may instead be more likely to be developed. By the time the Services realize that an expanded critical habitat designation would be appropriate, there may be no suitable places left to designate.

B. Mitigation

There are also obvious and understandable reasons for the Services' reluctance to invoke the regulatory controls in sections 7 and 9.¹¹³ In part, the challenges are scientific and legal. Demonstrating that the greenhouse gas emissions from a single federal project are solely responsible for jeopardizing a listed species—let alone causing take of individual animals—would be impossible because any individual project's emissions will blend with those of millions of other human activities.¹¹⁴ Stating that an individual project is adversely modifying critical habitat should be easier because a new set of greenhouse gas emissions will clearly cause changes, and even if those changes are unquantifiable and highly incremental, they are adverse.¹¹⁵ But the Services' standard practice is to treat small-habitat modifications as exempt from the adverse modification prohibition, and so long as that standard practice persists, almost any contribution to climate change is likely to escape coverage.¹¹⁶

Those legal challenges are closely related to several practical obstacles. If the Services were to use section 7 in an attempt to mitigate the causes of sea-level rise, theoretically they could use a

note 47, at 180–81. Which of these reactions predominates is an empirical question to which existing studies have not provided a thorough answer, and reactions may also evolve as land managers become more sophisticated in their understanding of critical habitat designations.

113. For detailed discussion of these challenges, see Ruhl, *supra* note 41, at 39–49.

114. See Ruhl, *supra* note 41, at 46–47. The Services could reach jeopardy findings by reasoning that an individual project contributes to the cumulative impact of climate change, and that cumulative impact is jeopardizing a species' likelihood of survival. That approach would be analogous to the approach required by the Council on Environmental Quality's implementing regulations for the National Environmental Policy Act. See 40 C.F.R. § 1508.27(b)(7) (2009). However, the Services generally have not adopted that approach.

115. See Owen, *supra* note 47, at 155–56 (explaining this argument); see also *MCI Telecomms. Corp. v. Amer. Tel. & Tel. Co.*, 512 U.S. 218, 225 (1994) (“Virtually every dictionary we are aware of says that ‘to modify’ means to change moderately or in minor fashion.”).

116. See *id.* at 168–70.

few different approaches. One would be to focus on a few major greenhouse gas-emitting federal projects and find that those projects are causing jeopardy, adverse modification, or take.¹¹⁷ If the Services do that, however, they would have to explain why those projects are subject to regulatory constraint while smaller projects are exempt.¹¹⁸ Because all greenhouse gas emissions contribute to the same overall problem, that distinction could be difficult to justify.¹¹⁹ Alternatively, the Services could attempt to regulate all federal greenhouse gas-emitting projects, but that would lead to an extraordinary increase in their already overwhelming workloads, to say nothing of the costs imposed on action agencies and other regulated entities.¹²⁰ In theory, the Services might achieve some administrative efficiency by asking action agencies to include standard mitigation measures as part of their project descriptions.¹²¹ For example, they might ask action agencies or project proponents to purchase carbon offsets to compensate for project emissions, and then they might invoke those offsets as the basis for finding compliance with ESA section 7's jeopardy and adverse modification prohibitions.¹²² But that approach would also put the Services in a difficult position, for it would compel them to become the organizers and overseers of a

117. See Moritz et al., *supra* note 46, at 224 (“While some federal actions may not contribute appreciable amounts of greenhouse gases to the atmosphere, many clearly do so.”).

118. That challenge is not unique to ESA implementation. See, e.g., Madeline June Kass, *A NEPA Climate Paradox: Taking Greenhouse Gases into Account in Threshold Significance Determinations*, 42 IND. L. REV. 47, 62–63, 67, 85 (2009) (discussing the challenges associated with deciding what level of GHG emissions counts as “significant”).

119. See INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS: SUMMARY FOR POLICYMAKERS 2, 5, 15–16 (S. Solomon et al. eds., 2007), available at <http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf> (explaining that most greenhouse gases are long-lasting and well-mixed, which means that emissions from all over the world contribute to the aggregate global problem).

120. See Owen, *supra* note 47, at 190 (quoting a service biologist who said agency staff were “barely keeping our heads above water” with their existing workload).

121. See, e.g., 42 U.S.C. § 7511a(e)(1) (2006) (establishing ratios for ozone emission offsets).

122. For this approach to be legally viable, the Services would need to consider the offset to be part of the “action” under consultation. The approach might also be limited by laws and regulations constraining the spending practices of action agencies, which might not be able to contribute to offset programs without additional legal authorization. Nevertheless, even if the approach seems legally conceivable, at least for some activities potentially subject to section 7, the practical and political impediments would be substantial.

massive carbon offsets market. That task is much closer to the traditional competence of EPA, which has years of experience regulating air quality, than of agencies traditionally tasked with protecting wildlife.¹²³

And, of course, looming behind all of these legal and practical difficulties are the politics. The challenges of environmental regulation, though never small, have grown more intense in the current political climate. EPA's incremental efforts to respond to climate change illustrate those challenges, for they have turned the agency into a constant target of political vitriol.¹²⁴ The venom that the Services would face if they turned the ESA—a political lightning rod even before climate change emerged as an issue—into the cutting edge of climate change regulation would likely be even worse. That reaction might well lead to funding limitations that undermine the Services' work or even to statutory amendments undercutting or entirely removing their authority.¹²⁵ Even if that backlash does not occur, the best results that the Services could hope for would be to constrain a subset of the United States' future emissions, which in turn represent just a fraction of the emissions contributing to the global problem, and to provide a model regulatory program capable of being imitated elsewhere.¹²⁶ Such “whittl[ing] away” may be the only realistic way to address climate change, but the Services' reluctance to wade into a firestorm, all in pursuit of a partial solution, is certainly still understandable.¹²⁷

123. Even for EPA, which has experience administering air pollutant-emissions trading systems, administering a major carbon offset program would likely be a challenging task. See Lesley K. McAllister, *The Enforcement Challenge of Cap-and-Trade Regulation*, 40 ENVTL. L. 1195, 1196–1202 (2010) (describing some of the challenges of overseeing carbon emissions trading programs).

124. See, e.g., John M. Broder, *Bashing E.P.A. Is New Theme in G.O.P. Race*, N.Y. TIMES, Aug. 18, 2011, at A1, available at <http://www.nytimes.com/2011/08/18/us/politics/18epa.html>. The rhetoric is not limited to the political branches. See, e.g., *Karuk Tribe of Cal. v. U.S. Forest Serv.*, 681 F.3d 1006, 1039–41 (9th Cir. 2012) (Smith, J. dissenting) (blasting a series of allegedly “extreme environmental decisions” issued by the Ninth Circuit).

125. See Holly Doremus, *Scientific and Political Integrity in Environmental Policy*, 86 TEX. L. REV. 1601, 1611, 1628, 1630 (2008) (describing political controversies that led to Congressional budgetary restrictions on ESA implementation).

126. See *Global Emissions*, U.S. ENVTL. PROT. AGENCY, <http://www.epa.gov/climatechange/ghgemissions/global.html> (last visited Sept. 15, 2012) (showing the United States' share of global emissions).

127. See *Massachusetts v. E.P.A.*, 549 U.S. 497, 524 (2007) (“Agencies, like legislatures, do not generally resolve massive problems in one fell regulatory swoop. They instead whittle away at them over time” (citation omitted)).

C. Adaptation

None of my observations about the challenges of using the ESA to mitigate sea-level rise is particularly new. The common response has been to argue that the Services should focus their efforts on climate adaptation, where the ESA arguably has more potential to do good.¹²⁸ That argument is sensible, but the Services' record suggests that promoting sea-level rise adaptation is also a difficult thing to do.¹²⁹

In part, the challenge arises from the inherent difficulties with regulating activities in the coastal zone, where land is widely coveted and development pressures tend to be intense.¹³⁰ But the challenge also arises from the Services' understandable desire to decouple climate change mitigation and adaptation. That decoupling creates an obvious fairness problem any time the Services seek to ratchet up controls on other activities in the coastal zone. So long as that regulation occurs without any corresponding attempt to control emissions, the affected agencies or landowners (or local governments that are encouraged to intensify their land use controls) quite reasonably can ask, "Why us? How can you increase our burden while you're letting the real cause of the problem off scot-free?" "Because you're the more accessible target" is not likely to be a satisfying answer.

Because of these obstacles, we should not be surprised that the Services prefer to invoke their nonregulatory tools to respond to sea-level rise. But here, as well, the absence of a regulatory program—and, particularly, the absence of a regulatory program focused on climate change mitigation—creates another challenge, since it cuts off a potentially valuable source of funding. Protecting biodiversity usually means protecting or restoring habitat, and protecting or restoring habitat usually costs money. That money typically comes from one of three sources.¹³¹ The first is taxpayer dollars, and while public money protects thousands of acres every

128. See, e.g., Ruhl, *supra* note 41, at 59–60.

129. See *supra* notes 83–102 and accompanying text.

130. See generally Blake Hudson, *Coastal Land Loss and the Mitigation-Adaptation Dilemma: Between Scylla and Charybdis*, 73 LA. L. REV. 31 (2012) (documenting intense development pressure in many coastal areas); Carol M. Rose, *The Story of Lucas: Environmental Land Use Regulation Between Developers and the Deep Blue Sea*, in ENVIRONMENTAL LAW STORIES 237, 242–45 (Richard J. Lazarus & Oliver A. Houck eds., 2005) (discussing the history of increasing demands upon coastal areas).

131. Of course, monitoring habitat or species conditions, engaging in planning processes, building simulation models, and conducting scientific research are all key components of the Services' proposed strategies for adapting to sea-level rise, and they all require money as well.

year, no public resource is unlimited.¹³² The second is private fundraising, and that asset, though important, cannot protect enough habitat to sustain most species, particularly if those species depend upon expensive coastal real estate.¹³³ Voluntary purchases are therefore likely to be important—perhaps necessary—components of protective strategies, but they are by no means sufficient. Consequently, in many areas of environmental and land use regulation, a third funding source has become increasingly important. That source is mitigation funding, which regulators exact from permit applicants as compensation for the environmental impacts that those applicants' proposed activities will create.¹³⁴

Unfortunately, mitigation funding currently holds little promise for addressing the biodiversity impacts of sea-level rise. For mitigation funding to be a viable approach, several conditions must exist. First, a regulated actor must be in the process of applying for a permit or some other sort of discretionary approval. Without such an application, regulators will have no opportunity to exact funding in exchange for permits. With sea-level rise, that condition often will be absent, at least in the immediate geographic areas where species are at risk.¹³⁵ In some of those areas, there may be few proposals for additional development—the threat to species will derive from the combination of sea-level rise and existing development patterns—and the absence of discretionary approvals will deprive regulators of any opportunity to exact funding. Even

132. See Rob Hotokainen, *President Meets Resistance on Federal Conservation Fund*, WASH. POST, Apr. 4, 2011, at A19 (describing historic underfunding of the Land and Water Conservation Fund and resistance to funding increases).

133. See Paul Voosen, *Myth-Busting Scientist Pushes Greens Past Reliance on 'Horror Stories'*, GREENWIRE (Apr. 3, 2012), <http://www.eenews.net/public/Greenwire/2012/04/03/1> (describing the realization by The Nature Conservancy, the largest conservation purchase group in the world, that a purely purchase-based strategy would not be sufficient to preserve biodiversity). See generally John D. Echeverria, *Regulating Versus Paying Land Owners to Protect the Environment*, 26 J. LAND RESOURCES & ENVTL. L. 1, 4–5 (2005) (discussing the appeal and the limitations of this approach).

134. See generally Jessica B. Wilkinson & Robert Bendick, *The Next Generation of Mitigation: Advancing Conservation Through Landscape-Level Mitigation Planning*, 40 ENVTL. L. REP. NEWS & ANALYSIS 10023 (2010).

135. ESA section 7's consultation requirement applies only to discretionary actions requiring federal authorization or funding. See 16 U.S.C. § 1536(a)(2) (2006); 50 C.F.R. § 402.03 (2009) ("Section 7 and the requirements of this part apply to all actions in which there is discretionary Federal involvement or control."). Where development has already occurred, that discretionary action is absent, and even where new development is proposed, federal permits are often unnecessary.

where development is happening, it may not require *federal* permits and therefore may not trigger the oversight of agencies focused on biodiversity protection. Absent the need for a wetlands permit or federal highway funding, most development projects are subject only to state or local discretionary review.¹³⁶

Second, mitigation funding approaches succeed best when the project's sponsor has some sort of appreciating asset—when land is about to become a housing development, for example—and the sponsor can treat the reduction in profits as a cost of doing business.¹³⁷ In many areas threatened by sea-level rise, the opposite circumstance exists. Land values are eventually likely to decline, not appreciate, because flooded land is usually worth less.¹³⁸ Consequently, regulators seeking funding for species protection would be imposing additional losses, not extracting value from appreciating assets. That is an awfully difficult, and potentially a rather inequitable, thing to do.

Despite those limitations, a regulatory approach partly premised on mitigation funding could still work, at least in theory. There are activities that contribute to sea-level rise, are subject to discretionary federal oversight, and generate a lot of money. New oil leases and new power plants, for example, often require federal approvals, generate significant greenhouse gas emissions, and produce big profits.¹³⁹ Therefore, these activities could be sources for mitigation funding. But the Services say they will never regulate greenhouse gas emissions from those activities.¹⁴⁰ Again, their reluctance is understandable; it may even represent a canny judgment that they can come closest to fulfilling their protective

136. See *Solid Waste Agency of N. Cook Cnty. v. U.S. Army Corps of Eng'rs*, 531 U.S. 159, 174 (2001) (emphasizing “the States’ traditional and primary power over land and water use”).

137. See Wilkinson & Bendick, *supra* note 134, at 10024 (noting the willingness of developers to treat mitigation payments “as a cost of doing business”); DANIEL S. KAHNEMAN, *THINKING, FAST AND SLOW* 269–321 (2011) (discussing multiple studies demonstrating people’s greater willingness to forego part of an anticipated financial gain than to absorb a numerically equivalent loss).

138. See THE NATURE CONSERVANCY, *supra* note 36, at 1 (projecting approximately \$1.6 billion of lost property value on Big Pine Key under a worst-case sea-level rise scenario).

139. See NAT’L COMM’N ON THE BP DEEPWATER HORIZON OIL SPILL AND OFFSHORE DRILLING, *DEEP WATER: THE GULF OIL DISASTER AND THE FUTURE OF OFFSHORE DRILLING* 55–85 (2011) (describing federal regulatory oversight over oil exploration); Clifford Kraus, *Higher Prices Buoy Profits as Oil Companies Scramble for New Fields*, N.Y. TIMES, July 29, 2011, at B3, available at <http://www.nytimes.com/2011/07/29/business/global/exxon-and-shell-earnings.html>.

140. See *supra* notes 84–86 and accompanying text.

mission by saving their limited political capital for other fights. But even if it reflects a certain harsh realism, that judgment still forecloses access to one of the few funding sources large enough turn the Services' nonregulatory agenda from an appealing aspiration into a practical reality.

VI. CONCLUSION

As I wrote this Essay, the North Carolina Legislature was considering a bill that would have mandated ignorance of the science of sea-level rise.¹⁴¹ The legislation, which passed the state senate before it was rejected its house of representatives, would have precluded government agencies from acknowledging the near-unanimous scientific predictions that sea-level rise will accelerate and, instead, would have required them to assume a continuation of historic trends.¹⁴² The proposal inspired its fair share of comedic ridicule, but it illustrates the serious dilemma in which the Services—and, indeed, any agency charged with addressing the impacts of sea-level rise or of climate change more generally—find themselves.¹⁴³ They know the extent of the problem they face, and they have, on paper, the tools to respond. But environmental law in practice is often quite different from environmental law on the books, and the political climate in which government agencies operate plays a huge role in defining the discrepancies.¹⁴⁴ At present, that political climate is incredibly hostile to regulatory responses to environmental problems. Sometimes it is hostile to any acknowledgement that those problems even exist.

So what, then, are the Services to do? At a minimum, they should continue their present initiatives. Educating the public

141. John Murawski, *Senate Approves Law that Challenges Sea Level Science: Lawmaker Calls Climate Change Forecasts Unreliable*, CHARLOTTE OBSERVER, June 13, 2012, <http://www.charlotteobserver.com/2012/06/13/3313953/senate-approves-law-that-challenges.html>.

142. See *id.*; Leigh Phillips, *Sea Versus Senators*, 486 NATURE 450 (2012), available at <http://www.nature.com/news/sea-versus-senators-1.10893> (describing the bill, as well as the Atlantic Ocean's refusal to accommodate the North Carolina Senate).

143. See, e.g., *The Colbert Report: The Word: Sink or Swim* (Comedy Central television broadcast June 4, 2012), available at <http://www.colbertnation.com/the-colbert-report-videos/414796/june-04-2012/the-word---sink-or-swim>.

144. See generally Daniel A. Farber, *Taking Slippage Seriously: Noncompliance and Creative Compliance in Environmental Law*, 23 HARV. ENVTL. L. REV. 297 (1999) (discussing pervasive gaps between statutory mandates and actual practices).

about the threats posed by sea-level rise is clearly important. That education can help correct common misconceptions about climate change, and it also can connect the problem, which to many people seems distant and abstract, with impacts and changes close to home.¹⁴⁵ Similarly, developing simulation models and informational resources can be a valuable service to private land managers and can also help local governments as they engage in land-use planning and make decisions about specific development proposals.¹⁴⁶ Even those modest initiatives will not be free of controversy; as North Carolina's legislative initiative shows, even providing information can be perceived as a threatening act.¹⁴⁷ Nevertheless, those modest actions are likely to be less controversial than more traditional regulatory responses, and they also can help lay foundations for more robust responses, if and when those responses occur.

Similarly, the Services could make several modest adjustments to the regulatory programs that they are already implementing. The Services should be anticipating sea-level rise in more of their critical habitat designations, even if they cannot anticipate with perfect accuracy where ideal habitat will emerge. The Services should likewise increase their efforts to use the section 7 process to protect species from other contributing threats.¹⁴⁸ Neither of these shifts will be easy to achieve, but the alternative—leaving potentially important habitat undesignated and other stresses only lightly checked, at least until species' circumstances leave no other option—is even worse. It would merely postpone the inevitable conflicts until the impacted species' desperate circumstances remove almost all flexibility to craft a creative response.¹⁴⁹ The

145. Of course, ample research has demonstrated that providing additional information about climate change does not always influence people's views because people are quite good at filtering out information that does not conform to their previous ideas or support their self-interest. See, e.g., Dan M. Kahan et al., *The Polarizing Impact of Science Literacy and Numeracy on Perceived Climate Change Risks*, NATURE CLIMATE CHANGE (May 27, 2012), <http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate1547.html>.

146. For a general discussion of the potential benefits of such information, see Dave Owen, *Mapping, Modeling, and the Fragmentation of Environmental Law*, 2013 UTAH L. REV. (forthcoming 2013).

147. See Murawski, *supra* note 141 (describing legislators' fears that acknowledging the risks of rising seas would depress property values).

148. See generally Craig, *supra* note 54, 43–44 (emphasizing the importance of reducing non climate stressors).

149. For a general discussion of the problems with allocating the burdens of uncertainty to protected species, rather than to resource users, see Dave Owen, *Law, Environmental Dynamism, Reliability: The Rise and Fall of CALFED*, 37 ENVTL. L. 1145 (2007).

Services should also provide formalized, written guidance on designating critical habitat and on implementing section 7 in the face of climate change.¹⁵⁰ Designating critical habitat and negotiating project adjustments and changes are not easy things to do; action agencies and project proponents are generally interested in minimizing expenses and time commitments, not protecting species. Guidance on accounting for climate change during ESA implementation processes could provide staff-level regulators with some valuable backing.¹⁵¹ The Services' present documents, which evince a commitment to everything but traditional regulation, do exactly the opposite.¹⁵²

In combination, a mix of slight adjustments to existing regulatory programs and an aggressive education, research, and outreach effort might actually do quite a lot to protect some species. Not all states, municipalities, or even private landowners are in a rush to convert habitats, particularly in the present real estate market, and information that can inform local environmental protection strategies will sometimes be put to use. Indeed, state and local governments have public safety reasons for wanting to keep human uses out of areas likely to be altered by sea-level rise, for those areas, almost by definition, are dangerous places to build.¹⁵³ By combining those incentives with the natural aversion of most landowners to legal risk, the Services might actually be able to protect some significant areas of coastal habitat. If they can work collaboratively with other federal programs that affect development in coastal areas, like the National Flood Insurance Program, the potential for protection may be even greater.¹⁵⁴

Nevertheless, in many areas, this combination of approaches will almost certainly be insufficient. No amount of education or

150. See *supra* note 90 and accompanying text (noting the absence of any guidance on using section 7 to address climate change adaptation).

151. For a discussion of the dynamics of these negotiations, see Owen, *supra* note 47, at 174.

152. See *supra* notes 99–102 and accompanying text.

153. See Justin Gillis, *Sea Level Rise Seen as Threat to 3.7 Million*, N.Y. TIMES, March 14, 2012, at A1, available at <http://www.nytimes.com/2012/03/14/science/earth/study-rising-sea-levels-a-risk-to-coastal-states.html>. Of course, North Carolina's recent legislative efforts suggest that some state and local governments would rather pretend those hazards do not exist. See Murawski, *supra* note 141.

154. For a general description of the NFIP program and its role in coastal development, see Raymond J. Burby, *Flood Insurance and Floodplain Management: The US Experience*, 3 ENVTL. HAZARDS 111 (2001). A few litigants have sought to compel consultation on floodplain mapping. See, e.g., Nat'l Wildlife Fed'n v. Fed. Emergency Mgmt. Agency, 345 F. Supp. 2d 1151 (W.D. Wash. 2004) (requiring consultation).

outreach will save the threatened species of the Florida Keys if sea levels continue to rise.¹⁵⁵ Neither will there ever be enough money available to simply place coastal habitats in preservation status. In some areas, the only way to stop sea-level rise from exterminating species will be to first slow and then, eventually, to stop sea-level rise. And unless some geoengineering scheme emerges as the white knight riding to our rescue, that means limiting greenhouse gas emissions.

Consequently, this Essay ends with a rather unoriginal suggestion. The most promising legal fix for sea-level rise, as for most of the environmental problems arising from climate change, lies in a combination of domestic legislation that drastically reduces greenhouse gas emissions and international agreements that commit other countries to do the same. At present, that combination of legislation and international agreements may seem unattainable. To many opponents of environmental regulation, it also seems rather undesirable. And even if effective treaties and legislation were suddenly in place, existing emissions will continue to raise sea levels for years to come; the changes would simply be smaller.¹⁵⁶ But without those legal changes, the challenges of rising seas will be too much for many of our coastal species to survive.

155. See Maschinski et al., *supra* note 12 (evaluating threats to species in the Florida Keys); THE NATURE CONSERVANCY, *supra* note 36 (mapping scenarios for rising seas; eventually, very little land remains).

156. See INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 23, at 317 (“Sea-level rise has substantial inertia and will continue beyond 2100 for many centuries.”).

