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## BOOK REVIEW

# NOAH BY THE NUMBERS: AN EMPIRICAL EVALUATION OF THE ENDANGERED SPECIES ACT

Jeffrey J. Rachlinski†

NOAH'S CHOICE: THE FUTURE OF ENDANGERED SPECIES. By Charles C. Mann & Mark L. Plummer. New York: Alfred A. Knopf. 1995. 302 pp. \$24.00.

The Endangered Species Act<sup>1</sup> ("Act") costs, but does not benefit; it has failed to promote the conservation of biodiversity in the United States. So say Charles Mann and Mark Plummer in their book *Noah's Choice: The Future of Endangered Species*.<sup>2</sup> Given the current political climate, in which cost-benefit analysis has become synonymous with good government,<sup>3</sup> they could hardly have delivered a more damning judgment. Small wonder that the book has been influential in the Congress's numerous hearings on reform of the Act.<sup>4</sup> *Noah's Choice* easily justifies the temporary moratorium that the 104th Congress im-

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<sup>1</sup> 16 U.S.C. §§ 1531-1544 (1994).

<sup>2</sup> CHARLES C. MANN & MARK L. PLUMMER, *NOAH'S CHOICE: THE FUTURE OF ENDANGERED SPECIES* (1995).

<sup>3</sup> See, e.g., Cass R. Sunstein, *Congress, Constitutional Moments, and the Cost-Benefit State*, 48 STAN. L. REV. 247 (1996) (proposing that Congress subject all federal regulations to cost-benefit balancing).

<sup>4</sup> One of the authors has given congressional testimony on the Act. See *Reauthorization of the Endangered Species Act: Hearings Before the Subcomm. on Drinking Water, Fisheries, and Wildlife of the Senate Comm. on Environment and Public Works*, 104th Cong. (1995) [hereinafter *Act Reauthorization*] (statement of Mark L. Plummer, Senior Fellow, Discovery Institute). Moreover, the book has been favorably cited on three other occasions. See *Improving the Endangered Species Act: Recommended Amendments: Hearings Before the House Comm. on Resources*, 104th Cong. 44-45 (1996) (statement of Robert J. Vincze, Counsel, Mo-Ark Association); *Possible Implications from Estimating Tropical Extinctions for Biodiversity Policy: Hearings Before the Task Force on the Endangered Species Act of the House Comm. on Resources*, 104th Cong. 46-47 (1995) (statement of Patrick Kangas, Natural Resources Management Program, University of Maryland); *Reforming the Endangered Species Act: The Property Rights Perspective: Hearings Before the Task Force on Endangered Species Act of the House Comm. on Resources*, 104th Cong. 32-34 (1995) (statement of Ike C. Sugg, Fellow in Wildlife and Land-Use Policy, Competitive Enterprise Institute). The book has also been criticized in Congressional testimony. See

posed on expanding the list of endangered and threatened species,<sup>5</sup> as well as the sweeping revisions proposed by Don Young, a longtime opponent of the Act and the current Chairperson of the House Committee on Resources.<sup>6</sup> If the Act does not prevent species extinction, or otherwise benefit endangered species, then a demonstration that the Act imposes *any* social cost justifies its substantial revision or even repeal. Although *Noah's Choice* provides a colorful description of the Act's costs, the book fails to carefully assess its benefits. It portrays an undisciplined program created by a statute that exaggerates the value that the general public places on biodiversity. Unfortunately, Mann and Plummer's case against the Act is based only on anecdotes and cursory evaluation of evidence of the Act's benefits.

After first observing that *Noah's Choice* does provide a useful contribution to the literature on the Act, this Article supplies crucial information missing from Mann and Plummer's critique: an empirical analysis of the effects of the Endangered Species Act. Careful assessment of the status of species protected by the Act reveals that it does improve the condition of endangered and threatened ("listed") species.<sup>7</sup> Although the results of the analysis suggest reforms that could make the Act more efficient, any revisions should focus on building upon the Act's success.

## I

### THE COSTS OF THE ENDANGERED SPECIES ACT

*Noah's Choice* puts forth a convincing argument that the Act has a high social cost. This may seem like a trivial contribution; the Act's two key provisions, contained in sections 7<sup>8</sup> and 9,<sup>9</sup> appear to have obvious costs. Section 7 forbids any federal agency from taking any

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*Act Reauthorization, supra*, at 37-48 (statement of Stuart L. Pimm, Professor of Ecology, University of Tennessee).

<sup>5</sup> Emergency Supplemental Appropriations and Recisions for the Department of Defense to Preserve and Enhance Military Readiness Act of 1995, Pub. L. No. 104-6, 1995 U.S.C.A.N. (109 Stat.) 73, 86. This law, signed by President Clinton in April, 1995, withdrew all funding from the Fish and Wildlife Service ("FWS") for placing any new species on either the endangered or threatened lists, as well as for critical habitat determinations, for the remainder of the government's fiscal year 1995 (ending on September 30, 1995). The battles between Congress and President Clinton over the federal budget for fiscal 1996 delayed restoring any funding for these activities until May, 1996. John H. Cushman, Jr., *Moratorium on Protecting Species is Ended*, N.Y. TIMES, May 21, 1996, at A1.

<sup>6</sup> H.R. 2275, 104th Cong. (1995). This Bill tracks the proposals in *Noah's Choice* closely.

<sup>7</sup> The Act distinguishes between "endangered" and "threatened" species. 16 U.S.C. § 1532 (6), (20) (1994). In this paper, I refer to both collectively as "listed" species. I discuss the distinction between the two designations *infra* notes 108-09, 144-46 and accompanying text.

<sup>8</sup> 16 U.S.C. § 1536 (1994).

<sup>9</sup> 16 U.S.C. § 1538 (1994).

action that "is . . . likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of [critical] habitat of such species."<sup>10</sup> As Mann and Plummer observe, this proscription values the prevention of extinction over *every other federal program*, regardless of the program's importance or social value.<sup>11</sup> Section 9 forbids private parties, as well as federal agencies, from "taking"<sup>12</sup> any endangered animal species.<sup>13</sup> The Act's definitions,<sup>14</sup> along with regulations promulgated by the Fish and Wildlife Service of the Department of the Interior ("FWS"),<sup>15</sup> make it clear that section 9 forbids a whole range of activities on private property, including development, logging, and farming.<sup>16</sup> These restrictions also apply without regard to the value of these activities or the costs they impose on private landowners. In short, making the case that the Act has high social costs should have been easy.

The history and folklore of the Act, however, suggest that its social costs are trivial. Consider just two examples, the cases of the snail darter and the West Indian (Florida) manatee. The discovery of the snail darter in the Little Tennessee River supported an injunction under section 7 that halted construction of the Tellico Dam by the Tennessee Valley Authority ("TVA").<sup>17</sup> On the face of it, this looks like a significant social cost—favoring a small, unknown fish over a

<sup>10</sup> 16 U.S.C. § 1536(a)(2) (1994).

<sup>11</sup> MANN & PLUMMER, *supra* note 2, at 25-26.

<sup>12</sup> 16 U.S.C. § 1532(19) (1994) (defining "take" as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct").

<sup>13</sup> 16 U.S.C. § 1538(a)(1) (1994). As to animals, this provision also prohibits importing, possessing, delivering or selling any listed species, as well as violating any regulation adopted pursuant to section 9. Plants are given lesser protection. *See infra* note 109 and accompanying text.

<sup>14</sup> 16 U.S.C. § 1532 (1994).

<sup>15</sup> The FWS has primary responsibility for implementing the Act. The National Marine Fisheries Service ("NMFS") (a sub-division of the Department of Commerce), however, also has some obligations. It is solely responsible for protecting 18 domestic species (seven cetaceans, six anadromous fish, one marine fish, and four pinnipeds) and shares responsibility with the FWS for seven species (six marine turtles and the Gulf sturgeon). *See* Office of Protected Resources, *Protecting the Nation's Marine Species* (visited Jan. 28, 1997) <[http://kingfish.ssp.nmfs.gov/tmcintyr/prot\\_res.html#ES](http://kingfish.ssp.nmfs.gov/tmcintyr/prot_res.html#ES) and Recovery>. The FWS has jurisdiction over the remaining 1,051 domestic species. *See* *Boxscore: Listings and Recovery Plans as of December 31, 1996* (visited Jan. 25, 1997) <<http://www.fws.gov/~r9endspp/boxscore.gif>>. This Article, as with most literature on the Act, focuses primarily on the FWS, because it is responsible for the lion's share of the listed species.

<sup>16</sup> An FWS regulation extends section 9 to threatened as well as endangered animal species. *See* 50 C.F.R. § 17.31(a) (1995). Another regulation extends the definition of "take" to include adverse modification of habitat. *See* 50 C.F.R. § 17.3 (1995); *see also* *Babbitt v. Sweet Home Chapter of Communities for a Greater Or.*, 115 S. Ct. 2407 (1995) (upholding this regulation).

<sup>17</sup> *See* MANN & PLUMMER, *supra* note 2, at 166-69 (citing *Tennessee Valley Auth. v. Hill*, 437 U.S. 153 (1978)).

huge public works project. Indeed, the public outcry after the United States Supreme Court upheld the injunction<sup>18</sup> resulted in amendment of the Act.<sup>19</sup> A subsequent cabinet-level analysis, however, concluded that the Tellico Dam project was an unnecessary waste of tax dollars.<sup>20</sup> The dam did not generate any electricity, did not promote flood control, provided only marginal recreational opportunities, and destroyed hundreds of acres of some of the most valuable farmland in the world.<sup>21</sup> Nevertheless, through a legislative "sleight of hand" by Tennessee's congressional delegation, the TVA built the dam in spite of the Act.<sup>22</sup> Although the Tellico Dam provided some benefits to an economically depressed area, its cost exceeded the revenues it ultimately generated in the local community.<sup>23</sup> The nation and the community would have been better off if the TVA had simply handed the local counties a check in the amount of the price of constructing the dam, rather than actually building it.<sup>24</sup> If the Act's principal impact on federal activity is to make it more difficult to undertake wasteful pork barrel projects like the Tellico Dam, it is surely a welcome addition to the U.S. Code.

The Florida manatee provides anecdotal support for the theory that section 9 also imposes few social costs.<sup>25</sup> During winter, manatees linger near the surface of the shallow, warm waters off of Florida's coast—waters they share with pleasure boaters.<sup>26</sup> Traveling at high speeds, boaters are unable to spot the lethargic creatures in time to avoid deadly collisions. Such collisions are so common that nearly all identified manatees have been scarred by propellers.<sup>27</sup> As many as forty manatee deaths each year are directly attributable to boating accidents,<sup>28</sup> amounting to 2.2% of the estimated population of

18 *Tennessee Valley Auth. v. Hill*, 437 U.S. 153 (1978).

19 Endangered Species Act Amendments of 1978, Pub. L. No. 95-632, § 7, 92 Stat. 3751, 3752-60 (1978); see also MANN & PLUMMER, *supra* note 2, at 170.

20 See MANN & PLUMMER, *supra* note 2, at 171.

21 See ZYGMUNT J.B. PLATER ET AL., ENVIRONMENTAL LAW AND POLICY: NATURE, LAW, AND SOCIETY 660-62 (1992).

22 See MANN & PLUMMER, *supra* note 2, at 171-73.

23 See *id.* at 174.

24 See *id.*

25 Unlike the more famous story of the snail darter, Mann and Plummer do not discuss the manatee.

26 See FLORIDA MANATEE RECOVERY TEAM, U.S. FISH AND WILDLIFE SERVICE, FLORIDA MANATEE RECOVERY PLAN 14 (1989) [hereinafter MANATEE RECOVERY PLAN].

27 See Steve Liewer, *Support Sought for Manatees; National Conference Urges Habitat Awareness*, FORT LAUDERDALE SUN-SENTINEL, Mar. 4, 1996, at B1. Propeller scars on manatees are so common that scientists studying the species use the scar patterns as a basis for identifying individual manatees. See Dail Willis, *Swimming Against Disease; Mystery: Scientists Are Trying to Discover What's Causing a Lung Infection That Has Killed Scores of Manatees off Florida Since March*, BALTIMORE SUN, Apr. 24, 1996, at A1.

28 See MANATEE RECOVERY PLAN, *supra* note 26, at 13.

1,800.<sup>29</sup> Boaters have taken a heavy toll on the manatees, and recreational boating represents one of the two prime causes of human-related mortality in the species.<sup>30</sup> Recent steps taken at both federal and state levels posting and policing speed limits in areas frequented by the manatee at those times of year when the species is likely to be present, along with strategic restrictions on the construction of boating docks,<sup>31</sup> should provide significant protection for the manatee. Given the ample availability of non-manatee populated waters for high-speed boating in Florida, as well as the dangerous nature of the activity itself, such measures hardly seem costly. Indeed, even if society cared nothing for the manatee, it might well take the same steps to protect unwitting boaters from potentially fatal collisions. In the case of the manatee, enforcement of the Act arguably has the side benefit of curtailing a dangerous and excessive behavior.

In addition to anecdotes like the Tellico Dam story, statistics on the Act's impact on the federal government also support the theory that it restricts only wasteful activities. In addition to creating a substantive roadblock, section 7 requires that all federal agencies consult with the FWS if they believe that their actions may affect any listed species.<sup>32</sup> Between 1987 and 1991, among the 73,560 consultations performed, only 131 involved potential jeopardy to any listed species.<sup>33</sup> Furthermore, only eighteen federal projects were terminated as a result of the Act.<sup>34</sup> Although the impact of the Act on private parties is unknown,<sup>35</sup> the statistics suggest that cases in which the Act impedes important, large-scale federal projects are exceptions rather than the rule.

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<sup>29</sup> Division of Endangered Species, U.S. Fish and Wildlife Service, *West Indian Manatee* (visited Nov. 15, 1996) <<http://www.fws.gov/~r9endspp/i/a/saaochtml>>.

<sup>30</sup> See MANATEE RECOVERY PLAN, *supra* note 26, at 14. Modification of their habitat is the other cause of the manatee's decline. *Id.*

<sup>31</sup> See 50 C.F.R. §§ 17.100-108 (1995); FLA. STAT. ch. 370.12(2) (West Supp. 1997); FLA. ADMIN. CODE ANN. r. 62N-22.001 (1995).

<sup>32</sup> 16 U.S.C. § 1536(a)(2) (1994).

<sup>33</sup> This excludes two "mega-consultations" involving pesticides and timber sales. See Oliver A. Houck, *The Endangered Species Act and Its Implementation by the U.S. Departments of Interior and Commerce*, 64 U. COLO. L. REV. 277, 318 (1993) (citing WORLD WILDLIFE FUND, FOR CONSERVING LISTED SPECIES, TALK IS CHEAPER THAN WE THINK: THE CONSULTATION PROCESS UNDER THE ENDANGERED SPECIES ACT (1992)).

<sup>34</sup> See *id.*

<sup>35</sup> Some reports suggest that the Act's effect on private parties may be substantial. See, e.g., THOMAS LAMBERT, CENTER FOR THE STUDY OF AM. BUSINESS, THE ENDANGERED SPECIES ACT: A TRAIN WRECK AHEAD 7-8 (1995); William P. Pendley, *The Endangered Species Act: The Pit Bull of Environmental Laws*, in *Farmers, Ranchers and Environmental Law* 169, 173-81 (Roger Clegg ed., 1995). A study conducted by the General Accounting Office concluded that 90% of all listed species have some or all habitat on private land; for 73% of the listed species, private land accounts for more than 60% of their habitats. U.S. GEN. ACCOUNTING OFFICE, ENDANGERED SPECIES ACT: INFORMATION ON SPECIES PROTECTION ON NONFEDERAL LANDS 4-5 (1994).

Although they rely largely on anecdotes rather than hard data, Mann and Plummer construct a persuasive response to the theory that the Act is costless.<sup>36</sup> *Noah's Choice* documents detailed case studies of instances in which the presence of an endangered species stopped a valuable public or private project dead in its tracks. To name just a few examples, the book describes a road needed to provide access to a hospital for a rural community that was not constructed so as to avoid disturbing an endangered beetle;<sup>37</sup> a community plagued by black flies that was unable to use an insecticide because of the presence of an endangered butterfly;<sup>38</sup> and a shopping mall forced to spend thousands of dollars every year to mow its grass carefully so as to provide a suitable habitat for the same endangered butterfly.<sup>39</sup> Case after case, they record the Act's very real and very human costs. Even if a massive iceberg does not lurk below the more visible cases like the snail darter and the manatee, *Noah's Choice* demonstrates that numerous costly instances of the Act's restrictions do indeed exist.

Of greater value to the debate, however, is the framework Mann and Plummer build around these anecdotes. They assert that the Act's effect on the economy is akin to cooking a frog:<sup>40</sup> "Drop a frog in a pot of boiling water . . . and it will immediately leap free. But put that same frog in a pot of cool water and gradually turn up the heat, and the frog will happily sit and be cooked to death."<sup>41</sup> So too with the Act. If it prevents the opening of one shopping mall, we do not notice because the effect on the economy is negligible. One fewer golf course yields no observable decline in recreational opportunities. One less road does not significantly hamper transportation. Although each project delayed or halted may not be significant in and of itself, Mann and Plummer observe that each does have a cost. One fewer shopping mall, golf course, or highway translates into an incremental loss of productivity and greater unemployment, even if it is not easily observed. Furthermore, the full impact of the Act must consist of the sum of these lost activities. When one adds up the cost of all of the lost private and public projects, the sum-total may surprise and alarm, even if each incremental cost can be justified.

Mann and Plummer's "cooked frog" metaphor is perhaps best illustrated by their discussion of the conflict between development and

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<sup>36</sup> *But see* Oliver A. Houck, *Reflections on the Endangered Species Act*, NAT. RESOURCES & ENV'T, Summer 1995, at 9, 10-12 (arguing that wasteful public subsidies create the illusion that protection of biodiversity interferes with economic productivity).

<sup>37</sup> MANN & PLUMMER, *supra* note 2, at 15-17.

<sup>38</sup> *Id.* at 95-97.

<sup>39</sup> *Id.* at 107.

<sup>40</sup> *Id.* at 85.

<sup>41</sup> *Id.*

protecting endangered species in Austin, Texas.<sup>42</sup> In the late 1980s the city found itself choosing between satisfying a boom in the demand for new housing and protecting a sizeable assortment of endangered birds, insects, bats, salamanders, and arachnids.<sup>43</sup> As the city's population began to spill into previously undeveloped countryside, developers turned their attention to property inhabited by these creatures.<sup>44</sup> The Act's restrictions arguably added to the pressure on housing prices in Austin,<sup>45</sup> in that each property the Act removed from development added another incremental cost to housing in Austin, for a substantial cumulative impact.

Thus do Mann and Plummer refute the theory that the Act is costless. But even if the Act generates social costs, it may also create benefits that make it, on balance, a sensible statute. Mann and Plummer recognize this, and admit that protecting endangered species may create some benefits.<sup>46</sup> They admit that a decline in biodiversity may result in losses to biotechnology as well as having potentially disastrous effects on ecosystems.<sup>47</sup> They also describe the loss in tourism that some regions might face if they lost their whooping cranes or California condors.<sup>48</sup> Mann and Plummer dismiss these political losses, however, as trivial, or inapplicable to a single species. They assert that standard economic analysis cannot provide a sensible value for any particular species.<sup>49</sup> Ultimately, they conclude that humans are willing to bear some costs to protect species out of a sense of moral obligation, for "reasons peculiarly our own."<sup>50</sup> This moral compulsion, they argue, is not absolute. It does not require adopting the so-called "Noah Principle"<sup>51</sup> of saving every species. Trade-offs must be made and some species must be sacrificed to other obligations, such as providing food and affordable housing. Mann and Plummer fault the Act for failing to make these trade-offs. They contend that as a consequence of refusing to make such choices, the Act attempts to protect species when, in fact, society should rationally decline to do so.<sup>52</sup>

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<sup>42</sup> *Id.* at 176-211.

<sup>43</sup> *Id.* at 176-87.

<sup>44</sup> *Id.*

<sup>45</sup> *Id.* Others have described a similar impact of the Act on housing prices and availability. See LAMBERT, *supra* note 35, at 8; Craig Anthony (Tony) Arnold, *Conserving Habitats and Building Habitats: The Emerging Impact of the Endangered Species Act on Land Use Development*, 10 STAN. ENVTL. L.J. 1, 32-36, 39-41 (1991); Katharine Rosenberry, *The Effect of the Endangered Species Act on Housing Construction*, 33 HASTINGS L.J. 551, 565-82 (1982).

<sup>46</sup> MANN & PLUMMER, *supra* note 2, at 119-24.

<sup>47</sup> *Id.* at 128-130.

<sup>48</sup> *Id.* at 126, 131.

<sup>49</sup> *Id.* at 131-32.

<sup>50</sup> *Id.* at 115, 134.

<sup>51</sup> *Id.* at 24-25.

<sup>52</sup> *Id.* at 213-15.



Worse yet, Mann and Plummer claim that the Act does not even protect endangered species.<sup>53</sup> They observe that since the Act's passage in 1973, only twenty-one species have been removed from the list of protected species, while 721 have been added.<sup>54</sup> Because the stated goal of the Act is to ensure that species recover and no longer need its protection,<sup>55</sup> this statistic is not inspiring. Furthermore, they assert that only one of the de-listed species (the American alligator) can thank the Act for its resurgence.<sup>56</sup> Among the listed species, only eleven have been re-classified from "endangered" to "threatened" status.<sup>57</sup> Mann and Plummer attribute only two of these partial successes to the Act (the Utah prairie dog and the Aleutian Canada goose).<sup>58</sup> As a final bit of evidence, Mann and Plummer cite the FWS's 1992 bi-annual Report on the Act.<sup>59</sup> According to this Report, of the species listed in 1992, 33% were "declining," 28% were "stable," less than 10% were "improving," 2% were "extinct," and 28% were of unknown status.<sup>60</sup> After noting that the status of some species would improve even without the Act, Mann and Plummer reach the "inescapable conclusion . . . [that] the Endangered Species Act has failed to help the overwhelming majority of species under its care to reach the 'point at which the measures provided pursuant to this Act are no longer necessary.'"<sup>61</sup> Thus, according to Mann and Plummer, endangered and threatened species continue to decline in the United States, despite the Act.

Mann and Plummer attribute this failure to the Act's adoption of the Noah Principle. The Act requires the protection of *all* endangered species regardless of the price. Its goal of saving every listed species from extinction would cost far more than Congress has historically been willing to spend on the endangered species program.<sup>62</sup> Mann and Plummer argue that the resources devoted to protecting biodiversity have never, and will never, match the enormity of the

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<sup>53</sup> *Id.* at 239-47.

<sup>54</sup> *Id.* at 240.

<sup>55</sup> Section 2(b) asserts that: "The purposes of this chapter are . . . to provide a program for the conservation of . . . endangered species and threatened species." 16 U.S.C. § 1531(b) (1994). The Act defines "conservation" as the "use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this chapter are no longer necessary." 16 U.S.C. § 1532(3) (1994).

<sup>56</sup> MANN & PLUMMER, *supra* note 2, at 241.

<sup>57</sup> *Id.*

<sup>58</sup> *Id.* at 242-43.

<sup>59</sup> U.S. FISH & WILDLIFE SERVICE, U.S. DEP'T OF THE INTERIOR, REPORT TO CONGRESS, ENDANGERED AND THREATENED SPECIES RECOVERY PROGRAM 17-20 (1992) [hereinafter FWS REPORT, 1992], *cited in* MANN & PLUMMER, *supra* note 2, at 243.

<sup>60</sup> MANN & PLUMMER, *supra* note 2, at 243.

<sup>61</sup> *Id.* at 245 (quoting 16 U.S.C. § 1532(3) (1994)).

<sup>62</sup> MANN & PLUMMER, *supra* note 2, at 214-15.

task.<sup>63</sup> "Noah had it easy," they write, "[t]he materials he needed . . . were at hand and the design . . . was guaranteed to be sufficient for the task."<sup>64</sup> The United States has no such guarantee and has other priorities. Given the budget constraints under which species protection must operate, they argue, trying to preserve everything is a foolish, "optative" goal.<sup>65</sup>

Insisting upon reaching the unreachable has two adverse consequences: it inefficiently stretches the resources available to protect species and disproportionately imposes the burden of protecting species on private landowners. As to the first point, Mann and Plummer echo the conclusions of others.<sup>66</sup> The FWS faces a large backlog of species awaiting listing<sup>67</sup> and receives only a fraction of the funding necessary to implement recovery efforts.<sup>68</sup> Consequently, unlisted species submerge into extinction before receiving the Act's protection<sup>69</sup> while listed species fail to recover, both because their numbers have declined too drastically before they first received protection<sup>70</sup> and because their recovery plans remain unfunded.<sup>71</sup>

As to the Act's impact on landowners, Mann and Plummer capture the sentiment and concerns of many when they argue that the Act's restrictions on private landowners are both counterproductive and unfair.<sup>72</sup> Because section 9 can convert a "worthwhile private endeavor" into a "potential crime," it gives landowners "great incentive to ensure that an official endangered species never appear[s] on their property."<sup>73</sup> Rather than providing landowners with positive reasons to conserve endangered species, they argue, the Act creates perverse

<sup>63</sup> *Id.*

<sup>64</sup> *Id.* at 212.

<sup>65</sup> *Id.* at 209-10.

<sup>66</sup> See, e.g., Ann Gibbons, *Mission Impossible: Saving All Endangered Species*, 256 SCIENCE 1386, 1386 (1992); Daniel J. Rohlf, *Six Biological Reasons Why the Endangered Species Act Doesn't Work—And What to Do About It*, 5 CONSERVATION BIOLOGY 273, 278-79 (1991).

<sup>67</sup> See Houck, *supra* note 33, at 292-96.

<sup>68</sup> See *id.* at 346-49.

<sup>69</sup> The precise number of species that have been lost while awaiting listing is unknown and probably unknowable, but the FWS reports that at least three candidate species have gone extinct before being listed. *Proposed and Candidate Species Information* (visited Nov. 4, 1996) <<http://www.fws.gov/~r9endssp/endcand.html>>. The agency cautions, however, that these species may have been extinct before the Act's passage. *Id.*

<sup>70</sup> See David S. Wilcove et al., *What Exactly Is an Endangered Species? An Analysis of the U.S. Endangered Species List: 1985-1991*, 7 CONSERVATION BIOLOGY 87, 88 (1993) (asserting that when listed, many species have populations too small to ensure long-term survival).

<sup>71</sup> See Houck, *supra* note 33, at 344-51.

<sup>72</sup> MANN & PLUMMER, *supra* note 2, at 176-211. See also LAMBERT, *supra* note 35, at 14-15; John Charles Kunich, *The Fallacy of Deathbed Conservation Under the Endangered Species Act*, 24 ENVTL. L. 501, 561-65 (1994); Pendley, *supra* note 35, at 181-88; Richard Stone, *Incentives Offer Hope For Habitat; Enforcing the Endangered Species Act with Positive Incentives*, 269 SCIENCE 1212, 1212 (1995).

<sup>73</sup> MANN & PLUMMER, *supra* note 2, at 187.

incentives for them to destroy suitable habitat. Mann and Plummer document specific instances of these perverse incentives in action. For instance, upon being informed that the San Diego mesa mint was about to be placed on the list of endangered plants, a construction company immediately cleared a 279-acre tract containing the plant,<sup>74</sup> while a development company owned by Ross Perot stripped a 333-acre site near Austin, Texas, of all juniper and oak to discourage the endangered golden-cheeked warbler from settling on the property.<sup>75</sup> Although section 5 of the Act allows the FWS to purchase land from private landowners to preserve habitat,<sup>76</sup> lack of funds forces the FWS to rely instead on the restrictions set forth in section 9,<sup>77</sup> thereby, in the words of Justice Scalia, "conscript[ing land] into national zoological use."<sup>78</sup> Whereas purchasing habitat would preserve it indefinitely, leaving it in private hands may subject it to perverse incentives that destroy the species.

Thus, the Act stands condemned by Mann and Plummer. As written, the Act imposes real, tangible social costs in an effort to reach the unattainable goal of protecting *all* species and, as a result, makes no progress towards achieving the more modest, desirable goal of simply protecting *some* species. Although others have criticized their book for failing to propose specific alternatives,<sup>79</sup> Mann and Plummer need not offer such proposals. Their mission is accomplished once they reach the conclusion that the Act has no benefits. Costs without benefits are not tolerated in contemporary America, nor should they be. Mann and Plummer do not pronounce final sentence on the Act, but given their verdict, repeal is the most obvious reform. Indeed, some of the reforms they do advocate are tantamount to repeal.<sup>80</sup> In particular, they propose eliminating the FWS regulation that restricts adverse modification of habitat by private landowners and replacing it with a "national biodiversity trust."<sup>81</sup> Moreover, they would withhold federal eminent domain power from this land trust.<sup>82</sup> Mann and

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<sup>74</sup> *Id.* at 187

<sup>75</sup> *Id.* at 196-97.

<sup>76</sup> 16 U.S.C. § 1534 (1994).

<sup>77</sup> MANN & PLUMMER, *supra* note 2, at 220.

<sup>78</sup> *Babbitt v. Sweet Home Chapter of Communities for a Greater Or.*, 115 S. Ct. 2407, 2421 (1995) (Scalia, J., dissenting).

<sup>79</sup> Donald A. Carr & William L. Thomas, *The Law and Policy of Endangered Species Act Reauthorization: Noah's Choices and Ecological Mandarins*, 25 ENVTL. L. 1281, 1289-90 (1995) (book review); Deborah Eudene, Book Note, 15 STAN. ENVTL. L.J. 233, 241-43 (1996).

<sup>80</sup> Mann and Plummer advocate altering the Act so as to (1) reduce the costs it imposes on those who live near endangered species, MANN & PLUMMER, *supra* note 2, at 216-19; (2) set attainable goals, *id.* at 219-21; (3) devote more resources to gathering information, *id.* at 221-22; and (4) allow for more localized, political balancing of competing interests, *id.* at 222-24.

<sup>81</sup> *Id.* at 227-29.

<sup>82</sup> *Id.* at 228-29.

Plummer would retain only the Act's prohibition against active hunting of endangered species—converting the Act into “a kind of glorified anti-poaching law.”<sup>83</sup>

Mann and Plummer's conclusion has the support of an unlikely collection of economists and conservationists.<sup>84</sup> Many scholars agree that the Act's combination of inadequate funding and perverse incentives undermines its ability to protect biodiversity, and argue that more positive incentives are needed.<sup>85</sup> The problem with this pronouncement, however, is the weakness of the data used to support it. If the Act has failed to protect endangered species, then it should be scaled down to more realistic goals. To conclude that the Act is failing simply because more species have been identified as endangered than have been identified as having recovered, however, is misguided. Even Mann and Plummer's use of the detailed data in the 1992 FWS Report on the Act is misleading.<sup>86</sup> Throughout their book, Mann and Plummer rely on carefully conducted research, except when the topic turns to the effectiveness of the Act in preserving species. Indeed, they relegate this section to an appendix,<sup>87</sup> suggesting that they do not regard the issue as critical. Yet clearly it is. If the Act has stemmed a tide of extinction, then reform must proceed with caution lest the valuable aspects of the Act be lost, and repeal can be justified only by a demonstration that our society has withdrawn from its commitment to preserving biodiversity.

In their analysis of whether the Act works, Mann and Plummer commit two critical errors. First, they fail to determine the Act's marginal impact on biodiversity. Even if 721 more species are endangered today than in 1973, in order to assess the Act's impact on endangered species, one must ask how many *more* would have been endangered or even extinct if the Act had never become law. Second, their description of the data provides a snapshot of biodiversity, but their conclusions require a short video. Data on the present status of species provide little indication of biodiversity trends. Unfortunately, Mann and Plummer overlook a wealth of data available on the status of endangered species. In the remainder of this Article, I examine some of these data. A thorough analysis supports the conclusion that, contrary to Mann and Plummer's appraisal, the Act *does* benefit en-

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<sup>83</sup> *Id.* at 227.

<sup>84</sup> See, e.g., Stone, *supra* note 72, at 1212. See also NATIONAL RESEARCH COUNCIL, SCIENCE AND THE ENDANGERED SPECIES ACT 4 (1995) [hereinafter NRC REPORT] (giving the Act high marks for adherence to scientific principles, but only lukewarm support for the Act's power to facilitate species recovery).

<sup>85</sup> See *supra* notes 72-78 and accompanying text.

<sup>86</sup> The National Research Council analyzed these data as well, but argued that the FWS's statistics were inconclusive. NRC REPORT, *supra* note 84, at 197.

<sup>87</sup> MANN & PLUMMER, *supra* note 2, app. at 243-45.

dangered species. The data also suggest that some relatively minor improvements in the implementation of the Act could make it more efficient, thereby protecting more species for the same investment.

## II

### THE PRESENT STUDY

Mann and Plummer's superficial analysis could easily have overlooked important benefits generated by the Act. The present study used data published by the FWS and available in the Federal Register to identify trends in the viability of listed species over time and under different circumstances, thereby creating a more detailed assessment of the Act's impact on biodiversity.

#### A. Methodology and Hypotheses

The 1988 amendments to the Act require the FWS to generate biannual reports on the endangered species program,<sup>88</sup> and the Agency has done so for 1990, 1992, and 1994.<sup>89</sup> The data on listed species contained in these reports served as the basis for the present analysis. The reports describe several variables for each species, including the listing designation (endangered or threatened); whether or not critical habitat has been designated; whether or not a recovery plan has been adopted; the recovery priority of the species;<sup>90</sup> whether the recovery efforts for that species conflict with economic development; and most importantly, the current status of each species' population (improving, stable, declining, extinct, or unknown).

This last variable, population status, was the primary target of the present analysis. Even though a species remains listed as endangered or threatened, if its population is currently improving, then the Act may claim some measure of success. Likewise, even the status of "stable" may represent a turnaround from the decline that caused the species to be listed. A species' status is thus a more refined measure of

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<sup>88</sup> Endangered Species Act Amendments of 1988, Pub. L. No. 100-478, § 1003, 102 Stat. 2306, 2306-07 (codified as amended at 16 U.S.C. § 1533(f)(3) (1994)).

<sup>89</sup> U.S. FISH AND WILDLIFE SERVICE, U.S. DEP'T OF THE INTERIOR REPORT TO CONGRESS, ENDANGERED AND THREATENED SPECIES RECOVERY PROGRAM (1990) [hereinafter FWS REPORT, 1990]; FWS REPORT, 1992, *supra* note 59; U.S. FISH AND WILDLIFE SERVICE, U.S. DEP'T OF THE INTERIOR REPORT TO CONGRESS, RECOVERY PROGRAM, ENDANGERED AND THREATENED SPECIES (1994) [hereinafter FWS REPORT, 1994]. At present, the 1994 Report is the most current, having been issued in late 1995.

<sup>90</sup> The FWS combines three variables into a single numerical value to describe recovery priority: degree of threat (high, moderate, and low), recovery potential (high or low), and taxonomy (monotypic genus, species, and subspecies). FWS REPORT, 1990, *supra* note 89, at 8. The FWS also considers the existence of an economic conflict with recovery efforts to be part of its recovery priority system, but such a conflict does not alter its priority number. *Id.* In the present analysis, economic conflicts were considered separately from recovery priority.

the Act's impact on biodiversity than the mere fact of its presence on the list of endangered and threatened species. This variable admittedly has been criticized by the National Research Council as being too subjective.<sup>91</sup> It is not clear when an increase in population size constitutes "improvement" or how long a population must remain constant to be considered "stable."<sup>92</sup> Ultimately these designations represent the subjective judgment of the FWS, and may only imperfectly reflect a given species' true condition. Furthermore, as Mann and Plummer observe, for some species improvement might not be the product of the Act's protection,<sup>93</sup> or might not represent true progress towards recovery.<sup>94</sup> Despite these problems, across the 891 species described in the 1994 Report, species status should correlate with the actual condition of species. Noise and error in the data may obfuscate small effects, but strong, accurate trends nevertheless should emerge, if they exist.

The Act creates three types of protection for endangered species. First, the Act protects all listed species from harm caused by the actions of federal agencies under section 7, and protects animal species from being harmed by private parties under section 9.<sup>95</sup> Second, once a species is listed, the FWS is charged with designating its "critical habitat,"<sup>96</sup> which is then protected from federal agencies.<sup>97</sup> Finally, the FWS is supposed to adopt a "recovery plan": a series of actions designed to spur improvements in the species' population.<sup>98</sup> In the present analysis, data on species status were used to illuminate the benefits of each of these three aspects of the Act.

The status of all species provides some indication of the impact of listing a species. In 1992, the FWS reported that only 38% of all listed species were known to be stable or improving—a statistic that Mann and Plummer use to condemn the Act.<sup>99</sup> The status of the listed species in any given year is worth noting, but may not say much about the effectiveness of the Act. Of greater significance is any change in this

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<sup>91</sup> NRC REPORT, *supra* note 84, at 197-98.

<sup>92</sup> *Id.*

<sup>93</sup> MANN & PLUMMER, *supra* note 2, at 244-45.

<sup>94</sup> This is the case for the pahrump poolfish, which is classified as improving. Although the species is in better condition than in 1975, when its only remaining habitat was drained, the entire population currently inhabits an artificial tank fed by an artesian well. *Id.* at 244.

<sup>95</sup> Plant species are protected to a lesser extent than animals. Plants are not completely protected from private parties under section 9, unless they are on federal land. 16 U.S.C. § 1533(a) (1994).

<sup>96</sup> 16 U.S.C. § 1533(a)(3)(A) (1994). *See also* 16 U.S.C. § 1532(5) (1994) (defining critical habitat).

<sup>97</sup> 16 U.S.C. § 1536(a)(2) (1994).

<sup>98</sup> 16 U.S.C. § 1533(f) (1994).

<sup>99</sup> MANN & PLUMMER, *supra* note 2, at 243 (relying upon statistics in the FWS REPORT, 1992).

percentage between the three FWS reports, but even this may be misleading. In 1990, the FWS reported that 82% of those species listed for less than one year were declining,<sup>100</sup> indicating that newly listed species are doing quite poorly. Continuously adding new species may therefore mask any beneficial impact that the Act has on species over time.<sup>101</sup> Several comparisons designed to avoid this problem are described in this study: the status of species in 1990 versus the status of these same species in 1994;<sup>102</sup> the status of those species listed for less than one year in 1994 versus the status of all other species in 1994; and the status of each species at the time it was listed<sup>103</sup> versus its current status.

As a further means of determining the effects of listing, the present analysis compared the length of time that each species has been listed to each species' reported status.<sup>104</sup> In its 1994 report, the FWS concluded that the length of time that a species has remained under the Act's protection correlates positively with species status.<sup>105</sup> Specifically, the FWS observed that 58% of those species listed for twenty years or more have stable or improving populations, as opposed to 44% of those species listed for four to twenty years, and 22% of those species listed for less than four years.<sup>106</sup> The FWS reported similar statistics in 1990.<sup>107</sup> The present analysis relies upon a more refined methodology designed to determine the precise relationship between the number of years listed and species status.

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<sup>100</sup> FWS REPORT, 1990, *supra* note 89, at 17. This statistic is not surprising in light of the fact that placing a species on the list requires that the FWS determine that it is in "danger of extinction throughout all or a significant portion of its range . . ." 16 U.S.C. § 1532(6) (1994).

<sup>101</sup> The early 1990s saw a dramatic increase in the listing of new species. Some of this increase resulted from the settlement of a suit by environmental groups in 1992, in which the FWS agreed to step up the listing process. See Kunich, *supra* note 72, at 534-35 & nn.105-09.

<sup>102</sup> Such a comparison was also used to estimate the status of species that had an unknown status—because further research by the FWS between 1990 and 1994 might have revealed the condition of some of the species that had an unknown status in 1990.

<sup>103</sup> The species status at the time of listing is frequently reported in the final rule adding the species to the endangered or threatened lists, published in the Federal Register.

<sup>104</sup> The data in the 1994 FWS Report does not include the length of time a species has been listed. This variable was obtained from dates provided in the 1990 FWS Report, and from the date of the final rule listing the species published in the Federal Register. Species listed before 1973 were treated as if they were listed in 1973, because that year marks the initiation of the program described in this paper. Although the Act itself dates back to 1967, the original statute provided no protection for endangered species.

<sup>105</sup> FWS REPORT, 1994, *supra* note 89, at 32.

<sup>106</sup> *Id.* at 33.

<sup>107</sup> In its 1990 Report, the FWS stated that 82% of those species listed less than one year were in decline, as opposed to 39% of those listed between one and seven years, 32% of those listed between seven and fifteen years, and 30% of those listed for more than fifteen years. FWS REPORT, 1990, *supra* note 89, at 17.

The present analysis also includes a comparison of those species listed as "threatened" with the status of those species listed as "endangered." The FWS designates a species as "threatened" rather than "endangered" when it has determined that it is not in immediate danger of extinction.<sup>108</sup> Because virtually the same restrictions apply to both groups,<sup>109</sup> threatened species should generally be in better condition than endangered ones.<sup>110</sup>

In addition, the present study should resolve some of the uncertainty over the impact on listed species of designating their critical habitats. Section 7(a)(2) forbids federal agencies from taking any action that is likely to "result in the destruction or adverse modification of . . ." critical habitats.<sup>111</sup> Because federal agencies are already forbidden from taking actions that would jeopardize the continued existence of any listed species under section 7, and are forbidden from taking any species under section 9 (which includes adverse modification of habitat<sup>112</sup>), a designation of critical habitat may add only a trivial level of protection.<sup>113</sup> The controversy that designating critical habitat inspires, however, suggests that its impact is broader than it

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<sup>108</sup> Threatened species refers to "any species which is likely to become an endangered species within the foreseeable future . . ." 16 U.S.C. § 1532(20) (1994).

<sup>109</sup> The protections against federal agencies outlined in section 7 apply to both endangered and threatened species. 16 U.S.C. § 1536(a) (1994). The restrictions against private parties created by section 9, on its face, extends only to endangered animal species, 16 U.S.C. § 1533(a) (1994), but through regulations adopted pursuant to section 4(d), 16 U.S.C. § 1533(d) (1994), the FWS has extended section 9 to apply to threatened animal species as well. 50 C.F.R. § 17.31 (1995). Consequently, the only practical effect of a different listing designation is that the FWS may, pursuant to section 4(d), allow limited takings of threatened species if it finds that such takings would further the recovery of the species. 16 U.S.C. § 1533(d) (1994); *see, e.g.*, *Sierra Club v. Clark*, 755 F.2d 608 (8th Cir. 1985).

<sup>110</sup> In theory, a similar comparison could have been made between plant and animal species, which would indicate some measure of success of section 9's restrictions on private parties. Because this restriction applies only to animals, one might have predicted that animals would be in better condition overall than plants. Alternatively, if plants and animals are in a similar condition, or if plants are in better condition, one might conclude that section 9 has little or no effect, or even has some perverse effects. However, plants and animals differ in numerous ways in addition to section 9 protection. Routes of recovery and life cycles generally vary dramatically between the kingdoms. Furthermore, other research has shown that when they are listed, plants are far closer to extinction than animals. Wilcove et al., *supra* note 70, at 89. These factors conspire to make cross-kingdom comparisons uninterpretable. Nevertheless, this paper reports such a comparison. *See infra* note 146 and accompanying text. As to other kingdoms of species, the Act protects only plants and animals. Although older taxonomic schemes categorize all species as either plants or animals, many modern systems use additional categories for protists, fungi, and monera. NRC REPORT, *supra* note 84, at 50. No species fitting into one of these newer taxa is currently listed, and it is not clear that the Act protects such species. *Id.*

<sup>111</sup> 16 U.S.C. § 1536(a)(2) (1994).

<sup>112</sup> *See* 50 C.F.R. § 17.3 (1995).

<sup>113</sup> James Salzman, *Evolution and Application of Critical Habitat Under the Endangered Species Act*, 14 HARV. ENVTL. L. REV. 311, 339-42 (1990).



seems.<sup>114</sup> Because it is conceptually easier to enforce, section 7's prohibition against the destruction of critical habitats may have more impact than the other restrictions.<sup>115</sup>

Although the Act requires that the FWS designate critical habitat at the same time it lists a species,<sup>116</sup> the Agency has in fact designated critical habitat for only a fraction of all listed species.<sup>117</sup> Comparing the status of those species with designated critical habitat to the status of those without it should isolate the impact of designation. As with listing, the benefits of critical habitat may be observable only after a few years have passed. To incorporate this possibility into the analysis, the relationship between the length of time that critical habitat has been designated and the status was determined for each listed species.<sup>118</sup>

The final layer of protection afforded by the Act, the species recovery plan, may also influence species status. The Act requires that the FWS draft recovery plans for all listed species, unless doing so would "not promote the conservation of the species."<sup>119</sup> Although the restrictions outlined in sections 7 and 9 are designed to arrest the decline of the listed species, most require some form of affirmative action to attain a population size sufficient to ensure their long-term survival. Recovery plans are supposed to outline the actions that would, if taken, facilitate such a recovery. The actual impact of recovery plans, however, is uncertain. The plans have been criticized for being vague and for failing to set recovery goals that ensure species survival.<sup>120</sup> Furthermore, the steps proposed in the plans often remain untaken,<sup>121</sup> as far less money is available for species recovery plans than is needed to implement them.<sup>122</sup> In the present analysis, the effect of recovery plans was assessed in much the same way as the effects of critical habitat. The status of those species with plans was

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<sup>114</sup> See Houck, *supra* note 33, at 307-08.

<sup>115</sup> See *id.* at 310-11.

<sup>116</sup> 16 U.S.C. § 1533(a)(3)(A) (1994). The FWS may decline to designate critical habitat for any species if doing so would not be "prudent," meaning that such a designation would only encourage people to collect or vandalize individual members of the species. See 50 C.F.R. § 424.12(a)(1) (1995). The FWS may be relying on the "prudence" exception far more than is justified. See Houck, *supra* note 33, at 303-07.

<sup>117</sup> See Houck, *supra* note 33, at 301.

<sup>118</sup> None of the three FWS Reports lists the length of time that critical habitat has been designated. This was determined from the publication date of the final rule designating critical habitat in the Federal Register.

<sup>119</sup> 16 U.S.C. § 1533(f)(1) (1994).

<sup>120</sup> See Timothy H. Tear et al., *Status and Prospects for Success of the Endangered Species Act: A Look at Recovery Plans*, 262 SCIENCE 976, 976 (1993).

<sup>121</sup> See Houck, *supra* note 33, at 345-47.

<sup>122</sup> See *id.* at 347.

compared to the status of those species without plans.<sup>123</sup> Finally, the combined effect of recovery plans and critical habitat designation was assessed as well.

The existence of a conflict between economic development and a species' conservation efforts may harm species status. Because the Act sides with species against economic activity, such conflicts should have no effect on species status. The extent to which species facing economic pressures fare worse than those that do not, is an indicator of the extent to which the Act fails. To address this, the status of species facing economic conflicts was compared to the status of those that do not face such conflicts. This analysis was also performed separately for species that have critical habitat designated and species that do not, and again for species that have recovery plans and species that do not, in an effort to determine whether either program alleviates any of the adverse impacts of economic conflict.

The comparisons performed in this study on listing designation, critical habitat, recovery plan, and economic conflict required some further control, because these parameters were not randomly assigned to species. Two variables were available as controls: the priority given to a species and the length of time a species has been listed.<sup>124</sup> As to priority, it might be the case that, for example, species that had critical habitat designated also had a higher priority. Species with a higher priority may have received greater resources, and hence may be doing better. Thus, any improvements observed among species with critical habitat may be attributable to greater resources being devoted to them, rather than to their having designated critical habitat. Preliminary analysis, however, revealed that this was simply not the case.<sup>125</sup> Of greater concern is the number of years of protection, because this variable has already been demonstrated to affect species status.<sup>126</sup> If species that had critical habitat were also listed longer than those without it, then any observed benefits of critical habitat may have resulted simply from differences in the length of time that spe-

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<sup>123</sup> Unfortunately, the date of implementation of the recovery plans was not available, making it impossible to analyze the effects of time under a recovery plan on listed species.

<sup>124</sup> As noted, the length of time that a species has been listed is of interest in its own right. This paragraph and the analysis it describes merely express the concern that other observed effects might have resulted solely from the influence of this important variable.

<sup>125</sup> Species with an unknown status were assigned slightly more priority than the other species, although the difference was only marginally significant.  $t(564) = 1.81, p < .10$ . The mean priority differed between the species with a different status (excluding extinct species and those with an unknown status).  $F(2, 557) = 20.20, p < .001$ . This effect resulted primarily from species that were in decline, which had a higher priority than those that were stable or improving. Because the species that were in the worst condition were given the highest priority, it could not be the case that species improvement resulted from being given higher priority. Thus, there was no further need to control for this variable in any of the remaining analyses.

<sup>126</sup> See *supra* notes 105-06 and accompanying text.

cies were listed. To account for these effects, analyses to control for these two variables were performed.<sup>127</sup>

Finally, the present study describes the number of species that are known to have become extinct since the Act was passed. These species obviously represent an important failure of the Act and thus merit special attention. Likewise, species that have recovered sufficiently to justify their removal from the lists of endangered and threatened species mark an important success of the statute, and are described herein as well.

## B. Results

### 1. *The Effects of Listing Species*

Table 1 depicts the status of the listed species in each of the three FWS Reports. The Table shows the raw number of listed species of each status and the percentage of all listed species accounted for by each status for each of the three FWS reports.<sup>128</sup> The last set of col-

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<sup>127</sup> These effects were controlled by calculating the semi-partial correlation between the variables of interest (listing designation, kingdom, critical habitat, recovery plan, and economic conflict) and species status. Partialled out from this statistic was the effect of the control variables (number of years of protection and priority given to species). The semi-partial correlation was calculated by running two regression analyses: one that included only the control variables and one that included the control variables and the variable of interest. The semi-partial correlation was equal to the total variance explained by the second regression minus the variance explained by the first. To the extent that there was multi-collinearity between the variables of interest and the control variables, this analysis attributed the apparent influence of the control variables on species status entirely to those variables, and hence was an extremely conservative analysis as to variables of interest. The method is described in JACOB COHEN & PATRICIA COHEN, *APPLIED MULTIPLE REGRESSION/CORRELATION ANALYSIS FOR THE BEHAVIORAL SCIENCES* 79-177 (2d ed. 1983). The fact that the dependent variable was an ordinal parameter with no obvious metric (i.e., the categories of species status had a clear ranking, but were not necessarily spaced equally) added further complexity. To account for this in the primary analysis, non-parametric statistics were used. To account for this in the analysis of the control variables, two binary variables were created and analyzed. The first was coded as "zero" for species in decline, and as "one" for species that were stable or improving (species that were extinct or had an unknown status were coded as "missing"). The second was coded as "zero" for species that were stable, and "one" for species that were improving (all other species were coded as "missing"). The semi-partial regression analysis described was run separately on each of these two binary variables. Although a logistic or probit regression is technically more appropriate than a conventional regression, the correction that these models offer is small in the case of the ratios being analyzed in these data. Hence, a conventional model was used for its analytic simplicity.

<sup>128</sup> Table 1 and all further analyses excluded 59 species from the 894 described in the 1994 Report. The American alligator was excluded because the species is listed only because of its similar appearance to the American crocodile, 50 C.F.R. § 17.11 (1995); the bidens cuneate because no information was reported about the species (the plant was later de-listed after the FWS determined that it is not a distinct taxonomic group, Endangered and Threatened Wildlife and plants; Final Rule to Delist Bidens cuneata (cuneate bidens), a Hawaiian Plant, 61 Fed. Reg. 4372 (1996) (to be codified at 50 C.F.R. § 17.12(h)); Davis' green pitaya cactus because it was included twice, and all 56 clam species. The clams were excluded because their data differed so dramatically from that of the other species. Only a

umns depicts the percentages excluding those species with an unknown status. Table 1 does little to dispel Mann and Plummer's diagnosis.<sup>129</sup> Fewer than 10% of all listed species were known to be improving, while for each reporting year most species listed were either declining or had an unknown status. Excluding those species with an unknown status revealed that roughly half of all known listed species populations were declining or extinct; the other half were mostly stable and only about one in eight species with a known status was improving. Table 1 documents little improvement over the four-year period between the Reports. Statistical analysis revealed that the distributions of species status in both 1992 and 1994 did differ significantly<sup>130</sup> from the distribution in 1990,<sup>131</sup> but this effect resulted largely from a rise in the number of species with an unknown status. With unknown species excluded, no differences between any of the three reports were observed.<sup>132</sup>

TABLE 1: STATUS OF LISTED SPECIES IN 1990, 1992, AND 1994

Population Status	Number of Species			Percent of Total Species			Percent of Known Species		
	1990	1992	1994	1990	1992	1994	1990	1992	1994
Improving	56	68	76	10.4	10.2	9.1	12.9	14.2	13.4
Stable	181	201	236	33.5	30.1	28.3	41.8	42.1	41.5
Declining	188	198	248	34.8	29.6	29.7	43.4	41.4	43.7
Extinct	8	11	8	1.5	1.6	1.0	1.8	2.3	1.4
Unknown	108	190	267	20.0	28.4	32.0	—	—	—
Total	541	668	835	100.0	100.0	100.0	100.0	100.0	100.0

single species of clams was known to be improving, forty-seven species were in decline, three were extinct, and five had an unknown status. In other words, among clam species with a known status (excluding the extinct species), 97.9% were in decline. The percentages of known species in decline among the other groups were: mammals, 42.5%; birds, 35.4%; reptiles, 42.9%; amphibians, 50.0%; fish, 38.0%; snails, 38.9%; crustaceans, 44.4%; insects, 38.9%; arachnids (all four species had an unknown status); and plants, 49.3%. Including clam species in the analysis makes all listed species appear to be in overall worse condition, has a particularly greater impact on animal species, and makes species without critical habitat appear to be in worse condition (none of the clam species have critical habitat designated). Otherwise, the clam species do not affect the analysis in any significant way. Although it is not clear why clams fared so poorly, as to the clam species at least, the Act has been a dismal failure.

<sup>129</sup> MANN & PLUMMER, *supra* note 2, at 243. Mann and Plummer only relied upon the data in the 1992 Report, but, as noted, there were no real differences seen between the 1992 and 1994 Reports, *see infra* note 131.

<sup>130</sup> Throughout this paper, the words "significant," "significantly," and "significance" denote only a statistically reliable result and do not indicate the import of the results.

<sup>131</sup> The distribution differed significantly between 1990 and 1992,  $\chi^2(4) = 12.30$ ,  $p < .025$ , and between 1990 and 1994,  $\chi^2(4) = 24.25$ ,  $p < .001$ , but not between 1992 and 1994,  $\chi^2(4) = 3.79$ ,  $p > .40$ .

<sup>132</sup> The  $\chi^2(3)$  statistics for all three comparisons were less than 1.60,  $p$ 's  $> .5$ .

As for species that appeared in both the 1990 and 1994 Reports, there was a slight trend towards improvement.<sup>133</sup> As shown in Table 2, among the 445 species with a known status in both years, 5% more were deemed stable or improving in 1994.<sup>134</sup> The difference between the two years was not significant, either with or without unknown species included in the analysis.<sup>135</sup>

TABLE 2: STATUS OF SPECIES LISTED IN BOTH 1990 AND 1994

Population Status	All Species Listed in Both Years				Species With Known Status in Both Years			
	Number		Percent		Number		Percent	
	1990	1994	1990	1994	1990	1994	1990	1994
Improving	52	68	9.8	12.8	49	62	12.0	15.1
Stable	179	197	33.6	37.0	172	181	42.0	44.1
Declining	187	171	35.2	32.1	183	160	44.6	39.0
Extinct	6	8	1.1	1.5	6	7	1.5	1.7
Unknown	108	88	20.3	16.5	—	—	—	—
Total	532	532	100.0	100.0	410	410	100.0	100.0

Comparison of the 1990 and 1994 data also provided an estimate of the status of unknown species. Of the 108 species with an unknown status in 1990, thirty-four (31.5%) had a known status in 1994. One of these was extinct. Among the remaining thirty-three, eleven (33.3%) were declining, sixteen (48.5%) were stable, and six (18.2%) were improving. The differences between this distribution of species status and those of all species from 1990 and 1994 were both marginally significant.<sup>136</sup> However, this effect resulted from the fact that many

<sup>133</sup> The 1990 Report included data on 581 species. Removing the 40 clam species left 541. Among the remaining species, the FWS de-listed four before the 1994 Report (one plant was determined not to be a distinct taxonomic group; two other plants were determined not to be in danger of extinction; and one bird, the dusky seaside sparrow, was removed due to extinction), and nine distinct population listings in the 1990 Report were consolidated into fewer listings in the 1994 Report (two jaguarundi, three American peregrine falcon, two pelican, and two sea turtle populations, all listed separately in the 1990 Report, were consolidated into one listing each in the 1994 Report). Conversely, the American eagle and the topminnow were listed as one entry in the 1990 Report, and as two entries in the 1994 Report. Both 1994 listings for each of these two species were retained in the data. *Bidens cuneata* was also excluded from the analysis. See *supra* note 128. Finally, the dugong was listed in the 1990 Report, but not the 1994 Report—it has always been regarded by the FWS as a foreign species, despite some domestic appearances in the U.S. Trust Territories. After these adjustments, 532 species appearing in both Reports were retained in the analysis.

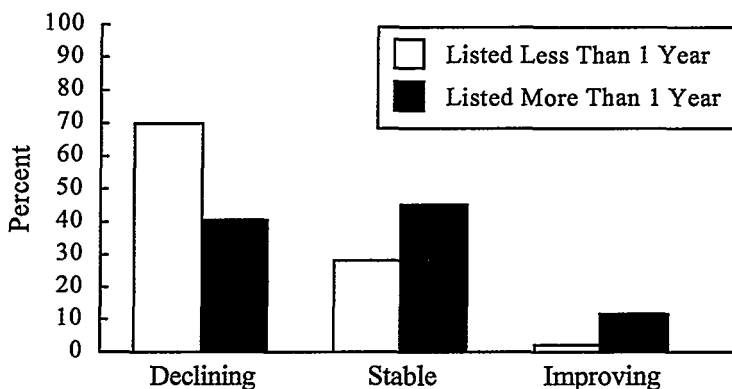
<sup>134</sup> An additional two species (the Guam broadbill and the Maryland darter) were declared extinct, but not removed, during the four-year period. Both were probably extinct before 1990. FWS REPORT, 1990, *supra* note 89, at 110, 198.

<sup>135</sup> Including unknown species,  $\chi^2(4) = 6.04$ ,  $p > .15$ ; without unknown species,  $\chi^2(3) = 3.37$ ,  $p > .25$ .

<sup>136</sup> As compared to 1990,  $\chi^2(2) = 4.98$ ,  $p < .08$ ; as compared to 1994,  $\chi^2(2) = 5.06$ ,  $p < .08$ . Note that because of the small sample size, the extinct species had to be excluded from the analysis to provide an accurate statistical test.

more of these species were found to be improving than in the general population of known species. Thus, it is not accurate to assume that the unknown species are largely in decline.

Just as in the 1990 Report,<sup>137</sup> newly listed species in the 1994 Report were in worse condition than the other species. Among the 147 species listed for less than one year, 56.5% had an unknown status, none were extinct, 29.3% were declining, 13.6% were stable, and 0.7% were improving. This is in contrast to the status of the 688 species listed for more than one year, 26.7% of which had an unknown status, 1.2% were extinct, 29.8% were declining, 31.4% were stable, and 10.9% were improving. Figure 1 makes this comparison among species with a known status that were not extinct. Among these species, 67.2%, 31.3%, and 1.6% of the 64 species listed for less than one year were declining, stable, and improving, respectively. This distribution of species status differed significantly from that among the 496 species that were listed longer than one year and had a known status, 41.3%, 43.6%, and 15.1% of which were declining, stable, and improving, respectively.<sup>138</sup>

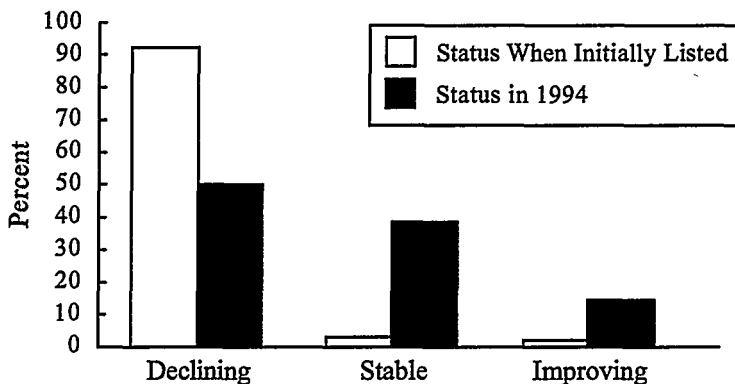


The original Federal Register listing indicated the initial status of 234 of the 835 (28%) species described in the 1994 Report. Excluding the three extinct species with an unknown status, 94.8%, 3.5%, and 1.7% of species were declining, stable, and improving, respectively, at the time they were listed. To facilitate a comparison among the same species, all species with either an unknown or extinct status in either 1994 or at the time they were listed were then excluded from the analysis, leaving 400 species. This revealed that as compared to their status in 1994 (49.3%, 37.5%, and 13.4% were declining, stable, and improving, respectively), these species demonstrated substantial

<sup>137</sup> See *supra* note 107 and accompanying text.

<sup>138</sup>  $\chi^2(2) = 18.27, p < .001$ . Significantly more of the new species listed for less than one year were of an unknown status (83 out of 147, or 56.4%) than were the species listed for more than one year (184 out of 688, or 26.7%).  $\chi^2(1) = 49.18, p < .001$ .

improvement (94.3%, 3.5%, and 2.5% declining, stable, and improving, respectively),<sup>139</sup> as shown in Figure 2 below.



Analysis of the number of years listed reveals that a species with a better population status was, on average, listed significantly longer.<sup>140</sup> Improving populations were listed longer than those with stable populations, and those with stable populations were listed longer than those with declining populations.<sup>141</sup> Specifically, species that were declining, stable, and improving were listed for an average of 8.2, 10.6, and 12.9 years, respectively. Figure 3 depicts this relationship in another way, showing the proportion of species in decline by the number of years of protection received. As can be seen from the regression line imposed on the graph, a steady improvement was observed. For each year of protection, a species was 1.5% more likely to be stable or improving as opposed to declining.<sup>142</sup> Although it is not shown graphically, species were also 0.9% more likely to be improving than stable for each year they are listed.<sup>143</sup>

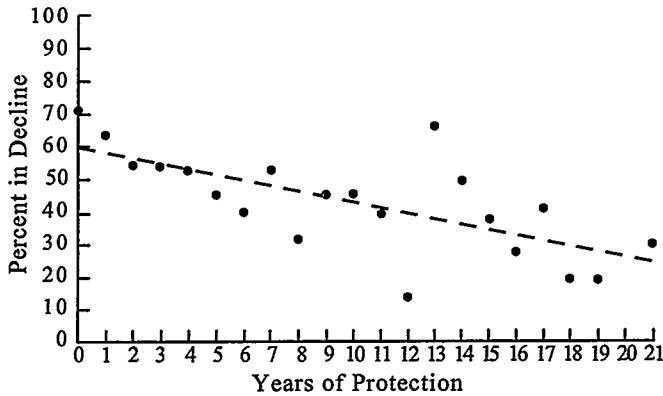
<sup>139</sup>  $\chi^2(2) = 200.94, p > .001$ . The percentage of species with an unknown status at the time of listing (234 out of 835, or 28.0%) did not differ significantly from the percentage of species with an unknown status in 1994 (267 out of 835, or 32.0%).  $\chi^2(1) = 0.40, p > .5$ .

<sup>140</sup> This analysis was performed only on species with an improving, stable, or declining status, and the result was statistically significant.  $F(2, 557) = 16.61, p < .001$ . A separate analysis revealed that species with an unknown status tended to be listed for less time (5.1 years) than species with a known status (9.9 years).  $t(586) = 10.30, p < .001$ . Extinct species were listed for a mean of 15.5 years.

<sup>141</sup> These differences were determined to be statistically significant through post hoc analysis (Tukey's HSD) of the ANOVA reported in *supra* note 140.

<sup>142</sup> This was determined by regressing the binary variable that distinguished declining species from stable and improving species on the number of years that species were listed. This regression was significant ( $F(1, 558) = 26.55, p < .001$ ) and yielded a beta coefficient of 0.015 for years of protection. This result means that each year of protection reduced the percentage of declining species by 1.5 percentage points and increased the percentage of improving and stable species by a like amount.

<sup>143</sup> This was determined by regressing the binary variable that distinguished stable from improving species on the number of years that species were listed. This regression, too, was significant,  $F(1, 310) = 6.25, p < .025$ , and yielded a beta coefficient of 0.009. Unlike the beta coefficient for the previous regression, this statistic was not directly inter-



Species listed as “endangered” were in worse shape than those listed as “threatened.” Of the 418 species listed as endangered that were not extinct and had a known status, 46.9% were in decline, 39.2% were stable, and 13.9% were improving, as opposed to 36.6%, 50.7%, and 12.7%, respectively, of the 142 threatened species. This difference was statistically significant.<sup>144</sup> Even though endangered species were listed longer, on average, than threatened species, this did not account for the differences in status between the two groups.<sup>145</sup> As noted, differences between the plants and animals were ambiguous.<sup>146</sup>

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pretable into a change in the overall distribution among the species that were declining, stable, and improving, because this regression only describes the relationship between species that were stable and improving.

<sup>144</sup>  $\chi^2(2) = 5.95, p < .025$ . The 11 species determined to be extinct were all listed as endangered. A significantly greater proportion of the endangered species had an unknown status (224 out of 650 species, or 34.5% of all species) than of the threatened species (45 out of 185 species, or 23.2%).  $\chi^2(1) = 8.33, p < .01$ .

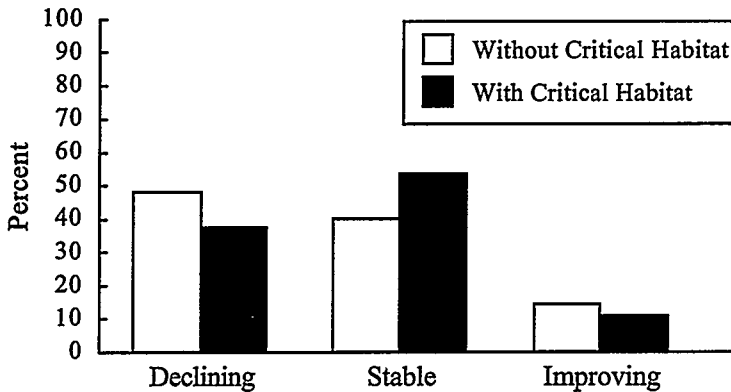
<sup>145</sup> Among species that had a known status and were not extinct, endangered species were listed for an average of 10.3 years, and threatened species were listed for an average of 8.7 years—a significant difference.  $t(289) = 2.56, p < .025$ . The semi-partial correlation for the effect of listing designation, controlled for the number of years that species were listed, on the binary variable that distinguished declining species from stable and improving species was .019, and was significant.  $F(1, 605) = 12.14, p < .001$ . The semi-partial correlation for the effect of listing designation, controlled for the number of years that species were listed, on the binary variable that distinguished between stable and improving species was .002, and was marginally significant.  $F(1, 310) = 0.63, p > .50$ .

<sup>146</sup> The comparison between the two kingdoms yielded a complex pattern of results. Among species with a known status that were not extinct, 49.3%, 38.3%, and 12.4% of the 290 plants were declining, stable, and improving, respectively, versus 38.9%, 46.3%, and 13.6% of the 270 animal species. These distributions differed significantly.  $\chi^2(2) = 6.16, p < .05$ . A smaller percentage of animals (75 out of 354, or 21.9%) than of plants had an unknown status.  $\chi^2(1) = 32.65, p < .001$ . When the length of time that species were listed was controlled for, however, this difference disappeared. Animals were protected for significantly longer than plants (13.2 versus 6.8 years, respectively).  $t(459) = 12.03, p < .001$ . The semi-partial correlation for the effect of kingdom, controlled for the number of years that species were listed, on the binary variable that distinguished declining species from stable and improving species was zero. The semi-partial correlation for the effect of kingdom, controlled for the number of years that species were listed, on the binary variable



## 2. The Effects of Critical Habitat

Only 110 species in the database had critical habitat designated (13.2%). As shown in Figure 4, among those species that were not extinct and had a known status, 45.9%, 40.1%, and 14.0% of the 479 species without critical habitat were declining, stable, and improving, respectively, as opposed to 34.6%, 54.3%, and 11.1% of the 81 species with critical habitat. Designating critical habitat shifted 11% of species from declining to stable. This difference was only marginally significant,<sup>147</sup> but persisted even when the length of time that species were listed was controlled for.<sup>148</sup>



Of those species that did have critical habitat designated, the length of time it had been designated did not generally differ by species status. Species that were declining had enjoyed critical habitat designation for a mean of 9.6 years, as opposed to 10.7 years and 12.9 years for species that were stable or improving, respectively. This trend, however, was not significant.<sup>149</sup>

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that distinguished between stable and improving species was .006, and was not significant.  $F(1, 309) = 1.90, p > .10$ .

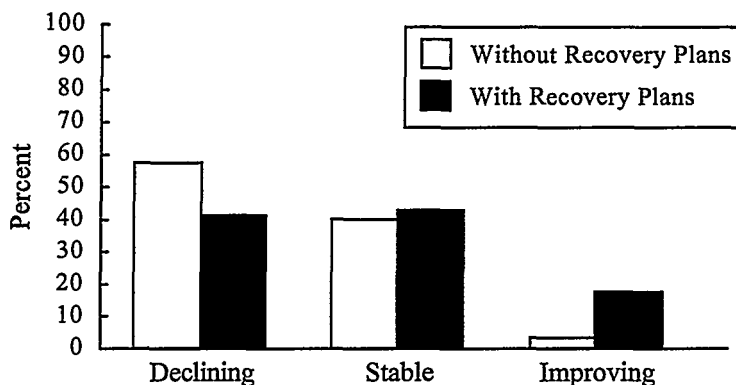
<sup>147</sup>  $\chi^2(2) = 5.77, p < .10$ . Of the eight extinct species, two had critical habitat. A slightly greater proportion of the species without critical habitat had an unknown status (240 out of 728, or 33.0%) than did those with critical habitat (27 out of 110, or 24.6%), but this difference was not statistically significant.  $\chi^2(1) = 3.12, p < .10$ .

<sup>148</sup> Among species that had a known status and were not extinct, those with critical habitat were listed longer (12.6 years) than those without critical habitat (9.4 years).  $t(143) = 5.05, p < .001$ . The semi-partial correlation for the effect of critical habitat, controlled for the number of years that species were listed, on the binary variable that distinguished declining species from stable and improving species was .003, and was not significant.  $F(1, 560) = 1.76, p > .10$ . The semi-partial correlation for the effect of critical habitat, controlled for the number of years that species were listed, on the binary variable that distinguished between stable and improving species was .009, and was marginally significant.  $F(1, 309) = 2.86, p < .10$ .

<sup>149</sup>  $F(2, 78) = 1.45, p > .20$ . The two extinct species with critical habitat had it for a mean of 12.0 years, and the 27 species with an unknown status with critical habitat had it for a mean of 12.3 years.

### 3. *The Effects of Recovery Plans*

Species recovery plans had been adopted for 598 (71.6%) of all listed species and had yet to be adopted for another 220 (26.6%). For the remaining seventeen species (2.0%), the FWS had determined that a recovery plan was unnecessary.<sup>150</sup> Species recovery plans had a positive effect on species recovery. As shown in Figure 5, species with plans were doing much better than those without plans. Of those species with adequate information, 57.3%, 40.0%, and 2.7% of the 110 species without a recovery plan were declining, stable, and improving, respectively, as opposed to 41.3%, 42.2%, and 16.6% of the 441 species with a recovery plan. These distributions differed significantly.<sup>151</sup> Across all species, the existence of a plan shifted 16% from declining status to stable and improving, with the bulk of the shift to improving. This effect persisted even when the length of time that species were listed was controlled for.<sup>152</sup> Perhaps more importantly, the existence of a recovery plan, more so than other factors, shifted species status to improving. Only three of the seventy-seven improving species lacked a recovery plan.



The FWS had both designated critical habitat and adopted a species recovery plan for ninety-nine (11.9%) species. Of these, twenty-

<sup>150</sup> The 17 exempt species were excluded from the analysis.

<sup>151</sup>  $\chi^2(2) = 17.37, p < .001$ . Of the eight extinct species, five had recovery plans and three were considered exempt. A greater percentage of the species without recovery plans had an unknown status (110 out of 220, or 50.0%) than of the species with recovery plans (152 out of 598, or 25.4%).  $\chi^2(1) = 59.76, p < .001$ .

<sup>152</sup> Among species that had a known status and were not extinct, those with a recovery plan were listed longer (10.3 years) than those without one (2.9 years).  $t(635) = 18.47, p < .001$ . The semi-partial correlation for the effect of having a recovery plan, controlled for the number of years that species were listed, on the binary variable that distinguished declining species from stable and improving species was .002, and was not significant.  $F(1, 548) = 0.57, p > .5$ . The semi-partial correlation for the effect of having a recovery plan, controlled for the number of years that species were listed, on the binary variable that distinguished between stable and improving species was .018, and was significant.  $F(1, 303) = 6.05, p < .025$ .

six had an unknown status and two were extinct. Table 3 shows that the remainder of these species were doing fairly well; only about one in three was in decline.

TABLE 3: EFFECT OF CRITICAL HABITAT AND RECOVERY PLANS ON SPECIES STATUS

Level of Protection		Percent of Known Species			Total Known Species
Habitat	Plan	Impr.	Stable	Decl.	
No	No	2.9	38.2	58.8	102
No	Yes	17.3	40.0	42.7	370
Yes	No	0.0	62.5	37.5	8
Yes	Yes	12.7	53.5	33.8	71

Table 3 also shows the effects of critical habitat and recovery plans separately. Adopting a recovery plan significantly improved the status of species that did not have critical habitat.<sup>153</sup> Even among species that had critical habitat, a recovery plan appeared to add some benefit by shifting species from stable to improving status, but this trend was not significant.<sup>154</sup> The lack of statistical significance probably resulted from the small number of species (eight) having critical habitat designated but no recovery plan. Likewise, although designating critical habitat for species that lacked a recovery plan stabilized 24% more species, due to a small sample size the effect was not significant.<sup>155</sup> Finally, designating critical habitat shifted 14% of these species from declining to stable, which was a marginally significant effect.<sup>156</sup> In sum, designating critical habitat and adopting a recovery plan both had independent beneficial effects on species status. Critical habitat moved species out of decline; recovery plans allowed species to improve.

#### 4. *The Effects of Economic Conflicts*

Pressure from economic development harmed species. The recovery efforts of 204 listed species (24.4%) were identified as having a conflict with economic development. Among species with a known status that were not extinct, 54.6%, 31.9%, and 13.5% of the 163 species facing economic conflicts were declining, stable, and improving, respectively, versus 40.1%, 46.4%, and 13.6% of the 397 species not facing such conflicts—a statistically significant difference.<sup>157</sup>

<sup>153</sup>  $\chi^2(2) = 16.17, p < .001$ .

<sup>154</sup>  $\chi^2(2) = 1.15, p > .5$ .

<sup>155</sup>  $\chi^2(2) = 1.92, p > .25$ .

<sup>156</sup>  $\chi^2(2) = 4.49, p < .11$ .

<sup>157</sup>  $\chi^2(2) = 11.25, p < .01$ . Of the eight extinct species, only one was noted as facing an economic conflict. A greater proportion of the species not facing economic conflicts had an unknown status (227 out of 631 species, or 36.0%) than those that did face such conflicts (40 out of 204 species, or 19.6%).  $\chi^2(1) = 18.99, p < .001$ .

Although economic conflicts did not alter the percentage of species identified as improving, conflicts caused a 15% shift from stable status to declining status.<sup>158</sup>

Further analysis revealed that critical habitat designation did not mitigate the adverse impact of economic conflicts. As shown in Table 4a, economic conflict had a significant, adverse impact among species without critical habitat. Although this effect was not significant among species with critical habitat, the trend was evident; economic conflicts shifted approximately 19% of species from stable and improving to declining status. This was a greater shift than that observed among species without critical habitat. The lack of significance probably resulted from the relatively small sample size.

TABLE 4a: EFFECT OF ECONOMIC CONFLICT AND CRITICAL HABITAT ON SPECIES STATUS

Critical Habitat	Economic Conflict	Percent of Known Species			Total Known Species	Statistics for Effect of Econ. Conflict	
		Impr.	Stable	Decl.		$\chi^2(2)$	<i>p</i> -value
No	No	14.1	44.1	41.8	354	10.41	<i>p</i> < .01
	Yes	13.6	28.8	57.6	125		
Yes	No	9.3	65.1	25.6	43	4.38	<i>p</i> > .10
	Yes	13.2	42.1	44.7	38		

Recovery plans exhibited a similar pattern. As shown in Table 4b, among species with recovery plans, economic conflicts shifted 11.5% of species into decline, which was significant. Among species without recovery plans, economic conflicts shifted 18.5% of species into decline, which was not significant. Once again, the failure to reach a significant effect among the species without a recovery plan may have resulted from the small number of observations.

TABLE 4b: EFFECT OF ECONOMIC CONFLICT AND RECOVERY PLAN ON SPECIES STATUS

Recovery Plan	Economic Conflict	Percent of Known Species			Total Known Species	Statistics for Effect of Econ. Conflict	
		Impr.	Stable	Decl.		$\chi^2(2)$	<i>p</i> -value
No	No	2.8	46.5	50.7	71	3.62	<i>p</i> > .10
	Yes	2.6	28.2	69.2	39		
Yes	No	16.4	45.6	38.1	318	6.05	<i>p</i> < .05
	Yes	17.1	33.3	49.6	123		

<sup>158</sup> Species facing economic conflicts were listed longer on average (9.5 years) than those that did not face such conflicts (8.0 years).  $t(346) = 2.61$ ,  $p < .01$ . Thus, the degraded condition of species facing conflicts cannot have resulted from fewer years of listing.

### 5. *Extinctions and Recoveries*

Since 1973, seven species have been removed from the lists due to extinction.<sup>159</sup> Another eight species that are probably extinct remain listed, awaiting final confirmation of their fate.<sup>160</sup> Thus, a total of fifteen extinctions may be said to have occurred among listed species. At least six are believed to have been extinct before the Act was passed,<sup>161</sup> and the rest were probably already in serious decline. Nevertheless, the conclusion is unmistakable—extinctions have occurred in spite of the Act. By contrast, the FWS has declared eight species recovered to the point that protection is no longer needed.<sup>162</sup> Although some of these successes may not have resulted from the Act's influence, the existence of some recoveries of listed species suggests that the Act can be successful.<sup>163</sup>

## III

### DISCUSSION

The data clearly demonstrate that endangered and threatened species are better off with the Act than they would be without it. They undermine the conclusions that the Act's mandates stretch resources in a manner harmful to biodiversity and that it creates perverse incentives that overwhelm its benefits. Each aspect of the Act's protection—listing, designating critical habitat, and adopting a species recovery plan—benefits listed species. In short, the Act works.

Listing appears to have turned the fortunes of about half of the species it protects.<sup>164</sup> Although nearly half of all listed species remain in decline, virtually all species are in decline when originally listed. Most remain in decline for the first year after listing, but as time passes, species populations stabilize and even improve.<sup>165</sup> Each year of protection under the Act improves the prospects for listed species.<sup>166</sup> A year of listing turns the fortunes of three out of every 200 listed species. In addition to demonstrating the benefits of the Act to biodiversity, this study shows that analyzing the distribution of species status at a single point in time undervalues the Act. Because the FWS

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<sup>159</sup> See FWS REPORT, 1994, *supra* note 89, at 32.

<sup>160</sup> See *supra* tbl. 1.

<sup>161</sup> See MANN & PLUMMER, *supra* note 2, at 240.

<sup>162</sup> This statistic was taken from the FWS's endangered species World Wide Web page. U.S. Fish and Wildlife Service, *Recovery Program for Endangered and Threatened Species* (last modified Jan. 1995) <<http://www.fws.gov/~r9endspp/factshts.html>>.

<sup>163</sup> See MANN & PLUMMER, *supra* note 2, at 240-41.

<sup>164</sup> See *supra* Part II.B.1.

<sup>165</sup> FWS REPORT, 1994, *supra* note 89, at 15. It is possible that over time, the FWS merely discovers thriving populations of listed species, but there is no evidence in these data that would either support or refute such a theory.

<sup>166</sup> See *supra* notes 140-43 and accompanying text.

continuously adds species that are in decline, summary statistics will tend to understate the Act's positive impact. The trends over time indicate that although many species remain at risk of extinction, the biodiversity glass is half full, not half empty.

Among listed species, those designated as endangered fared worse than those designated as threatened.<sup>167</sup> Because the FWS's regulations extend comparable protection to both endangered and threatened species, differences between these groups imply only that the FWS categorizes species properly. The lack of a difference suggests that complaints about the FWS's classification procedures<sup>168</sup> are irrelevant to species survival.

Designation of critical habitat appeared to benefit species, but the evidence for this proposition was weak.<sup>169</sup> Species that had critical habitat designated were 11% less likely to be in decline, but the effect was only marginally significant. Furthermore, some of this benefit was due to the confounding of critical habitat designation with the length of time on the list. The length of time that a species had enjoyed critical habitat designation also did not predict an improved status. Moreover, critical habitat did not seem to mitigate the adverse effects of economic conflicts on species. This latter analysis may have been expecting too much from the critical habitat designation, however, because critical habitat does not implicate private parties, who are the sources of economic conflict.<sup>170</sup> In sum, the data do support the conclusion that critical habitat benefits species, but the effect is not large.

Species recovery plans did further species recovery. Although the existence of a recovery plan was closely associated with the length of time species were listed, recovery plans clearly benefitted species, even when the length of time that species were protected was controlled.<sup>171</sup> In fact, recovery plans appeared to be the primary mechanism that set species on the road to recovery. Virtually all improving species had recovery plans. Listing and designating critical habitat stabilized species populations, and recovery plans facilitated improvement.

The data also revealed some imperfections and inadequacies in the Act. Clearly, the fact that half of all species remain in decline can be viewed as evidence of the Act's inadequacies. Because species cannot decline indefinitely without incurring a substantial risk of extinction, the Act's inability to prevent such decline among certain species is more evidence of its failure. Furthermore, although the Act is sup-

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<sup>167</sup> See *supra* notes 144-46 and accompanying text.

<sup>168</sup> See, e.g., Houck, *supra* note 33, at 286, 287-89 (commenting upon the occasional inability of the FWS to accurately classify species as Endangered or Threatened).

<sup>169</sup> See *supra* Part II.B.2.

<sup>170</sup> Section 7(a)(2) forbids "federal agencies" from destroying critical habitat, but makes no reference to private parties. 16 U.S.C. § 1536(a)(2) (1994).

<sup>171</sup> See *supra* Part II.B.3.

posed to protect species from economic pressures, species facing economic conflicts were more likely to be in decline.<sup>172</sup> Designating critical habitat did not ameliorate this problem, but because critical habitat only affects federal agencies, it should not have been expected to. More troubling was the failure of recovery plans to mitigate the impact of economic pressure. Even if section 9 fails to shield species from private economic activity, the steps in the recovery plans are supposed to ensure species survival through active conservation and habitat acquisition programs. Although these plans seem to benefit species overall, lack of funding may make it impossible for the recovery plans to buffer species from economic activity. Overall, the Act provides species with neither a completely effective shield nor a significant buffer against economic activities.

The fifteen known extinctions must also be regarded as a failure of the Act. Although some of them probably occurred before 1973, and others may have occurred among species that were already in a serious state of decline before 1973, some transpired in spite of the Act.<sup>173</sup> The Act clearly has allowed some extinctions, and will probably continue to allow more in the future. In addition to the failures among the listed species, some unlisted species may have been extirpated before they could be listed.<sup>174</sup> Others may have been listed only after the populations had dwindled to a point where recovery is now impossible.<sup>175</sup> Although it does benefit species, the Act is an imperfect guarantor of species survival.

The analysis presented in this Article reveals the real future of endangered species in the United States. If the Act remains in its present form, and current trends continue, the status of listed species can be expected to improve. Ten years hence, the percentage of currently listed species in decline will drop from roughly one-half to about one-third.<sup>176</sup> This beneficial trend would likely be furthered by continuing to designate critical habitat and to develop recovery plans.<sup>177</sup> If all 835 non-clam species on the list had both, it can be said

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<sup>172</sup> See *supra* Part II.B.4.

<sup>173</sup> See MANN & PLUMMER, *supra* note 2, at 240.

<sup>174</sup> See *supra* note 69.

<sup>175</sup> Wilcove et al., *supra* note 70, at 88.

<sup>176</sup> This estimate was obtained by extending the regression of the status of species on the number of years a species has been listed, as described *supra* note 142. This regression demonstrated that each year of listing moves 1.5% more species out of decline. Applying the statistic to the current percentage of declining species among species with a known status that are not extinct, 44.3%, and multiplying by 10, yields the prediction that 29.3% will be in decline in the year 2004. This analysis makes several assumptions—most notably, that the rate of improvement has been linear over the past two decades and that this trend will continue precisely as it has.

<sup>177</sup> See *supra* notes 153-56 and accompanying text.

that today only roughly one-third would be in decline.<sup>178</sup> If all 835 species remain on the list for another ten years each and each obtains a recovery plan and critical habitat, 81.2% will be stable or improving.<sup>179</sup> On the downside, because a large number of species undoubtedly will remain in decline for some period of time, extinctions will continue, and may even increase. In sum, however, the Act saves species, and will continue to do so if it remains in place.

Thus, the data analyzed in this Article undermine Mann and Plummer's theory that the Act's mandate to protect all species stretches resources so thin that none are protected, and that perverse incentives created by restrictions against private parties overwhelm any benefits the Act confers. Indeed, the data support the NRC's conclusion that the Act has "undoubtedly protected some species from extinction."<sup>180</sup> The results of this study do, however, support a milder version of the resource allocation hypothesis. That is, even if resources are not currently stretched too thinly to have *any* effect, they may be stretched to an inefficient degree. Species are paying a price for the lack of resources needed to fully implement the Act. Despite the fact that the Act requires critical habitat<sup>181</sup> and recovery plans<sup>182</sup> to be created for all species, and despite the fact that both protections benefit species,<sup>183</sup> 598 of the 835 species (71.6%) have recovery plans, 110 species (13.2%) have critical habitat, and only 99 species (11.9%) have both.<sup>184</sup> Clearly, the lack of resources prevents the Act from being all that it can be. The failure to designate habitat and to adopt recovery plans jeopardizes species. As noted above, if the FWS designated both critical habitat and recovery plans for all threatened species, the number of species in decline would drop to less than one-third. Although Mann and Plummer's hypothesis that attempting to protect all protects none is clearly wrong, attempting to protect all without adequate funding exposes some species that could otherwise be saved to the risk of extinction.

Species that are in danger of extinction, but are not yet protected by the Act, are at even greater risk. The lack of resources to gather the information necessary to list species leaves perhaps as many as

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<sup>178</sup> See *supra* tbl. 3.

<sup>179</sup> Cf. Houck, *supra* note 33, at 307-15 (questioning the effectiveness of critical habitat and the FWS's view that critical habitat designation is essential to an endangered species' survival). This estimate stated uses, as a baseline rate of species decline, the rate from species that have both critical habitat and a recovery plan, 33.8%, as reported *supra* tbl. 3.

<sup>180</sup> NRC REPORT, *supra* note 84, at 198.

<sup>181</sup> 16 U.S.C. § 1536(a)(2) (1994).

<sup>182</sup> 16 U.S.C. § 1533(f)(1) (1994).

<sup>183</sup> See *supra* Part II.B.2-3.

<sup>184</sup> See *supra* tbl. 3.



three thousand species that need protection off of the list.<sup>185</sup> The status of these species is largely unknown, but given that recently listed species are nearly all in decline, many of these species are in jeopardy. Arguably, some of these species could be saved if the FWS obtains more resources, or if it concentrates on a smaller subset of species.

Mann and Plummer fail to precisely define an alternative system for the reallocation of resources, but they do assert that the Act should account for the costs of protecting species as well as for the value of individual species.<sup>186</sup> As to cost, they suggest that protection of species might give way when the cost of doing so would be extremely high, such as when the species resides on valuable private property that is ripe for development.<sup>187</sup> Presumably, sacrificing the golden-cheeked warbler in suburban Austin would free up resources to promote more efficient conservation of a nearby wildlife refuge, where a dozen other listed species are located.<sup>188</sup> As to the value of species, Mann & Plummer assert that some measure of a species' contribution to social welfare should enter into the calculus for determining which ones to protect. For example, species that attract tourists, provide a valuable food source, or have medicinal potential would be given higher priority.<sup>189</sup> Mann and Plummer sprinkle examples of costly measures taken to protect unattractive "cold and slimy" species throughout their book in a persuasive technique to support such a priority system.<sup>190</sup> They contend that the Act would be more efficient, as well as better reflect society's true preferences, if such an ordering were implemented.<sup>191</sup>

To be fair to the Act, it does provide the FWS with some flexibility in allocating its resources. At every stage of decision-making, listing, designating critical habitat, and adopting (and funding) a species recovery plan, the FWS performs a brand of triage. Unlisted species facing a sufficient threat may justify an emergency listing.<sup>192</sup> Likewise, although all species are supposed to have critical habitat designated

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<sup>185</sup> OFFICE OF THE INSPECTOR GENERAL, U.S. DEP'T OF THE INTERIOR, REPORT NO. 90-98, AUDIT REPORT: THE ENDANGERED SPECIES PROGRAM 6 (1990). The FWS strongly disputes this statistic, however. As of August 1996, the FWS has identified 182 candidate species (that will probably be listed at some future date) and 243 proposed species (that may be listed at some future date), all of which are in need of protection. See *Candidates for Endangered Species Act Protection: 1996 Notice of Review* (visited Jan. 25, 1997). <<http://www.fws.gov/~9rendssp/norqa.html>>.

<sup>186</sup> See MANN & PLUMMER, *supra* note 2, at 143-45.

<sup>187</sup> *Id.* at 208-10.

<sup>188</sup> See *id.* at 208-09.

<sup>189</sup> See *id.* at 119-24.

<sup>190</sup> See, e.g., *id.* at 3-27 (discussing conservation of the burying beetle).

<sup>191</sup> *Id.* at 219-21.

<sup>192</sup> 16 U.S.C. § 1533(b)(7) (1994).

within one year of listing,<sup>193</sup> the FWS doles out critical habitat designation only sparingly.<sup>194</sup> Moreover, development and funding of recovery plans are supposed to flow to species "that are most likely to benefit."<sup>195</sup> It is true that the FWS is not allowed by statute to favor one class or type of species over another,<sup>196</sup> but it does have leeway to distribute its resources to those species with the greatest need.

The data presented here refute the underlying premise of Mann and Plummer's proposals: that the Act is an outright failure as it stands. The Act does pretty well without making intentional sacrifices of species. Instead, the data analyzed above counsel for a realignment of agency priorities. The first step in protection—listing—has the greatest marginal impact on species. Critical habitat and recovery plans provide a far more modest benefit. Rather than reducing the number of protected species and focusing efforts instead on designating critical habitat or funding recovery plans, if the FWS concentrated on simply listing more species, the Act would have a greater overall impact on biodiversity. Thus, rather than being stretched too thinly, the resources available to the FWS are not stretched enough. Adding species not already protected would confer the most benefit on biodiversity as a whole.

Alternatively, the data do support increased funding for the endangered species program. Throughout *Noah's Choice*, Mann and Plummer treat the FWS's endangered species budget as a fixed measure of the nation's commitment to protecting biodiversity.<sup>197</sup> If the Act fails to guard species from extinction, then their analysis makes sense—why spend more on a failed program? But money spent on the Act does benefit species. Thus, it may be that spending more would be socially efficient. If the current budget meets or exceeds the point at which spending another dollar in species protection would yield less than one dollar in social benefits, then Mann and Plummer are correct. The data suggest, however, that listing more species, designating more critical habitat, and adopting more species recovery plans would work to avert some extinctions. Given society's general

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<sup>193</sup> 16 U.S.C. § 1533(b)(6) (1994).

<sup>194</sup> See Houck, *supra* note 33, at 302-07.

<sup>195</sup> 16 U.S.C. § 1533(f)(1)(A) (1994). The FWS describes its priority system in some detail in its 1990 Report. FWS REPORT, 1990, *supra* note 89, at 8. The system incorporates three variables, degree of threat, recovery potential, and taxonomic subdivision, respectively, in order of importance of each variable. *Id.*

<sup>196</sup> See 16 U.S.C. § 1533(f)(1)(A) (1994) (recovery plans must be created "without regard to taxonomic classification").

<sup>197</sup> MANN & PLUMMER, *supra* note 2, at 212-15. The real "budget" for protecting biodiversity should, of course, include the costs that the Act imposes on private parties. As Mann and Plummer note, "[w]hen we pick nature, we must recognize the human losses . . ." *Id.* at 214.

interest in protecting *all* species from extinction,<sup>198</sup> there appears to be much more to be gained, in social terms, by greater implementation of the Act.

To be sure, the statute incurs costs other than the FWS's budget. Although the data analyzed above show that, from the perspective of its own budget, listing more species is the cheapest way for the FWS to protect biodiversity, this strategy would add to the costs that the Act imposes on private parties. The use of federal money to implement recovery plans, and particularly the land acquisition aspects of many plans, minimizes the costs imposed on private parties. These data, as well as this study, take no position on the relative fairness of section 9 as opposed to public acquisition of land. Rather, they indicate that either program will benefit listed species. Although Mann and Plummer's observation that the Act has costs is correct, their assessment of its benefits is wrong. Whatever the private costs of the Act, it clearly has a positive effect on biodiversity.

#### CONCLUSION: COSTS AND BENEFITS

Even if the Act benefits endangered species, it is not clear that these benefits are worth its costs or that the Act could not be more efficient. The Act does impose costs on both the federal government and private parties. The budget for the endangered species program for fiscal 1996 stands at \$85.7 million,<sup>199</sup> but this is just the tip of the iceberg of costs. Taking federal lands out of economically productive uses in order to protect biodiversity costs jobs; restrictions on habitat modification impose uncalculated costs on private parties. It may well be that our society does not truly value insects, clams, snails, or plants enough to allocate the resources necessary to preserve these species. It may be that only megafauna, like grizzly bears, bald eagles, and grey wolves, merit protection. These issues are beyond the scope of this Article, but the statistical analysis reported above shows that the Act is not easily dismissed as useless. If it remains in its present form, most of the listed species will be preserved. The claim that the Act fails to protect endangered species only clouds the more complicated questions that the Act raises. Deciding to live with or without the 1,069 currently listed species is the ultimate decision our society must face. The Act provides us with the tools to protect many of them. We must make many difficult choices that arise from the use of this law, but only in full light of the knowledge that it has benefits as well as costs.

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<sup>198</sup> Cf. *id.* at 133-34 (discussing human beings' stubborn refusal to embrace the "compelling logic" that some species must die in the name of progress).

<sup>199</sup> The fiscal 1995 budget allocated \$95.5 million for the FWS's endangered species program. See U.S. Dep't of the Interior, *Summary: Funding for the Department of the Interior Under the Omnibus 1996 Appropriations Act* (visited Jan. 25, 1997). <<http://www.ios.doi.gov/budget/96IntAppropHist.html>>.