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THE PURPOSES, EFFECTS, AND FUTURE OF THE ENDANGERED SPECIES ACT'S BEST AVAILABLE SCIENCE MANDATE

BY
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In recent years, the use of scientific data in administrative decisions has become increasingly contentious. The Endangered Species Act, because it repeatedly calls for consideration of the best available scientific data and has been at the center of a number of fierce disputes, provides a useful case study of the role of science in environmental policy.

To date there has been little explicit analysis of either the reasons for the Act's strong and repeated best available science mandate or the effects of the mandate on the Act's implementation. The mandate could have been intended to increase the substantive accuracy of decisions, to promote political credibility, to alter the terms upon which courts review agency decisions, or to change the decision-making process. Today, the mandate's effect on the substantive accuracy of decisions above the background levels guaranteed by the Administrative Procedure Act appears limited. Its ability to provide political credibility has been eroded by high-profile disputes in which the scientific data supporting decisions has been publicly shown to be thin. It is difficult to tell whether it has had any effect on the outcome of judicial review. Procedurally, the mandate may enhance the influence of career scientific employees relative to the political appointees who head the agencies. It could also be interpreted to impose an affirmative data collection requirement. Early regulations and judicial decisions found just such a requirement, but more recently both implementing agencies and courts appear to have moved away from that interpretation.

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Recent proposals to amend the Endangered Species Act have concentrated on imposing additional scientific hurdles to regulation. Those proposals would do little to improve the substantive reliability of agency decisions. Scientific information is and will remain limiting for a large proportion of decisions under the Act. In order to achieve the Act's conservation purposes, the implementing agencies must have the discretion to rely on thin scientific information at the outset. The best available science mandate, which allows the agency to extrapolate from existing data, provides that discretion. But the scientific information available could be put to more effective use, consistent with a robust political process. The agencies should be forced to openly acknowledge the limits of the available scientific data and choices made in the face of uncertainty. They should also be required to take stronger steps to improve the knowledge base over time, so that decisions can become progressively more reliable. These steps, which would not require legislative modification of the Act, could improve both the substance and the political credibility of implementing decisions.

I. INTRODUCTION

Depending upon who is telling the story, the Endangered Species Act (ESA)[1] is either the "pit bull of environmental laws"[2] or a political fig leaf providing cover for business as usual.[3] Those differing views are mirrored by opinions about the scientific underpinnings of the Act and its implementation. Environmentalists insist that political considerations lead the United States Fish & Wildlife Service and NOAA Fisheries, the two federal agencies responsible for implementing the ESA, to ignore science in favor of development, while the regulated community sees precisely the opposite problem.[4]

Both supporters and opponents of the ESA are intent on gaining the scientific high ground. In part, that desire undoubtedly stems from the Act itself, which requires that a number of key decisions rest upon the best available scientific information.[5] But it goes deeper than that. Scientific victory seems to hold the key to political victory. Both sides seem convinced that public opinion turns on whether, and to what extent, science supports the decisions of the agencies responsible for implementing the ESA.

There is good reason to think that this assumption is accurate. As a society, we hunger for objective, rule-based decision making, especially when the decision pits human interests against those of another species. We worry that decisions lacking a firm, objective basis may be arbitrary, wholly "political," wholly dependent upon the whims of the particular decision maker, or made on the basis of improper motivations. We look to "science" to provide the objectivity we crave. The demand for strong scientific support of ESA decisions will only grow in the future, as the costs of conservation measures become higher and more apparent.[6]

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1 Endangered Species Act of 1973, 16 U.S.C. §§ 1531–1544 (2000).

2 The original source of this description may be Donald Barry, then majority counsel of the House Committee on Merchant Marine and Fisheries. In any case, it has been repeated by a large number of commentators. *See, e.g.*, George Cameron Coggins, *An Ivory Tower Perspective on Endangered Species Law*, 8 NAT. RESOURCES & ENV'T 3, 3 (1993); 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, 279 (1993); Robert D. Thornton, *Searching for Consensus and Predictability: Habitat Conservation Planning Under the Endangered Species Act of 1973*, 21 ENVTL. L. 605, 605 (1991); Steven P. Quarles, *The Pit Bull Goes to School*, 15 ENVTL. F., Sept.-Oct. 1998, at 55; Timothy Egan, *Strongest U.S. Environment Law May Become Endangered Species*, N.Y. TIMES, May 26, 1992, at A11.

3 *See, e.g.*, Fraser Shilling, *Do Habitat Conservation Plans Protect Endangered Species?*, 276 SCIENCE 1662 (1997).

4 *See* Holly Doremus, *Listing Decisions Under the Endangered Species Act: Why Better Science Isn't Always Better Policy*, 75 WASH. U. L.Q. 1029, 1032 (1997).

5 *See infra* Section II.

6 *See* Astrid Wallner et al., *Do Natural Science Experiments Influence Public Attitudes Towards Environmental Problems?*, 13 GLOBAL ENVTL. CHANGE 185, 191 (2003) (noting that the more intrusive the regulatory measure, the more people demand scientific verification of its

Science, however, is not as objective or neutral a basis for decisions as we might hope. In recent years, the uncertainties and gaps in the supposedly "scientific" decision making of the ESA have become increasingly apparent, and increasingly the source of controversy and contention.[7] At the same time, several reviews have strongly endorsed the use of science in making decisions under the ESA.[8] That juxtaposition suggests that different observers are looking for different things from the use of science in these decisions. The controversies raise important questions about how science is actually being used, what we are seeking from science, what we are actually getting from it, and what we should realistically expect.

Needless to say, ESA implementation is not the only context in which these issues arise. While the Bush Administration was trumpeting the value of increased peer review to improve the science of regulatory decisions,[9] Congressman Henry Waxman (D-Cal.) issued a report excoriating the Administration's manipulation of science in a variety of contexts, including health, agricultural, environmental and natural resources, and defense policy.[10] But the ESA embodies an unusually strong legislative commitment to science as a foundation for policy, and it has been at the center of a series of very public controversies about the use of science. It therefore offers an excellent case study of the use of science in environmental policy.

This Article investigates the use and effects of science in ESA implementation. Section II begins with a description of the ESA's comprehensive "best available science" mandate, followed in Section III by a brief taxonomy of science explaining what standards are applied to scientific information in other contexts. Section IV then analyzes at some length the possible intent and apparent consequences of that mandate as currently implemented. Finally, Section V offers several suggestions to improve the use of science in the ESA context. While there is little evidence that federal regulatory agencies are routinely or intentionally misusing science, those agencies are not always making the best use of science. They are not addressing openly the limitations of science and their treatment of

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effectiveness).

[7] The shutoff of irrigation water in the Klamath Basin in the summer of 2001 is perhaps the best-known controversy. For a detailed description of those events, see Holly Doremus & A. Dan Tarlock, *Fish, Farms, and the Clash of Cultures in the Klamath Basin*, 30 ECOLOGY L.Q. 279, 319–24 (2003).

[8] U.S. GENERAL ACCOUNTING OFFICE, GAO-03-803, ENDANGERED SPECIES: FISH AND WILDLIFE SERVICE USES BEST AVAILABLE SCIENCE TO MAKE LISTING DECISIONS, BUT ADDITIONAL GUIDANCE NEEDED FOR CRITICAL HABITAT DESIGNATIONS 21–22 (Aug. 2003), *available at* http://www.gao.gov/cgi-bin/getrpt?GAO-03-803; NATIONAL RESEARCH COUNCIL, SCIENCE AND THE ENDANGERED SPECIES ACT 202 (1995); Ronald Carroll et al., *Strengthening the Use of Science in Achieving the Goals of the Endangered Species Act: An Assessment by the Ecological Society of America*, 6 ECOLOGICAL APPLICATIONS 1, 4 (1996).

[9] *See infra* note 181 (debate on an amendment demanding use of sound science introduced by Sen. Jake Garn (R-Utah)).

[10] SPECIAL INVESTIGATIONS DIVISION, UNITED STATES HOUSE OF REPRESENTATIVES, COMMITTEE ON GOVERNMENT REFORM—MINORITY STAFF, POLITICS AND SCIENCE IN THE BUSH ADMINISTRATION (2003), *available at* http://www.house.gov/reform/min/politicsandscience/pdfs/pdf_politics_and_science_rep.pdf.

uncertainty, they do not put enough emphasis on updating both science and the regulatory decisions that depend upon science, and their procedures are not calculated to build credibility. I offer some suggestions for improvement in each of these areas. Importantly, none of these suggestions require amendment of the ESA. That means they might realistically be tried even in the face of the legislative gridlock that has prevented ESA reauthorization since 1992.

II. THE BEST AVAILABLE SCIENCE MANDATE

A. Overview of the Endangered Species Act

Responsibility for ESA implementation is shared by the United States Fish & Wildlife Service (FWS) in the Department of Interior and NOAA Fisheries[11] in the Department of Commerce.[12] The great majority of listed species fall under the charge of FWS, which is responsible for terrestrial species and freshwater fish. NOAA Fisheries is responsible for fewer species, but has the highly controversial task of overseeing protection of marine species and anadromous fish, most notably salmonids.[13]

The first step in implementing the ESA is to identify groups for protection. Species, subspecies, and distinct population segments of vertebrate species all potentially qualify for listing.[14] Species in danger of extinction throughout all or a significant portion of their range are listed as endangered.[15] Those not yet endangered but likely to become so in the foreseeable future are listed as threatened.[16] The listing process can be started by the wildlife agencies on their own initiative, or by submission of a citizen petition.[17] At the time of listing, the wildlife agencies are also supposed to designate critical habitat for the species,[18] defined as those

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11 This agency was formerly known as the National Marine Fisheries Service.

12 I will refer to these two agencies together as "the wildlife agencies."

13 Some 26 evolutionary significant units of salmonids are listed as either endangered or threatened. 50 C.F.R. § 17.11 (2004). For a small taste of the controversies and complications of salmon conservation, see Michael C. Blumm & Greg D. Corbin, *Salmon and the Endangered Species Act: Lessons from the Columbia Basin*, 74 WASH. L. REV. 519 (1999); Michael C. Blumm & Melissa Powers, *Avoiding Dam Breaching Through Offsite Mitigation: NMFS' 2000 Biological Opinion on Columbia Basin Hydroelectric Operations*, 32 ENVTL. L. 241 (2002); Michael C. Blumm & Daniel J. Rohlf, *The BPA Power-Salmon Crisis: A Way Out*, 31 Envtl. L. Rep. (Envtl. L. Inst.) 10,726 (2001); Craig N. Johnston, *Salmon and Water Temperature: Taking Endangered Species Seriously in Establishing Water Quality Standards*, 33 ENVTL. L. 151 (2003); William H. Rodgers, Jr., *What a Salmon Czar Might Hope For*, 74 WASH. L. REV. 511 (1999); William H. Rodgers, Jr., *Deception, Self-Deception, and Mythology: The Law of Salmon in the Pacific Northwest*, 26 PAC. L. J. 821 (1995); Daniel J. Rohlf, *There's Something Fishy Going On Here: A Critique of the National Marine Fisheries Service's Definition of Species Under the Endangered Species Act*, 24 ENVTL. L. 617 (1994); William Stelle, Jr., *Implementing ESA Salmon Listings: Untangling Overlapping Programs*, 16 NAT. RESOURCES & ENV'T 112 (2001).

14 16 U.S.C. § 1532(16) (2000).

15 *Id.* § 1532(6).

16 *Id.* § 1532(20).

17 *Id.* § 1533(b)(3)(A).

18 *Id.* § 1533(a)(3)(A)(i).

areas requiring special protection where physical or biological features essential to the species are found.[19]

Listing is a time-consuming, expensive, and politically controversial process. Since the ESA's inception in 1973, the growth of the protected list has been limited by the level of resources devoted to listing. At the end of 2003, for example, 1,260 domestic species were on the protected list, more than 30 had been formally proposed for listing, and 256 more were recognized as candidate species, which means they are believed to qualify for listing but the relevant wildlife agency lacks the resources to send them through the process.[20] Political pressures also frequently appear to inhibit listing.[21] The wildlife agencies rarely initiate the listing process for controversial species. At a minimum, citizen petitions are required to begin that process and frequently litigation is necessary to complete it.[22] As a

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[19] *Id.* § 1532(5)(A)(i). This requirement has been the center of a fierce dispute in recent years. FWS regards the designation of critical habitat as an expensive process that provides little in the way of conservation benefits. *See Designation of Critical Habitat under the Endangered Species Act: Hearing Before the Subcomm. on Fisheries, Wildlife & Water of the S. Comm. on Env't & Pub. Works*, 108th Cong. (2003) (statement of Craig Manson, Assistant Secretary for Fish and Wildlife and Parks, Department of Interior) (criticizing the present system for designating critical habitat), *available at* http://laws.fws.gov/TESTIMON/2003/2003april10.html; Department of the Interior, Fish & Wildlife Service, Notice of Intent to Clarify the Role of Habitat in Endangered Species Conservation, 64 Fed. Reg. 31,871 (June 14, 1999) (announcing FWS's intent to revise habitat designation procedures). Consistent with these views, for many years, FWS has resisted critical habitat designation. Some environmental groups, however, view critical habitat as a valuable conservation tool. They have brought and won a large number of lawsuits requiring that FWS designate critical habitat. For detailed discussion of the critical habitat controversy, see Jason M. Patlis, *Paying Tribute to Joseph Heller with the Endangered Species Act: When Critical Habitat Isn't*, 20 STAN. ENVTL. L. J. 133 (2001).

[20] *See* U.S. FISH & WILDLIFE SERVICE, SUMMARY OF LISTED SPECIES, *at* http://ecos.fws.gov/tess_public/html/boxscore.html (visited Dec. 22, 2003); U.S. FISH & WILDLIFE SERVICE, PROPOSED SPECIES AS OF 12/22/2003, *at* http://ecos.fws.gov/tess_public/TESSWebpageNonlisted?listings=0&type=P (visited Dec. 22, 2003); U.S. FISH & WILDLIFE SERVICE, CANDIDATE SPECIES AS OF 12/22/2003, *at* http://ecos.fws.gov/tess_public/TESSWebpageNonlisted?listings=0&type=C (visited Dec. 22, 2003).

[21] *See, e.g.*, STEVEN L. YAFFEE, PROHIBITIVE POLICY: IMPLEMENTING THE FEDERAL ENDANGERED SPECIES ACT 133–34 (1982) (discussing external political factors which bear on listing decisions); Federico Cheever, *Butterflies, Cave Spiders, Milk-Vetch, Bunchgrass, Sedges, Lilies, Checker-Mallows and Why the Prohibition Against Judicial Balancing of Harm Under the Endangered Species Act Is a Good Idea*, 22 WM. & MARY ENVTL. L. & POL'Y REV. 313, 348–49 (1998) (concluding FWS is reluctant to list due to political pressures); Doremus, *supra* note 4, at 1149–50; Andrew Metrick & Martin L. Weitzman, *Patterns of Behavior in Endangered Species Preservation*, 72 LAND ECON. 1, 12 (1996) (concluding species with higher charismatic value receive more spending under the ESA than other species); Amy Whritenour Ando, *Waiting to Be Protected Under the Endangered Species Act: The Political Economy of Regulatory Delay*, 42 J. L. & ECON. 29, 29–30 (1999) (proposing listing decisions move quickly or slowly based on political pressure).

[22] D. Noah Greenwald et al., *Factors Affecting the Rate and Taxonomy of Species Listings Under the U.S. Endangered Species Act*, *in* THE ENDANGERED SPECIES ACT AT 30: LESSONS AND PROSPECTS (Frank W. Davis et al. eds., forthcoming 2004).

result of the fiscal and political barriers to listing, most species do not reach the protected list until their populations are extremely reduced.[23]

It is widely agreed that the inability to provide protection before the late stages of decline is a serious failing of the ESA.[24] In an attempt to address that problem, FWS during the Clinton Administration developed Candidate Conservation Agreements. Under these agreements, property owners commit to undertake specific conservation measures for the benefit of candidate species in return for assurances that they will not be subject to additional regulatory restrictions should the species be listed in the future.[25]

Once listed, species gain the protection of two important regulatory provisions. First, section 7 requires federal agencies to ensure that actions they carry out, fund, or authorize are not likely to jeopardize the continued existence of any listed species or adversely modify its designated critical habitat.[26] Actions fail this standard if they reasonably would be expected to appreciably reduce the likelihood of both survival and recovery in the wild,[27] or appreciably diminish the value of critical habitat for both survival and recovery.[28]

Section 7 is implemented through consultation by the action agency with the appropriate wildlife agency. Consultation culminates in production by the wildlife agency of a formal biological opinion concluding that the action is or is not likely to jeopardize the continued existence of the species or adversely modify its critical habitat.[29] Biological opinions are not legally binding on the action agency, which retains final responsibility for compliance with the mandate of section 7 and may choose to reject the

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23 *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, 91–92 (1993).

24 *See, e.g.*, Holly Doremus, *Patching the Ark: Improving Legal Protection of Biological Diversity*, 18 ECOLOGY L.Q. 265, 316–17 (1991) (explaining that species recovery can be extremely expensive by the time a species reaches the point of being endangered or threatened); John Charles Kunich, *The Fallacy of Deathbed Conservation Under the Endangered Species Act*, 24 ENVTL. L. 501, 550 (1994) (likening the ESA to a deathbed repentance, where the species is on the brink of extinction before intervention).

25 Under section 10 of the ESA, the wildlife agencies can authorize by permit acts that would otherwise be prohibited "to enhance the propagation or survival of the affected species." 16 U.S.C. § 1539(a)(1)(A) (2000). With Candidate Conservation Agreements, they issue permits that become valid if the species ever is listed. *See* 50 C.F.R. §§ 17.22(d), 17.32(d) (2004); Announcement of Final Policy for Candidate Conservation Agreements with Assurances, 64 Fed. Reg. 32,726, 32,727 (June 17, 1999). For a detailed discussion of Candidate Conservation Agreements, see Francesca Ortiz, *Candidate Conservation Agreements as a Devolutionary Response to Extinction*, 33 GA. L. REV. 413 (1999).

26 16 U.S.C. § 1536(a)(2) (2000).

27 50 C.F.R. § 402.02 (2004).

28 *Id.* Essentially, the regulations directly equate adverse modification of critical habitat with jeopardy, which is why FWS regards critical habitat designation as superfluous. The Fifth Circuit has ruled that the regulatory definition of adverse modification is unlawfully narrow. Sierra Club v. United States Fish & Wildlife Serv., 245 F.3d 434, 443 (5th Cir. 2001). FWS has made no public move to change the regulation, however, and continues to rely on it outside the Fifth Circuit.

29 *See* 16 U.S.C. § 1536(b)(3)(A) (2000) (requiring Secretary to issue an opinion); 50 C.F.R. § 402.14(g)(4) (2004) (requiring action agencies to enter into formal consultation if an action may affect a listed species or critical habitat).

wildlife agency's conclusion.[30] In practice, until recently, action agencies rarely departed from the wildlife agencies' views, which were expected to carry considerable weight with reviewing courts.[31] Recently, however, rising controversy about the science supporting biological opinions has encouraged action agencies to articulate and adhere to their own views about the effects of their proposed projects.[32]

If FWS issues a "jeopardy" opinion, it is obligated to include in that opinion an explanation of any "reasonable and prudent alternatives" (RPAs) it believes will avoid jeopardy.[33] RPAs must be feasible, within the authority of the action agency, and consistent with the purpose of the proposed action.[34] Again, the action agency retains authority for the ultimate decision to adopt or reject RPAs, subject to judicial review.

The second major regulatory provision of the ESA is section 9, which prohibits the "take" of an endangered animal by any person.[35] The statute and its implementing regulations define "take" broadly, to include not only capture or killing, but also significant habitat alterations that cause injury.[36] More flexibility is provided with respect to threatened animals; the wildlife agencies are simply directed to develop regulations necessary or advisable for the conservation of those species.[37]

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[30] Sierra Club v. Froehlke, 534 F.2d 1289, 1303–04 (8th Cir. 1976); 50 C.F.R. § 402.15 (2004).

[31] *See* Bennett v. Spear, 520 U.S. 154, 169 (1997) (asserting that a biological opinion "theoretically serves an 'advisory function'" but actually has a powerful effect); Pyramid Lake Paiute Tribe v. United States Dep't of the Navy, 898 F.2d 1410, 1415 (9th Cir. 1990) (stating that an action agency's reliance on FWS biological opinions must not be arbitrary or capricious).

[32] After the National Research Council (NRC) issued its preliminary report on the Klamath Basin, the Bureau of Reclamation quickly produced a new biological assessment on a long-term operating plan for the Klamath Project. Doremus & Tarlock, *supra* note 7, at 327–28. The biological assessment rejected the contested conclusions of the biological opinions in favor of the NRC preliminary report's statement that the evidence supported continuation of operations within the bounds of the status quo. *Id.* The wildlife agencies backed off from some, but not all of their demands. *Id.* at 327–31. A more direct confrontation seems to be brewing on the Missouri River, where the Army Corps of Engineers has recently produced a biological assessment taking issue with the conclusion of a 2000 biological opinion that called for restoring seasonal variation in river flows. U.S. ARMY CORPS OF ENGINEERS, NORTHWESTERN DIVISION, FINAL BIOLOGICAL ASSESSMENT ON THE MISSOURI RIVER MAINSTEM RESERVOIR SYSTEM, THE OPERATION AND MAINTENANCE OF THE BANK STABILIZATION AND NAVIGATION PROJECT, AND THE OPERATION OF KANSAS RIVER RESERVOIR SYSTEM (2003), *available at* https://www.nwd.usace.army.mil/pa/docs/BAFinal-110403.pdf.

[33] 16 U.S.C. § 1536(b)(3)(A) (2000); 50 C.F.R. § 402.14(h)(3) (2004).

[34] 50 C.F.R. § 402.02 (2004).

[35] 16 U.S.C. § 1538(a)(1)(B), (C) (2000).

[36] *See id.* § 1532(19) (including harm and harassment); 50 C.F.R. § 17.3 (2004) (defining "harass" to include an act that "creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns"; and defining "harm" to include "significant habitat modification [that] . . . actually kills or injures wildlife by significantly impairing essential behavioral patterns").

[37] 16 U.S.C. § 1533(d) (2000). FWS relies on a general regulation applying the full force of section 9 to all threatened species unless otherwise specified. 50 C.F.R. § 70.3 (2004). It has only rarely issued special rules relaxing the protection of threatened species. NOAA Fisheries has been more aggressive, issuing special rules for all threatened species for which it is responsible. For an excellent treatment of this authority and its use, see Robert L. Fischman & Jaelith Hall-Rivera, *A Lesson for Conservation from Pollution Control Law: Cooperative Federalism for*

Section 9 imposes extraordinarily broad liability, particularly in comparison to the laws that preceded it.[38] The ESA includes two mechanisms for authorizing actions that would otherwise violate this broad prohibition. The first is tied to section 7. Biological opinions include "incidental take statements" detailing the expected level of take from the proposed action, and prescribing measures to minimize and mitigate the impacts of that take.[39] Actions taken in compliance with an incidental take statement, by the federal action agency or anyone else whose actions fall within the scope contemplated by the biological opinion, are insulated from liability for take under section 9.[40]

For actions without a federal nexus, exemption from the take prohibition occurs through a permit process. Section 10 allows the wildlife agencies to issue permits for scientific purposes or the enhancement of survival of the species,[41] or for incidental take in the course of other lawful activities.[42] Issuance of enhancement of survival permits requires a finding that they "will not operate to the disadvantage" of the species and will be consistent with the purposes of the ESA.[43] Incidental take permits additionally require that the applicant submit a habitat conservation plan and that the wildlife agencies find that the impacts of the taking will be minimized and mitigated to the maximum extent practicable, adequate funding will be provided, and the taking will not appreciably reduce the likelihood of survival and recovery in the wild.[44]

B. The Best Available Science Mandate: Statutory and Regulatory Requirements for Consideration of Science and Observation of Scientific Norms

At several points, the ESA specifically references science. It repeatedly calls for use of the best available scientific information. That call is reinforced and in some respects extended by agency regulations, policies, and guidance. All these requirements, taken together, make up what I call the "best available science mandate" of the ESA.[45]

Recovery Under the Endangered Species Act, 27 COLUM. J. ENVTL. L. 45, 63–67 (2002).

38 For overviews of federal endangered species legislation prior to 1973, see MICHAEL J. BEAN & MELANIE J. ROWLAND, THE EVOLUTION OF NATIONAL WILDLIFE LAW (3d ed. 1997) and Holly Doremus, *Patching the Ark: Improving Legal Protection of Biological Diversity*, 18 ECOLOGY L.Q. 265, 295–97 (1991).

39 *See* 16 U.S.C. § 1536(b)(4) (2000); 50 C.F.R. § 402.14(h) (2004).

40 16 U.S.C. § 1536(o)(2) (2000); Ramsey v. Kantor, 96 F.3d 434 (9th Cir. 1996).

41 16 U.S.C. § 1539(a)(1)(A) (2000).

42 *Id.* § 1539(a)(1)(B).

43 *Id.*§ 1539(d). For a clear explanation of the role of permits for scientific research, see Robert L. Fischman & Vicky J. Meretsky, *Endangered Species Information: Access and Control*, 41 WASHBURN L.J. 90, 107–09 (2001).

44 16 U.S.C. § 1539(a)(2)(B) (2000).

45 The ESA is not by any means the only federal legislation to require use of the best available science. Two other conservation statutes, the Marine Mammal Protection Act of 1970, 16 U.S.C. §§ 1361–1431 (2000), and the Magnuson-Stevens Fishery Conservation & Management Act, 16 U.S.C. §§ 1801–1883 (2000), contain pervasive best science mandates. In addition, use of

1. Statutory Requirements

The ESA explicitly requires use of the best scientific data available for a number of decisions. Listing determinations must rest "solely on the basis of the best scientific and commercial data" available to the agency.[46] Citizen petitions seeking a listing or delisting trigger formal review of the status of the species if they present "substantial scientific information" indicating that the requested action may be warranted.[47] Critical habitat designation must be based on the best scientific data available, taking into consideration economic and other impacts.[48] Before listing a species or designating critical habitat, the listing agencies must give notice of their proposals to appropriate scientific organizations.[49] Every federal agency must, in consultation with FWS or NOAA Fisheries, ensure that actions it takes, funds, or permits do not jeopardize the continued existence of any listed

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the best available scientific information is expressly mandated in many other provisions of federal law. *See, e.g.*, 14 U.S.C. § 676 (2003) (requiring the Secretary of Transportation to use the best scientific information available establishing standards for the length of time an individual may serve on watch at Coast Guard search and rescue centers); 15 U.S.C. § 2643(d)(7) (2000) (requiring EPA to use the best available scientific information to help the public understand the risks of asbestos in building materials and removal of those materials); 16 U.S.C. § 460ss-2 (2000) (requiring the Klamath Fishery Management Council to use the best scientific information available in the development of harvest recommendations); 16 U.S.C. § 839b(h)(6)(B) (2000) (requiring the Pacific Northwest Power and Conservation Planning Council to use the best available scientific knowledge to develop a program to protect fish and wildlife while ensuring an adequate power supply); 16 U.S.C. § 3311(c)(1)(3) (2000) (requiring the Salmon and Steelhead Advisory Commission to use the best scientific information available in the development of recommendations for a management structure for salmon and steelhead fisheries); 16 U.S.C. § 3638 (2000) (requiring use of the best scientific information available by the Pacific Salmon Commission in regulating salmon fisheries); 16 U.S.C. § 4711(a)(2)(D) (2000) (requiring the Secretary of Transportation to use the best available science in the development of guidelines and regulations for preventing the introduction of invasive species through ballast water); 16 U.S.C. § 4722(c)(1) (2000) (requiring the Aquatic Nuisance Species Task Force to use the best available science when choosing federal efforts to control aquatic nuisance species); 16 U.S.C. § 4905(a)(3)(A) (2000) (requiring use of the best available science by the Secretary of Interior to create a list of exotic wild birds which may be imported to the United States); 16 U.S.C. § 5104(a)(2)(A) (2000) (requiring use of best available science by the Atlantic States Marine Fisheries Commission in the development of standards for the preparation of Atlantic coastal fishery management plans); 20 U.S.C. § 80q-9(a)(1)(B) (2000) (requiring use of best available scientific documentation by the Smithsonian Institution to determine the origin of Indian remains and funerary objects, in conjunction with historical information); 33 U.S.C. § 2102 (2000) (establishing that the siting and construction of artificial reefs requires permits from the Army Corps of Engineers based on the best available scientific information); 42 U.S.C. § 300g-1(b)(3)(A) (2000) (requiring EPA to set drinking water standards according to the best available science).

[46] 16 U.S.C. § 1533(b)(1)(A) (2000). The reference to "commercial" data does not soften the best science mandate. In this context, that term refers to data concerning the impact of commercial trade on listed species. Doremus, *supra* note 4, at 1043.

[47] 16 U.S.C. § 1533(b)(3)(A) (2000). Similarly, a petition requesting revision of critical habitat requires agency action if it presents substantial scientific information indicating that revision is justified. *Id.* § 1533(b)(3)(D)(i).

[48] *Id.* § 1533(b)(2).

[49] *Id.* § 1533(b)(5)(C).

species or adversely modify or destroy any designated critical habitat.[50] In the course of that process, and in the final determination, both the wildlife and action agencies must use the best scientific data available.[51] Exemptions from the duty to ensure against jeopardy, which can be issued by the God Squad,[52] are permanent unless, based on the best scientific information available, the wildlife agency finds that the action would cause the extinction of a species not yet considered.[53] Decisions and advice under the prong of the ESA which implements the Convention on International Trade in Endangered Species[54] must be based on "the best available biological information derived from professionally accepted wildlife management practices."[55]

Although the legislative best available science mandate of the ESA is extensive,[56] it is not all-encompassing. Perhaps surprisingly, the recovery planning provision of the Act does not mention scientific information.[57] Nor do the sections that allow the implementing agencies to create special rules for the conservation of threatened species,[58] and permit incidental take of listed species under certain conditions.[59] Those omissions highlight the curious nature of the best available science mandate. It seems unlikely that Congress intended to condone production of recovery plans or issuance of incidental take permits without reference to the best available science. That Congress did not expressly mention science in those provisions suggests that it goes without saying that agencies making decisions with a high scientific content must consult the best available science. It is curious, then, that in so many of the ESA's provisions Congress felt the need to make that obligation explicit.[60]

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[50] *Id.* § 1536(a)(2).

[51] *Id.* § 1536(a)(2) (action agency); *id.* § 1536(c) (wildlife agencies' determination of whether any listed species may be present in the action area).

[52] The formal name for this group is the Endangered Species Committee. *See id.* § 1536(e)–(p) (describing the committee, its composition, and the terms on which it reviews exemption requests).

[53] *Id.* § 1536(h)(2)(B)(i).

[54] *Id.* § 1537a.

[55] *Id.* § 1537a(c)(2). Interior need not make explicit estimates of population size for this purpose. *Id.*

[56] In addition to the provisions detailed above, the provisions of section 7 which allow the Endangered Species Committee to grant an exemption from the "no jeopardy" duty provide that such an exemption is not necessarily permanent if the wildlife agencies, using the best scientific data available, determine that it would cause the extinction of a species other than one for which the exemption was sought. *Id.* § 1536(h)(2)(B)(i).

[57] *Id.* § 1533(f). Despite this omission, the wildlife agencies have interpreted their recovery planning duties to encompass use of the best scientific and commercial data available. *See* Notice of Interagency Cooperative Policy for Peer Review in Endangered Species Act Activities, 59 Fed. Reg. 34,270, 34,270 (July 1, 1994) (stating policy of incorporating independent peer review in recovery activities).

[58] 16 U.S.C. § 1533(d) (2000).

[59] *Id.* § 1539(a).

[60] The best science mandate is half-heartedly included in section 10(j), which deals with introduced populations. *Id.* § 1539(j). Such populations receive less than the full protection of the Act, provided that they are geographically separate from natural populations. The precise extent of protection depends upon whether or not the population is deemed "essential to the

2. Implementing Regulations and Policies

FWS regulations expand the best available science mandate somewhat with respect to permit issuance. In deciding whether to issue a permit for scientific purposes or for enhancement of survival of a species, FWS lists as one factor to be considered "the opinions or views of scientists or other persons or organizations having expertise concerning the wildlife."[61] That does not mean, however, that such permits necessarily require independent scientific review. For Candidate Conservation Agreements, which require enhancement of survival permits, FWS has said that "[s]cientific experts will often be asked to assist" in developing those agreements, but in some cases will simply have the opportunity enjoyed by all members of the public to submit comments.[62] The regulations also apply the best available science mandate in a novel context: If FWS wishes to require the holder of an incidental take permit or an enhancement of survival permit issued in connection with a candidate conservation agreement to take additional conservation measures in order to respond to unforeseen circumstances, it must demonstrate, "using the best scientific . . . data available," that such circumstances exist.[63]

Beyond these limited regulations, the wildlife agencies have issued two policy statements that attempt to implement the best available science mandate by aligning their ESA decision-making processes with accepted scientific practices. One deals with the use of information. It requires evaluation by biologists of all information used in listing, recovery planning, preparation of biological opinions, and issuance of permits, and documentation of that evaluation.[64] It also directs agency biologists to prefer primary sources when possible[65] and to affirmatively seek and impartially evaluate data contrary to the agency's official position or proposed actions.[66]

The second policy statement calls for the wildlife agencies to seek peer review of listing proposals by three independent specialists[67] and to actively solicit peer review of draft recovery plans.[68] In both cases, the final

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continued existence" of the species. *Id.* § 1539(j). The wildlife agencies are directed to make that determination "on the basis of the best available information," *id.* § 1539(j)(2)(B), with the scientific nature of that information presumably implicit. For detailed discussion of section 10(j), see Holly Doremus, *Restoring Endangered Species: The Importance of Being Wild*, 23 HARV. ENVTL. L. REV. 1 (1999).

61 50 C.F.R. §§ 17.22(a)(2)(v), 17.32(a)(2)(v) (2004).

62 Announcement of Final Policy for Candidate Conservation Agreements with Assurances, 64 Fed. Reg. 32,726, 32,729 (June 17, 1999).

63 50 C.F.R. §§ 17.22(b)(5)(iii)(C), (d)(5)(iii)(C), 17.32(b)(5)(iii)(C), (d)(5)(iii)(C) (2004).

64 Notice of Interagency Cooperative Policy on Information Standards Under the Endangered Species Act, 59 Fed. Reg. 34,271 (July 1, 1994).

65 *Id.*

66 *Id.*

67 Notice of Interagency Cooperative Policy for Peer Review in Endangered Species Act Activities, 59 Fed. Reg. 34,270 (July 1, 1994). The wildlife agencies apply this policy to critical habitat designations as well as proposals to add species to the protected lists. U.S. GENERAL ACCOUNTING OFFICE, *supra* note 8, at 15.

68 Notice of Interagency Cooperative Policy for Peer Review in Endangered Species Act

document must summarize the opinions of the reviewers, and the full opinions must be included in the administrative record.[69] In a 1995 memorandum, the Director of FWS reminded agency staff that peer reviewed sources should be regarded as more reliable than anecdotal information,[70] but the agency does not limit itself to peer reviewed information. The same memorandum also noted that information supplied by experts, apparently without regard to whether it had been published in a peer reviewed journal, could be regarded as highly reliable.[71] In individual listing decisions, FWS has recognized that expert judgment plays a legitimate role in the analysis of data,[72] and that internal technical review of the sort typical of many government reports carries indicia of reliability.[73]

III. A BRIEF TAXONOMY OF STANDARDS FOR SCIENTIFIC DATA

Different standards for reliability, objectivity, and certainty have been applied, or proposed for application, to scientific data in different contexts and for different purposes. Before evaluating the purposes and effects of the best available science mandate, it is helpful to review some of those standards.

A. Research Science: Replication and Review

Scientists themselves have established norms for scientific research. Research science is a process dedicated to gathering and evaluating information about the natural world. Scientists gather data, individually or in teams, through observation and experimentation. The true power of the scientific process comes from formalized communication of that data, which allows other scientists to verify or challenge both the data and its interpretation. Through this process, over time, scientific conclusions can be either reinforced and extended or debunked and rebuilt.[74] The key elements

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Activities, 59 Fed. Reg. 34,270 (July 1, 1994).

69 *Id.*

70 Memorandum from FWS Director to Regional Directors, Petition Findings Under the Endangered Species Act: A Clarification (Nov. 30, 1995) (Appendix A to U.S. FISH & WILDLIFE SERVICE AND NATIONAL MARINE FISHERIES SERVICE, ENDANGERED SPECIES PETITION MANAGEMENT GUIDANCE (1996)).

71 *Id.*

72 *See, e.g.*, Endangered & Threatened Wildlife and Plants; Notice of Determination to Retain the Threatened Status for the Coastal California Gnatcatcher Under the Endangered Species Act, 60 Fed. Reg. 15,693, 15,697 (Mar. 27, 1995) (FWS discussion of multiple expert data analyses for the Coastal California gnatcatchers (*Polioptila californica californica*)).

73 *See, e.g.*, Endangered & Threatened Wildlife and Plants; Final Rule Determining Endangered Status for the Southwestern Willow Flycatcher, 60 Fed. Reg. 10,694, 10,704 (Feb. 27, 1995) (In response to a comment FWS stated: "In general, the Service expects that publications in peer-reviewed scientific journals, reports from land and resource management agencies, and dissertations or reports from academic or research institutions have undergone technical review.").

74 *See* Doremus, *supra* note 4, at 1057–65 (discussing the scientific process as a growing staircase that is rebuilt when it collapses and evolves over time).

of research science are the opportunity of others to replicate any scientist's work and the method of communication of that work to the scientific community at large.

There are no rules or norms that limit the type of data or information a scientist can consider in deciding what problems to tackle, how to approach those problems, or what interpretations to test. Creativity and imagination are valued qualities in scientists; tales of dreams inspiring new lines of thought or research are regularly presented to budding scientists as part of their education.[75] The screening step comes later in the process. Only certain kinds of information provide acceptable grounds for concluding that the world works in a particular way. Thus, while it was perfectly acceptable for Kekulé to be inspired by a dream to create a hypothesis about the structure of benzene, it would not be scientifically acceptable for him to argue that the dream *proved* that benzene had that hypothesized structure.[76] For that, he had to make observations about benzene for comparison with predictions based on the structure.

There are additional constraints at the formal communication step. Scientists, of course, communicate informally with one another all the time in individual discussions, but the scientific process relies heavily on broad dissemination of information through scientific journals. Journal publication is a highly ritualized process subject to a strong set of norms designed to promote scientific advancement. The journal peer review process tailors publication in ways that serve the needs of science.[77] Reviewers ensure that authors fully disclose the methods used in their studies so that others can attempt to replicate or extend their findings and so that readers have the opportunity to spot artifacts or places where confounding possibilities may have crept into the study. Reviewers also ensure that both the methods used and the claims authors make based upon their data are reasonably supportable and within applicable professional bounds. The methods typically must include feasible controls to limit the potential for confounding factors to affect the results. Uncertainties in the data must be revealed and, to the extent feasible, must be quantified. Statistical functions, such as standard errors and significance tests, are used for that purpose. An author is not allowed to claim that the data *confirm* the hypothesis unless it meets the significance level (informally) agreed upon by the discipline. In many disciplines, that threshold is a 95% confidence level.[78] Such a high level of

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[75] One of the best known examples is the story of August Kekulé, whose discovery of the molecular structure of benzene was inspired by a dreamlike vision he experienced when dozing before a fire of carbon atoms dancing in rows, eventually transforming into a snake which seized its tail in its mouth and whirled mockingly. Kekulé translated this vision into a carbon ring structure, which he then showed could explain the observed properties of benzene. Geoffrey Vickers, *Rationality and Intuition*, *in* ON AESTHETICS IN SCIENCE 143, 154 (Judith Wechsler ed., 1978); George E. Hein, *Kekulé and the Architecture of Molecules*, *in* KEKULÉ CENTENNIAL 1, 10 (1966); MARIO BUNGE, INTUITION AND SCIENCE 83–84 (1962).

[76] See *supra* note 75.

[77] *See generally* DARYL E. CHUBIN & EDWARD J. HACKETT, PEERLESS SCIENCE: PEER REVIEW AND U.S. SCIENCE POLICY (1990).

[78] Thomas O. McGarity, *Substantive and Procedural Discretion in Administrative Resolution*

certainty ensures that the scientific community does not prematurely treat a hypothesis as established, a result which might send researchers down unproductive paths. There is nothing magical about the particular confidence level required, however; the choice is not inherent in the scientific method but is purely one of policy.[79] Moreover, studies that do not meet the accepted level of statistical significance are not necessarily invalid or unpublishable. They may suggest, even if they do not confirm, that the hypotheses are correct. Aggregation of several such suggestive studies, or the combination of a suggestive study and a persuasive scientific theory, can lead to acceptance of the hypothesis.[80]

Finally, reviewers make judgments about the level of interest papers are likely to generate among readers.[81] Typically there is a known hierarchy among journals in a field, with those at the top limiting their publication to papers that meet the highest standards for a combination of importance or novelty and rigor. Papers on less important topics, or with more ambiguous results, tend to be relegated to lesser journals. Peer review is more a process of negotiation about where a particular study should be published and what claims can be made for it than a strict gatekeeper of what information can be disseminated in the scientific community. The scientific process is expected to sort out the more useful information, with the journal of publication acting as a very coarse first filter in that process.

Scientific norms are designed to fit the needs of the scientific process. Science is expected to be self-correcting over the long term. False data will eventually be revealed if others attempt to replicate it, and incorrect interpretations will be corrected as inconsistent data accumulates. In the short run, scientific conclusions, even those that gain a fairly broad consensus, may be wrong. But in the long run, the scientific process produces extremely robust information about the world. The consequences of a temporarily incorrect interpretation are therefore not seen as particularly high. It might lead other researchers down unproductive routes, thereby slowing the advance of science. It might, if the subject is medicine, encourage the pursuit of treatments that are not in fact efficacious. But it does not freeze any particular state of affairs. So long as tentative conclusions remain open to challenge, there is always the opportunity to refine understanding. The norms of science and of publication therefore are intended to advantage more reliable data and interpretations so that science might progress as efficiently as possible. But these norms are also intended to leave the process permanently open to minority views supported by data derived by appropriate methods.

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of Science Policy Questions: Regulating Carcinogens in EPA and OSHA, 67 GEO. L.J. 729, 748 (1979).

79 *Id.*

80 *See* Doremus, *supra* note 4, at 1071 ("Even if no single observation reaches the level accepted in the field as statistically significant, several close to that level may in the aggregate, especially if accompanied by an elegant explanation, persuade scientists of a theory's validity.").

81 *Id.* at 1146.

B. Courtroom Science: Relevance and Reliability

Because the context is quite different, substantially different standards have been developed to govern the presentation of scientific data in the courtroom. Unlike research science, courtroom science is a short-term project with consequences that are understood to be both important and irreversible. Courts must determine the rights of individuals on the basis of the information available at the moment of the decision and generally do not have the luxury of correcting their decisions as new information becomes available. Their task is further complicated by the fact that judicial decision makers, whether judges or juries, are not systematically trained in scientific or technical disciplines.

Driven by concerns that juries will be flummoxed by scientific testimony, unable to distinguish strong from weak evidence, and responsive to the emotional tug of injured plaintiffs and deep defendant pockets,[82] courts have developed threshold standards for the admission of scientific evidence. In the United States, there are two such standards: the *Frye v. United States*[83] test, which requires that the principle or method of testing be generally accepted in the relevant scientific community,[84] and the *Daubert v. Merrill Dow Pharmaceuticals, Inc.*[85] test, which requires the judge to find "that an expert's testimony both rests on a reliable foundation and is relevant to the task at hand."[86] *Daubert* currently controls in the federal courts, but some states continue to apply *Frye*.[87]

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[82] *See generally* PETER HUBER, GALILEO'S REVENGE: JUNK SCIENCE IN THE COURTROOM (1991) (discussing the role of junk science in the courtroom and in the media); David L. Faigman, *A Response to Professor Carlson: Struggling to Stop the Flood of Unreliable Expert Testimony*, 76 MINN. L. REV. 877, 881–82 (1992) (arguing that "in both the expert testimony and hearsay contexts, jurors cannot fully appreciate the limitations of the evidence . . . ."); Edward J. Imwinkelried, *Coming to Grips with Scientific Research in* Daubert*'s "Brave New World": The Courts' Need to Appreciate the Evidentiary Differences Between Validity and Proficiency Studies*, 61 BROOK. L. REV. 1247, 1247–48 (1995) (quoting opinions by courts that expressed concern over jurors' often misplaced faith in scientific evidence); Joseph Sanders, *Scientific Validity, Admissibility, and Mass Torts After* Daubert, 78 MINN. L. REV. 1387, 1429 (1994) (citing juries' inability "to distinguish between reliable and unreliable evidence" and their "lack of specialized knowledge [that] renders them incapable of assessing the merits of expert testimony" as reasons not to admit scientific evidence); Joseph Sanders, *Scientifically Complex Cases, Trial by Jury, and the Erosion of Adversarial Processes*, 48 DEPAUL L. REV. 355, 359–65 (1998) (summarizing studies on juror deliberations and concluding that "jurors do have trouble with complex scientific expert testimony").

[83] 293 F. 1013 (D.C. Cir. 1923).

[84] *Id.* at 1014.

[85] 509 U.S. 579 (1993).

[86] *Id.* at 597.

[87] Pamela J. Jensen, Frye *Versus* Daubert*: Practically the Same?*, 87 MINN. L. REV. 1579, 1580 (2003). Jensen found no consistent correlation between the admissibility of scientific evidence and adherence to the *Daubert* or *Frye* standard. She concludes that both tests leave the court with substantial latitude. *Id.* at 1616–19. A different study suggests that *Daubert* has, as a practical matter, led to more frequent exclusion of expert testimony in the federal courts. LLOYD DIXON & BRIAN GILL, CHANGES IN THE STANDARDS FOR ADMITTING EXPERT EVIDENCE IN FEDERAL CIVIL CASES SINCE THE *DAUBERT* DECISION 61 (2001), *available at* http://www.rand.org/publications/MR/MR1439/MR1439.pdf.

Daubert interpreted two provisions of the Federal Rules of Evidence. Rule 402 provides for the admission of all relevant evidence and the exclusion of all nonrelevant evidence.[88] Rule 702 specifically addresses expert testimony, providing that a qualified expert may testify to "scientific, technical, or other specialized knowledge [if it] will assist the trier of fact . . . to determine a fact in issue."[89] Under those rules, the Court held, "[T]he trial judge must ensure that any and all scientific testimony or evidence admitted is not only relevant, but reliable."[90] Reliability is ensured by requiring that the expert testify to "scientific knowledge,"[91] and relevance by demanding "a valid scientific connection" between that knowledge and an issue in the case at hand.[92] The focus with respect to both inquiries is on the process by which an expert reaches her conclusions (that is, her reasoning and methodology) rather than the conclusions themselves.[93]

Daubert emphasized that the judicial inquiry into the reliability and relevance of scientific evidence must be "a flexible one."[94] The Court enumerated several factors that might be considered in this inquiry, including: 1) Whether the theory or technique in question "can be (and has been) tested"; 2) "whether the theory or technique has been subjected to peer review and publication"; 3) a particular technique's "known or potential rate of error"; and 4) the degree to which the theory or technique is accepted within the relevant scientific community.[95] Other factors are not ruled out, nor is any listed factor necessarily dispositive or even relevant to a particular case. The trial judge enjoys considerable discretion to decide what factors are important indicators of reliability in any particular instance, as well as in its ultimate decision to allow or exclude challenged evidence.[96]

The Court in *Daubert* recognized that the screening role it created for the trial judge was more intrusive than the norms of science would impose on researchers. Responding to the charge that excluding scientific evidence

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88 FED. R. EVID. 402. Evidence is relevant if it has "any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence." FED. R. EVID. 401.

89 FED. R. EVID. 702.

90 *Daubert*, 509 U.S. at 589.

91 *Id.* at 590.

92 *Id.* at 591–92.

93 *Id.* at 592–93 (determining admissibility "entails a preliminary assessment of whether the reasoning or methodology underlying the testimony is scientifically valid and of whether that reasoning or methodology properly can be applied to the facts in issue"); *see also id.* at 595 ("The focus, of course, must be solely on principles and methodology, not on the conclusions that they generate.").

94 *Id.* at 594.

95 *Id.* at 593–94.

96 *See* Gen. Elec. Co. v. Joiner, 522 U.S. 136, 146 (1997) (holding that abuse of discretion is the proper standard by which to review a district court's decision to admit or exclude scientific evidence thus giving the district court considerable discretion); Kumho Tire Co. v. Carmichael, 526 U.S. 137, 141 (1999) (concluding "that *Daubert*'s general holding—setting forth the trial judge's general 'gatekeeping' obligation—applies not only to testimony based on 'scientific' knowledge, but also to testimony based on 'technical' and 'other specialized' knowledge").

would "be inimical to the search for truth,"[97] the Court explicitly distinguished the courtroom context from scientific research:

> [T]here are important differences between the quest for truth in the courtroom and the quest for truth in the laboratory. Scientific conclusions are subject to perpetual revision. Law, on the other hand, must resolve disputes finally and quickly. The scientific project is advanced by a broad and wide-ranging consideration of a multitude of hypotheses, for those that are incorrect will eventually be shown to be so, and that in itself is an advance. Conjectures that are probably wrong are of little use, however, in the project of reaching a quick, final, and binding legal judgment—often of great consequence—about a particular set of events in the past. We recognize that, in practice, a gatekeeping role for the judge, no matter how flexible, inevitably on occasion will prevent the jury from learning of authentic insights and innovations. That, nevertheless, is the balance that is struck by [Federal] Rules of Evidence designed not for the exhaustive search for cosmic understanding but for the particularized resolution of legal disputes.[98]

The explicit assumption underlying *Daubert* is that evidence that will be excluded is "probably wrong." That suggests that perhaps the role *Daubert* envisions for a court is not much different than the role typically assigned to peer review.[99] Information derived by untested, unreviewed methods—the error rate of which is not known or which are not generally accepted in the scientific community—may not be "probably wrong" (as the Court apparently supposes) but there is no *scientific* reason to believe it is probably right. If the Court mistrusts juries, thinking they are either easily bamboozled or systematically inclined to favor injured plaintiffs over deep-pocket defendants (or both), prohibiting experts from claiming the trusted mantle of science for such evidence makes sense.

C. Regulatory Science: "Sound Science," Precautionary Principle, or Agency Discretion?

Administrative regulation is a third context, distinct from either scientific research or litigation. Like litigation, regulation often has direct and immediate real-world consequences. Like research, however, it is not set in stone. Regulations are always subject to reexamination and refinement as the information base improves, although the impacts of either over- or underregulation prior to correction may not always be reversible. The consequences of error in one direction or another therefore do not clearly point toward either the "let a thousand competing theories bloom" research approach or the "keep out potentially misleading information" courtroom approach.

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[97] *Daubert*, 509 U.S. at 596.

[98] *Id.* at 596–97.

[99] That supposition is reinforced by the Court's reference to publication as one of the factors a judge might consider in determining whether or not to exclude evidence. *Id.* at 593–94.

Two competing theories about regulatory decision making have flourished in recent years, each driven more by ideology than by data or careful reflection, and each with an appealing soundbite. Regulated industries and antiregulatory zealots have appropriated the term "sound science" as the public banner of their effort to raise barriers to the use of science in regulation even higher than those *Daubert* erected in the courtroom.[100] Essentially, they believe that regulations should not be imposed without strong scientific justification. They may advocate high levels of scientific certainty as a threshold requirement for regulation, using the typical 95% confidence level required by scientific norms for assertions of scientific "proof." They may seek to limit the evidence agencies can consider to particular methodologies.[101] Or they may seek to impose endless requirements for additional study before regulatory action can be taken (imposing "paralysis by analysis").[102]

On the other side of the ideological spectrum are those who argue for extreme application of the precautionary principle. The precautionary principle in moderate form merely forestalls the "sound science" argument; it says only that the absence of scientific "proof" of harm should not foreclose regulation.[103] But the precautionary principle can be taken to extreme lengths, to the point that prohibition should be the default policy in the absence of irrefutable "proof" of safety.[104]

This argument comes down to a choice of the burden of proof to impose with respect to regulation. The "strong science" movement would like to impose very high burdens on regulators. Advocates of a "strong precautionary principle," on the other hand, seek to impose similarly high burdens in order to free activities from regulation. In reality, of course, we are not limited to those two extreme choices, and identifying the appropriate threshold level of regulatory certainty is more context-sensitive than

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100 *See, e.g.*, Elisa K. Ong & Stanton A. Glantz, *Constructing "Sound Science" and "Good Epidemiology": Tobacco, Lawyers, and Public Relations Firms*, 11 AM. J. PUB. HEALTH 1749 (2001) (describing a "sound science" program established by Philip Morris with the explicit aim of discrediting studies identifying secondhand smoke as a human carcinogen).

101 *See, e.g.*, H.R. 1662, 108th Cong. § 3 (2003) ("The Secretary may not determine that a species is an endangered or threatened species unless the determination is supported by data obtained by observation of the species in the field.").

102 *See* David C. Vladeck & Thomas O. McGarity, *Paralysis By Analysis: How Conservatives Plan to Kill Popular Regulation*, AM. PROSPECT, Summer 1995, at 78 (noting several House and Senate bills proposing administrative burdens to the regulation process).

103 For example, the Rio Declaration on Environment and Development provides: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." Rio Declaration on Environment and Development, UNCED, U.N. Doc. A/CONF.151/Rev1, 31 I.L.M. 874, 879 (1992).

104 *See, e.g.*, David Freestone & Ellen Hey, *Implementing the Precautionary Principle: Challenges and Opportunities*, *in* THE PRECAUTIONARY PRINCIPLE AND INTERNATIONAL LAW: THE CHALLENGE OF IMPLEMENTATION 265 (David Freestone & Ellen Hey eds., 1996) (asserting that the precautionary principle "revers[es] the traditional burden of proof in environmental pollution cases, so that the burden is placed upon the body proposing a possibly harmful activity to show that no harm will be caused").

soundbites acknowledge. It comes down to evaluation of the costs of over- or underregulation, which surely vary from one situation to another.

Currently, the required burden of proof is established through the interplay of regulatory statutes and judicial oversight of regulatory decisions. There is not a uniform requirement for a specific threshold level of scientific information to support regulatory decisions. Some statutes have a precautionary tinge. The Clean Air Act,[105] for example, directs the Environmental Protection Agency to establish National Ambient Air Quality Standards at levels that will protect the public health, allowing "an adequate margin of safety."[106] Others call fairly explicitly for a comparison of the expected costs and benefits of regulation.[107] Courts will often defer to an agency's judgment about the appropriate level of scientific certainty or caution, but there are well-known exceptions, particularly where the costs of regulation appear extremely high.[108]

The other important distinction between research science and courtroom science is the level of expertise held by the decision maker. Regulatory decision makers seem to fall somewhere between those in the research or litigation contexts. Agencies are assumed to have expertise in the scientific and technical aspects of issues with which they routinely deal. Agency decisions generally are ultimately made (or at least endorsed) by political actors who may or may not have scientific expertise, but at a minimum have access to substantial input from agency experts. Those experts, though, may not have the level of expertise typical of research scientists. Field-level agency scientists may have academic training only to the bachelor's or master's degree level, as opposed to the doctoral training typical of research scientists. Moreover, they may not have enough time in their jobs to systematically keep up with the latest developments in the field by, for example, regularly reading the key journals.[109]

Nonetheless, because agencies have access to scientific and technical expertise in making their decisions, and because those decisions need not be made for all time on a short timeline, it would be inappropriate to apply *Daubert* to administrative decisions. Of course, agency decisions are not

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105 42 U.S.C. § 7401–7671q (2000).

106 *Id.* § 7409(b)(1).

107 *See, e.g.*, Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. § 136a(c)(5)(C) (2000) (EPA shall register pesticides if they will perform their intended function without "unreasonable adverse effects on the environment."); *id.* § 136(bb) (defining unreasonable adverse effects on the environment as "any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits" of use of the pesticide).

108 *See, e.g.*, Indus. Union Dep't, AFL-CIO v. Am. Petroleum Inst. (*Benzene*), 448 U.S. 607 (1980) (requiring explicit finding that benzene exposure at existing levels posed a significant risk to worker health as a prerequisite for tighter regulation). The *Benzene* opinion, issued by a plurality of only three justices, has been much criticized. *See, e.g.*, Thomas O. McGarity, *Some Thoughts on "Deossifying" the Rulemaking Process*, 41 DUKE L.J. 1385, 1401–03 (1992) (arguing that the Court required OSHA to engage in a risk analysis not explicitly required by the statute).

109 I have phrased these points tentatively because I do not have systematic data to support them. I believe them to be true of at least some agencies based on my anecdotal observation and conversations with a fairly small number of agency employees.

directly subject to the evidentiary gatekeeping requirement of *Daubert*, since that decision interpreted the Federal Rules of Evidence, which do not apply to agency proceedings.[110] But some commentators and courts have suggested that *Daubert*'s concerns about keeping "junk science" out of the courtroom apply just as strongly to agency decision making.[111] I disagree. *Daubert* rests on the perceived need, made explicit in the legislatively adopted Rules of Evidence, to keep irrelevant or misleading information from the jury. There is no such need in the context of legislative agency decision making. Not only does the agency have full access to expertise that a jury will often lack, but agencies, unlike juries, must explain their decisions. If evidence relied upon by an agency does not support its decision, the decision can (indeed, must) be reversed by a reviewing court. As a result, there is no need to prevent agencies from being exposed to evidence that might encourage them to make irrational or illegitimate decisions.[112]

IV. THE FUNCTIONS OF THE ESA'S BEST AVAILABLE SCIENCE MANDATE

The ESA imported and extended an enthusiasm for scientific resource management that had its origins in the early conservation movement.[113] Building on that foundation, the ESA imposes a broad best available science mandate. It expressly directs the agencies charged with its implementation to use the best available scientific information when making decisions, and even forbids them from relying on anything else with respect to listing decisions. That mandate has been heartily embraced (in public statements, at least) by the implementing agencies and by critics from both sides of the conservation aisle. At the same time, its implementation has brought stinging criticisms, again from both environmental advocates and the regulated community.[114] The curious juxtaposition of attitudes suggests there may be more to the best available science mandate than first meets the eye. So far, however, detailed evaluation of its goals and function has been conspicuously lacking.

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110 *See, e.g.*, Niam v. Ashcroft, 354 F.3d 652, 660 (7th Cir. 2004) ("[T]he federal rules of evidence do not apply to the federal administrative agencies; so, strictly speaking, neither does *Daubert*.").

111 *See* Paul S. Miller & Bert W. Rein, *"Gatekeeping" Agency Reliance on Scientific and Technical Materials After* Daubert*: Ensuring Relevance and Reliability in the Administrative Process*, 17 TOURO L. REV. 297 (2000) (advocating the use of the *Daubert* principles in agency decisions); *Niam*, 354 F.3d at 660 ("'Junk science' has no more place in administrative proceedings than in judicial ones.").

112 Calls for application of the *Daubert* framework to agency decisions are therefore quite likely to be disingenuous, having the aim of preventing regulation rather than improving the accuracy of regulatory decisions.

113 Doremus, *supra* note 4, at 1040–41.

114 *See id.* at 1032–34 (citing environmentalists' contention that "implementing agencies have refused to take the protective steps science shows to be necessary," as well as forest industry discontent with the "cult of biology" established by the ESA).

A. The Intent Behind the Best Available Science Mandate

The best available science mandate might serve any or all of at least four purposes.[115] First, it could promote substantively more accurate decisions in a context where the legislature could readily conclude that science dominates decision-making needs. Second, it might increase public trust and build political credibility by encouraging the polity to believe that decisions are objectively determined by the evidence, rather than chosen arbitrarily or to serve the particular values of the decision maker. This potential purpose could be described in more negative terms as shielding the agencies from political accountability for their decisions. Third, it could affect judicial review of agency decisions, either protecting those decisions from close examination by invoking special deference to agency expertise or inviting more stringent review by providing the courts with an additional standard to enforce. Fourth, it could alter the decision-making process in ways that might be important (to fans or foes of regulation) either for their own sake or because they make a difference in the substance of the ultimate decisions.

There is no direct legislative history explaining the ESA's best available science mandate. It evolved from similar requirements in early federal endangered species legislation. The Endangered Species Preservation Act of 1966[116] directed the Secretary of Interior to seek the advice and recommendations of scientists and scientific organizations in making listing determinations.[117] The Endangered Species Conservation Act of 1969[118] introduced the best available science mandate, directing the Secretary to make listing decisions on the basis of "the best scientific and commercial data available."[119] Although consultation with scientists was no longer statutorily required, both House and Senate Reports admonished the Secretary to consult with scientific organizations and experts.[120] The language of the 1969 Act was simply carried over, without discussion, when the modern ESA was enacted in 1973.

Concurrent with development of the ESA, Congress was also explicitly mandating reliance on the best available science in other conservation statutes, including the Marine Mammal Protection Act[121] and the Fishery Conservation and Management Act.[122] As with the ESA, there was little

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115 I do not mean to suggest that I regard all of these purposes as necessarily either desirable or even legitimate, only that I believe each might be deliberately pursued by either the legislature or the agencies that implement the ESA.

116 Pub. L. No. 89-669, 80 Stat. 926 (1966) (repealed 1973).

117 *Id.* § 1(c); S. REP. No. 89-1463, at 3 (1966), *reprinted in* 1966 U.S.C.C.A.N. 3342, 3344–45; H.R. CONF. REP. No. 89-2205, at 3 (1966), *reprinted in* 1966 U.S.C.C.A.N. 3358.

118 Pub. L. No. 91-135, 83 Stat. 275 (1969) (repealed 1981).

119 *Id.* § 3(a).

120 H. REP. No. 91-382, at 6 (1969); S. REP. No. 91-526, at 4 (1969), *reprinted in* 1969 U.S.C.C.A.N. 1413, 1417.

121 Pub. L. No. 92-522, § 3(a), 86 Stat. 1027, 1030 (1972) (codified as amended at 16 U.S.C. §§ 1361–1421 (2000)).

122 Pub. L. No. 94-265, § 2(c)(3), 90 Stat. 331, 333 (1976) (codified as amended at 16 U.S.C. §§ 1801–1882 (2000)) (now known as the Magnuson-Stevens Fishery Conservation and

direct discussion of these other mandates. Taken as a whole, however, the circumstances, language, and what legislative history there is suggest that the best available science mandate was generally intended to ensure objective, value-neutral decision making by specially trained experts.[123] Legislators may have genuinely believed that the relevant decisions were strictly technical and that the necessary scientific information could readily be obtained. Alternatively, they may have cynically sought to capture the political benefits of presenting value choices as scientific decisions. Whatever their intentions, legislators did not seriously or publicly debate the need for or purpose of the best available science mandate.

B. The Effects of the Best Available Science Mandate in Practice

1. Substantive Decision Making

Taking the best available science mandate at face value, its most obvious purpose would seem to be to ensure that agency decisions are substantively as "good" as can be. The quality of ESA decisions could be measured against either or both of two very different standards: From the conservation vantage point, decisions should accurately reflect the needs of the species as revealed by the available scientific data; from the development standpoint they should restrict human activity only to the extent required for protection of the species. The best available science mandate might be intended to help society walk the razor's edge, avoiding extinction in as painless a manner as possible.

Its ability to play that role effectively depends first upon science being the key element in conservation decisions, and second upon the best available science mandate effectively motivating federal agencies to better utilize science in their decision-making process. When the best available science mandate was first adopted, legislators could well have assumed that both were true. Today, however, it is apparent that the first is far from always true, and the second is largely redundant.

a. Why Science Is Not Enough

At first blush, it is surely plausible that science should be the decisive factor in ESA decisions. After all, the purpose of the ESA is to conserve species and their ecosystems. Clearly science must play *some* role in that process. In the early days of the science mandate, legislators who focused on the most obvious cases and listened to the advice of scientists might well have believed nothing else was needed.[124] Today, however, we must

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Management Act).

123 *See* Doremus, *supra* note 4, at 1047–48 (stating that federal conservation statutes included a mandate to use science in order to "ensure objective, value-neutral, unemotional decisionmaking by experts with special training").

124 *See* Doremus, *supra* note 4, at 1048 (discussing reasons legislators chose to rely on science in conservation legislation).

acknowledge that ESA decisions involve far more than science. The tools of science alone are inadequate to determine the level of extinction risk society is willing to tolerate.[125]

The ESA requires us to solve a surprisingly large number of problems that are "wicked" in the terminology of Rittel and Webber.[126] Wicked problems cannot be objectively characterized; observers with different values see very different problems and correspondingly different solutions. Wicked problems cannot be solved until they are successfully defined, and that definition is a political, rather than a scientific, task.

The gray wolf (*Canis lupus*) and hatchery salmon provide two current examples of wicked conservation problems. The gray wolf once roamed throughout most of North America, with the exception of the Southeast, which was the domain of the red wolf (*Canis rufus*).[127] Today, successful populations of the gray wolf are found in the northern Great Lakes and northern Rocky Mountains, but the vast majority of the wolf's historic range in the continental United States remains unoccupied.[128] Because the existing populations appear biologically secure, FWS has reclassified the gray wolf from endangered to threatened,[129] and intends to remove it from the protected list entirely.[130] Defenders of Wildlife has sued over the downlisting,[131] and litigation is certain to follow if FWS does delist the wolf. The key disputed issue is not the likelihood of survival of the species in its few current strongholds within the continental United States, but whether the wolf ought to be restored to some or all of its remaining historic

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[125] *See id.* at 1097–1103 (describing difficulties in scientific determinations of what constitutes a species); *id.* at 1117–22 (discussing problems with scientifically determining acceptable and unacceptable risks of species extinction).

[126] Horst W. Rittel & Melvin M. Webber, *Dilemmas in a General Theory of Planning*, 4 POL'Y SCIS. 155, 160–67 (1973).

[127] *See* U.S. FISH & WILDLIFE SERVICE, GRAY WOLF RANGE IN THE CONTIGUOUS UNITED STATES, *at* http://midwest.fws.gov/wolf/learn/range.htm (last visited Feb. 27, 2004) (showing historic range as excluding only the southeast and much of California); Robert H. Schmidt, *Gray Wolves in California: Their Presence and Absence*, 77 CALIF. FISH & GAME 79, 80 (1991) (arguing that historic data demonstrate that the gray wolf did occur throughout California).

[128] Letter from John F. Kostyack et al. to Gale Norton, Abandonment of Gray Wolf Recovery in the Northeast U.S.—Notice of Intent to Sue over Violations of the Endangered Species Act (Sept. 25, 2003) [hereinafter Wolf 60-Day Notice] (stating that today the gray wolf "can be found on just three percent of its historic range in the lower 48 states"), *available at* http://www.westwildcon.org/utahwolf/utwolforum/NWF%20files%20suit/60-dayletter.htm.

[129] Final Rule to Reclassify and Remove the Gray Wolf from the List of Endangered and Threatened Wildlife in Portions of the Conterminous United States; Establishment of Two Special Regulations for Threatened Gray Wolves, 68 Fed. Reg. 15,804, 15,857 (Apr. 1, 2003).

[130] Removing the Eastern Distinct Population Segment of Gray Wolf from the List of Endangered and Threatened Wildlife (Advance Notice of Proposed Rulemaking), 68 Fed. Reg. 15,876, 15,878 (Apr. 1, 2003); Department of Interior, Fish & Wildlife Service, Removing the Western Distinct Population Segment of Gray Wolf from the List of Endangered and Threatened Wildlife (Advance Notice of Proposed Rulemaking), 68 Fed. Reg. 15,879, 15,881 (Apr. 1, 2003).

[131] Complaint, Defenders of Wildlife v. Norton, No. CV 03 1348 BR (D. Or Oct. 1, 2003) (on file with author). The National Wildlife Federation has also given notice of its intent to sue over the reclassification. Wolf 60-Day Notice, *supra* note 128.

range.[132] That is not a scientific question; it is a question of values on which people sharply disagree.

Hatchery salmon present a similarly nonscientific dilemma. In many of the places where wild salmonids are dwindling, hatcheries produce steady quantities of fish. The question is whether the presence of a stable hatchery population should preclude listing of the remaining wild fish.[133] That question does have scientific dimensions, since hatchery fish may genetically diverge from wild fish even if they are not now distinct, and may present a disease threat to the wild fish. But fundamentally it is a question of values; the answer depends upon whether or not hatchery fish are considered an adequate substitute for wild ones. Science should be able to describe the nature and extent of differences between wild and hatchery fish, but it cannot ultimately prescribe the decision.

b. Why the Best Available Science Mandate Plays Only a Limited Substantive Role

Of course, there are many aspects of ESA decision making that do depend strongly on science. Even in those areas, however, the best available science mandate is not a strong substantive factor. At its inception, the best available science mandate might reasonably have been thought to play an important role in constraining the substance of administrative decision making. Today, such a role appears vestigial at best, because the best available science mandate essentially duplicates the background requirements of the Administrative Procedure Act (APA)[134] and other general limitations on agency decision making.[135]

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132 The legal issue in both cases is the precise meaning of the ESA's definition of an endangered species as one that is "in danger of extinction throughout all or *a significant portion of* its range." 16 U.S.C. § 1532(6) (2000) (emphasis added). FWS contends that the relevant range is limited to areas currently occupied by the species, while Defenders of Wildlife argues that it refers to the historic range. Case law tends to support Defenders of Wildlife's position. *See* Defenders of Wildlife v. Norton, 258 F.3d 1136, 1145 (9th Cir. 2001) (presence of viable population on public land not sufficient explanation for declining to list where private lands amounted to 80% of the historic range); Defenders of Wildlife v. Norton, 239 F. Supp. 2d 9, 19 (D.D.C. 2002) (rejecting FWS's conclusion that three large geographical areas, which comprise three-quarters of the historic range of the Canada lynx (*Lynx canadensis*), are not a significant portion of its range); Defenders of Wildlife v. Babbitt, 958 F. Supp. 670, 685 (D.D.C. 1997) (finding decision not to list Canada lynx arbitrary and capricious where evidence showed that lynx had been extirpated from much of its historic range).

133 That question is currently unsettled. In *Alsea Valley Alliance v. Evans*, 161 F. Supp. 2d 1154 (D. Or. 2001), the District Court ruled that NOAA Fisheries, once it decided that the hatchery and wild fish belonged in the same distinct population segment, could not then refuse to consider the abundance of the hatchery fish in determining whether to list the wild ones. *Id.* at 1161. The United States declined to appeal the decision, and the appeal of intervenor environmental groups was dismissed on the ground that the decision, which remanded a listing rule, was not a final and appealable decision as to the intervenors. Alsea Valley Alliance v. Dep't of Commerce, 358 F.3d 1181, 1183 (9th Cir. 2004).

134 5 U.S.C. §§ 551–559, 701–706, 1305, 3105, 3344, 4301, 5335, 5372, 7521 (2000).

135 *See* J.B. Ruhl, *The Battle over Endangered Species Act Methodology*, 34 ENVTL. L. 555, 582 (2004) ("[I]t is difficult to pinpoint the incremental legal effect, if any, of the 'best scientific data

The APA directs federal courts to hold unlawful and set aside agency actions that are "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law."[136] In the 1960s and early 1970s, when the best available science mandate was developed, Congress could reasonably have believed that the APA provided little protection against technically inaccurate decision making. Prior to the 1946 adoption of the APA, courts had granted an extraordinary level of deference to agencies, upholding agency action essentially without any review of its factual predicate,[137] and requiring only minimum rationality.[138] Agencies enjoyed essentially the same level of deference that courts had traditionally afforded legislatures.[139] That extreme deference was imported into review under the APA, and persisted well into the 1970s.[140]

In 1971, the Supreme Court's opinion in *Citizens to Preserve Overton Park v. Volpe*[141] for the first time sanctioned a more intrusive form of review, which came to be known as the "hard look" doctrine. *Overton Park* was hardly pellucid; it said both that courts must engage in a "thorough, probing, in-depth review,"[142] and that "the ultimate standard of review is a narrow one."[143] In 1969, and even in 1973, Congress might reasonably have thought judicial oversight would not ensure that the wildlife agencies' decisions would meet high technical standards.

With the D.C. Circuit taking the lead, however, the courts gradually began to require agencies to support their factual findings with evidence in the record and to provide a plausible explanation for their policy choices.[144] The Supreme Court seemed to discourage this sort of intrusive review in *Vermont Yankee Nuclear Power Corp. v. Natural Resources Defense Council*,[145] holding that courts could not impose procedural requirements on

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available' standard.... [It] sounds powerful, but, as interpreted and as implemented, it has probably not led to outcomes any different from those that would have been permitted or rejected [under the APA.]").

136 5 U.S.C. § 706(2)(A) (2000). Actions taken through formal adjudication or formal rulemaking are reviewed under a substantial evidence test. *Id.* § 706(2)(E). The ESA does not mandate any formal proceedings. In any case, many courts and commentators have concluded that the substantial evidence test is virtually indistinguishable from the arbitrary or capricious test. *See, e.g.*, RICHARD J. PIERCE, JR., ADMINISTRATIVE LAW TREATISE § 11.4 (4th ed. 2002) (noting that if the tests are distinguishable, it is "too subtle to explain" in a way that would be useful to courts); Edward Rubin, *It's Time to Make the Administrative Procedure Act Administrative*, 89 CORNELL L. REV. 95, 138 (2003) (citing commentators that find little difference between the standards).

137 PIERCE, *supra* note 136, § 11.4.

138 Merrick B. Garland, *Deregulation and Judicial Review*, 98 HARV. L. REV. 505, 532 (1985).

139 Rubin, *supra* note 136, at 139.

140 *See* Garland, *supra* note 138, at 532. ("[R]eversal of an agency decision on the ground that it was substantively 'arbitrary and capricious' remained a relatively rare event through the end of the 1970s.").

141 401 U.S. 402 (1971).

142 *Id.* at 415.

143 *Id.* at 416.

144 Garland, *supra* note 138, at 533–34.

145 435 U.S. 519 (1978).

agencies beyond those required by Congress.[146] A few years later, however, in *Motor Vehicle Manufacturers Ass'n v. State Farm Mutual Automobile Insurance Co.*,[147] the Court endorsed a form of hard look, requiring an agency changing its previous regulatory stance to explain in some detail why its earlier conclusions were wrong or no longer applied.[148] Under this now familiar standard, even in the absence of an explicit legislative science mandate, an agency making a decision with substantial scientific content must explain how its decision follows from, or at least is not inconsistent with, scientific evidence of which the agency has been made aware. The ESA's best available science mandate adds little to that. It merely requires that the agency consider or use the best available scientific information, not that it make the most scientifically defensible decision.[149]

Modern APA review would also appear to subsume the other sense in which the best available science mandate might be thought to regulate decisions: requiring the agencies to avoid unnecessary disruption of human activity. Justice Scalia read the best available science mandate to perform this function in *Bennett v. Spear*.[150] In light of the statute's emphasis on the importance of conservation, that reading is a stretch at best.[151] Even if one accepts it, however, the best available science mandate is not needed to prevent useless regulation. Restrictions imposed under the ESA that demonstrably do not further conservation ends would be arbitrary and capricious with or without the best available science mandate.[152]

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146 *Id.* at 519.

147 463 U.S. 29 (1983).

148 *Id.* at 57.

149 Even the listing provisions, the strongest manifestation of the best science mandate, require only that the decision be based on the best available scientific information. It forbids basing the decision on anything else, but it does not expressly say that the decision must follow the most plausible interpretation of that data.

150 520 U.S. 154, 176–77 (1997) Justice Scalia stated:

> The obvious purpose of the requirement that each agency 'use the best scientific and commercial data available' is to ensure that the ESA not be implemented haphazardly, on the basis of speculation or surmise. While this no doubt serves to advance the ESA's overall goal of species preservation, we think it readily apparent that another objective (if not indeed the primary one) is to avoid needless economic dislocation produced by agency officials zealously but unintelligently pursuing their environmental objectives.

Id.

151 Professor Buzbee has ably criticized Justice Scalia's suggestion that the ESA embodies a purpose of avoiding overenforcement. William W. Buzbee, *Expanding the Zone, Tilting the Field: Zone of Interests and Article III Standing Analysis After* Bennett v. Spear, 49 ADMIN. L. REV. 763, 784–86 (1997).

152 *See, e.g.*, Ariz. Cattle Growers' Ass'n v. United States Fish & Wildlife Serv., 273 F.3d 1229, 1243 (9th Cir. 2001) (holding that FWS could not impose conditions on a federal grazing permit without showing that listed species would be affected by grazing on the allotment). Even without the APA, regulations which do not further their supposed purpose would probably violate substantive due process. *See, e.g.*, County of Sacramento v. Lewis, 523 U.S. 833, 845–46 (1998) (Substantive due process doctrine protects against arbitrary or oppressive government action.); Gen. Motors Corp. v. Romein, 503 U.S. 181, 191 (1992) (Test for due process is "a legitimate legislative purpose furthered by rational means."); Nebbia v. New York, 291 U.S. 502, 525 (1934) (Due process requires that law not be arbitrary or oppressive and that means chosen

Additionally, it does not make conceptual sense to use a best available science mandate to minimize unnecessary disruption. Emerging science will sometimes be wrong, or at least wrongly interpreted. The best available scientific information at any point in time may point in the wrong direction. If Congress had truly wanted to minimize mistaken or unnecessary disruption, it could have done so more directly and more effectively by setting a threshold burden of proof or minimal science requirement.

Today, general requirements imposed by the executive branch further reduce the substantive importance of the best available science mandate. Executive Order 12,866, issued by Bill Clinton in 1993, requires that every executive branch agency "base its decisions on the best reasonably obtainable scientific, technical, economic, or other information concerning the need for, and consequences of, the intended regulation."[153] Even in the absence of the best available science mandate, the Executive Order requires wildlife agencies to obtain and use the best scientific information. Of course, this mandate is neither as secure nor as strong as a legislative one; executive orders can be revoked at will by subsequent presidents, or agency compliance can simply be left unsupervised. The Executive Order is not intended to be judicially enforceable.[154]

In terms of improving decision making, the ESA's best available science mandate might impose at least one thing that the APA and other background requirements do not—an affirmative obligation to find data, rather than to simply evaluate what others present. A few courts have interpreted the best available science mandate to impose precisely such an obligation. For example, in *Roosevelt Campobello International Park Commission v. United States Environmental Protection Agency* (*Roosevelt Campobello*),[155] the First Circuit read the ESA's best available science mandate to require real time simulation studies of navigation in an area proposed for an oil refinery and tanker terminal before a permit allowing construction could be granted.[156] All parties agreed that such studies "would contribute a more precise appreciation of risks of collision and grounding,"[157] which could result in an oil spill harmful to listed species. The court concluded that the simulations were feasible, could be financed by the permit applicant, and would provide information needed to assess the risks of a catastrophic oil spill. Those studies and others, the court wrote, "obviously represent as yet

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must have a "real and substantial relation" to the ends sought to be achieved.).

153 Exec. Order No. 12,866, § 1(b)(7), 58 Fed. Reg. 51,735, 51,736 (Oct. 4, 1993). This Executive Order repealed and replaced one issued by Ronald Reagan which had required that agencies base decisions on "adequate information concerning the need for and consequences of the proposed government action." Exec. Order No. 12,291, § 2(a), 46 Fed. Reg. 13,193, 13,193 (Feb. 17, 1981).

154 Exec. Order No. 12,866, § 10, 58 Fed. Reg. at 51,744; *see* Idaho Mining Ass'n v. Browner, 90 F. Supp. 2d 1078, 1102 (D. Idaho 2000) (ruling that courts lack authority to review agency compliance with Executive Order 12,866).

155 684 F.2d 1041 (1st Cir. 1982).

156 *Id.* at 1052.

157 *Id.* at 1055.

untapped sources of 'best scientific and commercial data.'"[158] Similarly, the Ninth Circuit held in *Connor v. Burford*[159] that ESA section 7 required the agency to develop projections of the impacts of oil and gas development, even if those projections would be imprecise estimates.[160]

Following *Roosevelt Campobello*, the district court for the District of Massachusetts required that a biological opinion await the results of ongoing, "demonstrably feasible" studies bearing directly on the impacts of a proposed action in *Conservation Law Foundation v. Watt*.[161] Similarly, noting that a congressional report on 1978 amendments to the ESA explained that the best available science mandate requires that biological opinions prepared under section 7 be based on the best evidence "that is available or can be developed during consultation,"[162] a federal district court concluded in *Village of False Pass v. Watt*[163] that the action agency has a duty "to continue acquiring information until an affirmative finding of no jeopardy can be made."[164]

A more recent decision, however, rejects the claim that the best available science mandate requires development of new information. In *Southwest Center for Biological Diversity v. Babbit* (*Southwest Center*),[165] the D.C. Circuit overturned a trial court's requirement that FWS conduct a population census before deciding whether or not to list the Queen Charlotte goshawk (*Accipiter gentilis laingi*).[166] According to the appellate court, "The 'best available data' requirement makes it clear that the Secretary has no obligation to conduct independent studies."[167] Despite that broad language, the *Southwest Center* decision can be distinguished from the earlier ones on two bases. First, there was no claim in *Southwest Center* that the study demanded by the trial court was feasible. Second, *Roosevelt Campobello* and the decisions that follow it deal with the section 7 duty not to jeopardize the continued existence of listed species, whereas *Southwest Center* deals with the listing requirements of section 4. The two are different in important respects. Section 7 requires that the action agency "insure" that its actions are not likely to cause jeopardy.[168] That word, which does not appear in section 4, can be read to impose a stronger duty to gather information. The purposes of the two sections support that distinction. Listing provides protection for species thought to be dwindling. If existing information

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158 *Id.*

159 848 F.2d 1441, 1454 (9th Cir. 1988).

160 *Id.* at 1454.

161 560 F. Supp. 561, 572 (D. Mass. 1983).

162 H.R. REP. NO. 96-697, at 12 (1979), *reprinted in* 1979 U.S.C.C.A.N. 2557, 2576.

163 565 F. Supp. 1123 (D. Alaska 1983).

164 *Id.* at 1157.

165 215 F.3d 58 (D.C. Cir. 2000).

166 *Id.* at 61. *See also* Cook Inlet Beluga Whale v. Daley, 156 F. Supp. 2d 16, 19–20 (D.D.C. 2001) (holding the agency was "not required to conduct further testing to determine the effect of various environmental factors, such as oil drilling, on the whale population"); Am. Wildlands v. Norton, 193 F. Supp. 2d 244, 251 (D.D.C. 2002) (holding best science mandate of section 4 "does not obligate the Service to conduct new, independent studies").

167 *Southwest Center*, 215 F.3d at 60.

168 16 U.S.C. § 1536(a)(2) (2000).

indicates that the species needs protection, it should be listed. Demands for additional information should not stand in the way of listing, which will provide an incentive for affected parties to gather and reveal information that might show that the species does not in fact need protection. Section 7, on the other hand, protects species already shown to be in critical condition from extinction. Requiring the collection and analysis of reasonably obtainable information will enhance, not undermine, conservation efforts.[169]

2. Public Trust and Political Accountability

Notwithstanding its limited substantive role in ESA decisions, the best available science mandate could have an important political role. It might be directed at the public, rather than at the agencies or courts. When they first developed the best available science mandate, legislators and regulators alike might well have believed that it would increase public acceptance of ESA decisions. People are more likely to accept outcomes that prove unfavorable to their interests when they trust the motives of the actor.[170] The apparent objectivity of science seems ideally suited to enhancing trust. It is no surprise, therefore, that politicians have often cloaked decisions made on other grounds in the garb of science.[171]

Today, with respect to the ESA, that motive may be far stronger than it was in 1973. When the ESA was enacted, its economic and social costs were hardly apparent.[172] Today, those costs can hardly be ignored.[173] While public trust is therefore in higher demand today, it is also in shorter supply. The federal government was widely trusted at the dawn of the environmental era; today, only a quarter of Americans will admit to trusting the federal

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169 A district court decision rejects any distinction between the best science mandates of section 4 and section 7. San Luis & Delta-Mendota Water Auth. v. Badgley, 136 F. Supp. 2d 1136, 1147 (E.D. Cal. 2000) ("There is no reason, however, why Section 7 authority interpreting 'best scientific data available' should not be applied to Section 4 cases."). That decision also appears to impose a vague duty to gather additional information in the listing context, although the court may well have had existing studies in mind. *See id.* at 1151 (concluding that decision to list the Sacramento splittail (*Pagonicthys macrolepidotus*) was arbitrary and capricious because there was no evidence "that USFWS attempted to acquire a broader range of unbiased data").

170 Roderick M. Kramer, *Trust and Distrust in Organizations: Emerging Perspectives, Enduring Questions*, 50 ANN. REV. PSYCHOL. 569, 585 (1999).

171 *See* Doremus, *supra* note 4, at 1038–39; Wendy E. Wagner, *The Science Charade in Toxic Risk Regulation*, 95 COLUM. L. REV. 1613, 1652–54 (1995).

172 The ESA was passed in 1973 with virtually no opposition. Only 12 members of the House voted against it, 119 CONG. REC. 30,167–68 (1973), and no Senators did so, 119 CONG. REC. 25,694 (1973). The law's costs did not become widely apparent until the Supreme Court's decision in *Tennessee Valley Authority v. Hill*, 437 U.S. 153 (1978), which held that the ESA forbade completion of the Tellico Dam, required protection of listed species at all costs. *Id.* at 172–73.

173 FWS is required to report to Congress annually on its ESA expenditures, together with the expenditures of other federal agencies and states receiving grants under the ESA. 16 U.S.C. § 1544 (2000). The most recent report available, for fiscal year 2000, reports total expenditures over $610 million. U.S. FISH & WILDLIFE SERVICE, FEDERAL AND STATE ENDANGERED AND THREATENED SPECIES EXPENDITURES, FISCAL YEAR 2000, at ii (2003), *available at* http://endangered.fws.gov/expenditures/reports/FY_2000.pdf. That, of course, is an underestimate of total ESA costs because it does not include opportunity costs.

government.[174] Science is no longer an automatic counterweight to that distrust. Scientists, and by implication science itself, do not enjoy as much credibility as they had in 1973. According to a 2003 Harris poll, the percentage of Americans who regard scientists as having very high prestige has declined from 66% to 57% since 1978.[175]

Nonetheless, scientists still rank above any of the other professions people were asked about, including doctors, teachers, and lawyers.[176] Science undoubtedly still commands more "role-based" trust than politics or government. Independent of the individual or organization, roles embedded in a system that seems to ensure role-appropriate, trustworthy behavior can induce trust.[177] The system of science, with its public proclamations of neutrality and objectivity, should bring trust to the role of scientist. But "role-based trust can be quite fragile,"[178] and in the context of the ESA, public trust in the supposedly scientific decisions that implement the ESA is demonstrably fraying.

Empirically, the best available science mandate has not proven successful at dampening controversies over ESA implementation. Since the law's earliest days, there have been complaints from both sides about the scientific underpinnings of ESA decisions. The General Accounting Office in 1979 confirmed environmentalists' complaints that scientifically deserving but uncharismatic species were not being protected.[179] From the other side, legislators convinced that species were being listed without adequate scientific justification began introducing amendments demanding sound science in 1978.[180]

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174 *See* Kramer, *supra* note 170, at 588 (noting that between 1964 and 1997, trust in the federal government fell from 75% to 25%).

175 William J. Broad & James Glanz, *Does Science Matter?*, N.Y. TIMES, Nov. 11, 2003, at F1.

176 *Id.*

177 Kramer, *supra* note 170, at 578.

178 *Id.*

179 U.S. GENERAL ACCOUNTING OFFICE, ENDANGERED SPECIES: A CONTROVERSIAL ISSUE NEEDING RESOLUTION (1979). That conclusion was reaffirmed in two subsequent reports. U.S. GENERAL ACCOUNTING OFFICE, ENDANGERED SPECIES: SPOTTED OWL PETITION EVALUATION BESET BY PROBLEMS (1989); U.S. GENERAL ACCOUNTING OFFICE, ENDANGERED SPECIES: FACTORS ASSOCIATED WITH DELAYED LISTING DECISIONS (1993). A series of independent commentators have continued to point out the extent to which factors other than science dominate the listing process. *See, e.g.*, YAFFEE, *supra* note 21, at 158–60 (exposing the role of negotiations between conflicting social objectives); Ando, *supra* note 21, at 37–40 (discussing the influence of special interest groups and public opinion in species protection); Metrick & Weitzman, *supra* note 21, at 2–3 (finding that "visceral" characteristics, like "physical size" and "higher form of life" influence species protection over scientific characteristics, like degree of endangerment). Others have found that provision of funding for recovery efforts is similarly independent of the species' biological status. J.R. DeShazo & Jody Freeman, *The Congressional Competition to Control Delegated Power*, 81 TEX. L. REV. 1443, 1467 (2003); Julie K. Miller et al., *The Endangered Species Act: Dollars and Sense?*, 52 BIOSCIENCE 163, 163 (2002).

180 *See* 124 CONG. REC. 21,556–73 (1978), *reprinted in* CONGRESSIONAL RESEARCH SERVICE, A LEGISLATIVE HISTORY OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED IN 1976, 1977, 1978, 1979, AND 1980, at 1073–1101 (1982) (debate on amendment introduced by Sen. Jake Garn (R-Utah)).

The complaints have not only gotten more strident over the years, they have more frequently ended up in court. Litigation over ESA science, including both the substance of scientific decisions and the procedures by which those decisions are reached, has become commonplace. A rough search of a major legal database turned up a total of 52 reported federal decisions substantively discussing the scientific requirements of the ESA or the scientific foundations of ESA decisions.[181] The earliest of those decisions date to 1979, shortly after the regulatory framework had been established. But fully 39 of them (75%) were issued within the last ten years, 27 (52%) within the last five years, and ten (19%) in the first nine months of 2003. Most of the litigation is still brought by those seeking stronger protection of the species, but development interests are also using the courtroom. Of the 27 decisions since 1999, nine involved anti-regulatory plaintiffs.

The challenges have also gone beyond the courtroom. Proposals for legislative reforms focused on the use of science under the ESA have been around since 1978,[182] but they too are growing more common. In recent years a number of bills have proposed new thresholds for the use of scientific information, particularly favoring field data over other types of information[183] and prescribing detailed requirements for review of the science used in regulatory decisions.[184]

The scientific world itself is the latest battleground. Two general reviews of the scientific foundations of the ESA have been positive, but both focused on the Act's structure rather than its implementation.[185] Recent reviews of specific decisions have been more mixed. Calls for such reviews, like litigation, are accelerating. The National Research Council (NRC), the policy arm of the National Academy of Sciences, regularly conducts studies of science-intensive policy decisions at the request of the federal government. NRC reviews are carried out by committees of experts selected by the NRC. Committee members are not paid for their work; they volunteer their time either because they are interested in the problem and anxious to contribute to a solution or because they benefit from the prestige conferred

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[181] The search was conducted in early October 2003, using the ALLFEDS database of Westlaw. The query sought decisions in which the terms "endangered species" and "science" or "scientific" appeared in the same paragraph in the syllabus or digest. Cases were eliminated if a brief reading showed that they did not involve an ESA claim (for example, cases raising claims only under the National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321–4370e (2000) (NEPA)) or that the decision did not analyze the best science mandate (for example, some cases dealt only with whether a scientist studying the species had standing to pursue an ESA claim).

[182] *See supra* note 180 and accompanying text.

[183] *See, e.g.*, H.R. 1253, 108th Cong. § 13(b) (2003) ("The Secretary may not determine under section 4 that the Preble's meadow jumping mouse [(*Zapus hudsonius preblei*)] is an endangered species or a threatened species unless the determination is supported by data obtained by observation of the species in the field.").

[184] *See, e.g., id.* § 13(c) (requiring review by three individuals chosen randomly from a list nominated by the National Academy of Sciences before listing of the Preble's meadow jumping mouse can become final).

[185] *See generally* NATIONAL RESEARCH COUNCIL, *supra* note 8; Carroll et al., *supra* note 8.

by appointment.[186] In recent years, the NRC has repeatedly been asked to review policy decisions either directly made under the authority of the ESA or closely related to endangered species protection.[187] The NRC's preliminary report on the Klamath Basin created a furor when it concluded that biological opinions setting minimum lake levels to protect endangered suckers and minimum river flow levels to protect threatened salmon had no substantial scientific basis.[188]

Perhaps the best available science mandate once provided political cover for the ESA, but the scientific basis for many ESA actions is in fact surprisingly thin. As that becomes increasingly apparent, the political usefulness of the mandate seems to be fading.

3. Altering the Terms of Judicial Review

As explained above, it is possible that the best available science mandate was originally intended to encourage more searching judicial review.[189] But the ESA's best available science mandate is hardly a sure recipe for strong judicial review in the modern world. By painting decisions as technical, the best available science mandate could have precisely the opposite effect. According to the Supreme Court, when examining a "scientific determination, as opposed to simple findings of fact, a reviewing

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186 For an insightful, accurate, no-holds-barred description of the NRC committee process by an experienced participant, see William H. Rodgers, Jr., *Indian Tribes and the Endangered Species Act*, *in* THE ENDANGERED SPECIES ACT AT 30: LESSONS AND PROSPECTS, *supra* note 22.

187 *See, e.g.*, NATIONAL RESEARCH COUNCIL, *supra* note 8, at 3–4 (outlining request for an NRC committee to review a list of issues and their relation to the ESA and to consider better ways to implement the ESA); NATIONAL RESEARCH COUNCIL, UPSTREAM: SALMON AND SOCIETY IN THE PACIFIC NORTHWEST 1–2 (1996) (stating that the NRC assembled a committee after Congress requested advice regarding possible listing of Pacific salmon); NATIONAL RESEARCH COUNCIL, DOWNSTREAM: ADAPTIVE MANAGEMENT OF GLEN CANYON DAM AND THE COLORADO RIVER ECOSYSTEM 24–25 (1999) (describing questions the NRC committee was asked to address with respect to plans for adaptive management); NATIONAL RESEARCH COUNCIL, THE MISSOURI RIVER ECOSYSTEM: EXPLORING THE PROSPECTS FOR RECOVERY 14–15 (2002) (stating that the NRC committee was to research the scientific basis for river management after NEPA procedures were in progress); NATIONAL RESEARCH COUNCIL, GENETIC STATUS OF ATLANTIC SALMON IN MAINE: INTERIM REPORT FROM THE COMMITTEE ON ATLANTIC SALMON IN MAINE 7–8 (2002) (stating that Congress mandated that NRC study Atlantic salmon (*Salmo salar*) in Maine due to controversy over listing); NATIONAL RESEARCH COUNCIL, ENDANGERED AND THREATENED FISHES IN THE KLAMATH RIVER BASIN: CAUSES OF DECLINE AND STRATEGIES FOR RECOVERY 2–3 (prepublication copy Oct. 2003) [hereinafter KLAMATH RECOVERY STRATEGIES] (noting that NRC formed a committee to analyze science behind biological assessments and biological opinions); NATIONAL RESEARCH COUNCIL, THE DECLINE OF THE STELLAR SEA LION IN ALASKAN WATERS: UNTANGLING FOOD WEBS AND FISHING NETS 2 (2003) (stating that NRC reviewed causes of Steller sea lion (*Eumetopias jubatus*) decline with respect to ESA consultation carried out in November 2000). At least two more such reports are currently in process, one exploring the relationship between instream flows and salmon survival in the Columbia River basin and the other looking at the management of threatened and endangered species in the Platte River basin. The author is a member of the Platte River committee.

188 NATIONAL RESEARCH COUNCIL, SCIENTIFIC EVALUATION OF BIOLOGICAL OPINIONS ON ENDANGERED AND THREATENED FISHES IN THE KLAMATH RIVER BASIN: INTERIM REPORT 3–4 (2002).

189 *See supra* note 115 and accompanying text.

court must generally be at its most deferential."[190] Courts are reluctant to second-guess either the conclusions or the methodological choices of agencies assumed to have considerable technical expertise.[191] Consequently, where there is substantial scientific uncertainty, such that experts disagree on the interpretation of the available data, the agency's interpretation will generally enjoy substantial deference.[192] A leading commentator has charged that the desire to minimize judicial review is today an important reason why agencies embrace "science charades," deliberately emphasizing the scientific aspects of what are ultimately value choices.[193]

Notwithstanding the entrenched deference to technical decisions, the judicial review picture is not entirely one-sided. Federal courts do appear to have embraced a "substantive hard look"[194] approach that extends to decisions with high scientific content. Courts are willing to examine both the evidence and the reasoning supporting a decision. Agency claims of expertise or general knowledge are not enough to support a decision that lacks scientific support in the record.[195] The agency may not reject one part of a range of probabilities without an adequate explanation,[196] and must fully consider and explain its rejection of any relevant information.[197]

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190 Baltimore Gas & Elec. Co. v. Natural Res. Def. Council, 462 U.S. 87, 103 (1983).

191 *See, e.g.*, Louisiana *ex rel.* Guste v. Verity, 853 F.2d 322, 329 (5th Cir. 1988) (applying minimum rationality test to agency's scientific conclusions).

192 *See, e.g.*, Marsh v. Or. Natural Res. Council, 490 U.S. 360, 378 (1991) (deferring to the agency's fact-intensive determination not to prepare a supplemental environmental impact statement in finding it not arbitrary and capricious); Selkirk Conservation Alliance v. Forsgren, 336 F.3d 944, 956 (9th Cir. 2003) ("[The federal agencies] did not violate their duty to rely on the best scientific data available when they reasonably concluded that the effects of road construction and timber harvesting would be sufficiently mitigated by enforcement of the terms in the Conservation Agreement so as not to jeopardize the existence of the species. While another decisionmaker might have reached a contrary result, the agencies conducted a reasonable evaluation of the relevant information and reached a conclusion that, although disputable, was not 'arbitrary and capricious.'"); United States v. Guthrie, 50 F.3d 936, 946 (11th Cir. 1995) ("Having examined the articles, studies, and books relied upon by the Secretary when he concluded that the Alabama red-bellied turtle (*Pseudemys alabamensis*) is a separate taxonomic species, we are satisfied that, despite the absence of total agreement within the scientific community, his finding is entirely reasonable. It certainly is not arbitrary and capricious."); Carlton v. Babbitt, 903 F. Supp. 96, 110 (D.D.C. 1995) ("[D]isagreement between scientists is not sufficient to demonstrate arbitrariness by the government.").

193 Wagner, *supra* note 171, at 1662–66.

194 Garland, *supra* note 138, at 533.

195 Natural Res. Def. Council v. Administrator, United States Envtl. Prot. Agency, 902 F.2d 962, 968 (D.C. Cir. 1990); Parravano v. Babbitt, 837 F. Supp. 1034, 1046 (N.D. Cal. 1993); Northern Spotted Owl v. Hodel, 716 F. Supp. 479, 483 (W.D. Wash. 1988).

196 Idaho Dep't of Fish & Game v. Nat'l Marine Fisheries Serv., 850 F. Supp. 886, 990 (D. Or. 1994), *vacated as moot*, 56 F.3d 1071 (9th Cir. 1995).

197 Chlorine Chemistry Council v. Envtl. Prot. Agency, 206 F.3d 1286, 1291 (D.C. Cir. 2000) ("best available evidence" standard did not allow EPA to ignore evidence that chloroform in drinking water showed threshold response); Conner v. Burford, 848 F.2d 1441, 1454 (9th Cir. 1988) (agency "cannot ignore available biological information"); Carlton v. Babbitt, 900 F. Supp. 526, 531 (D.D.C. 1995) (decision not to reclassify grizzly bear (*Ursus arctos horribilis*) as endangered was arbitrary and capricious in part because agency rejected plaintiff's population estimate without explanation).

In the ESA context, judicial review has been far from a rubber stamp. Indeed, courts have been far tougher than scientific peer review on the wildlife agencies.[198] Listing decisions, to which the most uncompromising version of the best available science mandate applies,[199] have proven extraordinarily vulnerable to judicial review. Of 32 reported decisions evaluating the merits of agency listing determinations, fully 25 (78%) have ruled against the agency.[200] Obviously this is a very crude measure; undoubtedly some decisions were missed by the search and not all of the decisions overturning agency actions conclude that the agency erred in some way related to the science of the decision. But even a quick look at the decisions amply demonstrates that the best available science mandate provides little armor against judicial reversal. Courts have been quite willing to find that the agency did not adequately explain its evaluation of the scientific evidence[201] or its interpretation of the legal significance of that science,[202] did not point to support for its conclusion in the record,[203] failed to consider available evidence,[204] committed procedural errors in its

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198 A recent report by the General Accounting office found that agency-solicited peer reviews of listing and critical habitat determinations have produced almost no dissent. U.S. GENERAL ACCOUNTING OFFICE, *supra* note 8, at 48–57. The GAO looked at 54 listing decisions and 27 critical habitat decisions for which peer review was obtained, typically by multiple reviewers. *Id.* Only two reviewers disagreed with a listing decision, and only four disagreed with a critical habitat decision. *Id.* There were only two decisions, critical habitat determinations for which only one reviewer responded, in which a majority of reviewers disagreed with the agency's decision. *Id.* at 54–55.

199 Listing decisions must be based *solely* on the best available scientific and commercial data. 16 U.S.C. § 1533(b)(1)(A) (2000).

200 These numbers are based on review of all reported decisions on listing determinations through mid-2003 found through a Westlaw computer search. For this purpose, critical habitat designations were considered listing determinations. Decisions holding only that a statutory deadline had been missed were not included.

201 *See, e.g.*, Moden v. U.S. Fish & Wildlife Serv., 281 F. Supp. 2d 1193, 1205 (D. Or. 2003) (agency did not adequately explain its decision to reject a petition to delist the Lost River sucker (*Deltistes luxatus*) and shortnose sucker (*Chasmistes brevirostrus*)); Fund for Animals v. Williams, 246 F. Supp. 2d 27, 37 (D.D.C. 2003) (agency failed to adequately explain decision not to list trumpeter swan (*Cygnus buccinator*) population); Friends of the Wild Swan v. United States Fish & Wildlife Serv., 12 F. Supp. 2d 1121, 1135 (D. Or. 1997) (agency failed to explain its decisions to revise boundaries of distinct population segment and to rely on data it had previously discounted).

202 *See, e.g.*, Defenders of Wildlife v. Norton, 258 F.3d 1136, 1146 (9th Cir. 2001) (remanding decision not to list flat-tailed horned lizard (*Phrynosoma mcallii*) because agency did not adequately explain why large areas of historic range from which lizard had been extirpated did not constitute "significant portion of its range").

203 *See, e.g.*, Carlton v. Babbitt, 900 F. Supp. 526, 531 (D.D.C. 1995) (refusal to reclassify grizzly bear as endangered was not warranted because claim that human-caused mortality was decreasing was not supported by the record).

204 *See, e.g.*, Connor v. Burford, 848 F.2d 1441, 1454 (9th Cir. 1988) (in section 7 consultation, agency could not ignore data developed in course of NEPA compliance with respect to effects of oil and gas development on endangered species); San Luis & Delta-Mendota Water Auth. v. Badgley, 136 F. Supp. 2d 1136, 1151 (E.D. Cal. 2000) (listing of Sacramento splittail set aside because FWS ignored data suggesting that population was increasing and data conflicting with the apparently biased studies relied on); Friends of the Wild Swan v. United States Fish & Wildlife Serv., 945 F. Supp. 1388, 1398 (D. Or. 1996) (denial of petition to list bull trout

treatment of scientific information,[205] or failed to correctly interpret or satisfy the Act's requirements.[206] Only a few decisions expressly reject the agencies' substantive scientific determinations;[207] but even without taking that step, the courts have quite effectively forced the agencies to look hard at the scientific evidence.[208]

4. Changing the Decision-Making Process

Finally, the best available science mandate might alter the process by which ESA decisions are reached, which might be desirable for its own sake or might have an indirect effect on the substance of those decisions. In order to implement the mandate, the wildlife agencies have by policy imposed one such procedural requirement, that they seek independent peer review of

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(*Salvelinus confluentus*) was arbitrary and capricious because FWS failed to consider evidence showing that invasive species posed a serious threat).

[205] *See, e.g.*, Alabama-Tombigbee Rivers Coalition v. Dep't of Interior, 26 F.3d 1103, 1106–07 (11th Cir. 1994) (setting aside listing of Alabama sturgeon (*Scaphirhyncus suttkusi*) because agency improperly excluded public from proceedings of expert group asked to evaluate supporting data); Idaho Farm Bureau Fed'n v. Babbitt, 58 F.3d 1392, 1405 (9th Cir. 1995) (setting aside listing of Bruneau hotspring snail (*Pyrgulopsis bruneauensis*) because FWS refused to provide draft report upon which listing relied to opponents); Endangered Species Comm. of the Bldg. Indus. Ass'n of S. Cal. v. Babbitt, 852 F. Supp. 32, 38 (D.D.C. 1994) (relying on best science mandate to hold listing of California gnatcatcher invalid because agency refused to obtain and share raw data underlying key report).

[206] *See, e.g.*, Home Builders Ass'n of N. Cal. v. United States Fish & Wildlife Serv., 268 F. Supp. 2d 1197, 1211 (E.D. Cal. 2003) (overturning designation of critical habitat for Alameda whipsnake (*Masticophus lateralis euryxanthus*) because it did not identify with sufficient specificity the physical or biological features essential to the species); Am. Wildlands v. Norton, 193 F. Supp. 2d 244, 256 (D.D.C. 2002) (holding the agency acted arbitrarily and capriciously when it determined that hybridization was a threat to the westslope cutthroat trout (*Oncorhynchus clarki lewisi*) but then included hybrids in the population to determine whether the fish was threatened or endangered); Alsea Valley Alliance v. Evans, 161 F. Supp. 2d 1154, 1163 (D. Or. 2001) (overturning decision to list wild coho salmon (*Oncorhynchus kisutch*) because agency determined that hatchery fish were genetically identical to wild ones but declined to consider hatchery fish in evaluating population status), *appeal dismissed* 358 F.3d 1181 (9th Cir. 2004); Middle Rio Grande Conservancy Dist. v. Babbitt, 206 F. Supp. 2d 1156, 1184 (D.N.M. 2000) (setting aside designation of critical habitat for Rio Grande silvery minnow (*Hybognathus amarus*) because agency failed to identify specific physical and biological features essential for the conservation of the species); Or. Natural Res. Council v. Daley, 6 F. Supp. 2d 1139, 1152 (D. Or. 1998) (holding that agency improperly relied on determination that coho salmon would not become endangered in next few years, ignoring statutory standard requiring determination of whether species was likely to become endangered in the foreseeable future); Defenders of Wildlife v. Babbitt, 958 F. Supp. 670, 681 (D.D.C. 1997) (holding that agencies improperly required "conclusive evidence" to support listing of Canada lynx).

[207] *See Defenders of Wildlife*, 958 F. Supp. at 681 (holding that agency factual findings were directly contradicted by undisputed record evidence and by agency's own biologists); Northern Spotted Owl v. Hodel, 716 F. Supp. 479, 482 (W.D. Wash. 1988) (holding that refusal to list northern spotted owl (*Strix occidentalis caurina*) was arbitrary and capricious because agency disregarded all expert opinion on population viability).

[208] Challenges under section 7 have been less successful, but again agency decisions have been vulnerable. Of 42 reported decisions under section 7 found in a search of the ALLFEDS database in Westlaw, 21 (50%) struck down the agency action in at least some respect.

listing decisions, critical habitat determinations, and recovery plans.[209] That requirement may soon be irrelevant in light of the recent proposal of a far more general peer review requirement.

A rider to the Consolidated Appropriations Act of 2001 added section 515,[210] popularly known as the Information Quality Act or Data Quality Act. The Data Quality Act directs the Office of Management and Budget (OMB) to issue guidelines for "ensuring and maximizing the quality, objectivity, utility, and integrity of information . . . disseminated by Federal agencies"[211] and requires all federal agencies to establish mechanisms to allow affected persons to obtain correction of information that does not meet those standards.[212] Because of the way it was adopted, the Data Quality Act has essentially no legislative history.[213] Its aim appears similar to that of the closely related Shelby Amendment,[214] a rider to an earlier appropriations bill that requires that data produced by federally funded research studies be made available to the public. Senator Richard Shelby (R-Ala.), the author of that provision, has described it as intended to ensure use of the best science in regulatory decisions.[215]

The Office of Management and Budget (OMB) issued guidelines under the Data Quality Act in February 2002,[216] and proposed supplemental guidelines specifically for peer review in September 2003.[217] The 2002 Guidelines define "information" broadly to include "any communication or representation of knowledge such as facts or data, in any medium or form," excluding only opinions where the presentation makes clear that it is not fact or the agency's views.[218] "Dissemination" is also broadly defined as "agency initiated or sponsored distribution of information to the public," a definition OMB believes includes rulemakings.[219] "Influential" information,

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209 *See supra* text accompanying notes 67–73.

210 Pub. L. No. 106-554, § 515, 114 Stat. 2763, 2763A-153 (2000).

211 *Id.* § 515(a), 114 Stat. at 2763A-154.

212 *Id.* § 515(b)(2)(B), 114 Stat. at 2763A-154.

213 Paul Noe et al., *Learning to Live With the Data Quality Act*, 33 Envtl. L. Rep. (Envtl. L. Inst.) 10,224, 10,224, 10,226 (2003); Sidney A. Shapiro, *OMB's Dubious Peer Review Procedures*, 34 Envtl. L. Rep. (Envtl. L. Inst.) 10,064 (2004).

214 Omnibus Consolidated and Emergency Supplemental Appropriations Act, 1999, Pub. L. No. 105-277, 112 Stat. 2681 (1998).

215 Richard Shelby, *Accountability and Transparency: Public Access to Federally Funded Research Data*, 37 HARV. J. ON LEGIS. 369, 376 (2000). A widely circulated interpretation of the Data Quality Act is that it was demanded by industry "because of indiscriminate Internet 'datadumps' by agencies like EPA of corporate data that embarrassed companies into actions that they are not required by regulation to undertake but rather felt strong-armed to do by the presence of the data." Noe et al., *supra* note 213, at 10,226.

216 Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies; Republication, 67 Fed. Reg. 8451 (Feb. 22, 2002).

217 Proposed Bulletin on Peer Review and Information Quality, 68 Fed. Reg. 54,023 (Sept. 15, 2003). Professor Shapiro has questioned whether the Data Quality Act authorizes these extraordinarily broad proposed guidelines. Shapiro, *supra* note 213, at 10,064–65.

218 Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies; Republication, 67 Fed. Reg. at 8460.

219 *Id.*

meaning information reasonably expected to "have a clear and substantial impact on important public policies or important private sector decisions,"[220] is subject to higher standards than other information, including a requirement that the agencies reveal the data and methods used to generate it sufficiently to facilitate independent reanalysis.[221] The extent to which compliance with the Guidelines is subject to judicial review remains uncertain.[222]

The 2003 proposal would require "appropriate and scientifically-rigorous" peer review of all "influential" regulatory information.[223] That would appear to include any studies relied upon by the wildlife agencies in making decisions about listing, critical habitat, or jeopardy under the ESA.[224] For information used to support major regulatory actions, peer review would have to be conducted according to detailed OMB standards.[225]

OMB officials assert that following the guidelines will make agency rules "more competent and credible and reduce their vulnerability to political and legal attack."[226] Experience with peer review under the ESA, however, makes that outcome seem unlikely. Peer review of ESA listing determinations has been difficult to obtain,[227] and when conducted has had little effect on the agency decisions.[228] Those observations are not surprising. Academic scientists, the most likely independent reviewers, have little incentive to participate in regulatory reviews. They provide peer review for journals without compensation because their reputations and career advancement depend upon the viability of those peer-reviewed journals. Scientists also willingly serve on NRC committees without pay; the prestige

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220 *Id.*

221 *Id.*

222 The first high-profile lawsuit under the Data Quality Act, filed by the Competitive Enterprise Institute to compel withdrawal of a report on global climate change issued by the White House Office of Science and Technology Policy in 2000, was settled out of court when the White House agreed to add a disclaimer to the report on its web site saying that the report had not been subjected to Data Quality Act guidelines. Jonathan Groner, *Correcting the Record: Business Girds for Unexpected Fight with Bush Administration over Regulatory Review*, LEGAL TIMES, Nov. 17, 2003, at 1, 14. The next salvo is expected to involve data supporting the National Institute of Health's recommendations that Americans cut back on salt consumption. *Id.*

223 Proposed Bulletin on Peer Review and Information Quality, 68 Fed. Reg. 54,023, 54,027 (Sept. 15, 2003).

224 Agencies would generally be allowed to presume that studies already published in scientific journals had been adequately peer reviewed. *Id.*

225 *Id.*

226 Shankar Vedantam, *Bush Would Add Review Layer for Rules; Industry Cheers Science Peer-Appraisal Plan; Critics Say it Will Discourage Regulation*, WASH. POST, Aug. 30, 2003, at A10 (quoting John Graham, administrator of the OMB Office of Information and Regulatory Affairs), *available at* 2003 WL 62211562.

227 U.S. GENERAL ACCOUNTING OFFICE, *supra* note 8, at 17 (While FWS solicited three or more reviewers in 94 out of 100 listing and critical habitat determinations reviewed, it received at least 3 responses in only 38 instances, and no response at all in 15 decisions.). OMB's proposed guidelines would further complicate the search for qualified peer reviewers by discouraging use of the same reviewers for multiple matters. Proposed Bulletin on Peer Review and Information Quality, 68 Fed. Reg. at 54,027.

228 Peer reviews overwhelmingly supported the agency's decision. U.S. GENERAL ACCOUNTING OFFICE, *supra* note 8, at 21, 27.

of the NRC may simply appeal to their egos, but also is likely to offer some career advantages. The wildlife agencies cannot offer either prestige or reciprocal career advantage. Undoubtedly, some scientists welcome the opportunity to play a role in what they regard as important public policy decisions, but they must balance the satisfaction that could provide against time lost from other activities, including pursuit of their own research agendas. On balance, there seems little reason for academics to offer their services, especially on a short time scale.[229] Those that do choose to participate probably want to minimize the time spent on the task. Since finding and explaining any shortcomings of the decision takes time, while a mere glance may allow a reviewer to conclude that a decision looks superficially acceptable, time pressures are likely to work in favor of the agency's decision.

A more subtle procedural effect of the best available science mandate is likely to play a more important substantive role than peer review. The emphasis on science might shift the balance of power within the regulatory agencies toward scientific experts. That could have a purpose distinct from promoting accurate decision making. If agency scientific personnel generally have a stronger conservation orientation than others in the agency, giving them more power in internal debates should promote conservation even if the decisions are not strictly scientific. If scientific personnel are predominately career employees rather than political appointees, advantaging them in internal debates could also serve to dampen the inevitable policy swings from one administration to the next.

By shifting power toward agency scientists, the best available science mandate may well help to counter the tendency of agencies to make politically easy decisions inconsistent with the law's purposes. Given the evidence that, even with the best available science mandate, ESA decisions often do follow the political winds, the best available science mandate may be playing a vital role in stiffening agencies' conservation backbones. It prevents the agencies from openly making decisions based on the costs of conservation or expected political opposition. Undoubtedly, expected economic and political costs still figure in, but they cannot be openly acknowledged as the basis for a decision.[230] Decisions must be scientifically defensible, even if other unacknowledged factors contribute to them. The

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229 FWS typically seeks review within the 60-day time period permitted for public comment. *Id.* at 20. One scientist who has been solicited for reviews told this author that the letter, which came in an ordinary envelope and was not accompanied by a phone call or e-mail, never even reached his desk until a couple of weeks before the deadline for review of a proposal running more than 100 pages in the Federal Register. OMB's proposal to require release of the names of reviewers, Office of Management and Budget, Proposed Bulletin on Peer Review and Information Quality, 68 Fed. Reg. at 54,028 (Sept. 15, 2003), a significant departure from the academic norm of anonymous review, may also discourage academics who do not wish to become embroiled in intense controversy.

230 An exception is the designation of critical habitat. Although the agency must consider the best available scientific evidence, the statute permits exclusion of areas from critical habitat if the economic or other relevant costs of designation outweigh the conservation benefits. 16 U.S.C. § 1533(b)(2) (2000).

mere suggestion that a decision expressly considered political or economic factors can make judicial reversal more likely.[231]

V. MAKING THE BEST OF THE BEST AVAILABLE SCIENCE MANDATE

Science obviously is crucial to ESA decisions, although standing alone it is not enough to fully determine most of those decisions. The best available science mandate, combined with the background requirements of the APA and the availability of judicial review, are reasonably effective in ensuring that the agencies make appropriate use of the scientific information available to them under the circumstances. But more can be done to improve both the scientific accuracy and the political acceptability of ESA decisions.

There is little evidence that federal agencies are affirmatively misusing science in their implementation of the ESA.[232] To the extent there is evidence of abuse or disregard of scientific data, it lies in the failure of the wildlife agencies to list controversial species without judicial prompting.[233] The best available science mandate attempts to counter that tendency by limiting the extent to which the agencies can openly rely on political considerations, and judicial review ensures that the ultimate decision must have at least some scientific grounding. The mandate does not completely eliminate the role of politics, but it is difficult to imagine a practical change that would take politics completely out of the picture. That might not even be desirable because it would put inordinate political stress on the Act as a whole, perhaps for little gain. If a species lacks sufficient public support to overcome the political barriers to protection, its protection may offer society little of value.[234]

Opponents of the ESA see the Klamath Basin saga as proof that the wildlife agencies use section 7 to extort unjustified conservation measures from action agencies or permit applicants. While there surely have been

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231 In *Biodiversity Legal Foundation v. Babbitt*, 943 F. Supp. 23 (D.D.C. 1996), the court overturned the decision not to list the Archipelago wolf (*Canis lupis ligoni*). *Id.* at 26. The decision was based on the court's conclusion that FWS improperly relied on the hope of future changes in management of the Tongass National Forest to conclude that the species did not qualify for listing. *Id.* at 25–26. In the course of the decision, however, the court noted that in a briefing session at the field office, factors listed as weighing against listing included minimizing controversy with the Alaska congressional delegation. *Id.* at 24–25 n.4. Inclusion of that fact in the opinion suggests that it influenced the court's decision.

232 Professor Wendy Wagner has reached a similar conclusion with respect to public health and environmental regulation generally: There is little evidence of "bad science" underlying regulations. Wendy E. Wagner, *"Bad Science" Fiction: The Imaginary Crisis in Public Health and Environmental Regulation*, 66 LAW & CONTEMP. PROBS. 63, 63 (2003).

233 *See supra* note 180 and accompanying text.

234 Some might argue that even unpopular, uncharismatic species may have important ecosystem values or unrecognized potential for future use. It is impossible to wholly refute such arguments, but it is notable that they rarely cite any examples of species whose protection has been controversial under the ESA. Species that are not themselves charismatic have found considerable political support through their association with ecosystems people care about, as has been the case for the northern spotted owl and marbled murrelet (*Brachyramphus marmoratus marmoratus*), whose protection helps conserve old growth forests.

some problems in implementing section 7, I do not believe it is fair to characterize those as deliberate misuse of science. Rather, they point up three shortcomings related to the use of science, and a fourth problem independent of science. The scientific problems are that information is often severely limiting; that the agencies have not developed a coherent, consistent, transparent means of dealing with scientific uncertainty; and that they do not regularly or effectively update their information base. The nonscientific problem is that the ESA provides a much more effective lever for controlling some actions, particularly those with a federal nexus, than others. This coverage problem is, as a practical matter, closely bound up with the use of science in agency decisions. It provides a strong, perhaps unconscious, incentive for the wildlife agencies to overemphasize the importance of threats they perceive as controllable, while ignoring others.

In the Klamath situation, the wildlife agencies initially had to develop biological opinions on the basis of very little data because systematic study of the species did not begin until very recently.[235] Based on the reasonable assumption that fish need water, they focused on lake levels and river flows. But they did not sufficiently recognize or make clear the uncertainties underlying that assumption. Had they done so, they would have had to search more closely for key data gaps and might have been encouraged to seek information to fill those gaps. The coverage problem also played a role in the Klamath; the wildlife agencies focused almost exclusively on the federal Klamath project, the most apparent controllable stressor in the system, to the exclusion of other stressors that may be more biologically important.[236]

The Klamath example, which is typical of the difficulties of implementing the ESA, suggests several steps that could improve the use of science. First, the agencies should more forthrightly acknowledge the limits of science, including both the extent to which their decisions require nonscientific elements and the uncertainties in the data they use to make those decisions. Second, they should do more to expand and update their knowledge base, and to put new knowledge to use. Third, they should build public credibility and political acceptance of their decisions by, among other things, making greater efforts to overcome their project-specific myopia. These three steps, the most important elements of which could all be accomplished without legislation, would do more than any current legislative proposals to improve the use of science under the ESA.

A. Openly Acknowledge the Limits of Science

Acknowledging the limits of science will not be an easy step for the wildlife agencies because their field-level personnel likely perceive science

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235 *See* NATIONAL RESEARCH COUNCIL, *supra* note 188, at 15 ("While information of a sporadic or anecdotal nature is available over as much as 100 years, routinely collected data on environmental characteristics and fish are available only since 1990 or later.").

236 Doremus & Tarlock, *supra* note 7, at 344–46; KLAMATH RECOVERY STRATEGIES, *supra* note 187, at 276–80.

as the source of their authority and their bulwark against political pressures. But it is a vital step if they are to preserve the crumbling vestiges of their scientific credibility.

The limits of science have two dimensions. The first is that, as described above,[237] some decisions under the ESA are inherently not scientific; they require value choices rather than objective interpretation of empirical data. These decisions, such as how much of the historic range of the gray wolf must be occupied before the wolf can be removed from the protected list, should be made and explained through notice and comment rulemaking. If they are within the political boundaries left to the wildlife agencies by Congress, they will be entitled to deference under *Chevron, U.S.A. v. Natural Resources Defense Council, Inc.*[238] But if the policy choices are not acknowledged and the basis for them explained, the decisions should be reversed. This will force them into the political forum in which they belong.

The second dimension is a bit more subtle. Many aspects of ESA decisions are dominated by science, but the existing data is limited and equivocal, leaving a great deal of uncertainty. Choices of how to interpret equivocal data and what to do in the face of uncertainty are not "scientific" as the public understands that term, although they are familiar to scientists and indeed are an unavoidable part of the scientific enterprise.[239]

Uncertainty is endemic in the ESA context. It can plague our understanding of (among other things): the historic conditions to which the species was exposed and the extent to which those conditions have been altered by human activity;[240] population sizes and trends;[241] life cycles, including the relationship between survival at particular stages and population status;[242] threats to the species and, where there are multiple

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237 *See supra* Section IV.B.1.a.

238 467 U.S. 837, 844 (1984) (interpretation of ambiguous statute by agency charged with implementing that statute will be upheld if reasonable).

239 Doremus, *supra* note 4, at 1065–68 (emphasizing the tension between the supposed objectivity of the scientific method and the subjectivity of the political and social context).

240 For example, debates about how to manage the Platte River are complicated by uncertainty about the extent to which the river channel was wooded before white settlement. *Compare* W. Carter Johnson & Susan E. Boettcher, *Restoration of the Platte River: What Is the Target*, 43 LAND & WATER, May-June 1999, at 20 (characterizing historic riparian conditions along the Platte as dominated by riparian forest vegetation types, rather than previous assumptions that the riparian corridor was open in nature, dominated by prairie, wet meadow, and wetland plant communities), *with* Paul J. Currier, *Wetland Restoration on the Platte River Floodplain in Nebraska*, *in* ECOLOGY OF WETLANDS AND ASSOCIATED SYSTEMS 611, 614 (1998) (concluding that riparian forest types historically existed purely at the periphery of an open-channeled, wetland, and meadow-dominated riparian corridor on the Platte).

241 The size of the Delta smelt population, for example, has proven exceedingly difficult to measure. *See, e.g.*, WIM KIMMERER & RANDY BROWN, CALFED BAY-DELTA PROGRAM ENVIRONMENTAL WATER ACCOUNT, SUMMARY OF THE ANNUAL DELTA SMELT TECHNICAL WORKSHOP, SANTA CRUZ, CAL., AUG. 18–19, 2003 (2003) (on file with author) (noting disagreement over population estimates).

242 For example, although protection of the winter-run chinook salmon in the Sacramento River system has concentrated on reducing take by the state and federal water project pumps, there is significant uncertainty about the population-level effects of that take. CALFED BAY-

threats, their relative importance;[243] and the effect of management actions on species.[244]

In part, what to do about uncertainty is the question Professor J.B. Ruhl frames as a choice of "methodology."[245] When faced with uncertain data, we must decide how much certainty to require—that is, what level of confidence we want to have in our decision—before altering the status quo. The question essentially is what burden of proof we want to impose on the wildlife agencies. Professor Ruhl elegantly describes three options that encompass the possible range of choices: we might, borrowing from the norms of research science, require a very high level of confidence before taking action to protect a species (the "Scientific Method," in Professor Ruhl's terminology); at the other extreme we might take conservation actions unless we have a very high level of confidence that they will not be effective (the "Precautionary Principle Method"); or in the middle, we might give a great deal of discretion to selected experts (the "Professional Judgment Method").[246] Of course, these are not the only conceivable alternatives or even the only ones familiar to the law. We could require that the agency make a finding that threats exceed a specified level before giving a species protection, or that it conclude that a conservation measure is more likely than not to benefit the species before imposing it. We could even throw up our hands at the scientific difficulties and move to technology-based standards.[247] But Professor Ruhl sets out a useful framework for choosing a required certainty level in light of the consequences of that choice.

At present, the ESA does not explicitly mandate any specific confidence level for any of the decisions it requires, but as interpreted by the courts it is

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DELTA ENVIRONMENTAL WATER ACCOUNT REVIEW PANEL, FIRST ANNUAL REVIEW OF THE ENVIRONMENTAL WATER ACCOUNT FOR THE CALFED BAY-DELTA PROGRAM (Dec. 2001) (on file with author) (the author is a member of the review panel).

243 The most extreme example is provided by salmon in the Pacific Northwest, which are affected by hydropower dams, harvest, forest practices, hatcheries, and ocean conditions. Holly Doremus, *Water, Population Growth, and Endangered Species in the West*, 72 U. COLO. L. REV. 361, 376–78 (2001). Sorting out the key effects has proven a daunting task.

244 For example, given the extreme changes in the Colorado River from presettlement conditions, it is far from certain that restoring flows in some respects will enhance the condition of native fishes over invasive ones.

245 J.B. Ruhl, *supra* note 135, at 559–60.

246 *Id.*

247 Because health- or environment-based standards are so difficult to derive, we have accepted technology-based regulation as a substitute in a number of contexts under the pollution laws. *See, e.g.*, Wendy E. Wagner, *The Triumph of Technology-Based Standards*, 2000 U. ILL. L. REV. 83, 85 (arguing that, in light of scientific uncertainty over pollution's impact on public health, technology-based pollution control standards provide the most reliable means of abatement); Adam Babich, *Too Much Science in Environmental Law*, 28 COLUM. J. ENVTL. L. 119, 125 (2003) (asserting that technology-based standards are the only methods acceptable when scientists, policymakers, and politicians are unable to agree on implementation of risk-based standards). That does not seem a likely answer to the ESA's science dilemmas. The major threats to species, which are typically tied to wholesale habitat modification, do not seem amenable to technological solutions. The most difficult issues we face are not *how* to develop, or log, or divert water, but *how much* of those things we can do without causing extinction.

not entirely indifferent on the methodology question. The wildlife agencies cannot require "conclusive evidence" (essentially the "Scientific Method") that a species is near extinction before listing it.[248] That makes good sense, given that the Act's primary goal is to protect species from extinction. Because data about the status of dwindling species are often limited and difficult to obtain, requiring scientific certainty as a predicate for listing would surely undermine that goal. Nor can Professor Ruhl's Scientific Method be applied to section 7 decisions. Federal agencies must "insure" that their actions are "not likely" to jeopardize listed species. That's not exactly a clear standard, but its history supports the wildlife agencies' long held view that it calls for some level of caution in favor of the species. Section 7 originally was less equivocal; it provided that federal agencies must insure that their actions *would not* jeopardize listed species.[249] That formulation seemed to call for a strongly precautionary approach. Section 7 was amended in 1979 to soften that obligation. The amendment requires only that the agencies insure that action "is not likely" to cause jeopardy, using the best available science.[250] The Conference Report explained:

> [A]s currently written . . . the law could be interpreted to force [the wildlife agencies] to issue negative biological opinions whenever the action agency cannot guarantee with certainty that the agency action will not jeopardize the continued existence of the listed species or adversely modify its critical habitat. The amendment will permit the wildlife agencies to frame their section 7(b) opinions on the best evidence that is available or can be developed during consultation. . . .
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> This language continues to give the benefit of the doubt to the species, and it would continue to place the burden on the action agency to demonstrate to the consulting agency that its action will not violate section 7(a)(2).[251]

Following the 1979 amendment, the wildlife agencies cannot require absolute certainty that the proposed action will not jeopardize the species, but equally they cannot be required to prove jeopardy beyond a reasonable doubt in order to halt an action.

Given the extraordinary levels of uncertainty surrounding most endangered species, the wildlife agencies must enjoy some discretion to take their best cautious guess at what conservation measures are required, or they would be paralyzed. That does not mean, however, that they must be given unreviewable authority to deal with uncertainty as they see fit. The wildlife agencies should be more transparent about the level of uncertainty in the information supporting their actions, how they have chosen to deal with that uncertainty and the basis for those choices, whether the uncertainty can be reduced, and if so what steps would be required to reduce it. An excellent model is the Council on Environmental Quality

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[248] Defenders of Wildlife v. Babbitt, 958 F. Supp. 670, 679 (D.D.C. 1997) (agencies improperly required "conclusive evidence" to support listing of Canada lynx).

[249] Pub. L. No. 93-205, § 7, 87 Stat. 892, 892 (1973).

[250] Pub. L. No. 96-159, § 4, 93 Stat. 1226, 1226 (1979).

[251] H.R. CONF. REP. NO. 96-697 (1979), *reprinted in* 1979 U.S.C.C.A.N. 2572, 2576.

regulation for dealing with uncertainty in the context of compliance with the National Environmental Policy Act (NEPA).[252] That regulation requires agencies to acknowledge gaps and uncertainties in information and, if the missing information cannot reasonably be obtained, to include a statement explaining how it would be relevant to evaluation of the project's environmental impacts.[253] Agencies must also appraise the available information using "theoretical approaches or research methods generally accepted in the scientific community."[254] The agencies, in other words, must use their professional judgment to interpret incomplete information, but they must also be prepared to show that they have exercised that judgment according to relevant professional standards.

If the agencies do not volunteer such transparency, as they have not over the ESA's first thirty years, courts can and should force them to provide it. This falls well within the scope of modern "hard look" review, both doctrinally and functionally. The rationality of the agencies' choices cannot be understood without an explanation of potentially confounding uncertainties, and the agency cannot be made politically responsible for the manner in which it deals with uncertainty unless those dealings are publicly revealed. Nothing in the training or professional role of agency personnel suggests that their choices will systematically mirror those the larger society would make. There is, therefore, no reason to give them unreviewable authority to decide how to deal with uncertainty.

Two district court cases overturning critical habitat designations illustrate how this type of review might work. In *Home Builders Ass'n of Northern California v. United States Fish and Wildlife Service*,[255] the district court vacated and remanded the designation of critical habitat for the Alameda whipsnake (*Masticophus lateralis euryxanthus*).[256] *Middle Rio Grande Conservancy District v. Babbitt*[257] set aside the designation of critical habitat for the Rio Grande silvery minnow (*Hybognathus amarus*).[258] In both cases, the major substantive objection concerned the agency's lack of specificity in designating the constituent elements that constitute critical habitat.

The silvery minnow rule designated a 163-mile stretch of the Rio Grande, virtually the entire occupied habitat, as critical habitat.[259] It described the primary constituent elements of that habitat as:

> (i) "Stream morphology that supplies sufficient flowing water to provide food and cover needed to sustain all life stages of the species," (ii) "Water of sufficient quality to prevent water stagnation (elevated temperatures, decreased oxygen, carbon dioxide build-up, etc.)," and (iii) "Water of sufficient

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252 42 U.S.C. §§ 4321–4370e (2000).
253 40 C.F.R. § 1502.22 (2004).
254 *Id.*
255 268 F. Supp. 2d 1197 (E.D. Cal. 2003).
256 *Id.* at 1203, 1240.
257 206 F. Supp. 2d 1156 (D.N.M. 2000).
258 *Id.* at 1193.
259 *Id.* at 1164.

> quality to prevent formation of isolated pools that restrict fish movement, foster increased predation by birds and aquatic predators, and congregate pathogens."[260]

The whipsnake rule designated as critical habitat those parts of a mapped area of over 400,000 acres that provide the primary constituent elements essential for the species.[261] The rule described those elements in the following terms:

> [T]he primary constituent elements are those habitat components that are essential for the primary biological needs of foraging, sheltering, breeding, maturation, and dispersal. The primary constituent elements are in areas that support scrub communities including mixed chaparral, chamise-redshank chaparral, and coastal scrub and annual grassland and various oak woodlands that lie adjacent to scrub habitats. In addition, the primary constituent elements for the Alameda whipsnake may be found in grasslands and various oak woodlands that are linked to scrub habitats by substantial rock outcrops or riparian corridors. Other habitat features that provide a source of cover for the whipsnake during dispersal or lie in reasonable proximity to scrub habitats and contain habitat features (e.g., rock outcrops) that support adequate prey populations may also contain primary constituent elements for the Alameda whipsnake.[262]

The preamble added:

> Within these communities, Alameda whipsnakes require plant canopy covers that supply a suitable range of temperatures for the species' normal behavioral and physiological requirements (including but not limited to foraging, breeding, and maturation). Openings in the plant canopy or scrub/grassland edge provide sunning and foraging areas. Corridors of plant cover and retreats (including rock outcrops) sufficient to provide for dispersal between areas of habitat, and plant community patches of sufficient size to prevent the deleterious effects of isolation (such as inbreeding or the loss of a subpopulation due to a catastrophic event) are also essential. Within these plant communities, specific habitat features needed by whipsnakes include, but are not limited to, small mammal burrows, rock outcrops, talus, and other forms of cover to provide temperature regulation, shelter from predators, egg laying sites, and winter hibernaculum. Many of these same elements are important in maintaining prey species. Adequate insect populations are necessary to sustain prey populations.[263]

Both courts found the descriptions of constituent elements too general to withstand review. The concerns motivating the decisions are real and substantial. The courts were concerned both that the rules would not

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[260] *Id.* (quoting Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for the Rio Grande Silvery Minnow, 64 Fed. Reg. 36,274, 36,279, 34,288 (July 6, 1999)).

[261] Final Determination of Critical Habitat for the Alameda Whipsnake (*Masticophis lateralis euryxanthus*), 65 Fed. Reg. 58,933, 58,933 (Oct. 3, 2000).

[262] *Id.* at 58,949.

[263] *Id.* at 58,935–36.

adequately inform the regulated community and that they would allow FWS to expand the reach of critical habitat beyond that required by the species, causing unnecessary economic disruption.[264] If these cases are read simply as requiring a clearer explanation of why FWS could not be more specific in its critical habitat designations, they are not problematic. But both include language that seems to require the agency to provide levels of knowledge that frequently will be unattainable on the required time scale.[265]

In cases of uncertainty, the wildlife agencies must be allowed to use their professional judgment to take their best guess about whether the species qualifies for listing, what areas constitute its critical habitat, and whether proposed federal actions will jeopardize its continued existence. They should be required, however, to acknowledge incomplete data, and explain any extrapolations, gap-filling steps, assumptions, and choices about dealing with uncertainty. The agencies should also be required to analyze how, if at all, remaining uncertainties could be reduced, including rough estimates of the time and expense required to carry out gap-filling studies, and the value for future decisions of the information those studies would reasonably be expected to generate.

B. Increase the Knowledge Base

The discussion of uncertainty above leads naturally to the next recommendation. There are many points at which the relevant questions, although scientific, cannot currently be answered because uncertainty is so great. Sometimes, the scientific questions are sufficiently difficult to untangle that uncertainty cannot be eliminated. But in other cases information that is feasible to generate or collect could, over time, significantly reduce uncertainty.[266] While I argue for giving the wildlife

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.[264] *See* Middle Rio Grande Conservancy Dist. v. Babbitt, 206 F. Supp. 2d 1156, 1185 (D.N.M. 2000) ("As it stands, the final rule's determination of 'primary constituent elements' is insufficient. The terms are too vague to provide a standard, much less an understanding of what the protected species requires or how the river should be managed and protected. . . . [T]he final rule speaks only in broad terms not useful in limiting designation of critical habitat to the most essential areas and not helpful in understanding what the silvery minnow actually requires to return from the brink of extinction.").

[265] *See id.* at 1189 ("Defendants must establish that a continuous flow is necessary to the minnow's survival and is clearly capable of saving the silvery minnow from extinction."); Home Builders Ass'n of N. Cal. v. United States Fish & Wildlife Serv., 268 F. Supp. 2d 1197, 1210–11 (E.D. Cal. 2003) ("Clearly, if no primary constituent elements are known, the Service may not lawfully designate a critical habitat under the ESA. Applying this requirement to the designation of critical habitat at issue here, the court finds that it is impossible for the Service to comply without determining what physical and biological features are essential to the conservation of the snake."). The designation of critical habitat, like so many other ESA decisions, must be done on a short timeline. Critical habitat must be designated concurrent with listing, subject to a sharply limited one-year extension if more information is needed. 16 U.S.C. § 1533(b)(6)(C) (2000).

[266] *Cf.* James W. Conrad, Jr., *The Reverse Science Charade*, 33 Envtl. L. Rep. (Envtl. L. Inst.) 10,306, 10,308 (2003) (arguing that it is not necessarily a categorical mistake to look to science to resolve some questions even if there is not enough information now, emphasizing "the capacity for scientific experimentation and data collection to reduce the policy component of

agencies discretion at the point of initial decision making, such discretion properly comes with a price: The agencies must make and keep a strong commitment to improving their knowledge base over time, and to updating decisions when significant new information becomes available.

The agencies can take important steps in that direction without legislative change.[267] One step would be to make more forceful use of the information-generating tools the law already provides. Both agencies and courts should return to the earlier interpretation that section 7 imposes an obligation on the action agency to provide any reasonably obtainable information.[268] ESA regulations require that the action agency provide the wildlife agencies with "the best scientific and commercial data *available or which can be obtained during the consultation.*"[269] These regulations are close to the earlier interpretation of section 7, but suffer from a fatal flaw. The regulations treat consultation as a one-time, short-term affair. Consultation is conducted under strict timelines. Ordinarily, it must be completed within ninety days unless the action agency agrees to an extension.[270] That is too short a period to allow for most new studies, and even new analysis of existing data may be difficult to fit within it. Subjecting data-gathering obligations to such narrow timelines practically insures that little data will be generated. Indeed, such a sharply limited obligation, especially if combined with the expectation that inability to affirmatively prove jeopardy will result in a no-jeopardy biological opinion, would give action agencies a strong incentive *not* to seek information prior to entering into formal consultation.

The current regulatory flaw could be fixed in either or both of two ways. One option would be for the agency to rewrite the regulations. Recognizing that consultation is frequently a recurring process,[271] and that planning for conservation should be an aspect of every federal project,[272] the wildlife agencies could require that action agencies provide in the course of consultation any information that can reasonably be obtained by the time of

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transscientific or science-policy choices").

267 Professor Ruhl has noted elsewhere the remarkable flexibility that has been discovered in the supposedly rigid statutory language of the ESA. J.B. Ruhl, *Who Needs Congress? An Agenda for Administrative Reform of the Endangered Species Act*, 6 N.Y.U. ENVTL. L. J. 367, 370–72 (1998). My suggestions here simply offer additional examples.

268 *See supra* notes 155–63 and accompanying text.

269 50 C.F.R. § 402.14(d) (2004) (emphasis added).

270 16 U.S.C. § 1536(b)(1) (2000).

271 The duty to consult lasts as long as there is federal discretionary involvement in control over a project. 50 C.F.R. § 402.03 (2004); Tenn. Valley Auth. v. Hill, 437 U.S. 153, 173 (1978). For ongoing actions such as the federal management of water projects or river systems, consultation must be reinitiated in response to new information. *See* 50 C.F.R. § 402.16 (2004) (stating that reinitiation of consultation is required where new information shows that the action may harm a species or critical habitat in a way the government did not consider in the prior consultation).

272 After all, Congress has expressly found that species "have been rendered extinct as a consequence of economic growth and development untempered by adequate concern and conservation." 16 U.S.C. § 1531(a)(1) (2000). This concern is most efficiently provided at the earliest stages of project planning.

consultation. That would include information that could be generated on the time scale of project planning, as well as information that could be generated during operation of the project when future consultation can reasonably be anticipated.

The other possibility is that the agency (or the courts) could adopt a stronger view of the section 7 duty to insure that federal actions are not likely to cause jeopardy. That phrase should be read to place the burden of proof on the action agency, so that a jeopardy opinion must result unless the available information is sufficient to establish that the proposed action more likely than not will not jeopardize the species. That interpretation would provide an incentive for the action agency (and the permit applicant, if there is one) to fund and perform feasible studies prior to the consultation period.

At one time, the wildlife agencies adopted precisely this reading. The regulations dealing with consultation used to provide that, if there were insufficient information to determine whether the proposed action would violate the prohibition on jeopardy, the action agency would be required to provide additional information before it could issue a no jeopardy opinion.[273] Despite its subsequent softening, that regulation appears to be required by the Act's mandate that action agencies *insure* that their proposed actions will not cause jeopardy.[274]

In addition to increasing the initial knowledge base supporting ESA decisions, the agencies must do a better job of updating that initial information and using new information to update regulatory decisions. Those affected by ESA regulations—such as irrigators whose access to contracted water from a federal project is reduced based on a shaky guess about the needs of a listed species—are entitled to expect periodic updating. Better updating can be done within the existing legislative framework. Without question, updating will require additional resources. Given that the wildlife agencies have never had adequate resources to fully implement the ESA, that might prove problematic. However, the agencies should be in a strong political position to request funding targeted to this kind of information generation because it should improve both conservation outcomes and political palatability.

With respect to section 7 consultations for ongoing projects, the onus can be put on the action agency to increase the information base, and the possibility of reduced restrictions should provide sufficient incentive. For example, ESA regulation in the Sacramento-San Joaquin Delta system has focused on the direct effects on listed fish of the enormous pumps that transfer water from the rivers to the state and federal water projects. Yet little is known about the population-level impacts of takings at the pumps;[275] it is possible that changes to other parts of the system could provide greater conservation benefits. That possibility should not prevent FWS from imposing limitations on takings at the pumps, but those limitations should

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273 *See* Village of False Pass v. Watt, 565 F. Supp. 1123, 1153–54 (D. Alaska 1983) (quoting former 50 C.F.R. § 402.04).

274 16 U.S.C. § 1536(a)(2) (2000).

275 *See supra* note 242.

be accompanied by requirements for population modeling that could provide better understanding of system-wide impacts on the species. Water users should willingly fund those studies, which might show that the regulations they find most onerous are not necessary.

With respect to listing, the law already requires the wildlife agencies to review the status of every protected species every five years,[276] and to annually review candidate species.[277] Unfortunately, because the listing program is always strapped for resources, reviews often lag behind schedule. Interested parties, however, can compel review either through a lawsuit to enforce the five-year review requirement[278] or, if new information becomes available before review is required, through a petition to change the status of the species.[279] With respect to critical habitat designation, the statute does not require five-year reviews,[280] but does allow interested persons to petition for revision of designated critical habitat.[281] If such a petition presents substantial scientific information indicating that revision may be warranted, the agency must "determine how [it] intends to proceed with the requested revision" within one year.[282] Necessary revisions must be made within a reasonable time.[283]

For both listing and critical habitat, the major hurdle to timely updates is that there are simply not enough resources available to continually reevaluate all of these decisions. The agencies, understandably, devote their resources preferentially to perceived crisis areas and their obligations under court orders.[284] Although funds are always tight, direct regulatory expenditures on the ESA are relatively small.[285] Congress should provide additional funding specifically for review and updating of the status of species and the accuracy of critical habitat designations. That sort of

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276 16 U.S.C. § 1533(c)(2) (2000).

277 *See id.* § 1533(b)(3)(C)(i) (requiring agencies to treat any petition on which they make a finding that listing is warranted but precluded by work on higher priority species as if it were resubmitted on that date, requiring a new 12-month finding).

278 Agricultural interests convinced FWS to conduct a five-year status review of the Delta smelt (*Hypomesus transpacificus*) simply by filing such a lawsuit. Eric Bailey, *Is Tiny Fish Back from the Brink?*, L.A. TIMES, Mar. 27, 2003, at B1; *In Brief: U.S. to Review Status of Endangered Fish*, L.A. TIMES, June 19, 2003, at B8.

279 16 U.S.C. § 1533(b)(3) (2000) (setting out requirements and timelines for responding to petitions).

280 *See id.* § 1533(a)(3)(B) (the Secretary "may, from time-to-time . . . as appropriate, revise" a critical habitat designation).

281 *Id.* § 1533(b)(3)(D).

282 *Id.* § 1533(b)(3)(D)(ii).

283 Biodiversity Legal Found. v. Norton, 285 F. Supp. 2d 1, 17 (D.D.C. 2003).

284 *Designation of Critical Habitat Under the Endangered Species Act: Hearing Before the Subcomm. on Fisheries, Wildlife and Water of the S. Comm. on Envt. and Pub. Works*, 108th Cong. (2003) (testimony of Craig Manson, Assistant Secretary for Fish and Wildlife and Parks, Department of the Interior), *available at* http://laws.fws.gov/TESTIMON/2003/2003april10.html.

285 In fiscal year 2001, for example, the FWS budget for all endangered species activities was approximately $121 million, with only $6.3 million of that earmarked for listing activities. U.S. GENERAL ACCOUNTING OFFICE, GAO-02-581, ENDANGERED SPECIES PROGRAM: INFORMATION ON HOW FUNDS ARE ALLOCATED AND WHAT ACTIVITIES ARE EMPHASIZED 7, 8, tbl.1 (June 2002).

funding should have bipartisan political appeal because it would provide both economic and conservation benefits.

C. Build Public Trust

The third major step that could improve the use of science in the ESA would be to build greater public trust and credibility. Most ESA decisions will, for the foreseeable future, be underdetermined by scientific data. The wildlife agencies can no longer rely on the apparent scientific nature of their task to ensure public trust because it has become obvious that they are routinely making judgment calls based on their (potentially biased) interpretations of uncertain evidence. If the ESA is to survive the revelation that the emperor has few scientific clothes, other sources of public trust must be sought.

The two steps already suggested should help build trust. Openly acknowledging uncertainty and how it is dealt with, and committing to systematically increasing knowledge where feasible, should assure the public that the agency is not simply seeking raw power to implement its own vision of the public good. Ideally, the process of developing and evaluating additional data should itself enhance trust. For that to happen, the development and evaluation must be done in an open and transparent manner, with the public allowed to see who is making decisions and on the basis of what information.

I am skeptical of the value of traditional peer review, of the sort currently sought by FWS on its listing decisions, to enhance the credibility of ESA science. As explained above,[286] that sort of review is difficult to obtain and rarely alters agency decisions. Like editorial peer review, its most likely outcome is merely a better explanation of the decision, something courts already appear quite capable of demanding.[287]

More resource-intensive peer review, along the lines of an NRC report or a standing advisory panel like those used by the CalFed Bay-Delta Authority[288] can serve a different, and useful, function. This kind of oversight, which requires the input of substantial time and energy (preferably by a panel of experts over an extended period of time) can prevent agencies from falling into intellectual ruts by making them justify the basic assumptions and approaches that can easily fade into the background over time. The NRC's Klamath report has had this effect. Whether it is right or wrong on the science, it has forced the wildlife and action agencies to rethink their approach to the problem. Because this type of review is so resource-intensive, however, it cannot feasibly be applied

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286 *See supra* notes 227–28 and accompanying text.

287 *See supra* notes 198–208 and accompanying text.

288 For a general description of the CalFed program, see Katherine L. Jacobs et al., *CALFED: An Experiment in Science and Decisionmaking*, ENVIRONMENT, Jan./Feb. 2003, at 30.

routinely to all ESA decisions.[289] When it is undertaken, ensuring balanced membership on the panel is crucial to the credibility of the review.[290]

Agency credibility would also be enhanced by the development of more effective institutional mechanisms for separating scientific advice from the political aspects of decisions. Events such as charges that White House political strategist Karl Rove gave top Interior officials a presentation on the importance of supporting the President's agricultural constituency at the height of the Klamath controversy,[291] complaints from agency scientists that biological opinions have been improperly altered without input from scientists,[292] and the hurried import of a special team to rewrite a biological opinion in the midst of a high-profile controversy over management of the Missouri River[293] undermine the scientific credibility of ESA decisions. There is inevitably a political aspect to many of these decisions, but that aspect should be kept as separate as possible from the scientific one. The public is entitled to an honest accounting of the agencies' best understanding of the risks and benefits of alternative decisions, and an explanation of who was involved in the ultimate choice among those alternatives and the basis for that choice. The explanation of the role of uncertainty in the ultimate decision called for above would also be helpful here.

Finally, there is a step not directly related to science that could help build agency credibility and political acceptance of the social costs of the ESA. That is allocating the costs more equitably. I am not talking here about

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289 In fiscal year 2001, FWS conducted more than 1,000 formal consultations and approved more than 100 incidental take permits. U.S. GENERAL ACCOUNTING OFFICE, *supra* note 285, at 17. It would obviously be absurd to convene something like the NRC's Klamath committee, which spent 18 months and several hundred thousand dollars preparing its reports, for each of these decisions.

290 *See* U.S. GENERAL ACCOUNTING OFFICE, GAO-01-536, EPA'S SCIENCE ADVISORY BOARD PANELS: IMPROVED POLICIES AND PROCEDURES NEEDED TO ENSURE INDEPENDENCE AND BALANCE 19 (2001) (concluding that EPA has not done enough to protect against conflicts of interest on its review panels or to balance and inform the public about points of view represented on the panels). The NRC has an established procedure that is supposed to ensure balance on its committees, but in my view that procedure does not always function effectively. NRC committees are typically made up of persons from a wide variety of disciplines. That provides helpful breadth, but it means that often there is only one or at most two representatives of any specific discipline. That person is likely to dominate proceedings on the committee relevant to their discipline, and inevitably their viewpoints will affect the ultimate report. For truly balanced focused review, I believe it would frequently be preferable to keep the number of disciplines small and include at least two or three persons from each represented discipline on the panel.

291 Tom Hamburger, *Water Saga Illuminates Rove's Methods*, WALL ST. J., July 30, 2003, at A4, *available at* 2003 WL 3975522. At the request of Sen. John Kerry (D-Mass.), the Department of Interior's Inspector General is investigating charges that the White House improperly influenced Klamath decisions. Eric Bailey, *Klamath Decisions to Be Probed*, L.A. TIMES, Sept. 6, 2003, at B6, *available at* 2003 WL 2432478.

292 *See* Steve Hymon, *Federal Biologist Invokes Whistleblower Act*, L.A. TIMES, Oct. 29, 2002, at B7 (reporting on an ex-employee of FWS who accused NMFS and the United States Bureau of Reclamation of misconduct in their methods for allowing flow requirements that harmed endangered fish), *available at* 2002 WL 2514073.

293 Mike Ferullo, *Inspector General Examines Decision to Replace Missouri River Scientists*, 34 Env't Rep. (BNA) 2607 (Nov. 28, 2003).

the allocation of costs between federal and state governments and private parties, or between those whose actions currently threaten species and those who profited from equivalent actions in the past, although of course how those balances should be struck is always open to debate. My point rather is that costs are not now equitably shared among all the private parties who bear current responsibility for the problems of listed species. People who are asked to bear special burdens, and who can see that others similarly situated are not sharing their pain, are likely to rebel. Yet ESA implementation has long suffered from project-specific myopia, concentrating the costs of conservation on those who happen to be sitting under the law's biggest hammer.

Again the Klamath provides a striking example. ESA implementation in the Klamath Basin has focused almost entirely on the federal Klamath Project, despite the fact that there are many other contributors to the problems of the listed fishes.[294] Federal agencies understand the unfairness implicit in requiring only one of several groups responsible for species decline to contribute to conservation. The Bureau of Reclamation, which operates the Klamath Project, has taken the position that "the Project should not be responsible for effects of all of the water development and land management activities throughout the Basin."[295] NOAA Fisheries agrees, but has not yet found a legal path to imposing responsibility more broadly.[296] Taking a broader view will not be easy. It will require the agencies to expand their vision and push the limits of their statutory power. But it is essential to the long-term political acceptability of the ESA.

VI. CONCLUSION

Evaluation of the ESA's best available science mandate produces several lessons. The mandate's strongest current role is not in affecting the substantive treatment of science but in limiting open reliance on other factors and perhaps in encouraging "hard look" judicial review. The mandate, together with judicial review under the APA, has encouraged federal agencies to make reasonably good use of science in their substantive decisions under the ESA. The ESA is not broken with respect to its use of science.

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294 *See* NATIONAL RESEARCH COUNCIL, *supra* note 187 (explaining the many causes of declines of Klamath's fishes).

295 U.S. DEP'T OF INTERIOR, BUREAU OF RECLAMATION, FINAL BIOLOGICAL ASSESSMENT: THE EFFECTS OF PROPOSED ACTIONS RELATED TO KLAMATH PROJECT OPERATION (APRIL 1, 2002–MARCH 31, 2012) ON FEDERALLY-LISTED THREATENED AND ENDANGERED SPECIES 2 (2002).

296 In its most recent biological opinion on the Klamath Project, NMFS (as it was then called) imposed responsibility on the Project for only 57% of the higher flows NMFS deemed necessary to protect the coho salmon, and directed the Bureau of Reclamation to initiate a process to identify other sources to provide the rest. NAT'L MARINE FISHERIES SERVICE, BIOLOGICAL OPINION: KLAMATH PROJECT OPERATIONS 55–56 (2002). That led to remand of the biological opinion, because the non-Bureau flows were not assured. Pac. Coast Fed'n of Fishermen's Ass'ns v. United States Bureau of Reclamation, No. C 02-2006 SBA (July 15, 2003) (on file with author). In order to let the Project off the proverbial hook, the wildlife agencies must first ensure that someone else is on it.

As currently implemented, however, the best available science mandate still leaves room for improvement. Both the ESA's ability to achieve its conservation goals and its political robustness would be enhanced if the agencies implementing it more openly acknowledged the limits of science and the basis for their choices in light of those limits. While the wildlife agencies should enjoy considerable discretion to give species the benefit of the doubt at the outset, that discretion should be coupled with an obligation to more effectively generate additional information and use that information to update regulatory decisions. Those steps could certainly be implemented by the agencies under the current legislative scheme, and probably could be forced on the agencies by reviewing courts. If they are to be fully effective, however, Congress should add funding directed specifically at enhancing the ESA knowledge base. Finally, public trust in the agencies is important for the political durability of the ESA and will become more so in the future as costs increase. The current treatment of science, hiding the uncertainties and nonscientific decisions, is not building credibility. More transparent decision making, a commitment to continually increasing knowledge, appropriate use of outside peer review, and a demonstrated willingness to pursue all responsible parties could help supply needed credibility.