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Science, Judgment, and Controversy in Natural Resource Regulation

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I. INTRODUCTION

The modern environmental movement is heir to the Enlightenment's substitution of science, broadly defined, for religion as the fundamental norm for organizing society. There are, of course, important ethical, religious and "spiritual" strands to modern environmentalism, but environmentalism is primarily science-based. Environmentalism would not exist were it not for the writings of scientists such as Aldo Leopold,[1] Rachael Carson,[2] Rene Dubos[3] and Paul Sears,[4] to name just a few. Environmental law is even more indebted to science than the environmental movement. Science has been seen both as the justification for environmental law and as the means for fairly administering it.

Initially, environmentalism was built on a simple but radical principle: let nature be. The hope was that science could point the way to measures that would let nature co-exist with human exploitation. The modern recognition of the complexity of nature and the need for active management has made science even more important. Today, environmental law seeks to find the perfect balance between preservation and exploitation.

Administration of the Endangered Species Act (ESA) in the Klamath Basin illustrates the challenges of scientifically managing nature. A series of science-based decisions are needed, from species listing to consultation on federal actions. Those decisions carry substantial costs for the people who share the landscape with protected species. Unless science can provide some level of confidence that management actions are both necessary and

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1. Aldo Leopold, *A Sand County Almanac* (Oxford U. Press 1949).
2. Rachel Carson, *Silent Spring* (Houghton Mifflin Co. 1962).
3. Rene Dubos, *Reason Awake: Science for Man* (Columbia U. Press 1970).
4. *The Subversive Science: Essays Toward an Ecology of Man* (Paul Shepard & Daniel McKinley eds., Houghton Mifflin Co. 1969).

effective, those decisions will be widely perceived as unfair. The key question, not yet answered, is just how much confidence should be expected.

That science must play a role in natural resource management decisions goes almost without saying. It is obvious that we cannot protect endangered species unless we know something about their needs, that we cannot rebuild depleted fisheries without some sense of their population dynamics, and that we cannot sensibly decide whether and to what extent to log in our national forests unless we know something about how that decision will impact the physical and biotic environment. Not surprisingly, the law has responded to the need for scientific input. A wealth of legislative and regulatory mandates require that environmental and natural resource management agencies seek the advice of scientists, consider the best available scientific information, or obtain outside scientific review of their decisions.

We think it fair to say that natural resource regulation is heavily "scientized." By this we mean both that the current regulatory structure requires the use of science in a wide range of decisions, and that decision makers emphasize the role of science in those decisions. Nonetheless, critics on all sides of the political spectrum claim to believe that regulatory decisions remain insufficiently scientific. Critics equate scientific decision making with an objective, rational, analytically rigorous approach. In contrast, they assume that "political" decision making is subjective, emotional, and responsive to special interests.[5] They agree that decisions informed more by science than politics will produce better regulatory outcomes.[6] However, at this point the consensus disappears. Critics sharply disagree about whether regulators are plagued primarily by too little good information or too much bad information.

There may well be points in the decision making process at which greater objectivity would be desirable. As we argue in more detail below, however, science can never provide the perfect rationality we have been condi-

5. Some legal academics, particularly proponents of quantifiable decision making, have also urged the need to make regulatory decisions, particularly those in the environmental realm, more scientific. *See e.g.* E. Donald Elliott, *Strengthening Science's Voice at EPA*, 66 L. & Contemp. Probs. 45, 49 (Autumn 2003) ("there is currently too much politics and not enough science in our environmental decisions").

6. Two reports issued within months of each other from very different political perspectives illustrate this point. In July 2003, the conservative Hoover Institution published *Politicizing Science: The Alchemy of Policymaking* (Michael Gough ed., Hoover Press 2003), a collection of essays, many about environmental regulation, complaining that politics was overriding science to produce rampant unnecessary environmental regulation. The next month, Representative Henry Waxman, a liberal Democrat, released a report asserting that the George W. Bush administration had sacrificed scientific integrity at federal agencies in order to further its conservative agenda. U.S H. Comm. on Govt. Reform - Minority Staff Special Investigations Div., *Politics and Science in the Bush Administration*, http://democrats.reform.house. gov/features/politics_and_science/pdfs/pdf_politics_and_science_rep.pdf (Nov. 13, 2003). Early in 2004, the Union of Concerned Scientists weighed in with its own report charging the Bush administration with manipulating, distorting, and suppressing science on an unprecedented scale. Union of Concerned Scientists, *Scientific Integrity in Policymaking: An Investigation into the Bush Administration's Misuse of Science*, http://www.ucsusa.org/global_environment/rsi/page.cfm?pageID=1642 (March 2004).

tioned to expect from it. Therefore, simplistic generalized demands for objective rationality are not a useful reform strategy. Typically, the disputes are fundamentally about how incomplete data are interpreted and applied, rather than about what the data are or how they have been gathered. Agency judgments, in other words, are the real issue. It is impossible to entirely prevent the influence of the decision maker's subjective values and biases from creeping into decisions. A more useful inquiry would take a closer look at the role of judgment, asking at what stage and through what mechanisms judgment factors into resource management decisions; whether the effect of that judgment process is to advance or retard the identification and achievement of societal goals; and, when correction is needed, how judgments might be more closely constrained.

II. WHAT SCIENCE-BASED DECISION MAKING IS INTENDED TO ACHIEVE

Before considering whether the use of science in resource management decisions requires reform, and if so in what guise, it is worth examining more closely what benefits science is supposed to bring. Science mandates, in their various forms, are expected to serve several distinct goals.

First, science is supposed to help society achieve exogenously-determined substantive goals by ensuring that the most precise and accurate information available is factored into decisions. For example, before harvest of marine mammals may be authorized under the Marine Mammal Protection Act (MMPA), the National Marine Fisheries Service (NMFS, also known as NOAA Fisheries) must find, on the basis of the best scientific evidence available, that the permitted harvest is consistent with "sound principles of resource protection and conservation" and "will not be to the disadvantage" of the stock in question.[7] Science is invoked to help assure that the substantive conservation goals of the Act, primarily maintenance of stocks at the optimum sustainable population level,[8] are met.

Second, science is expected to clarify highly general goals in specific contexts, or to strike a viable balance between conflicting goals. Again the MMPA provides an example. Optimum sustainable population is defined as the population level that will provide the greatest productivity for harvest, consistent with the health of the ecosystem.[9] That goal is a compromise between exploitation and protection; science is expected to identify the point at which society can have its cake while eating as much of it as possible. Similarly, under the ESA, federal agencies must ensure, using the best scientific data available, that their actions will not jeopardize the continued existence of a listed species.[10] But if, in the course of the consulta-

7. 16 U.S.C. §§ 1371(a)(3)(a), 1373(a) (2000).
8. 16 U.S.C. § 1361(2) (2000).
9. 16 U.S.C. § 1362(9) (2000).
10. 16 U.S.C. § 1536(a)(2) (2000).

tion process through which this obligation is implemented, the regulatory agency determines that the proposed action will cause jeopardy, it must recommend reasonable and prudent alternatives that won't jeopardize the listed species.[11] These statutory requirements assume that science can find a perfect balance point, allowing extraction and development precisely up to the point at which they become inconsistent with conservation. In this paradigm, science justifies regulatory restrictions that impose substantial economic impacts on individuals and communities dependent on resource exploitation by showing those restrictions to be necessary and effective.

Third, science mandates might be intended to constrain the exercise of discretion by agencies that are no longer automatically trusted to pursue the public interest. As Justice Scalia put it in *Bennett v. Spear*:

> 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.[12]

When the science mandates of the ESA and other conservation laws were first put in place in the early 1970s, they might reasonably have been seen as needed to increase judicial oversight, because judicial review under the Administrative Procedure Act (APA) at that time was extraordinarily deferential to agency decisions.[13] Today, however, ordinary APA review requires that agencies provide some scientific justification for highly technical decisions even in the absence of any explicit legislative science mandate. It is not clear that science mandates add any additional constraint.[14]

Science mandates do help to limit the influence of forbidden considerations in regulatory decisions, in a way that the APA's limits on arbitrary and capricious decisions do not. For example, in response to the Reagan administration's refusal to add species to the protected list, the ESA was amended in 1982 to require that listing decisions rest solely on the best sci-

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11. 16 U.S.C. § 1536(b)(3)(A).

12. 520 U.S. 154, 176-77 (1997). We do not endorse Justice Scalia's exercise in statutory interpretation, which ignores both the ESA's overriding conservation purpose and the specific history of its science requirements. *See generally* 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, 785-86 (1997) (commenting on Justice Scalia's lack of textual support for interjecting economic concerns).

13. *See* Merrick B. Garland, *Deregulation and Judicial Review*, 98 Harv. L. Rev. 505, 532 (1985).

14. Holly Doremus, *The Purposes, Effects, and Future of the Endangered Species Act's Best Available Science Mandate*, 34 Envtl. L. 397, 423 (2004).

entific data available.[15] That change was intended to prevent the regulatory agencies from deciding not to list species based on concerns about the economic costs of conservation.[16] While no one believes the change has entirely kept costs out of the implicit regulatory analysis, at least it foreclosed open reliance on costs as a basis for refusing to list.

A science mandate need not be as explicit as the ESA's listing provision to have this effect. It may be enough that the decision to be made is clearly a scientific one. For example, under a statute conditioning tuna imports on the Secretary of Commerce finding that the practice of setting nets based on the presence of dolphins was not having a significant adverse effect on dolphin populations in eastern Pacific tuna fisheries, a federal court recently held that the Secretary could not consider the impact of the decision on trade or international relations.[17] The court effectively reversed the agency's decision that there was no significant effect, because the evidence suggested that conclusion was based more on concerns about foreign relations than on the available scientific evidence.[18]

Finally, it is often hoped that requiring agencies to base their regulatory decisions on science will tone down intense conflicts over the allocation of scarce natural resources. For example, the CALFED Bay-Delta Authority, created by agreement between California and the federal government in the late 1990s, strongly emphasized credible scientific analysis independent of regulatory decision making, as well as ongoing oversight by distinguished outside scientists.[19] CALFED was intended to resolve the bitter conflicts between the state and federal governments, water users and environmental groups, and among competing water users, that had long paralyzed efforts to address the environmental problems plaguing the San Francisco Bay-Delta.[20] A strong science program was seen as an essential element of the program; the expectation was that more complete, transparent, and credible scientific information would defuse some of the controversy.[21] Emphasis on science in decision making, however, and even increased information, if decoupled from increased understanding, can exacerbate controversy by

15. 16 U.S.C. § 1533(b)(1)(A) (2000).

16. Holly Doremus, *Listing Decisions Under the Endangered Species Act: Why Better Science Isn't Always Better Policy*, 75 Wash. U. L.Q. 1029, 1055 (1997); H.R. Conf. Rpt. 97-835, at 20 (Sept. 17, 1982); H.R. Rpt. 97-567, at 20 (May 17, 1982).

17. *Earth Island Inst. v. Evans*, No. C 03-0007 TEH, slip op. at 26-30 (N.D. Cal., Aug. 9, 2004).

18. *Id.* at 32.

19. *See* CALFED Bay-Delta Program, *Programmatic Record of Decision*, 74-76, http://calwater.ca.gov/Archives/GeneralArchive/rod/ROD8-28-00.pdf (Aug 28, 2000).

20. For descriptions of background on CALFED and the difficult and protracted negotiations that gave birth to the program, see Patrick Wright, *Fixing the Delta: The CALFED Bay-Delta Program and Water Policy Under the Davis Administration*, 31 Golden Gate U. L. Rev. 331 (2001); Elizabeth Ann Rieke, *The Bay-Delta Accord: A Stride Toward Sustainability*, 67 U. Colo. L. Rev. 341 (1996); A. Dan Tarlock, *Federalism Without Preemption: A Case Study in Bioregionalism*, 27 P. L. J. 1629, 1643-44 (1996).

21. *See* Katharine L. Jacobs, Samuel N. Luoma, & Kim A. Taylor, *CALFED: An Experiment in Science and Decisionmaking*, 2003 Environment 30, 30, 36 (Jan.-Feb.).

making it easier for people on all sides of the dispute to selectively reinforce their beliefs.[22] Furthermore, it is easy to oversell the value of science in calming controversy. Most of the conflicts over natural resource management boil down to disagreements about values and priorities. Unless scientific information reveals that all competing goals can be achieved, it will not solve these underlying conflicts.[23]

III. THE INEVITABILITY OF JUDGMENT IN REGULATORY DECISION MAKING

Simple science mandates – directives that agencies use the best available scientific data, consult with scientists in formulating decisions, and seek review of data by outside scientists – could ensure accurate decisions, closely constrain agency discretion, and defuse controversy if: (1) the available scientific data were reliably complete, precise, and relevant to the decision (or could be made so within the time frame allowed for decision making); and (2) agency decision makers could be relied upon to strike the same balance between competing goals as the larger society would. Unfortunately, neither of these conditions is routinely satisfied.

The hard reality is that the scientific information available to support environmental and natural resource policy decisions is frequently incomplete, ambiguous, and contested. An array of critical interpretive judgments, not fully determined by the data, are needed to translate that kind of science into policy. The Klamath Basin water conflict[24] illustrates the inevitable role of judgment in natural resource regulation.

A. *The Klamath Basin Water Conflict*

The Klamath Basin, straddling the Oregon-California border, contains two distinctly different parts. The inland Upper Basin is high, flat, and arid, with a climate similar to the Great Basin. Near the coast, the Lower Basin is characterized by steep mountains and abundant rainfall. Until white settlement of the area in the late 19th century, the Upper Basin landscape was a system of interconnected shallow wetlands – the Everglades of the west. The vast majority of those wetlands were drained early in the 20th century for conversion to agriculture. The federal Klamath Project, operated by the Bureau of Reclamation, irrigates the highest-value farm land in the Upper Basin. The major natural waterbody in the Upper Basin, Upper Klamath Lake, serves as the primary storage reservoir for the Project. Upper Klamath Lake is extensive but very shallow, averaging only eight feet deep. It cannot store enough water to carry over from year to year. As a result,

22. Daniel Sarewitz, *How Science Makes Environmental Controversies Worse*, 7 Envtl. Sci. & Policy 385 (2004).

23. *See id.* at 386.

24. For a detailed description of this conflict, *see* Holly Doremus & A. Dan Tarlock, *Fish, Farms, and the Clash of Cultures in the Klamath Basin*, 30 Ecology L.Q. 279 (2003).

Klamath Project water supplies are always at the mercy of the highly variable annual precipitation.

Three species of fish in the Klamath Basin are protected by the ESA: the Lost River and shortnose suckers, which inhabit Upper Klamath Lake and other water bodies of the Upper Basin; and the Southern Oregon / Northern California coastal coho salmon, which range up the Klamath River and its tributaries as far as Iron Gate Dam, the unofficial dividing point between the Upper and Lower Basins. The ESA requires that all federal agencies ensure that their actions do not jeopardize the continued existence of listed species.[25] With listed species both in the Upper and Lower Basins, the Bureau of Reclamation for the first time had to consider subordinating irrigation deliveries in favor of species conservation. Its decisions were made through a prescribed process of consultation with two wildlife agencies: the U.S. Fish and Wildlife Service (FWS), which is responsible for the endangered suckers; and NOAA Fisheries (also known as the National Marine Fisheries Service), which oversees the threatened coho salmon. The action agency provides the wildlife agencies with a "biological assessment," its written evaluation of the effects of its action on listed species.[26] After reviewing that assessment, the wildlife agencies issue a "biological opinion" concluding whether or not the proposed action violates the prohibition on jeopardy. If they render a jeopardy finding, the wildlife agencies must suggest "reasonable and prudent alternatives" consistent with the proposed action and within the action agency's authority, that will not cause jeopardy.[27] The action agency ultimately makes the decision whether or not to proceed with the action, and in what form. However, if it proceeds in the face of a jeopardy opinion it can expect, at least, skeptical review from the courts.[28]

In 2001, a drought intensified competition for the Klamath Basin's limited water resources. The Bureau prepared a biological assessment calling for maintaining distribution of water to farmers, at the cost of reducing water levels in Upper Klamath Lake and in-stream flows in the Klamath River below those at which the Project had traditionally been operated. FWS found that the Bureau's proposal would jeopardize the listed suckers. In order to protect them, it called for maintaining higher water levels in Upper Klamath Lake. NOAA Fisheries concluded that the coho would also be jeopardized by the Bureaus's proposal; it prescribed higher seasonal flows in the Klamath mainstem than the Bureau proposed. Although it did not concede that the wildlife agencies' analyses were correct, the Bureau be-

25. 16 U.S.C. § 1536(a)(2).

26. 16 U.S.C. § 1536(c).

27. 16 U.S.C. § 1536(b)(3)(A). 50 C.F.R. § 402.14(h)(3) (2004).

28. *See Bennett v. Spear*, 520 U.S. 154, 169 (1997) (explaining that a biological opinion "theoretically serves an 'advisory function,'" but actually has a powerful coercive effect because it will influence reviewing courts).

lieved it was effectively bound by the two biological opinions. Consequently, there would be no water available from Upper Klamath Lake for project irrigators. For the first time, the head gates of a federal irrigation project were closed in order to protect fish.

The resulting outcry focused on the extent of scientific support for the biological opinions. The Bush administration sought review of the science by the National Research Council (NRC), the policy advice arm of the independent National Academies. The NRC followed its usual procedure, appointing a committee of experts from a variety of disciplines to spend several months reviewing the Klamath biological opinions. The committee's preliminary report concluded, in terms far less nuanced than most NRC reports, that there was "no substantial scientific foundation" for either FWS' demands for higher lake levels or NOAA Fisheries' demands for higher river flows.[29] The committee also noted that there was no substantial scientific support for the Bureau of Reclamation's proposal to reduce lake levels and instream flows.[30] Subsequently, in a much more detailed final report, the committee reiterated and expanded upon its conclusions.[31] Because the Klamath conflict has been used by critics of the ESA to argue that regulatory decisions are not sufficiently scientific,[32] it makes a useful example of the inevitable role of non-scientific judgments in the regulatory process.

B. *A Taxonomy of Judgment in the Regulatory Process*

The Klamath conflict illustrates the three types of judgment needed to translate scientific data into regulatory decisions: scientific, management, and policy. It also vividly demonstrates that typically natural resource conflicts are fundamentally about the judgments applied to the existing scientific data, rather than about the data themselves or the methods by which they are derived.

1. *Scientific Judgments*

The scientific process is an extraordinarily powerful method of generating reliable, objective information about the natural world over time. Scientists gather data through observation or experimentation. They then

29. Natl. Research Council Comm. on Endangered and Threatened Fishes in the Klamath River Basin, *Scientific Evaluation of Biological Opinions on Endangered and Threatened Fishes in the Klamath River Basin Interim Report* 4 (Natl. Acad. Press 2002).

30. *Id.*

31. Natl. Research Council Comm. On Endangered and Threatened Fishes in the Klamath River Basin, Endangered and Threatened Fishes in the Klamath River Basin: Causes of Decline and Strategies for Recovery (Natl. Acad. Press 2004) [hereinafter *Final NRC Report*].

32. *See, e.g.*, Juliet Eilperin, *House Panel Approves Species Act Changes*, Wash. Post A19 (July 22, 2004) (discussing legislator's arguments for three-member panel approval of any agency decision under the ESA); Natalie M. Henry, *Walden to Tout ESA Reform at Klamath Basin Field Hearing*, Env. & Energy Daily, http://www.eenews.net/EEDaily/Backissues/071604/071604d.htm (July 16, 2004)

communicate their results and methodology to the relevant scientific community. This process allows other scientists to scrutinize data and repeat experiments in order to refute or support the observations. As observations accumulate, this process builds a tentative consensus in the scientific community. Eventually, with sufficient levels of research producing consistent results, this tentative consensus can mature into confidence among scientists that they understand how parts of the natural world work.

Judgment is an inherent aspect of the scientific research process. In the early stages or at the frontiers of knowledge, science is a messy process characterized by competing explanations. Research scientists must constantly exercise judgment in deciding what to test, what explanations to accept, and which data to prefer when some are consistent with their preferred explanation and others are not.

Scientific judgments are closely intertwined with judgments about the desirability of avoiding different types of error, which are not "scientific" at all. Research scientists in many fields, by convention, do not claim that they have "proven" their point unless the data meet a specific level of statistical significance, providing 95% confidence that their observations are not attributable to chance alone. There is nothing magic about that confidence level. It has become customary because it serves the goals of research science. It keeps scientists in the field from prematurely accepting a hypothesis as proven and moving on, likely down an unproductive research path. But, as Professor McGarity so aptly put it twenty-five years ago, "statistical significance is an issue of pure policy."[33] Furthermore, scientific conventions about statistical significance have limited force; they only foreclose claims of proof on the basis of single studies. They do not prevent scientists from believing a connection is real on the basis of far less conclusive evidence, or from acting on that belief in, for example, choosing their next research project. Nor do they prevent an accumulation of studies, each of which falls short of statistical significance, from being taken as a whole to prove the connection.[34] Even without additional studies, a persuasive explanation of the relationship between an alleged cause and effect may lead scientists to accept its existence without strong data.

An additional scientific judgment step, beyond those inherent in the research process, is often required when research science is applied to resource management. Much of the ecological research which forms the fundamental basis for resource management efforts is conducted by academics, and funded by general research programs. Not surprisingly, academic researchers focus on locations and systems that are convenient to study and fit their research goals. Those are not necessarily the same systems that re-

33. Thomas O. McGarity, *Substantive and Procedural Discretion in Administrative Resolution of Science Policy Questions: Regulating Carcinogens in EPA and OSHA*, 67 Geo. L.J. 729, 748 (1979).

34. *See* Doremus, *supra* n. , at 1070-71, and sources cited therein.

quire management.[35] Management controversies may bring targeted research funding but quite often, especially early in the management cycle, agency personnel must extrapolate results from small scale manipulation to large scale management, or from one location, system, or species to a very different one.[36]

The Klamath biological opinions required numerous scientific judgments. Those most directly connected to the controversy were about the effect of water levels in Upper Klamath Lake on the endangered suckers and of flow levels in the mainstem Klamath River on the threatened coho salmon. As is so often the case in natural resource management, those judgments had to be made on the basis of very limited information.

Scientific interest in the suckers and salmon was not high until they were listed under the Endangered Species Act. The earliest data correlating environmental conditions with the status of the suckers, therefore, dated only to 1990. Even for that brief period, the available data were spotty and had not been collected systematically. Thus when it produced its biological opinion in 2001, FWS knew it was working with limited data. It had to decide whether the operation of the Klamath Project, as proposed by the Bureau of Reclamation, would impermissibly affect the suckers. Applying its established interpretation of the ESA that the benefit of the doubt in section 7 consultation must go to the listed species,[37] FWS called for lake levels to remain higher than the Bureau proposed, and even higher than they had been kept in recent dry years.

The NRC committee criticized the agency's scientific judgments, reasoning that the available data contradicted FWS' claim that low water levels in Upper Klamath Lake might contribute to mass die-offs of adults or impede juvenile recruitment, so that even a cautious interpretation of those data could not support FWS' call for higher water levels. The committee's view was surely a tenable one, but not incontestable. It is not always easy to tell whether available data confirm or refute a particular hypothesis. The data, limited as they were, showed that adult fish kills had occurred in years of high, low, and average summer lake levels.[38] That data straightforwardly supports the NRC committee's interpretation that lake levels are not the

35. When Professor Tarlock taught at Indiana University, Bloomington, he was involved in coordinating the University's response to a proposal by a public utility to run a power line through a University-owned hardwood forest. A young professor of biology offered to brief the Board of Trustees on the adverse environmental impacts of power lines, but he had to be dissuaded from talking about the interruption of mountain lion and grizzly bear migration patterns, since those species were not known to exist in southern Indiana.

36. Gordon L. Baskerville, *Advocacy, Science, Policy, and Life in the Real World*, 1 Conservation Ecology 9, http://www.consecol.org/vol1/iss1/art9/ (1997).

37. U.S. Fish & Wildlife Serv. and Natl. Marine Fisheries Serv., *Endangered Species Act Consultation Handbook: Ps. for Conducting Section 7 Consultations and Confs.* 1-6 (Mar. 1988) [hereinafter *Consultation Handbook*].

38. *Final NRC Report*, *supra* n. 31, at 239.

crucial factor in mass mortality events.[39] The picture is more complicated with respect to the impacts of low spring lake levels on recruitment. Because lake levels are closely related to the availability of spawning habitat, the NRC committee agreed that it was "a reasonable hypothesis" that lake levels might suppress spawning.[40] There was some data available to test that hypothesis, but not very much. There were six years of data comparing April lake levels with larval abundance, and relative abundance data for eight older year classes in mass mortality events, which could be compared with water levels when those fish were spawned.

The committee found the data suggested that any relationship between lake levels and larval recruitment is weak or indirect.[41] With respect to the larval abundance data, the committee noted that measurements of larval abundance had a high degree of sampling variance, so that it was difficult to have confidence in the accuracy of any particular point.[42] Five of six points on the graph of spring water levels versus larval abundance suggested a reasonably strong correlation between the two. Discounting the outlying sixth point as either wrong (due to sampling error) or anomalous (due to the chance variation allowed even by the most stringent statistical significance tests) probably would have been within the bounds of accepted scientific practice. As the committee pointed out, the conclusion that spawning success is not related to the availability of spawning habitat "seems counterintuitive."[43] The committee's interpretation that lake levels at the time of spawning were not crucial to later population levels was bolstered by the year class evidence from fish kills, which did not show a correlation with mean water level during spawning.

The regulatory agencies and the NRC committee agreed that the available data did not conclusively prove or conclusively disprove the supposition that higher spring lake levels improved recruiting success. Scientific judgments interpreting such limited and equivocal data reflect the educated intuition of the scientists making them, but are also nearly inextricably bound up with those scientists' views about the appropriate degree of risk of ecological versus economic harm. Any judgment based on such a small amount of data has a high probability of being wrong. There is some evidence, though, that such judgments are less affected by subjective predictions, such as policy preferences, if they are made with explicit consideration of a model, even a crude one, of the system concerned.[44]

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39. In its preliminary report, the NRC committee noted that there were no fish kills in low water years in the 1990s. Natl. Research Council Comm. on Endangered and Threatened Fishes in the Klamath River Basin, *supra* n. 29, at 18.

40. *Final NRC Report*, *supra* n. 31, at 225.

41. *Id.* at 226.

42. *Id.* at 225.

43. *Id.* at 226.

44. *See* Michael A. McCarthy et al., *Comparing Predictions of Extinction Risk Using Models and Subjective Judgment*, 26 Acta Oecologia 67 (2004).

2. *Management Judgments*

Management judgments are judgments about the amenability of various aspects of a managed system to manipulation, and the likely response of the system and the political community to the variety of possible perturbations. Management decisions, such as choices of priorities among several possible approaches to solving a problem, are necessarily made in light of those judgments. Management judgments are frequently informed by, but hardly ever wholly determined by, the available scientific evidence. There can be a strong feedback loop; once management judgments are made, they can strongly influence the collection and interpretation of scientific data, which in turn can tend to entrench the original management decisions.

In the Klamath Basin, FWS and NMFS had to make management judgments about where to focus their regulatory efforts. Both chose to focus heavily on the Klamath Project, relying on the section 7 consultation process to drive changes in Project operations. Other possibilities, including section 9 enforcement proceedings against private irrigators who divert water above Upper Klamath Lake,[45] or section 7 consultation for other federal actions such as management of national forest lands in the Lower Basin, were essentially ignored. That choice drew considerable criticism in the final NRC report,[46] because the committee believed that regulation of the Klamath Project alone would be both inequitable and ineffective.[47] Before the committee issued its final report, we ourselves had called for a broader approach to the Basin's problems.[48]

We remain persuaded that any lasting solution to the Klamath conflict must extend beyond the boundaries of the Klamath Project. That does not, however, mean that the regulatory agencies made improper, or even incorrect, management judgments. The rule of law requires that regulators enforce applicable statutes, but those statutes often leave considerable implementation discretion. In deciding how to exercise that discretion, agencies take into account both the accessibility to intervention and the leverage provided by different parts of the system. In the Klamath situation, regulators were entitled to consider that section 7 consultation proceedings, as angry as they might make people, would almost certainly be less controversial than section 9 enforcement. After all, section 7 operates through the intermediary of another federal agency. When the section 7 process produced a judgment that the headgates at Upper Klamath Lake had to be closed, that judgment was endorsed not only by the regulatory agencies, but

45. The Klamath Project irrigates only a fraction of the irrigated acreage in the Upper Basin. Doremus and Tarlock, *supra* n. 24, at 345.

46. *Final NRC Report*, *supra* n. 31, at 323-339

47. *See id.* at 327-329.

48. Doremus & Tarlock, *supra* n. 24, at 343-49. The contours of this broader solution are beyond the scope of this article. The necessary mind set is suggested in Ed Marston, *Reclaiming the Spirit of Reclamation*, 44 Natl. Resources J. 681 (2004).

also by the Bureau of Reclamation, an agency Project irrigators had every reason to believe would give full consideration to their interests. Even so, closure of the headgates produced a firestorm of outrage that reverberates even today on the web and in the local community. A direct attack on irrigators above the Project through section 9 probably would have produced an even more extreme reaction, likely including charges of black helicopters.

The regulatory agencies also had reasonable grounds to believe that targeting the Klamath Project would provide the greatest conservation return on enforcement efforts. The Project, unlike private irrigators, has a direct line to federal budget decisions. Its operation is the highest-profile ongoing federal action in the Basin, and the one with the strongest local political support. Reducing federal water deliveries was calculated to bring both attention and a substantial infusion of federal conservation dollars to the Basin. Indeed, the water crisis of 2001 appears to have had precisely that effect. Congress and the Department of Interior have pumped money into a new basin-wide restoration program being developed by the Bureau of Reclamation.[49] Oregon and California have agreed to join the federal government in a new cooperative approach to addressing the Basin's environmental woes.[50] Even with the benefit of hindsight, it cannot be said that regulators made a clear error in focusing their efforts on the Klamath Project. They had every reason to suppose that the Project, the single largest diverter in the system and a pipeline to federal funding, would provide the most bang for the regulatory buck.

3. *Policy Judgments*

Policy judgments are judgments about social goals, the relative importance of those goals, and the importance of avoiding specific types of errors. Choices about the extent of scientific certainty required to justify regulatory action, for example, are policy judgments. By their very nature, policy judgments cannot be made on any objective basis.

The sequence of regulatory events that produced the controversial biological opinions of 2001 included a number of policy judgments. Such policy judgments logically precede, and provide the context for, the scientific judgments. Congress has provided vague indications of how many of these judgments should be made, but has generally left a broad space for agency discretion. The regulatory agencies, in turn, frequently leave their policy judgments unexplained, and even unacknowledged. Policy judg-

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49. U.S. Bureau of Reclamation Klamath Basin Area Office, *Program Document Second Draft, Klamath River Basin Conservation Implementation Program*, http://www.usbr.gov/mp/kbao/CIP/docs/CIP-ProgramDoc.pdf (Feb. 2004).

50. *Klamath River Watershed Coordination Agreement*, http://www.usbr.gov/mp/kbao/docs/CIP-ProgramDoc.pdf *(2004)*.

ments essential to regulatory choices, therefore, often remain quite opaque to the general public.

The first set of policy judgments in the Klamath sequence were those required in to list the suckers and salmon under the ESA. First, FWS and NOAA Fisheries had to decide which fish to group together as "species." The statute provides only that the term "species" includes subspecies and, for vertebrates, "distinct population segments," a term not further defined.[51] Identifying groups for protection has been particularly challenging for Pacific salmon. The genetic basis of much of the observed life history and morphological variation in salmon is poorly understood. Within recognized salmon species, runs are often largely, but not completely, reproductively isolated from one another by the time and location of spawning.

In 1991, believing that runs should be protected if they represented a unique evolutionary unit, NOAA Fisheries developed a policy for identifying distinct population segments of salmon.[52] The policy provides for protection of groups that are "substantially reproductively isolated" from others, so that they promise to evolve as a separate lineage,[53]and "represent an important component in the evolutionary legacy of the species."[54] In 1995, NOAA Fisheries identified the coho salmon stocks in the Rogue, Klamath, Trinity, and Eel River basins, together with those in several smaller basins in the same area, as a single distinct population segment.[55] The agency found a relatively large genetic distance between the northern and southern fish in this Evolutionarily Significant Unit (ESU),[56] and noted that fish from this group were more likely to spend the ocean portion of their life cycle off the California coast than their cousins from more northerly rivers.[57] Neither of these distinguishing traits amounted to a bright line. The recognized ESU itself showed considerable genetic diversity,[58] and the ocean distributions overlapped.[59] Faced with groups of fish that were not perfectly distinct from each other, genetically or in their ocean behavior, NOAA Fisheries had to make judgments about where to draw lines. It might have excluded the Rogue River salmon from this group, or included those in the Elk River to the south.[60] Because nature itself has not provided bright lines,

51. 16 U.S.C. § 1532(16) (2000).

52. *Policy on Applying the Definition of Species Under the Endangered Species Act to Pacific Salmon*, 56 Fed. Reg. 58612 (Nov. 20, 1991).

53. *Id.* at 58618.

54. *Id.*

55. *Endangered and Threatened Species: Proposed Threatened Status for Three Contiguous ESUs of Coho Salmon Ranging from Oregon Through Central Cal.*, 60 Fed. Reg. 38011, 38016 (July 25, 1995) (designating this distinct population as the "Southern Oregon/Northern California Coasts Coho Salmon ESU").

56. *Id.* at 38013.

57. *Id.* at 38014.

58. *Id.* at 38013.

59. *Id.* at 38014.

60. *See id.* at 38016 (noting that some genetic samples from the Rogue were similar to those from Columbia River fish, and one sample from the Elk clustered with Umpqua River fish).

any choice the agency made could be criticized as arbitrary. FWS provided essentially no explanation for its particular choice, sticking with general references to the genetic and ocean distribution patterns.

Once they had identified listable "species," FWS and NOAA Fisheries had to make policy judgments about the degree of acceptable risk to those species. The statute defines a species as "endangered" if it is "in danger of extinction throughout all or a significant portion of its range,"[61] and "threatened" if it is "likely to become endangered in the foreseeable future"[62] That language makes it clear that endangered species must be in worse condition than threatened ones, but can hardly be considered a definitive explanation of the degree of risk needed to support listing in either category. The listing agencies have not made any effort to describe in general terms what degree of risk over what period of time they think makes a species endangered or threatened. Their individual listing decisions frequently provide little information about the degree of risk facing the species, no doubt in part because robust estimates of the probability of extinction are unavailable. In listing the coho salmon, NOAA Fisheries noted that the population had dramatically declined from historic levels, although the Rogue River population had recently bounced back a bit; that coho were absent from many streams in the region that had once harbored them; and that a high proportion of the naturally spawning fish in the region were first-generation hatchery fish.[63] In listing the suckers, FWS noted that the populations had declined drastically (by as much as 50%) in the last several years, and that no significant recruitment of young fish had been observed for 18 years.[64]

Once the species were listed, and consultation had begun on the effects of the Klamath Project, NMFS and FWS had to determine what level of risk would fall below the jeopardy threshold and precisely what it means to "insure" that jeopardy is "not likely."[65] The Services' joint regulations suggest caution in this determination: "action[s] expected to . . . reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild" are considered to jeopardize the continued existence of the species.[66] As with their listing determinations, the regulatory agencies did not clearly address the extent to which they believed the Bureau's proposed operation of the project would reduce the likelihood either of survival or of recovery of the listed species.

As these examples should make clear, even with the best of intentions it is very difficult to separate out the three different kinds of judgment. When

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61. U.S.C. 1532(6).

62. U.S.C. 1532(20).

63. *Endangered and Threatened Species: Threatened Status for Southern Or./Northern Cal. Coast Evolutionarily Significant Unit (ESU) of Coho Salmon*, 62 Fed. Reg. 24588, 24591 (May 6, 1997).

64. *Endangered and Threatened Wildlife and Plants: Determination of Endangered Status for the Shortnose Sucker and Lost River Sucker*, 53 Fed. Reg. 27130, 27131 (July 18, 1988).

65. This is the operative language of ESA 7(a)(2), 16 U.S.C. 1536(a)(2).

66. C.F.R. 402.02.

the Services opined that the Bureau's proposed operation of the Project would cause jeopardy, they were necessarily making both scientific and policy judgments. Undoubtedly those judgments were influenced by unstated management judgments about the reaction their decisions would provoke.[67] The NRC review committee may also have had a hard time separating out these distinct judgments. The committee was formally asked only to review the science underlying the 2001 biological opinions.[68] The committee read that charge (unnecessarily, in our view) as requiring that, in deciding whether scientific evidence adequately supported the regulatory requirements, it apply norms of research science that require high levels of certainty to support a claim of "proof."[69] In addition, the committee's evaluation of the science may have been affected by its policy preferences. The committee chair wrote that "it is obvious" that the regulatory agencies will make professional judgments in a way that privileges the species they are charged with protecting, but "[w]here the economic stakes are high," special attention should be given to the role of speculation in those decisions.[70] It seems that the committee chair, at least, believed that overregulation would generally be the norm,[71] and that regulators would need to be reined in when their zeal threatened to impose high economic costs on society. That the committee as a whole may have shared this view is supported by its divergent treatment of the lake level and diversion point screening requirements in the 2001 FWS biological opinion. The call for higher lake levels was criticized because it lacked substantial scientific support. But the committee endorsed FWS' call to screen the main diversion point from Upper Klamath Lake to the Project's irrigation works. The committee acknowledged that the "benefits of this measure to the population are unknown."[72] Presumably it believed this less controversial step, which did not threaten to deprive farmers of their livelihood, required less supporting evidence. If the committee was indeed inclined to demand clearer scientific support for the biological opinions because of their perceived economic consequences, that policy judgment may have affected its scientific judgments.[73]

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67. It is hardly surprising that FWS will not release jeopardy opinions (unlike no-jeopardy opinions) without the signature of the regional director. U.S. Fish & Wildlife Serv. and Natl. Marine Fisheries Serv. *Consultation Handbook, supra* n. 37, at 1-4 to 1-5.

68. *Final NRC Report, supra* n. 31, at 4.

69. *Id.* at 314.

70. William M. Lewis, Jr., *Klamath Basin Fishes: Argument is No Substitute for Evidence*, 28(3) Fisheries 20, 21 (Mar. 2003).

71. As explained below, the available empirical evidence is directly to the contrary. *See infra* nn. 98-99 and accompanying text.

72. *NRC Final Report, supra* n.31, at 237.

73. In fact that particular policy judgment, although tenable and perhaps even appealing on its face, is rejected by the ESA, which establishes a uniform federal duty to avoid jeopardy and adverse modification of critical habitat, independent of the economic benefits of the proposed action. 16 U.S.C. § 1536(a)(2).

IV. CONTROLLING REGULATORY JUDGMENT

As these examples drawn from the Klamath conflict illustrate, the real battleground in arguments about the use of science in natural resource regulation is typically not the data themselves but the scientific, management, and regulatory judgments used to interpret and translate the data into regulations. Environmentalists calling for more or better science do so because they think current science mandates have not done enough to achieve substantive conservation goals. Critics in the regulated community, by contrast, believe current science mandates have not done enough to protect against unnecessary and unproductive regulation. Both sides claim to want more science and less judgment, but a more accurate assessment is that both want the inevitable judgments to be more closely aligned with their policy preferences. The fundamental disagreement is over the appropriate burden of proof. Environmentalists want regulatory agencies to be more cautious about approving activities that may affect listed species, applying the precautionary principle to impose protective regulations even if the supporting evidence is less than certain. The regulated community, on the other hand, wants the agencies to be more cautious about imposing regulatory restrictions on their actions, and therefore calls for application of the very demanding standards of certainty imposed on claims of proof in the research science community.[74]

Both sides, however, tend to frame their arguments in the political arena as calls for more scientific decision making, relying on a widespread misperception (which they may share) that science can provide objective, perfectly rational, decisions. Both, therefore, end up promoting a debate about "good" versus "bad" (or "sound" versus "junk") science. That debate, which has taken on Miltonian proportions, is rooted in the endless and futile search for a perfect world. The horror and brutality of the 20th century destroyed the progressive vision of progress through science, reason and technology. Chicago school economics destroyed the idea of an objective, expert public interest. The Enlightenment idea that the physical sciences can be the basis of perfect rationality, though, lives on. As John Passmore observed, "the Enlighteners accepted the Socratic doctrine that vice is always a form of ignorance, that if man once learns what is best for him to do, he will necessarily act in that way."[75]

Proponents of science-based decision making on both the right and left look to science to produce the perfect decision; apparently neither side will accept less. Opponents of specific conservation actions want to know ex-

74. For a general explanation of these contrasting approaches to regulation, *see* J.B. Ruhl, *The Battle Over Endangered Species Act Methodology*, 34 Envtl. L. 555 (2004). For a comparison of the incentives and costs of error that might call for differing standards of proof in regulatory as opposed to research science, see Holly Doremus, *The Purposes, Effects, and Future of the Endangered Species Act's Best Available Science Mandate*, 34 Envtl. L. 397 (2004).

75. John Passmore, *The Perfectibility of Man*, 320 (Scribner's 1970).

actly how many species or individual members of a protected species those actions will save, while opponents of risk-based conservation decisions want to know exactly how many will be killed.[76] The search for scientific perfection in this context, however, is misguided for two fundamental reasons. First, as sensible ecologists have constantly warned, ecology and the related biological sciences will never reach the precision and elegance of physics and mathematics. Second, the search for the perfect science-based decision deflects attention from the real issue, which is whether the decision is legitimate. One of the strengths of the law is that it has never sought perfection or even truth in the absolute sense, being satisfied with the more attainable goal of legitimacy. The scientific attributes of reason and accuracy are necessary components of legitimacy, but we have only traditionally expected that decision makers make a good faith effort to reach a justifiable decision in light of available information. In the context of natural resource regulation, the key legitimacy question is not whether the variety of judgments that go into regulatory decisions are objectively correct or certain, but whether they are adequately serving legitimately chosen societal goals.

A. *Conventional Controls Do Not Closely Constrain Judgments*

As we have seen, natural resource regulation and management decisions are typically not closely constrained by the available data, because those data are so incomplete and ambiguous. It is not surprising that people on both sides of the political spectrum, distrusting the regulatory agencies, want regulatory decisions to be more closely constrained. Indeed, the science mandates that pepper conservation statutes were originally intended in large part to increase agency accountability. In practice, however, they can have precisely the opposite effect, insulating agency judgments from oversight by the courts and the political process.

Courts consider themselves ill-suited to intervene in the situations which leave the greatest room for judgment: when agencies make decisions with a highly technical content in the face of substantial uncertainty. Judges are acutely aware that they lack specialized scientific expertise, and therefore are not well qualified to oversee the exercise of scientific judgment.[77] They are also reluctant to impose limits on agency policy judgments where Congress appears to have delegated to the agency responsibility for striking the balance between competing policy goals.[78]

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76. *See generally Gifford Pinchot Task Force v. U.S. Fish & Wildlife Serv.*, 378 F.3d 1059 (9th Cir. 2004).

77. *See Intl. Harvester Co. v. Ruckelshaus*, 478 F.2d 615, 650-51 (D.C. Cir. 1973) (Bazelon, J., concurring) ("Socrates said that wisdom is the recognition of how much one does not know. I may be wise if that is wisdom, because I recognize that I do not know enough about dynamometer extrapolations, deterioration factor adjustments, and the like to decide whether or not the government's approach to these matters is statistically valid.").

78. *Chevron U.S.A., Inc. v. Natl. Resources Defense Council*, 467 U.S. 837, 865 (1984).

Natural resource regulatory decisions often share both of these attributes. Courts therefore tend to approach them gingerly. Scientific judgments are generally set aside only in the most egregious situations, as when it is clear that there is a major inconsistency between the underlying information and the ultimate conclusion. Federal agencies may not ignore a clear scientific consensus, especially if their own experts agree with that consensus.[79] They may not entirely ignore relevant scientific information.[80] Finally, they must offer a coherent explanation of how their decisions rationally follow from, or at least are consistent with, the available evidence.[81] The policy judgments that are necessarily implied or closely intertwined with scientific judgments in natural resource regulatory decisions often go unrecognized, or perhaps unacknowledged, by the courts.

Management judgments about which parts of a problem to tackle first, and how fiercely, are also resistant to judicial review. The courts recognize that agencies must enjoy enforcement discretion, as well as discretion to set priorities on how to address multi-faceted problems. Holding otherwise could allow multiple responsible parties to escape responsibility by pointing fingers at others' contributions. So courts have ruled, for example, that plaintiffs cannot challenge regulatory agencies' alleged failure to adequately restrict fishing pressure, despite their mandate to protect salmon habitat;[82] and that species can be listed under the ESA without necessarily showing that listing will ameliorate all threats.[83] Agency predictions about

79. Examples include *Northern Spotted Owl (Strix Occidentalis Caurina) v. Hodel*, 716 F. Supp. 479, 483 (W.D. Wash. 1988) (holding that FWS acted arbitrarily and capriciously in failing to list the northern spotted owl in the face of unanimous expert opinion, "including that of its own expert, that the owl is facing extinction"); and *Center for Biological Diversity v. Lohn*, 296 F. Supp. 2d 1223, 1236-40 (W.D. Wash. 2003) (remanding decision not to list orca population because decision rested on assumption that all orcas worldwide belong to the same taxon, an assumption the agency's scientific advisory panel had unanimously rejected).

80. *See, e.g., Conner v. Burford*, 848 F.2d 1441, 1454 (1988) ("In light of the ESA requirement that the agencies use the best scientific and commercial data available to insure that protected species are not jeopardized, 16 U.S.C. § 1536(a)(2), the FWS cannot ignore available biological information," or refuse to use that information to develop projections about the impact of proposed actions on listed species); *San Luis & Delta-Mendota Water Auth. v. Badgley*, 136 F. Supp. 2d 1136, 1151 (E.D. Cal. 2000) ("there is no indication Defendants considered substantial evidence that suggests that the splittail should not be listed, despite the significant contrary data and opinion" of the state fish and wildlife agency).

81. *See, e.g., Natl. Assn. of Home Builders v. Norton*, 340 F.3d 835 (9th Cir. 2003) (holding that FWS inadequately explained its designation of Arizona population of cactus ferruginous pygmy owl as a distinct population segment); *Natl. Resources Defense Council v. U.S. Dept. of the Interior*, 113 F.3d 1121, 1125-26 (9th Cir. 1997) (holding that FWS had failed to adequately explain its conclusion that designation of critical habitat would not be beneficial to the coastal California gnatcatcher); *Am. Rivers v. U.S. Army Corps of Engineers*, 271 F. Supp. 2d 230, 255-57 (D.D.C. 2003) (finding that FWS had failed to adequately explain why recent improvements in the condition of listed species justified "dramatic departure" from the conclusions of an earlier biological opinion); *Am. Wildlands v. Norton*, 193 F. Supp. 2d 244, 254 (D.D.C. 2002) (finding that FWS had failed to offer "a scientifically based explanation" for its decision to include hybrid fish in its assessment of the status of the westslope cutthroat trout).

82. *Common Sense Salmon Recovery v. Evans*, 329 F. Supp. 2d 96, 102-05 (D.D.C. 2004).

83. *City of Las Vegas v. Lujan*, 891 F.2d 927, 934 (DC Cir. 1989).

the response of both natural and social systems to management measures also tend to get considerable deference.[84]

The political process does affect agency judgments, but not in a way that is likely to accurately reflect societal goals. Although conservation statutes generally provide opportunities for public input, it is extraordinarily difficult for the lay public to play an effective role in shaping highly technical regulatory decisions.[85] The barriers to participation are exacerbated by the tendency of agencies to hide the policy judgments they make behind the scientific ones. Those decisions may be difficult to recognize, let alone challenge.[86] The Klamath conflict is a good example. Few members of the public are likely to have the expertise, or the patience, to grapple with the details of the available evidence concerning the relationship between lake levels and sucker well-being.

That highly technical regulatory judgments are not accessible to the general public does not make them immune to political pressures. Instead, it skews those pressures. Only the best-funded interests, which are not likely to favor conservation, will be effectively represented in regulatory proceedings that turn on those sorts of issues.[87] Moreover, the opacity of technical decisions can allow agencies to hide their political choices from the view of courts or voters. The technical nature of natural resource regulatory decisions, therefore, can actually undermine the ability of courts and the public to hold agencies to the mandates articulated by Congress.[88]

B. *Do Regulatory Judgments Fit Societal Goals?*

That natural resource regulatory decisions involve a substantial measure of judgment, and that the exercise of that judgment is not likely to be closely overseen by courts or voters, are not causes for concern in and of themselves. Those aspects of regulatory decisionmaking are worrisome only if and to the extent that agency judgments in practice run counter to societal goals reflected in legislation. Our analysis here is intentionally

84. In *Natl. Wildlife Fedn. v. Babbitt*, 128 F. Supp. 2d 1274, 1298 (E.D. Cal. 2000), plaintiffs challenged the issuance of an Incidental Take Permit based on a habitat conservation plan for the Natomas Basin just outside of Sacramento. Plaintiffs challenged, among other things, FWS' projection (speculation) that only a fraction of the basin's acreage would be developed over the life of the permit, and the consequent conclusion that a combination of purchased reserves and continued agricultural use would be sufficient to protect the covered species. The court found that the agency's judgments were within its discretion because they concerned "the uncertainties inherent in the market-based mitigation mechanism employed by the HCP," and were an inevitable aspect of the complicated decisionmaking implicit in the permit process.

85. Wendy E. Wagner, *The Science Charade in Toxic Risk Regulation*, 95 Colum. L. Rev. 1613, 1674-77 (1995).

86. *See id.* at 1627-28.

87. *See id.* at 1677.

88. Even individual legislators, particularly those with powerful committee positions, can exert political pressures that push the agencies toward actions inconsistent with the intent of seemingly clear statutes like the ESA. *See generally* J.R. DeShazo & Jody Freeman, *The Congressional Competition to Control Delegated Power*, 81 Tex. L. Rev. 1443 (2003).

descriptive, rather than normative. We believe it is possible to roughly identify the trade-offs Congress directed the regulatory agencies to make, and that the degree of correspondence between agency decisions and that direction is a legitimate test of whether agency judgments are being made appropriately.

Federal natural resource laws often have multiple, even competing goals. Essentially, though, the modern statutes embody a commitment to give the environment more weight than it traditionally had been given when in conflict with extractive or development interests. They were adopted when it became clear that pursuing economic goals without adequate attention to the environment was causing serious environmental degradation. They exist to counteract what would otherwise be unopposed economic pressures.[89] Their science mandates were primarily intended to serve that goal by limiting the role of economic and political pressures in the regulatory process.

The ESA, source of the most frequent and intense controversies over natural resource management in the United States, is perhaps the clearest example. It was enacted in 1973 specifically because earlier, less strongly regulatory, federal statutes had failed to stem the tide of extinctions.[90] Its regulatory provisions are supported by an explicit Congressional finding that "various species of fish, wildlife, and plants in the United States have been rendered extinct as a consequence of economic growth and development untempered by adequate concern and conservation."[91] The first time the Supreme Court encountered the ESA, it famously described the law as giving endangered species "the highest of priorities"[92] and requiring their protection "whatever the cost."[93] The law has since been amended so that it is no longer so single-minded. It now allows development so long as it that development is compatible with conservation,[94] and provides a narrow exemption procedure if, after a trial-type hearing, a cabinet-level committee finds that the benefits of a project clearly outweigh those of any alternative

89. In the 1960s, the environmental movement aggressively used benefit-cost analysis to criticize public works projects as inefficient. During the Kennedy-Johnson administrations, benefit-cost analysis was enthusiastically embraced by many progressives as a way to rationalize everything from military spending to environmental regulation. However, environmentalists soon bristled at efforts to subject the protection of remote public risks to benefit-cost analysis, especially as lives saved became the measure of benefits. More and more, environmentalists embraced precaution as a separate decision criterion and, with some important exceptions, benefit-cost analysis has become associated with efforts to undermine environmental regulation. For a recent criticism of the use of benefit-analysis to undermine risk-based regulation intended to protect future generations *see* Frank Ackerman & Lisa Heinzerling, *Priceless: On Knowing the Price of Everything and the Value of Nothing* (The New Press 2004).

90. Holly Doremus, *Patching the Ark: Improving Legal Protection of Biological Diversity*, 18 Ecology L.Q. 265 (1991).

91. U.S.C. § 1531(a) (2000).

92. *Tenn. Valley Auth. v. Hill*, 437 U.S. 153, 194 (1978).

93. *Id.* at 184.

94. U.S.C. § 1539(a)(1)(B) (2000); 16 U.S.C. § 1539(a)(2)(A).

consistent with conservation.[95] Those changes have not altered the basic ordering of priorities, however; the overriding goal of the law remains conservation in the face of development pressures.

This history explains why the ESA is not neutral about the use of a precautionary framework. It requires some degree of caution in order to achieve the overriding goal of conservation. That's why it requires that decisions rest on the "best *available* science," instead of mandating some specific threshold level of scientific support. That does not mean that species cannot be subjected to any risk; the agencies retain significant discretion as to how much risk is acceptable. But it does mean there has to be a finger on the scale, of some indeterminate size, on the side of the species. The regulatory agencies cannot, for example, require conclusive evidence as a prerequisite to listing a species.[96] It also means that, at a minimum, the economic costs of protection cannot by themselves be the basis of a less protective stance unless the statutory exemption process is invoked or Congress grants a legislative exemption. When the regulated community demands "sounder science," it is trying to replace the current, vaguely precautionary, direction of the statute with the very high threshold of certainty that characterizes claims of "proof" in controlled research science.

Of course, without going to the extreme of requiring virtual certainty to justify regulation, one could worry that the underspecified ESA directive to use caution invites unnecessary over-regulation by a mission-driven regulatory agency. The chair of the Klamath NRC committee shared that concern.[97] On its face, that is a plausible initial assumption. The available evidence, however, contradicts it. There is strong evidence that the regulatory agencies do not list species whose conservation predictably conflicts with economic activities unless and until forced to do so by litigation.[98] The evidence is less overwhelming with respect to section 7, perhaps because evaluation is more difficult. Nevertheless, it is clear that biological opinions rarely find jeopardy; when they do, the regulatory agencies go out of their way to devise reasonable and prudent alternatives that minimize the regulatory burden.[99] In the Klamath context, for example, NMFS in its

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95. U.S.C. § 1536(h).

96. *Defenders of Wildlife v. Babbitt*, 958 F. Supp. 670, 679 (D.D.C. 1997).

97. *See supra* n. 31, at 354 and accompanying text.

98. *See, e.g.*, DeShazo & Freeman, *supra* n. 88; Amy Whritenour Ando, *Waiting to Be Protected Under the Endangered Species Act: The Political Economy of Regulatory Delay*, 42 J. L. & Econ. 29 (1999); Andrew Metrick & Martin L. Weitzman, *Patterns of Behavior in Endangered Species Preservation*, 72 Land Econ. 1 (1996); David S. Wilcove, Margaret McMillan, & Keith C. Winston, *What Exactly Is an Endangered Species? An Analysis of the U.S. Endangered Species List, 1985-1991*, 7 Conservation Biology 87 (1993); U.S. General Accounting Office, *Endangered Species: Factors Associated with Delayed Listing Decisions* (1993); Steven L. Yaffee, *Prohibitive Policy: Implementing the Federal Endangered Species Act* (The MIT Press 1982); U.S. General Accounting Office, *Endangered Species: A Controversial Issue Needing Resolution* (1979).

99. 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, 354 (1993).

2002 biological opinion found that Project operations would jeopardize the coho, but required only that the Bureau provide roughly half the water flow NMFS thought the fish required in the mainstem Klamath.[100] While the regulatory agencies may well perceive conservation as their primary mission, they are clearly vulnerable to focused political pressure against conservation measures. In that broad sense, therefore, agency judgments appear to be less conservation-oriented than is called for by legislated societal goals.

Furthermore, limitations in the available information can lead to inaccuracies in scientific judgments, which in turn can infect regulatory decisions. Where that is the case, even if regulatory agencies summon the political courage to mandate conservation measures, those measures might not prove effective. That would obviously decrease the likelihood that societal conservation goals would be met. In addition, it would tend to erode political support, as the regulated community's losses are not balanced by conservation benefits.

It is very difficult to evaluate the accuracy of regulatory decisions, but we suspect that inadvertent inaccuracy is a far more common shortcoming than conscious overregulation, which appears quite rare. Most outside evaluations have given at least a qualified endorsement to the science behind regulatory decisions.[101] But several have noted how little information is available, and few have tried to evaluate the likelihood of conservation success. Data on the status of listed species show that many are not noticeably improving.[102] That could simply confirm that the regulatory agencies are too timid to require needed measures, it could reveal that the agencies lack authority over important threats, or it could indicate that required conservation measures are not working as expected.

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100. Natl. Marine Fisheries Serv., *Biological Opinion: Klamath Project Operations* 57 (May 31, 2002). The justification for this limitation was that the Project should only have to provide additional water in proportion to its withdrawals within the watershed. That portion of the 2002 Biological Opinion was subsequently overturned by a reviewing court, because there was no assurance that the additional water necessary to assure salmon persistence would be forthcoming. *Pac. Coast Fedn, of Fishermen's Assns. v. U.S. Bureau of Reclamation*, No. C 02-2006 SBA (July 15, 2003).

101. Independent peer reviews sought by the regulatory agencies for ESA listing decisions, critical habitat designations, and recovery plans have almost always agreed with the agency decision. U.S. General Accounting Office, *Endangered Species: Fish and Wildlife Service Uses Best Available Science to Make Listing Decisions, but Additional Guidance Needed for Critical Habitat Designations* 21–22, http://www.gao.gov/cgi-bin/getrpt?GAO-03-803 (Aug. 2003). The regulatory agencies also fare well in most NRC reviews. There have been at least six NRC reviews of specific ESA decisions. Only one, the Klamath review, has disagreed fundamentally with the regulatory action taken.

102. FWS must report every two years on the status of all species listed under the ESA. The most recent report shows 21% of listed species declining, 30% stable, and only 6% improving. The status of 39% of listed species is reported as "uncertain." U.S. Fish & Wildlife Serv., *Recovery Report to Congress, Fiscal Years 2001-2002* 16, http://endangered.fws.gov/recovery/reports_to_congress/2001-2002/report_text.pdf (not dated).

C. *How Might Regulatory Judgments Be Tied More Closely to Societal Goals?*

In theory, Congress could readily solve the problem of regulatory agencies enjoying too much discretion and failing to exercise that discretion appropriately in the service of societal goals. The statutes could be amended to be much more prescriptive. That has occurred in the pollution context. For example, when EPA moved too slowly to regulate hazardous air pollutants, Congress enacted a list of such pollutants and ordered EPA to regulate them on a specific schedule.[103] Without getting quite that prescriptive, Congress could be clearer about how agencies should treat uncertainty. It has done that, for instance, in the Clean Air Act by requiring that EPA set National Ambient Air Quality Standards that, "allowing an adequate margin of safety, are requisite to protect the public health;"[104] and in the Clean Water Act's Total Maximum Daily Load provision, which directs EPA to set TMDLs with "a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality."[105]

A legislative solution of this sort is not likely for the ESA, or for that matter the federal land management statutes or other natural resource laws. Lists are simply impractical. Numerical bounds, such as requirements that species face a prescribed extinction risk before they can be listed, are not useful in the face of very weak scientific information because extinction probabilities cannot be calculated with any accuracy. Finally, Congress has shown no interest in facing up to the political costs of making these choices explicitly. It is more politically advantageous to declare aspirational goals in ringing terms, but leave the implementing agencies with the hard task of determining the extent to which those goals will be achieved.[106]

Without openly addressing the exercise of agency discretion, however, Congress and the executive branch make numerous decisions that affect that discretion. Making effective use of scientific information in policy making is as much an institutional challenge as it is a scientific one. Decisions about how to structure agencies, advisory committees, and interactions with various constituencies, while indirect, may be the strongest tools available for controlling agency judgments.

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103. U.S.C. § 7412 (2000)
104. U.S.C. § 7409(b)(1) (2000)
105. U.S.C. § 1313(d)(1)(C) (2000)
106. *See e.g.* Wendy E. Wagner, *Congress, Science, and Environmental Policy*, 1999 U. Ill. L. Rev. 181; William H. Rodgers, Jr., *The Lesson of the Owl and the Crows: The Role of Deception in the Evolution of the Environmental Statutes*, 4 J. Land Use & Envtl. L. 377 (1989).

1. *The Choice of Decision Maker*

The first key choice is the assignment of decision making authority. Regulatory outcomes may strongly depend upon which of two or more competing agencies is delegated authority to determine what scientific information to collect, interpret, and apply. Even within a single agency, the distribution of authority can be critical.

Most obviously, if conservation is the primary goal, decision making authority must not rest with those whose economic interest depends upon development or extractive activities. Even scientific judgments must be dissociated from economic self-interest. Where the evidence is equivocal or even short of overwhelming, people tend to interpret it as consistent with their own interests.[107] Short-term self-interest can also drive management and policy judgments in directions that systematically disfavor conservation, even in the face of an apparent long-term financial interest in conservation.

A striking illustration comes from fisheries regulation in the United States, where placing the power to make initial decisions on annual quotas in the hands of the fishing industry, even subject to oversight by a regulatory agency, has been a conservation disaster. Under the Magnuson-Stevens Fishery Conservation and Management Act,[108] regional Fishery Management Councils propose annual quotas, on the basis of stock assessments performed by NOAA scientists and reviewed by scientific advisory bodies to the Councils.[109] Council membership is dominated by commercial and recreational fishing interests.[110] Quotas must be based on the best available scientific evidence.[111] They are supposed to prevent overfishing or, in the case of already overfished stocks, provide for recovery to maximum sustainable yield. In two case studies, Eagle and Thompson found that regulatory judgments contributed to significant overfishing.[112] In one of their two case studies, the initial scientific assessments appeared to be reasonably accurate, but the regional Council systematically proposed quotas either above those recommended by the scientific advisory bodies or at the very top of the range deemed scientifically plausible. In the other, the scientists appear to have systematically overestimated the available catch,

107. *See e.g.* Jeffrey J. Rachlinski, *The Psychology of Global Climate Change*, 2000 U. Ill. L. Rev. 299, 305; Russell B. Korobkin & Thomas S. Ulen, *Law and Behavioral Science: Removing the Rationality Assumption from Law and Economics*, 88 Cal. L. Rev. 1051, 1093 (2000).

108. U.S.C. §§ 1801 - 1883 (2000).

109. *See* Josh Eagle & Barton H. Thompson, Jr., *Answering Lord Perry's Question: Dissecting Regulatory Overfishing*, 46 Ocean & Coastal Mgmt. 649, 654-55 (2003).

110. *Id.*; Natl. Marine Fisheries Serv., *1999 Report to Congress on Apportionment of Membership on the Regional Fishery Management Councils* (2000).

111. U.S.C. § 1851(a)(2) (2000).

112. Eagle & Thompson, *supra* n. 109, 655.

and in addition the Council exceeded their recommendations for several years.[113]

Financial conflicts are not the only source of biases that can skew regulatory judgments. Agency mission and culture can have a similar effect. It is not surprising, for example, that FWS and the Bureau of Reclamation came to very different conclusions about the needs of the endangered suckers in the Klamath Basin based on the same underlying data. Experts are no more immune to interpretive biases than lay persons.[114] Recent news coverage of the Food and Drug Administration's drug review process illustrates the extent to which the perceived organizational mission can override individual views. A survey conducted by the Inspector General of the Department of Health and Human Services found that nearly one in five FDA scientists had felt pressured to recommend approval of a new drug against their own best judgment.[115]

The extent to which decisions are centralized or decentralized may also be important, as may the geographic location of the office where decisions are made. Greater decentralization is likely to weaken the extent of control exercised by the political appointees at the top level of agency administration. Central political control will be especially difficult to maintain if judgments are delegated to the field office level, where they will be made by career employees rather than political appointees.[116] The substantive effect of such weakened control will depend, obviously, on both the views of the administration and those of the local agency officials.

Where the field office is located in a resource-dependent community and agency personnel tend to have long tenure in a single location, regulatory judgments made by local career employees are likely to favor local interests. That is even more true if the agency views its mission as promoting or

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113. Eagle and Thompson note in this case study that the Pacific Fishery Management Council appeared to become more conservation oriented in the early 1990s. They do not offer an explanation for the shift. *Id.* at 670.

114. *See* Natl. Research Council, *Understanding Risk: Informing Decisions in a Democratic Society* 11-13 (Paul C. Stern & Harvey V. Fineberg, eds., Natl. Academy Press 1996); Daniel Kahneman & Amos Tversky, *Subjective Probability: A Judgment of Representativeness*, in *Judgment Under Uncertainty: Heuristics and Biases* 32, 46 (Daniel Kahneman, Paul Slovic, Amos Tversky, eds., Cambridge U. Press 1982); Daniel Kahneman & Amos Tversky, *On the Psychology of Prediction*, in *Judgment Under Uncertainty: Heuristics and Biases* 48, 68 (Daniel Kahneman, Paul Slovic, Amos Tversky, eds., Cambridge U. Press 1982).

115. Dept. of Health and Human Servs., Office of Inspector General, *FDA's Review Process for New Drug Applications: A Management Review* 12 http://oig.hhs.gov/oei/reports/oei-01-01-00590.pdf (Mar. 2003).

116. The Army Corps of Engineers, for example, which administers the Clean Water Act's wetlands filling permit provisions, is highly decentralized. A recent General Accounting Office study found that district offices, which are responsible for most decisions to assert federal jurisdiction over wetlands, interpreted the scope of federal jurisdiction very differently. General Accounting Office, *Waters and Wetlands: Corps of Engineers Needs to Evaluate Its District Office Practices in Determining Jurisdiction*, http://www.gao.gov/new.items/d04297.pdf (Feb. 2004). The Bush administration has tried to exert tighter control over decisions to regulate at the boundary of federal authority by issuing a memorandum requiring that such decisions be elevated to Corps headquarters in D.C. *Id.* at 14 n. 14.

supporting local industry. The Bureau of Reclamation, for example, in its 2001 biological assessment for operation of the Klamath Project, interpreted the scientific evidence to permit water deliveries to Project irrigators that would reduce lake levels and river flows below historic minimums. The Bureau has long perceived irrigators served by its projects as its clients, and it works hard to satisfy their needs.[117] Compounding that mission orientation, the biological assessment was drafted by the Klamath Falls office that operates the Project. Bureau employees in Klamath Falls are likely to be acutely aware of the social value of agriculture to the local community, and have absorbed local beliefs about the economic value of agriculture. By contrast, the FWS and NOAA Fisheries biological opinions, which called for considerably lower deliveries to carry out their conservation missions, were prepared by employees based in Sacramento and Long Beach, respectively. Those employees were insulated by both mission and distance from the economic impacts of regulatory decisions on upper Basin agricultural interests.

Finally, the training and professional identity of the individuals who make judgments should be expected to play a role. In particular, the extent to which decision makers are trained in the natural sciences, and identify themselves as biologists, will likely play an important role in their scientific and policy judgments. On the one hand, research scientists, those with doctoral degrees or equivalent professional research experience, are likely to have strongly internalized research norms against prematurely asserting that a connection has been established between a specific action and species decline. That acculturation might work against conservation. On the other hand, those scientists who study ecology, conservation biology, or an individual endangered species tend to be unusually devoted to their work, and intensely focused on the particular area or system which they choose to study.[118] This absorption in their work tends to bring with it a correspondingly intense interest in the long-term health of the environment in general and their focal interests in particular. It may not be the norm for these scientists to be politically active, but most of them share the view that conservation is more important than economic development.[119] That view will tend to push their judgments in a more protectionist direction.

We suspect that those scientists who choose to go into agency, rather than academic, jobs, feel more strongly about protecting species, and less strongly about the norms of academic science. Thus, we would expect sci-

117. *See e.g. Rio Grande Silvery Minnow v. Keys*, 333 F.3d 1109, 1127-28 (10th Cir. 2003), *vacated*, 355 F.3d 1215 (10th Cir. 2004) (Bureau argued that its irrigation contracts left no discretion, and therefore its operations were not subject to ESA consultation requirements).

118. Gerald Holton, *The Scientific Imagination* 241 (2d ed., Harvard U. Press 1998).

119. Ecologists are more likely than the general public to assign intrinsic value to the natural world. *See* Paul A. Sabatier & Matthew Zafonte, *The Views of Bay/Delta Water Policy Activists on Endangered Species Issues*, 2 Hastings W.-N.W. J. Envtl. L. & Policy 131, 145 (1995); Ernst Mayr, *Toward a New Philosophy of Biology: Observations of an Evolutionist* 89 (Harvard U. Press 1988).

ence mandates, because they tend to strengthen the role of agency scientists relative to other career employees and political appointees, to encourage more strongly conservationist regulatory judgments. That effect should be intensified by decision making structures that give agencies with a conservation mission a strong role, such as the ESA's consultation procedures. The Bush administration, which does not favor conservation, has made considerable use of the converse approach. It has shifted decision making power away from conservation agencies to agencies with extractive missions, and has also minimized the role of conservation scientists through aggressive oversight by political appointees.[120]

2. Tools for Increasing Transparency

We explained earlier that agency scientific, management, and policy judgments may escape public oversight yet remain vulnerable to focused political pressures, because they are hidden under a veneer of scientific opacity and claims of objectivity. Any steps that make the various types of judgment that go into regulatory decisions more openly apparent should help balance the political scales. Transparency is, of course, not a panacea. Disclosure does not solve, and can even exacerbate, political conflict. But by revealing informational gaps and political judgments, it can focus the debate, and potentially reveal an expanded menu of choices.

a. *Demanding transparency through judicial review*

Transparency is difficult to achieve, given that both Congress and the agencies seem to believe that hiding their judgments is in their best political interest, and that agencies fear that candor will increase their vulnerability to judicial reversal. Courts could increase transparency by demanding clearer explanations of the policy judgments that necessarily underlie regulatory decisions, and deferring to those judgments when they are explained. For example, FWS and NOAA Fisheries have typically avoided explaining what degree of risk they regard as unacceptable in ESA listing or consultation decisions . In their Section 7 Handbook, they explain their belief that they must give the benefit of the doubt to the species when faced with data gaps.[121] In individual decisions, they do not explain to what extent they believe they are giving the benefit of the doubt to the species, or what uncertainties prompt them to do so.

Courts, which seem quite prepared to demand careful, coherent explanations of the scientific leaps that agencies make,[122] could be equally demanding with respect to policy judgments. Like the parents of teenagers, courts

120. *See* Holly Doremus, *Science Plays Defense: Natural Resource Management in the Bush Administration*, __ Ecology L.Q. __ (forthcoming 2005).

121. *Consultation Handbook*, *supra* n. 67, at 1-6.

122. *See supra* n.79.

should reinforce socially desirable behavior by rewarding candor and punishing secretiveness. Congress has done precisely that by mandating environmental review of proposed federal actions under the National Environmental Policy Act.[123] Where Congress has not directly demanded candor, courts can and should take up the slack. One good example from the natural resources context is *Fishermen's Dock Cooperative, Inc. v. Brown*.[124] A coalition of commercial fishers challenged a quota for summer flounder set by the Department of Commerce. A scientific advisory committee had selected a quota one standard deviation below the mean estimated recruitment over the previous five years. Plaintiffs claimed that the Magnuson Act's requirement for use of the best scientific data available mandated that the quota be set, instead, at the mean annual recruitment level.

The court disagreed. It noted that use of the best scientific data need not mandate "one and only one possible quota."[125] Given the uncertainty of the data, any specific quota could be attacked as arbitrary. Under the circumstances, the agency "necessarily had some discretion to decide what precise degree of assurance it would seek within the uncertainty of the data."[126] It had explained why it chose the lower quota, essentially noting that its primary goal was to stay below the target mortality and that some assumptions in the model it used could be optimistic.

The *Fishermen's Dock* decision is a good model in three respects. First, the court recognized that the best available science frequently will not point to a single, clearly identifiable management choice. Second, it realized that the selection of a particular choice within the range identified by the available science depended upon value choices. Third, the court gave the agency's decision greater deference because it had explained both the scientific and value bases for the particular choice made. Courts should also take the next step, remanding decisions where such transparency is lacking. Courts should be on the lookout for (and litigants should point out) circumstances in which regulatory decisions necessarily involve value choices. Agencies should have to explain those choices, with reference to their goals, their understanding of the degree of uncertainty in the data, and the extent to which they have employed a precautionary approach. At the same time, courts need to rein in their own tendency to interfere with agency policy judgments within boundaries left open by the legislature. Agencies must be assured that revealing their political choices will not undermine their legal position. Instead of effectively pressuring agencies to engage in a science charade, courts should provide incentives for the agencies to reveal their political choices, thereby facilitating political accountability.

123. U.S.C. §§ 4321 - 4347 (2000).
124. F.3d 164 (4th Cir. 1996).
125. *Id.* at 169.
126. *Id.* at 171.

b. *Making the Views of Scientists Public*

Requiring that the unvarnished views of agency scientists or advisory panels, as well as the final agency decision, be publicly accessible would also significantly increase transparency and accountability. Conservationists have always assumed, or at least hoped, that science mandates would strengthen the hand of conservation scientists in natural resource regulation. In practice, this effect has been limited because control of agency decisions ultimately rests with political appointees, who have proven quite willing to reject the recommendations of agency scientists. They can frequently do so with political impunity because the public lacks access to those recommendations unless they are leaked to the press.

Currently, agency scientific recommendations may not even be discoverable in litigation. Some courts have ruled that they are covered by the deliberative process privilege,[127] which protects internal pre-decision discussions in order to allow agencies to engage in frank and complete consideration of the decision. Ideally, Congress would mandate public disclosure of the recommendations or reports of agency scientists. It would be simple enough to require that agency biologists make their drafts public, and that supervisors who make or require changes in the original analysis publicly acknowledge and explain those changes. Failing congressional action, courts could exclude such recommendations or reports from the deliberative process privilege. Where Congress has directed agencies to use the best available scientific information in their decisions, the public is entitled to know what agency scientists think of the scientific data, without filtering by political appointees.

That does not mean that agency scientists must always control the ultimate decisions, or even that they can necessarily be trusted to avoid mixing policy judgments with their scientific evaluations. Scientific judgments are most likely to be accurate if they are made by scientists with both broad experience in the relevant field and specific knowledge of the corresponding system or species. But, as explained above, scientific judgments can be difficult to untangle from policy or management judgments. Delegation of policy judgments to agency scientists can be defended as a necessary counterweight to development pressures from mission-oriented agencies and financial beneficiaries. However, in the end we think that will prove a self-defeating proposition. Agencies may find ways to select for scientists who fall on the less conservation-oriented, or at least on the less activist side of the political spectrum. Alternatively, supervisors may begin to openly re-

127. *Center for Biological Diversity v. Norton*, 336 F. Supp. 2d 1155, 1161 (D.N.M. 2004); *Center for Biological Diversity v. Norton*, No. Civ. 01-409 TUC ACM (D. Ariz. July, 24 2002).

ject scientific advice because they believe that advice is deliberately skewed.[128]

We suggest that both the scientific and policy advice of agency scientists should be available to the public. This could be achieved by requiring the various judgments of agency scientists to be included in the public record, but also structuring those evaluations to separate scientific from other judgments. Even if agency scientists are just as inclined as agency politicians to hide their political judgments, and just as skilled at doing so, mandating public release of their advice should help expose those judgments. Agency decision makers who must disclose internal scientific advice counter to their ultimate decision will face political and judicial pressures to explain the discrepancy. That will give them incentives to reveal the policy judgments both in their ultimate decision and in the recommendations of their scientists.[129]

c. *Outside Scientific Review*

It is difficult to object to the concept of peer review. Outside review is widely viewed as a tool for increasing the accuracy of scientific judgments, and for holding those judgments within accepted professional boundaries. It is generally a prerequisite for publishing results in scientific journals. The Supreme Court has endorsed its role in assuring scientific credibility.[130] Reformers, particularly those from the anti-regulatory camp, have focused on requiring peer review of highly technical regulatory decisions.[131]

The journal model of peer review, however, is not an effective method of constraining regulatory judgments within the broad sideboards already established by judicial review under the APA's arbitrary or capricious standard. Journals typically send a submitted paper to several experts in the field. Reviewers evaluate the paper's quality on the basis of the methods used to collect data, statistical analyses, whether prior studies have been appropriately acknowledged, and whether claims based on the data fall within professional boundaries. Journal-style peer review is routinely

128. Eagle & Thompson, *supra* n. 109, at 669, provide data suggesting just such an effect when fishery science advisors consciously reduced their estimates of allowable catch in an effort to combat the tendency of managers to set regulatory targets too high.

129. These documents must be practically, as well as legally accessible. In their evaluation of fisheries regulation, Eagle and Thompson noted how difficult it was for them to find and dig out of the extensive record the advice of NOAA's Fishery Science Centers and regional council advisory committees on appropriate quotas. They suggested that the practical unavailability of that information might contribute to the willingness of the regional councils to ignore scientific advice. *Id.* at 676.

130. *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 593 (1993).

131. These calls for peer review often betray their antiregulatory leanings through their asymmetric structure. The Sound Science and Endangered Species Act Planning Act, HR 1662, http://walden.house.gov/issues/esa/108thcongress/108thcongressbill1662.pdf (accessed May. 18, 2005), for example, which emerged from the House Resources Committee in the 108th Congress but never made it to floor action, would have required peer review of decisions to add a species to the protected list after review, but not of decisions not to list a species, and of jeopardy but not of no-jeopardy consultation decisions.

sought on ESA listing decisions, critical habitat designations, and recovery plans.[132] It almost never finds flaws in the agency action.[133] This is not surprising. Journal-style peer review is designed to keep scientific judgments within very broad professional boundaries. The threat of judicial review and professional norms together already provide sufficient incentives to keep agencies within those broad boundaries; journal-style peer review adds very little to the equation.[134]

Appropriate outside review which generates a publicly available report can, however, make scientific, political, and even management judgments more transparent. Journal-style review is not the best model for this purpose. Review by a committee with the ability to interact with the decision makers and other interested persons would be more effective. Committee, rather than individual, review allows representation of diverse disciplines, and discussion among reviewers from various perspectives. A multidisciplinary committee is far more likely than individual experts in a single field to uncover and question the policy and management judgments agencies have used to define a problem, and to offer alternative definitions of the problem with accompanying solutions for public consideration. A review committee will be most effective at increasing transparency if it has both the opportunity to question decision makers (rather than having to rely on the written record alone), and the authority to compel responses. Of course, committee review is a resource-intensive step; it should be used only where the levels of controversy and of uncertainty justify it.[135]

The NRC's Klamath committee illustrates the benefits of a committee approach to review. Had the biological opinions been sent out by the agency for peer review, they would almost certainly have been sent to two or three experts in fish conservation, or perhaps in population viability. The

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132. *Endangered and Threatened Wildlife and Plants: Notice of Interagency Cooperative Policy for Peer Review in Endangered Species Act Activities*, 59 Fed. Reg. 34270 (July 1, 1994). The wildlife agencies apply this policy to critical habitat designations as well as proposals to add species to the protected lists.

133. *Endangered Species: Fish and Wildlife Service Uses Best Available Science to Make Listing Decisions, But Additional Guidance Needed for Critical Habitat Designations, supra.* n. 101, 21–22.

134. In 2000, Congress postponed a substantive response to calls to reform the U.S. Army Corps of Engineers by directing the National Academy of Sciences to undertake a study of the efficacy of independent peer review of Corps feasibility reports on proposed water projects. The resulting study, Natl. Research Council, *Review Procedures for Water Resources Project Planning* (Natl. Academy Press 2002), provides a thoughtful analysis of the need for new forms of independent review of science-based judgments.

135. It is difficult to prescribe blanket rules for the appropriate use of intensive committee-style peer review. Perhaps the current practice of seeking NRC review when a decision is sufficiently controversial to need the added credibility that review can provide is as good a method as any other. J.B. Ruhl has tried to explore in more detail and on a more general level the question of when the benefits of any kind of peer review of ESA regulatory decisions will outweigh its costs. J.B. Ruhl, *Prescribing the Right Dose of Peer Review for the Endangered Species Act*, 83 Neb. L. Rev. 398 (2005). He suggests peer review of decisions with very high economic costs (exceeding $100,000,000) and some random samples of other decisions. We would add that high-intensity peer review is appropriate only if the decision is characterized by a high level of uncertainty.

NRC committee included not only experts in these areas, but also a limnologist, a resource economist, a forest biologist, a consulting engineer, a geomorphologist, a law professor, and others.[136] That make-up both qualified the committee to take a broad look at the system and virtually guaranteed that it would do so. The chairman of the Klamath committee had extensive experience with the review of politically-charged government research.[137] The committee's final report documented a variety of actions, both past and present, within the Klamath watershed that have contributed to the decline of the listed species, and a similar range of steps that might help move those species toward recovery. It is highly unlikely that individual peer reviewers, no matter how dedicated, would have brought such a broad view of the problem to their task.

Effective outside reviews can also spur learning, by inspiring new thinking, demanding accountability, and highlighting gaps in the existing data base that could be filled. That seems to be one positive outcome of the Klamath NRC review. The committee's final report included a detailed set of recommendations for research and monitoring.[138] The report triggered, for the first time, meetings focusing on the science of the upper and lower basin (unfortunately so far only separately). It remains to be seen whether sufficient resources will be devoted to these efforts, and what new information they will produce. In any event, the NRC Klamath report increased awareness of important unanswered questions.

Review committees can either be *ad hoc*, as is typical of those regularly convened by the National Research Council, or long-term, like the review committees used by the CALFED Bay-Delta Authority.[139] Where regulatory decisions are examined repeatedly over a period of years, a standing committee can better ensure that the agency does not fall into the same mistakes year after year. A standing committee, with the benefit of repeated meetings, may also have the opportunity to become better educated itself about the system over time, and to refine its interpersonal operations. On the other hand, it may be difficult to get experts to make the multi-year commitment necessary for a standing committee. Over time, members of a standing committee also may become undesirably close to the regulators (or their appointing bodies) whose actions they are supposed to be overseeing.

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136. *See Final NRC Report, supra* n. 31, at 381-84 (brief biographies of the committee members).

137. Professor William Lewis, who chaired the Klamath committee, had earlier chaired the NRC's Committee to Review the Glen Canyon Environmental Studies. That committee was charged with overseeing, over the course of nearly 10 years, the Bureau of Reclamation's study of the potential effects of changes in the operation of the Glen Canyon Dam on the Colorado River ecosystem and endangered fish species downstream. *See* Natl. Research Council, *River Resource Management in the Grand Canyon* (Natl. Acad. Press 1996). The committee's work helped convince the Bureau to consider periodic flushing flows or "controlled floods" as ecosystem restoration measures.

138. *Final NRC Report, supra* n. 31 at 345-50.

139. *See* California Bay-Delta Authority, *ISB*, http://www.science.calwater.ca.gov/sci_tools/isb.shtmlhttp://www.science.calwater.ca.gov/sci_tools/isb.shtml (accessed Jan. 29, 2005) (describing CALFED's Independent Science Board, a standing multi-disciplinary review body).

While they can be very useful in highlighting the judgments made by regulators, outside reviews can themselves serve to hide the policy judgments of the reviewers if not carefully performed and presented. Review committees should not simply be invited to critique an agency decision. They should be asked instead to: evaluate the degree of scientific support for a particular decision; identify gaps or weaknesses in the available data; highlight what interpretive judgments were made and how the agency dealt with uncertainty; quantify, at least roughly, the likelihood of errors associated with too much or too little regulation; and consider what value additional data would carry for the regulatory decision. Explicitly charging the review committee with revealing policy judgments made in the course of the regulatory process should discourage the committee from simply substituting its own policy views for those of the regulatory agency under the guise of scientific review. It could also help avoid mischaracterization and misunderstanding of the review. The most troubling aspect of the Klamath NRC review was the way the committee's interim report was portrayed as showing that the regulatory agencies had engaged in "junk science." Had the committee been more conscious of distinctly separating its review of the scientific support for the regulatory decisions from review of the decision itself, its interim report might have been less vulnerable to such misuse.

It is also important that outside review not turn into a fly-specking exercise. No decision is perfect, especially when made in the face of limited information. Outside reviews by "hired guns" often devolve into exercises in identifying every small criticism to which the decision might be subject, even if those flaws had no discernible impact on the decision. Regulatory decisions, because of the notice and comment procedure prescribed by the APA, are always subject to that kind of review if there is an interested party with the resources to finance it. When submitted as mere comments on a rule making, those criticisms do not carry the authority of an independent scientific review. In committee review, however, interested parties can bury the committee with those sorts of criticisms, hoping to overwhelm the committee into adopting their agenda.[140] The review will be most useful if committee members are both capable of viewing the decision at a broad level, and inclined to do so. The committee charge can help to insure that attitude, but it is also important that committee members be selected not only for their independence and specific expertise but also to some extent for their ability to see the larger picture. We believe the NRC selection process seeks that quality, although it is not infallible.

Finally, outside reviews may by their very nature carry more credibility than they deserve. Outside reviewers may be expert in fields implicated by

140. Professor Doremus experienced this kind of trivial data overload as a member of an NRC committee reviewing ESA decisions in the Platte River basin. A consulting firm hired by water users sought to overwhelm the committee with detailed, but ultimately unimportant, criticisms of the regulatory agency's conclusions about the Platte's channel dynamics.

a regulatory decision, but they will frequently be relative newcomers to the details of the particular system. While they can provide a valuable perspective, they might easily miss or misunderstand important details. Just as the authors of journal articles have the opportunity to respond to negative reviews, regulatory agencies should have the opportunity to respond to external reviews. Reviews of regulatory decisions should move the conversation forward, not automatically supply the final word.

3. *Strengthening the Institutional Role of Science*

We also believe that agencies can be structured to strengthen the institutional role of science, not merely that of conservation-minded scientists. The CALFED Bay-Delta program has made a deliberate effort to do just that. The key elements are a science program independent of any regulatory function, led by a strong director with impeccable scientific credential, and standing advisory panels of outside experts who regularly interact both with the science program and with the agency's regulatory arms. Strong and credible agency science, aided by committed outside reviewers, can increase the accuracy and transparency of agency regulatory decisions, as well as generate the added bonus of promoting effective and efficient learning, which will more closely constrain scientific judgments over time.

The CALFED experience also shows the difficulty of making that structure effective over the long run. Substantial resources must be devoted to the scientific enterprise; just as CALFED has struggled overall to maintain sufficient funding, the Science Program has struggled to obtain the resources promised in the original Record of Decision. The political benefits of spending on research will often be less attractive than spending on "pork-barrel" restoration projects whose effectiveness is never subjected to close scrutiny. Furthermore, outside review by CALFED's standing panels is hard work. The most recent report by the Environmental Water Account panel reveals the frustrations of the reviewers with their inability to control the review agenda, which has left much of their time at the mercy of agency presentations that can be more self-serving than informative.[141] In order to be most effective, outside review panels should themselves control the agenda of presentations (as NRC panels do), should be involved in the assembly of review materials prior to their meetings, and should be supported by an agency supervisor with the authority to demand that their recommendations be followed.

141. *See* 2004 EWA Review Panel, *Review of the 2003-04 Environmental Water Account (EWA)*, http://science.calwater.ca.gov/pdf/ewa/EWA_technicalhttp://science.calwater.ca.gov/pdf/ewa/EWA_technical_review_final_011705.pdf (Jan. 17, 2005). Professor Doremus served on the CALFED EWA review panel for three years, until she concluded that the committee's limited impact on agency attitudes and actions did not justify the time and effort its members were expending.

V. CONCLUSION

Science is a necessary element of natural resource management decisions, but it is rarely decisive. The available scientific information is hardly ever sufficient to objectively determine those decisions. Substantial doses of judgment are needed to interpret incomplete information, identify elements of the regulated system most likely to respond to management intervention, and clarify the goals of regulation. Those judgments simply cannot be removed from the equation, and in most cases they, rather than the underlying data, are determinative. Rather than demanding perfectly rational regulatory decisions, those seeking reform of regulation (from either side of the political spectrum) would be better served by a closer examination of the judgments that go into regulatory decisions.

Those critical judgments are only very loosely constrained, allowing the regulatory agencies substantial discretion to exercise their biases and policy preferences. The extent of the range of judgments allowed by existing legislation and regulation is strikingly illustrated by the ability of the Bush administration to halt and reverse many Clinton administration conservation efforts.[142] Courts and the conventional political process have not been very effective in overseeing these regulatory judgments, in large part because the technical nature of the decisions allows many of them to be hidden. Unrealistic demands for perfect scientific, objective decision making will only exacerbate this problem by driving judgments further underground.

Congress could act to more closely constrain agency regulatory judgments, but is not likely to do so. We suggest that any steps that either make the variety of judgments that go into these decisions more transparent or encourage focused acquisition of relevant data will help put sideboards on agency judgments, making it more likely that society's substantive conservation goals will be met. Courts could help force regulatory judgments into the open through conscious application of existing hard-look review. Peer review by independent experts, appropriately conducted, can both expose regulatory judgments and encourage learning. Institutional structures that encourage agencies to focus on what they do and do not know about the systems they regulate can also have a role.

Because judgments will always be an important part of natural resource management, we believe the institutions responsible for management and regulation should be consciously designed and evaluated with an eye to the effect of agency structure on those judgments. It clearly matters how decision making authority is divided between agencies with conservation missions and those with extractive or development missions. It matters whether and how the extent of uncertainty in the information supporting regulation is made apparent to the political community. It matters whether

142. *See generally* John D. Leshy, *Natural Resources Policy in the Bush (II) Administration: An Outsider's Somewhat Jaundiced Assessment*, 14 Duke Envtl. L. & Policy Forum 347, 352-54 (2004).

regulatory decisions are subject to outside review, by whom, and how that review is structured. All of these institutional factors, and others, matter not because they will facilitate or impede perfect scientific decision making, but because they will inevitably affect the way judgments are made. The debate over natural resource management and regulation needs to be expanded beyond the futile search for perfect rationality to encompass a more realistic discussion of how to make the best possible decisions in an inevitably imperfect world.