

An hourglass-shaped graphic with a globe in the top bulb and another globe in the bottom bulb. The hourglass is light blue and has a dark blue cap at the top. The globe in the top bulb is dark blue, and the globe in the bottom bulb is light blue. The text is centered within the hourglass.

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Report RL32992

The Endangered Species Act and "Sound Science"

Eugene H. Buck and M. Lynne Corn, Resources, Science, and Industry Division; Pamela Baldwin and Kristina Alexander, American Law Division

August 7, 2008

Abstract. This report provides a context for evaluating legislative proposals through examples of how science has been used in selected cases, a discussion of the nature and role of science in general, and its role in the ESA process in particular, together with general and agency information quality requirements and policies, and a review of how the courts have viewed agency use of science.

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CRS Report for Congress

The Endangered Species Act and “Sound Science”

Updated August 7, 2008

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**Prepared for Members and
Committees of Congress**

The Endangered Species Act and “Sound Science”

Summary

The adequacy of the science supporting implementation of the Endangered Species Act (ESA) is receiving increased congressional attention. While some critics accuse agencies responsible for implementing the ESA of using “junk science,” others counter that decisions that should rest on science are instead being dictated by political concerns.

Under the ESA, certain species of plants and animals (both vertebrate and invertebrate) are listed as either *endangered* or *threatened* according to assessments of the risk of their extinction. Once a species is listed, powerful legal tools are available to protect the species and its habitat. Efforts to list, protect, and recover threatened or endangered species under the ESA can be controversial. Some of this controversy stems from the substantive provisions of this law, which can affect the use of both federal and nonfederal lands. The scientific underpinnings of decisions under the ESA are especially important, given their importance for species and their possible impacts on land use and development.

The Fish and Wildlife Service in the Department of the Interior and the National Marine Fisheries Service in the Department of Commerce administer the ESA, and each agency has policies and requirements to ensure the integrity and objectivity of the science that underlies ESA decisions. The Information Quality Act (IQA or Data Quality Act) also imposes general requirements and has resulted in agency changes to carry out the goals of that act to maximize the quality, objectivity, utility, and integrity of information disseminated by the agencies.

In several situations, economic and social disputes have resulted from actions taken to list, protect, and recover species under the ESA. Critics in some of these disputes assert that the science supporting ESA actions is insufficiently rigorous. Others assert that in some instances decisions were political rather than scientific. Controversy has arisen over what might be the essential elements of “sound science” in the ESA process and whether the ESA might benefit from clarification of how science is to be used in its implementation. The courts have had occasion to review the use of science by the agencies, which generally must show their decisions were not arbitrary and rest on credible science. For some purposes, even if that science considered imperfect or incomplete, but still the best available, it may be used.

Several bills affecting science as used in the ESA have been introduced in recent Congresses, but to date none have been enacted. Legislative activity in the 110th Congress is summarized in CRS Report RL33779, *The Endangered Species Act (ESA) in the 110th Congress: Conflicting Values and Difficult Choices*.

This report provides a context for evaluating legislative proposals through examples of how science has been used in selected cases, a discussion of the nature and role of science in general, and its role in the ESA process in particular, together with general and agency information quality requirements and policies, and a review of how the courts have viewed agency use of science. This report will be updated as events warrant.

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The Endangered Species Act and “Sound Science”

Introduction

Recently, many situations have focused increasing congressional attention on the adequacy of the science¹ supporting implementation of the Endangered Species Act (ESA).² Some accuse agencies of using “junk science,” while others assert that decisions that should rest on science are instead being dictated by political concerns. Legislation to address the use of science was introduced in the 107th, 108th, and 109th Congresses, but did not pass. Similar legislation has been introduced in the 110th Congress.

The ESA was enacted to identify species at risk of extinction, to provide means to help such species recover,³ and to protect the ecosystems of which declining species are a part.⁴ Listings and other actions under the ESA may affect land uses and development. Endangered species are likely to reflect stressed resources or ecosystems, with various interests on all sides of the resource issues. In some situations, such as protecting salmon in the Klamath River Basin or northern spotted owl habitat in the Pacific Northwest, economic and social disputes have resulted from actions taken to list, protect, and recover species under the ESA. As a result, the protective posture of the ESA⁵ and the use of science in its implementation have received renewed attention. By law, ESA decisions must have as sound a basis in science as is available, but this requirement can mean different things to different people.

The agencies that administer the ESA, the Fish and Wildlife Service (FWS) in the Department of the Interior, and the National Marine Fisheries Service (NMFS)⁶ in the Department of Commerce, have procedures and policies in place to ensure the objectivity and integrity of the science that underpins agency decisions. In addition, the Information Quality Act (IQA) resulted in guidelines from the Office of

¹ In the context of this report, “science” refers to the physical and life sciences, not the social sciences (e.g., economics).

² P.L. 93-205 (as amended), 87 Stat. 884; 16 U.S.C. §§1531, et seq. For general background on the ESA, see CRS Report RL31654, *The Endangered Species Act: A Primer*.

³ Section 3(3), 16 U.S.C. §1532.

⁴ Section 2(b), 16 U.S.C. §1531(b).

⁵ See *Tennessee Valley Authority v. Hill*, 437 U.S. 153 (1978), which discusses the history and importance of species protection under the ESA.

⁶ NMFS is also referred to as “NOAA Fisheries.”

Management and Budget (OMB) in 2001 that also relate to the quality of agency information. The agencies have responded to the IQA with additional ESA-related guidelines.

An issue in recent years has been how science is used in the ESA processes for listing species, consulting on federal actions, designating critical habitat, and developing recovery plans. Discussions during oversight hearings held on controversies concerning the Canada lynx⁷ and Klamath River Basin suckers and coho salmon⁸ focused on whether more scientific rigor is necessary in implementing the ESA. From the 107th through the 110th Congresses, bills have been introduced to require empirical or field-tested data as well as independent scientific reviews, science review boards, and increased public involvement. Questions have also been raised on how to handle situations when the *available* science is not extensive. Some suggest that considerations other than species conservation should prevail; others seek to change the current posture of the law by changing the role of “science.” For still others, efforts to amend the ESA in these regards are seen as an attempt to undermine the ESA, which they assert struck a reasonable balance on these issues, and they question whether an amendment concerning science is advisable or practical. These considerations are complicated by the costs and time required to acquire more extensive data, particularly in connection with many lesser-known species. Many rare and endangered species are little studied because they are hard to find or because it is difficult to locate enough of them to support scientific research. In addition, restrictions on activities that might affect listed species could discourage some research.

This report approaches the complex issues surrounding “sound science” by discussing (1) recent controversies; (2) the role of science in general — what science is, and what it can and cannot do — as background for assessing the adequacy of science in ESA implementation; (3) the role of science in the legal and policy ESA context; (4) current requirements on the quality and use of information and science by FWS and NMFS; and (5) legislation to address concerns relating to ESA science.

⁷ On March 6, 2002, the House Resources Committee held an oversight hearing on the interagency Canada lynx survey regarding alleged misrepresentation of data by biologists. See [http://frwebgate.access.gpo.gov/cgi-bin/useftp.cgi?IPaddress=162.140.64.21&filename=78011.pdf&directory=/diskc/wais/data/107_house_hearings] for more information.

⁸ On March 13, 2002, the House Resources Committee held an oversight hearing on two federal biological opinions on endangered and threatened fishes in the Klamath River Basin. In response to these biological opinions, the Bureau of Reclamation had suspended water deliveries to many farmers in the Klamath Basin. The National Research Council released a report in October 2003 finding no sound scientific basis for key water level decisions in the biological opinions or for any other water levels. For more information, see [http://frwebgate.access.gpo.gov/cgi-bin/useftp.cgi?IPaddress=162.140.64.21&filename=78195.pdf&directory=/diskc/wais/data/107_house_hearings] and CRS Report RL33098, *Klamath River Basin Issues and Activities: An Overview*.

Questioning the Adequacy of Science in ESA Actions

Several situations have focused congressional attention on concerns about the adequacy of ESA science: (1) allegations of sample tampering in population surveys for Canada lynx; (2) National Research Council conclusions about ESA biological opinions relating to Klamath River Basin water; (3) concerns over how to treat surplus hatchery-propagated salmon; (4) Steller sea lion protection and its conflicts with North Pacific fishery management; and (5) Florida panther data.

Canada Lynx Survey

Before the Canada lynx (*Lynx canadensis*) was listed in 2000,⁹ a federal interagency group began a three-year nationwide survey of habitat in 1999 to detect the presence or absence of Canada lynx, a species then under consideration for ESA listing. This survey annually covered more than 60 sampling areas in several states. Hair samples were collected and analyzed for DNA characteristics to identify the species that left the hair samples on rubbing posts. A positive result (i.e., a “hit”) of a lynx hair sample in an area already known to be occupied lynx habitat was used to help calibrate survey effectiveness. If a hit came from habitat where lynx occupancy was unknown, tracking surveys in snow and other investigations were conducted to verify the hit. These tracking surveys and associated investigations were intended to help determine the extent and significance of lynx occurrence in the area. A conclusion that wild, resident lynx were present was not automatically made from survey hit information, since the hit could also be from feral lynx (e.g., an escapee from a lynx fur farm), pet lynx, or wild but transient lynx.

Controversy arose from media reports of possible irregularities with the collection and testing of lynx survey samples. Several federal and state researchers had submitted unplanned hair samples for testing which had not been collected naturally from the wild, to test the capability of the testing procedures.¹⁰ Some individuals feared that unplanned test samples might be used to extend the known range of ESA-protected lynx and impose additional restrictions on land owners. Concerns were also raised that media coverage may have sensationalized the situation beyond its facts.¹¹ For details, see GAO Report GAO-02-496T, *Canada Lynx Survey: Unauthorized Hair Samples Submitted for Analysis*.¹²

⁹ 65 *Fed. Reg.* 16051- 16086 (March 24, 2000) listed the species as threatened across the northern tier of 11 states from Washington to Maine, plus Utah and Colorado.

¹⁰ Testing blind reference samples is typically an important element in scientific analysis control, but submitting the unplanned samples for testing was not part of a written protocol agreement with the testing laboratory. A lack of intent to defraud may be indicated by reports that the biologists told others what they were doing, recorded the samples as being blind checks in their sample logs, and supplied sample numbers to the testing facility that were not part of the study’s coordinate system.

¹¹ Ted Williams, “Lynx, Lies, and Media Hype,” *Audubon Magazine* (May-June 2002): 24-33.

¹² Since that time, a lawsuit was filed by Defenders of Wildlife concerning listing of the
(continued...)

Klamath River Basin Water

Klamath Basin farmers contended that restrictions on irrigation water use, to benefit ESA-listed coho salmon and suckers, were not scientifically justifiable and should not have been imposed. Because of disagreements over the fundamental guidance contained in the 2001 biological opinions for these fish by FWS and NMFS for Bureau of Reclamation water programs in the Upper Klamath River Basin, the Secretary of the Interior sought and secured review of the scientific decisions contained in these biological opinions by the National Research Council (NRC).¹³ The NRC released its Interim Report from the Committee on Endangered and Threatened Fishes in the Klamath River Basin on February 6, 2002,¹⁴ and a final report on October 21, 2003.¹⁵ The Committee concluded there was neither sound scientific basis for maintaining Upper Klamath Lake levels and increased river flows as recommended in the 2001 biological opinions, nor sufficient basis for supporting the lower flows in the Bureau's original operations plan for 2001. Further, the NRC concluded that recovery of endangered suckers and threatened coho salmon in the Klamath Basin might best be achieved by broadly addressing land and water management concerns (including the Klamath dams). NRC also concluded that operation of the Klamath Project (as opposed to operation of other basin projects such as that on the Trinity River) was not the cause of a 2002 lower basin fish kill, and changes in Klamath project operations would not have prevented the fish kill.

In 2002, using the NRC Interim Report as a basis for overruling previous NMFS and FWS opinions, the Secretary of the Interior reduced Klamath Lake levels and Klamath River flows to divert water to irrigation at historic levels. The issue intensified in the autumn of 2002 when (1) approximately 30,000 chinook and threatened coho salmon died in the lower Klamath River, attributable to bacterial and protozoan infections promoted by low water levels and warm water temperatures;¹⁶

¹² (...continued)

species as threatened and specific features of its listing as Distinct Population Segments (DPSs) under ESA. See 68 *Fed. Reg.* 40076-40101, July 3, 2003, for details. In addition, Defenders also sued FWS to force designation of critical habitat. The U.S. District Court for the District of Columbia instructed FWS to propose critical habitat by November 1, 2005, and to issue a final rule for critical habitat by November 1, 2006. See 70 *Fed. Reg.* 68294-68328. To date, no designation has occurred.

¹³ Functioning in accordance with general policies determined by the National Academy of Sciences (NAS), the NRC is the principal operating agency of both the NAS and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities.

¹⁴ Committee on Endangered and Threatened Fishes in the Klamath River Basin, Board on Environmental Studies and Toxicology, Division on Earth and Life Sciences, National Research Council, *Scientific Evaluation of Biological Opinions on Endangered and Threatened Fishes in the Klamath River Basin*, Interim Report (Washington, DC: February 2002), 26 pp.

¹⁵ *Endangered and Threatened Fishes in the Klamath River Basin: Causes of Decline and Strategies for Recovery*, available at [<http://www.nap.edu/openbook/0309090970/html/>].

¹⁶ Michael Milstein, "Top Official Pledges Study of Fish Die-Off," *The Oregonian* (October 3, 2002). Others estimated the fish mortality much higher. According to the *Washington* (continued...)

(2) a federal whistleblower charged that the scientific determination of water levels needed to support threatened coho salmon in the Klamath River was changed without any biological analysis;¹⁷ and (3) Oregon State University researchers released an analysis of the NRC Interim Report, concluding that the speedy completion of this document contributed to multiple errors that detract from its scientific usefulness.¹⁸ For more detailed information on this controversy, see CRS Report RL31098, *Klamath River Basin Issues: An Overview of Water Use Conflicts*.

Hatchery Salmon

Agency scientists have distinguished between hatchery-raised and wild salmon to maximize production of naturally spawned fish, which are believed to be more vigorous and genetically diverse. These distinctions have been controversial in several respects. In 1998, Oregon Department of Fish and Wildlife personnel were videotaped using baseball bats to kill 6,000 Oregon coastal coho salmon at the Fall Creek Hatchery in the Alsea River basin. This effort to euthanize hatchery fish was undertaken as part of an effort to reestablish a strain of all natural coho salmon, in the belief that the hatchery fish could weaken the gene pool of ESA-listed wild coho salmon, which had dwindled to about 100 fish,¹⁹ and to reduce the food supply of predatory seals to the mouth of the Alsea River at Waldport. Sportsmen who valued any salmon regardless of its genetic makeup were appalled at what they considered to be wanton waste of these fish, and raised questions about the adequacy of the science supporting the decision to kill what managers considered to be surplus hatchery-propagated salmon (i.e., the numbers of salmon returning were considered by managers as exceeding their capacity to use them in a biologically reasonable way).

A court in *Alsea Valley Alliance v. Evans*²⁰ invalidated the NMFS decision to distinguish between hatchery and wild salmon for purposes of listing determinations under the ESA in instances when there was no evidence of a genetic distinction between the two stocks. The court held that the ESA allows the listing and protection of species, subspecies and distinct populations of vertebrates (with respect to salmon, NMFS uses the term *evolutionarily significant units* (ESU)), but does not authorize distinctions for listing below that level.

In response, NMFS issued a final Hatchery Listing Policy (HLP) on how to consider hatchery fish in listing determinations for Pacific salmon and steelhead

¹⁶ (...continued)

Post, 77,000 salmon died. Jo Becker and Barton Gellman, "Leaving No Tracks," *Washington Post*, June 27, 2007.

¹⁷ "NMFS Biologist Says Political Pressure Led to Watered-Down Klamath BiOp," *Endangered Species & Wetlands Report*, v. 8, no. 2 (November 2002): 12.

¹⁸ Michael S. Cooperman and Douglas F. Markle, "The Endangered Species Act and the National Research Council's Interim Judgment in Klamath Basin," *Fisheries*, v. 28, no. 3 (March 2003): 10-19.

¹⁹ See [<http://www.nwcouncil.org/library/isab/isab2001-3.htm>] for a detailed explanation of the scientific basis for this action.

²⁰ 161 F. Supp. 2d 1154 (D. Or. 2001).

species.²¹ The HLP resulted in hatchery fish being considered as part of an ESU many more times than was true in the past, but not in every instance. The HLP applied only to considering hatchery fish for the purposes of *listing* decisions.

A federal court found the HLP was not based on the best available scientific data and declared it invalid.²² The court found the HLP undermines a fundamental purpose of the ESA — to preserve natural, self-sustaining populations. The court found it scientifically questionable whether risk assessment criteria developed by NMFS for making status determinations could be applied to fish populations that included both hatchery and wild fish, since the criteria were designed to be applied only to wild fish. NMFS’s downlisting of steelhead salmon from endangered to threatened by applying the HLP was ruled invalid.

Steller Sea Lions

The western population of Steller sea lions is listed as endangered under the ESA, and their abundance has been declining for several decades.²³ Starting in late 1998, NMFS prepared three biological opinions that were based on the hypothesis that intense fishing for pollock, Pacific cod, and Atka mackerel off Alaska was causing localized depletion of these fish and therefore starving Steller sea lions. Critics among commercial fishermen argued that NMFS based its biological opinion on a scientifically untested hypothesis to make a jeopardy finding under the ESA, while NMFS insisted on a higher standard of certainty for the science, under the Magnuson-Stevens Fishery Conservation and Management Act, supporting fishery management measures to address localized fish depletion problems. In a fourth biological opinion on this fishery, NMFS took a different approach, after Steller sea lion feeding studies and population trends at some rookery sites raised questions about the localized depletion hypothesis. Litigation on this issue was settled early in 2003.²⁴ In response, NMFS (1) published an addendum to its 2001 biological opinion to clarify the effects of the fisheries on Steller sea lions and their critical habitat and (2) completed a Final Programmatic Supplemental Environmental Impact Statement and Record of Decision concerning the Alaska groundfish fishery.

Florida Panther

The Florida panther (*Puma concolor coryi*) is listed as endangered throughout its range. The species is threatened primarily by habitat loss. These losses stem from urbanization, agricultural conversion, and highway accidents. High levels of mercury

²¹ 70 *Fed. Reg.* 37204 (June 28, 2005).

²² *Trout Unlimited v. Lohn*, No. CV06-0483-JCC, 2007 WL 1795036 (W.D. Wash. June 13, 2007).

²³ For more background on this issue, see [<http://www.fakr.noaa.gov/protectedresources/stellers/default.htm>].

²⁴ *Greenpeace v. National Marine Fisheries Service*, No. C98-0492Z, Agreed Order at 2 (W.D. Wash). For a detailed discussion of this litigation, see Jerry McBeath, “Greenpeace v. National Marine Fisheries Service: Steller Sea Lions and Commercial Fisheries in the North Pacific,” *Alaska Law Review*, v. 21 (June 2004): 1-42.

contamination in prey species is also thought to be a threat, as well as genetic inbreeding in this extremely small population — roughly a few dozen animals.

A proposal in 2003 for a limestone mine within panther habitat generated an FWS Biological Opinion (BiOp) which, when issued, stated that the mine would not jeopardize the species. An FWS employee, Andrew Eller, claimed that FWS issued the BiOp knowingly using flawed science, and filed a challenge to the decision under the IQA; he claimed, among other things, that agency biologists were under orders not to find that projects would jeopardize listed species. An FWS review panel admitted some of the flaws or errors, but did not agree that the agency had pressured the scientist. In a lawsuit brought by the National Wildlife Federation, the Florida Wildlife Federation, and the Florida Panther Society, a U.S. district judge held on August 20, 2004, that the agency relied on flawed biology, and revoked the permit for the mine.²⁵ Even so, Mr. Eller was fired by FWS in November 2004; FWS cited missed deadlines and criticized his exchanges with the public. In March 2005, the agency admitted that it had violated the IQA, and in June 2005, FWS reinstated Mr. Eller at his previous salary.²⁶

General Political Influence Charges

In addition to specific claims of poor science such as those cited above, there have been claims of more general interference in scientific decisions under ESA. Among the most recent and high-profile claims are charges that a former deputy assistant secretary at the Interior Department, as well as other DOI officials, were responsible for changing a number of decisions that had been supported by career staff. The DOI Inspector General (IG) found that the official, Julie MacDonald, had interfered with scientific determinations regarding endangered species. Ms. MacDonald resigned shortly thereafter. In a hearing before the House Committee on Natural Resources on July 31, 2007, the DOI deputy inspector general, Mary Kendall, said that DOI did not investigate allegations of Vice-President Cheney's involvement in some of the decisions, but would have done so if it had been aware of the allegations at the time. Some Republican Members of the committee argued that even if the involvement occurred, the contacts would not have been improper.²⁷

As a result of the IG investigation and the resignation, FWS is reconsidering decisions concerning seven species: white-tailed prairie dog, Preble's meadow jumping mouse, Hawaiian picture-wing fly, arroyo toad, southwestern willow flycatcher, California red-legged frog, and Canada lynx. The reconsideration came after FWS regional directors reported that Ms. MacDonald influenced the outcome without a scientific basis. On August 30, 2007, the Center for Biological Diversity filed a notice of intent to sue DOI, claiming interference with decision-making

²⁵ *National Wildlife Federation v. Norton*, 332 F. Supp. 2d 170 (D. D.C. 2004).

²⁶ For background on the Eller controversy, see John Heilprin, "Agency: Data on Panthers Flawed," *Associated Press*, March 21, 2005; and Manuel Roig-Franzia, "Biologist Rehired by the U.S. Fish and Wildlife Service," *Washington Post*, July 6, 2005, p. A15.

²⁷ "Endangered Species Official Says Misconduct Casts 'Cloud' Over Scientific Integrity of Interior Program," *Daily Environmental Report (BNA)*, August 1, 2007, p. A-6.

concerning 55 listed species. Claims concerned primarily FWS elimination of designated critical habitat in a number of states, but also decisions to de-list or down-list some species, and not to list others.²⁸ Pressure cited for the decisions were primarily by Ms. MacDonald, but other DOI officials were also named in the notice.

Science: The Interaction with Policy

“Science” or “sound science” is held up as desirable by all sides of the ESA debate. Some studies are seen as supporting a certain action by one party, and as insufficient for decision-making by another. And at times, other studies are held up as supporting opposing sides. With these apparent contradictions, it is useful to examine, in an ESA context, (a) what is “science;” (b) what is the scientific method; and (c) how do science and public policy interact?

What Is Science?

The National Academy of Sciences has given a fairly typical definition of science:²⁹

Science is a particular way of knowing about the world. In science, explanations are limited to those based on observations and experiments that can be substantiated by other scientists. Explanations that cannot be based on empirical evidence are not a part of science.

Science therefore is not simply an aggregation of facts unconnected with each other; rather, science is a way of examining phenomena to produce explanations of the “why” and “how” of these phenomena. Terms used in describing the nature of science include scientific fact, scientific hypotheses, and scientific laws and theories.³⁰ Scientific knowledge is dynamic, changing as new information becomes available. In this sense, science does not reveal “truth,” so much as produce the best available or most likely explanation of natural phenomena, given the information available at the time; in many cases, analysis of the data may even give an estimate of the degree of confidence in the explanation. Moreover, scientific conclusions naturally depend on the questions that are asked. For instance, the question of whether an action is likely to jeopardize the continued existence of a species in the next 10 years might have a different answer than if the time in question is the next 100 years.

²⁸ “Enviros Threaten Legal Action on Behalf of 55 Endangered Species,” *Environmental News Service*, August 30, 2007.

²⁹ National Academy of Sciences, *Science and Creationism: A View from the National Academy of Sciences, Second Edition* (Washington, DC: National Academy Press, 1999), p.1. (Hereinafter referred to as *Science & Creationism*.)

³⁰ In scientific inquiry, a *fact* means that the observation has been repeatedly confirmed and is considered true. A *hypothesis* provides a tentative statement that can be tested. A *law* is a descriptive generalization about how some aspect of observable reality behaves under stated circumstances. A *theory* is a well-substantiated explanation of some aspect of observable reality that can incorporate facts, laws, inferences, and tested hypotheses. *Science & Creationism*, p.1-2.

Scientific Method

The *scientific method* is the heart of science, and has been defined as

Investigating a system by formulating hypotheses (educated guesses based on initial observations) about the behavior of the system, then making predictions based upon these hypotheses, and finally designing experiments (or making observations) to test these predictions. After several tests validate different predictions, a hypothesis becomes a scientific theory or law. This process is the basis of western science.³¹

Scientific methods may vary based on the objective and the nature of the subject matter.³² Usually, the scientific investigation begins after some casual observation about the real world (e.g., dairy maids who have had cowpox rarely contract smallpox) and an observer who wonders “why?” It begins then with a hypothesis based on observations (e.g., humans who have had cowpox are immune to smallpox). Testable predictions are made based on the hypothesis (e.g., inoculation with cowpox will prevent smallpox). Data are systematically collected and classified to test the predictions (e.g., patients were first inoculated with cowpox and then exposed to smallpox). The data are interpreted and a conclusion is drawn based on the outcome of the experiment (e.g., since the patients inoculated with cowpox did not contract smallpox, cowpox inoculations will prevent smallpox). Models (e.g., epidemiological or microbiological) may be developed to describe the phenomenon or help make predictions (e.g., the spread of the disease). Noteworthy results are often published, which usually requires scientific peer review. Once the hypothesis is considered to be thoroughly tested, it is considered or contributes to a “theory” or “law” and becomes part of the body of scientific knowledge. Even accepted theories and laws remain open to re-examination if new information arises. It is through these methods that science gives weight to the viewpoints of one scientist versus another. The work of a scientist that has not survived (or even been submitted to) this process is given less weight than the work of one that has.

Several of these elements — data collection, models, and scientific peer reviews — have become important in legislative discussions. Scientific peer reviews generally evaluate the analysis, interpretations, and conclusions developed from the

³¹ Henry W. Art (gen. ed.), *The Dictionary of Ecology and Environmental Science*, A Henry Holt Reference Book (New York: H. Holt, 1993), p. 479. The sequence of events described in the paragraph may be significantly modified where extremely long-range or long-term phenomena do not permit easy experimentation. In such instances, hypotheses must be tested in other ways. Astronomy and climatology are fields in which such problems are common, but researchers on endangered organisms also face similar challenges when the rarity of their subject precludes many experiments.

³² Basic tools in science include systematic classification, numeric measurements, controlled variation of conditions, replication of results by different observers, experimentation by isolating variables, predictions based on the law of cause and effect, mathematical analysis, and more. For more information, see *McGraw-Hill Encyclopedia of Science & Technology* (New York: McGraw Hill), v. 16 (1992): 115-117. Note, too, that there is no reason to confine this definition to western science, although this form of thinking did arise in European civilization.

data, and sometimes review the data (observable facts). Models have long been part of the scientific method; models include physical models (e.g., DNA strands or various sizes of balls to represent the solar system), mathematical formulas, computer simulation programs, and many more.³³ Models are based on stated or implicit assumptions that can usually be applied to predict outcomes based on changing different variables. As new information becomes available, models can be confirmed, modified, or discarded. With this definition, models are a seamless part of the scientific process, and science without models and modeling would be difficult to imagine. The models as well as the facts and scientific theories may in turn be cited by decision-makers.

The scientific method is not the only way of “knowing.” Traditional knowledge and common sense also play an important role. For instance, elders among Native groups may report that whales have calved in a certain lagoon as far back as their own grandparents can remember, or that certain springs in the desert have never before gone dry until recent decades. A scientist’s decades of experience with a particular species sometimes also falls into this category. Although such information has often been disregarded in the past, greater attention is now paid to it.

In addition, many common sense observations (e.g., that salmon cannot jump up rivers that contain long stretches of dry creek bed or that heavy rain across bare slopes produces sediment runoff) might merit study to quantify the observation, but not to verify it. Experience and common sense, especially when supported by scientific analyses tending in the same direction, can provide important input for ESA-related (and other) decisions.

Other Scientific Values: Transparency and Updating. The scientific method has, at its heart, two values that are strongly implied (as in the description above) but not often stated: (1) a transparent approach in which both new and old data are available to all parties; and (2) a continuing effort to update data, and therefore modify, and even reject, previously accepted hypotheses in light of new information.³⁴ Together, transparency and updating are the cleansing mechanism that

³³ More formally, a *model* can be defined as a “simplified representation of a system or structure, usually on a smaller scale than that of the original. A theoretical model is a mental construct that may be formalized into mathematical equations or verbal descriptions. If accurate, it may be used to make predictions about the original system. Models can also be physical; a flowchart is a two-dimensional model of a system, and three-dimensional models or prototypes are often made of airplanes and other vehicles in the process of development.” *The Dictionary of Ecology and Environmental Science*, p. 7. (This definition would probably have been more precise if it had said that models whose predictions prove to be false are inadequate, and the models must therefore be modified or discarded.)

³⁴ Scientific history is all but littered with famous approaches that were once widely held and later rejected (even though considered “good science” in their heyday): geological catastrophism, Lamarkian evolution, the four “humors” of medicine, Newtonian physics, Ptolomaic cosmology, etc. A transparent re-examination of these hypotheses, and a commitment to updating the information on which they were based, led to their replacement with hypotheses which more accurately explained available data. No doubt some widely
(continued...)

gradually sweeps away scientific misunderstandings and errors — a *sine qua non* for scientific advancement. Logically, then, policy decisions based on science would include a mechanism providing for a transparent policy process, and a commitment not only to review such decisions, but actually to gather new information to assure that decisions remain consistent with the best available science. On the one hand, the speed of data-gathering sometimes may exceed that of the slow regulatory process. On the other hand, lack of funding may stop data-gathering altogether. And a lack of transparency (e.g., due to fear of lawsuits or to hidden assumptions that may affect decision-making) can also lead to decisions based on science that does not meet the best-available standard.³⁵

Science and Policy

Scientists and policy-makers typically ask different kinds of questions. On the one hand, scientists deal with facts and observations along with the models and hypotheses to explain them (with some of the latter potentially useful for predicting likely future events, such as volcanic eruptions, solar flares, nuclear hazards, and rates of extinction). On the other, decision-makers usually seek to affect how the world “ought to” or “should” be. Science provides one source of input for making policy decisions that balance diverse considerations. The complexity, uncertainty, and risk associated with many ESA issues, and the predictive nature of science with its emphasis on the probability of various outcomes rather than on absolute certainty, can make the interaction of scientists and decision-makers frustrating for both. How are decision-makers to respond to a forecast that the chance of a hurricane coming ashore in a particular place in the next 24 hours is 20%? That the risk of heart disease is an additional 8 women in 10,000? That a species has a 60% chance of becoming extinct in the next 100 years?³⁶ The ESA itself does not provide clear guidance to agencies on how to address such questions. In the example of salmon, scientists have done their best to give a quantitative response. Should a salmon run with a particular level of risk be listed as endangered, threatened, a low-priority candidate, or not at all? The ESA specifies that “solely” scientific criteria may be considered in a listing decision, but what guidelines do agencies (NMFS and FWS) follow in assessing risk? The tolerance of unspecified risks invites *ad hoc* choices which may not be consistent between, or even within, the agencies. The same question of risk tolerance applies to §7 consultations regarding jeopardy.³⁷

³⁴ (...continued)

held hypotheses of our own time will be replaced in light of new data.

³⁵ For a discussion of transparency in and updating, see Doremus, Holly. “Using Science in a Political World: the Importance of Transparency in Natural Resource Regulation.” p. 143-164 in: Wagner, Wendy and Rena Steinzor (eds.) *Rescuing Science From Politics: Regulation and the Distortion of Scientific Research*. Cambridge University Press. Cambridge, UK. 2006.

³⁶ In addition, while there may be a consensus view, absolute unanimity among scientific experts, even on such seemingly simple estimates, would be fairly unusual.

³⁷ Under §7, federal agencies are required to consult with NMFS or FWS when actions they fund, authorize, or carry out may affect any ESA-listed species. This section requires all (continued...)

In the context of such decisions, where does science stop and policy begin? The indistinct boundary between science and policy can be further obscured by some scientists (usually associated with particular positions) or decision-makers who want science to provide certainty for complex policy decisions.³⁸ As a result, policy questions (e.g., how much risk to bear?) may be cast as science questions, and decision-makers may ask scientists to make what are essentially policy choices.

At first glance, it might appear that science could be completely objective and neutral. Yet scientists often have personal values that influence (consciously or unconsciously) the questions they ask, the models or experiments used, the assumptions made, and the interpretation of the results of an experiment.³⁹ Also, scientists working for various agencies, companies, tribes, and other interest groups may be influenced by policy positions of their employer. Vigorous debate is part of the essence of science, but the result can be difficult for courts and policy-makers to assess.

The influence can be quite subtle, and two examples may illustrate the problem. In a controversy over national forest management policy in Wisconsin, assumptions were incorporated into “diversity indices,” which were to be used to create a baseline against which various alternative forest plans could be measured.⁴⁰ This seemingly simple exercise, apparently grounded in science, contained an assumption which facilitated an outcome that would produce moderate to high levels of timber harvest. Specifically, the diversity indices stressed populations of habitat generalists (e.g., ruffed grouse, ground squirrels, common yellowthroats (a bird), and pileated woodpeckers, species commonly found in Wisconsin’s second growth, suburbia, and cut-over areas). By choosing such species as the measure of the alternatives, then alternatives that produced more of them would be “preferred.” Timber harvest was a major tool to promote this type of habitat, and an alternative featuring fairly high harvest levels and little old growth was chosen as the preferred option — an outcome to be expected based on the initial choice of species. Inclusion of other species dependent on deep forests (e.g., northern goshawks and barred owls) would have resulted in a different “preferred” option.

A second example, even more subtle, of the risks of unstated assumptions in scientific inquiry concerns the initial discovery of the snail darter in the Little Tennessee River. This fish was discovered by Dr. David Etnier of the University of

³⁷ (...continued)

Federal agencies to ensure that their actions are not likely to jeopardize the continued existence of any endangered or threatened species. Consultations pursuant to §7 are conducted with federal action agencies to avoid, minimize, or mitigate the impacts of their activities on listed species.

³⁸ Thomas J. Mills, “Position Advocacy by Scientists Risks Science Credibility and May Be Unethical,” *Northwest Science*, v. 74, no. 2 (2000), p.165-168.

³⁹ Depending on which assumptions are used in the technical analysis, different predictions may result from different scientists.

⁴⁰ For a discussion of the planning process at these two national forests and the associated lawsuits, see Oliver A. Houck, “On the Law of Biodiversity and Ecosystem Management,” *Minnesota Law Review*, v. 81 (April 1997): 869-979.

Tennessee in August 1973, as the controversy over the ESA and the building of the Tellico Dam was growing. He recognized it at the time as a species new to science, and not known from other locations. Two years later, the fish was listed as endangered by FWS. Eventually, the fish lay at the heart of one of the biggest controversies in the history of the ESA. The area of the fish's discovery was searched, in part, because of the proposed substantial change in the riverine habitat through the construction of a large dam.⁴¹ Years later, after the dam was completed, this species was found in small numbers at nine additional locations and in 1984 was reclassified as threatened.⁴² The subtle bias (searching that specific area rather than some others) produced a result (major controversy and ground-breaking lawsuits) that might not have occurred had all similar habitats been equally searched. Yet such problems are well known in science: one makes discoveries in the places one examines, and not in the places one doesn't.

The Information Quality Act

Recent federal statutes have affected the information federal agencies gather and use, and have located significant oversight powers in the Office of Management and Budget (OMB) through the Office of Information and Regulatory Affairs (OIRA). Section 515 of Appendix C of the Treasury and General Government Appropriations Act for Fiscal Year 2001,⁴³ generally known as the Information Quality Act (IQA) or the Data Quality Act, directs OMB to (1) issue government-wide guidelines to federal agencies to ensure and maximize the quality, objectivity, utility, and integrity of information disseminated by federal agencies; (2) establish a procedure for people to seek corrections of agency information; and (3) require periodic reports to the Director of OMB of complaints regarding agency information. OMB published final guidelines on February 22, 2002.⁴⁴ Departments and agencies were required to issue their own guidelines to achieve the information quality goals, and to establish administrative mechanisms to allow persons to request correction of information maintained and disseminated by the agency; and to report periodically on the number and nature of complaints received and how such complaints were handled.⁴⁵

⁴¹ A listing proposal may, by itself, trigger expanded scientific investigations and direct scarce resources to those species rather than to others. This additional attention and funding may also occur when an unusual habitat is threatened by development, as it did in the Tellico project.

⁴² This aspect of the Tellico Dam history was only a small part of the larger story. "Appendix B: A Chronology of Tellico" in CRS Report 90-242, *Endangered Species Act: The Listing and Exemption Processes* (archived; available upon request from the authors), presents more details on the snail darter and Tellico Dam controversy. For more on the history of Tellico and the discovery of the snail darter, see William B. Wheeler and Michael J. McDonald, *TVA and the Tellico Dam* (Knoxville, TN: University of Tennessee Press, 1986).

⁴³ P.L. 106-554 (H.R. 5658), 114 Stat. 2763A-153 and 154.

⁴⁴ 67 *Fed. Reg.* 8452 (February 22, 2002).

⁴⁵ The IQA itself and the implementing regulations seem focused on the transparency of
(continued...)

Some have applauded the IQA as likely to result in better procedures and more credible information. Others have expressed concerns that the act may be used to stymie agency action through the “correction” procedures, and that the OMB oversight might result in more political input into scientific decisions.

The OMB guidelines set out the entities to which the guidelines apply and define basic terms. *Government information* means information that is created, collected, processed, disseminated, or disposed of by an agency. *Disseminated* means agency initiated or sponsored distribution of information to the public, as opposed to another agency or in response to a Freedom of Information Act request, for example.

The purpose of the guidelines was to develop a process for reviewing the quality of information before it is disseminated. Quality includes the objectivity, utility, and integrity of information. Objectivity involves presentation and substance: whether information is presented in an accurate, clear, complete, and unbiased manner, and whether the information is accurate, reliable, and unbiased. Some of the elaboration on objectivity is very significant to the ESA context. For example, the OMB guidelines address peer review as contributing to objectivity, stating that if:

data and analytic results have been subjected to formal, independent, external peer review, the information may generally be presumed to be of acceptable objectivity. However, this presumption is rebuttable based on a persuasive showing by the petitioner in a particular instance. If agency-sponsored peer review is employed to help satisfy the objectivity standard, the review process employed shall meet the general criteria for competent and credible peer review recommended by OMB-OIRA to the President’s Management Council (9/20/2001) ... , namely “that (a) peer reviewers be selected primarily on the basis of necessary technical expertise, (b) peer reviewers be expected to disclose to agencies prior technical/policy positions they may have taken on the issues at hand, (c) peer reviewers be expected to disclose to agencies their sources of personal and institutional funding (private or public sector), and (d) peer reviews be conducted in an open and rigorous manner.”⁴⁶

The element of integrity of information is relevant to current ESA issues and accusations in that *integrity* refers to “the security of information-protection of the information from unauthorized access or revision, to ensure that the information is not compromised through corruption or falsification.”⁴⁷ Although this guideline seems to refer to unauthorized alteration of information, it may be relevant in that both sides of recent issues have accused the other of changing information to serve political ends.

⁴⁵ (...continued)

federal information, especially after the fact of its dissemination, though less so in the gathering of data. On the other hand, a commitment to updating information is only implied. See *Other Scientific Values: Transparency and Updating* above.

⁴⁶ 67 *Fed. Reg.* 8459 - 8460.

⁴⁷ *Ibid.* at 8460.

The information quality directives and policies of FWS and NMFS that predated the IQA and those that have been adopted since that act are discussed under “Agency Regulatory Requirements and Policies” below. OMB also plays a role under the Paperwork Reduction Act in that OMB must review and approve all efforts of an agency to collect information from nonfederal sources.⁴⁸

Practical Problems in Applying Science

For some obscure groups of organisms (e.g., freshwater clams, small freshwater fish species, and many insects), it may prove difficult to find sufficient experts to provide peer reviews, and these specialists often have other duties and may not be available (or willing) to serve governmental regulators in a timely manner. Also, there is the issue of compensating scientists who participate in peer reviews: currently, academic scientists reviewing documents for their eligibility for grants or for publication receive little, if any, compensation. Reviews are generally accomplished by mail, and are (by design) normally anonymous. Grafting such a system onto a contentious area which may require extensive meetings, lost time from primary research and teaching activities, and potentially the polar opposite of academic anonymity could prove difficult, or further limit the pool of willing reviewers. In addition, achieving peer review by impartial, unbiased scientists may also be an issue if the listing or action being reviewed could involve major economic factors in which the scientists have an interest (e.g., research funding, employment, etc.).

In 1998-1999, the Society of Conservation Biology (SCB), in cooperation with FWS, performed a national review of 135 recovery plans, covering 181 species listed under the ESA.⁴⁹ The National Center for Ecological Analysis and Synthesis at the University of California, Santa Barbara, reviewed the database resulting from this study.⁵⁰ It found among other things that a relatively low proportion (30%-40%) of recovery criteria were clearly based on biological information, that inclusion of academic scientists on recovery teams led to more explicit use of biological information in recovery plans, and that recovery plans developed with federal scientists only were less likely to reflect adequate attention to species biology. FWS responded to this study with ten action items to strengthen recovery planning by increasing efforts to expand the diversity of recovery plan contributors, improving the internal consistency of recovery plans, and continuing to expand ties to academic and professional communities, etc.⁵¹

⁴⁸ 5 U.S.C. §§ 1320, et seq.

⁴⁹ For more information about their methods, see [<http://www.nceas.ucsb.edu/recovery>].

⁵⁰ Leah R. Gerber and Cheryl B. Schultz, “Authorship and the Use of Biological Information in Endangered Species Recovery Plans,” *Conservation Biology*, v. 15, no. 5 (October 2001): 1308-1314.

⁵¹ Deborah T. Crouse, Loyal A. Mehrhoff, Mary J. Parkin, Diane R. Elam, and Linus Y. Chen, “Endangered Species Recovery and the SCB Study: A U.S. Fish and Wildlife Service Perspective,” *Ecological Applications*, v. 12, no. 3 (June 2002): 719-723.

Science in ESA Implementation

Issues and Background

Property rights advocates, business interests, environmentalists, scientific organizations, and federal agencies have all decried, at various times, the scientific basis of various ESA decisions. This seeming consistency is misleading, since the reasoning and objectives of the groups may be diametrically opposed. To some extent, the debate over the application of science in ESA is predictable, given the scarcity of information on many wild species and the even higher likelihood of very limited data on rare species. Some examples of questions that have surfaced in recent years that turn on matters at the dividing line between science and policy are:

- If a species' distribution is poorly known (as was the case with Alabama sturgeon), should it be listed?
- If a species' taxonomic status is a matter of dispute (as when some argued whether northern goshawks of the Rocky Mountain area were a distinct population segment), should it be protected as a "distinct population segment" under ESA?
- If a species is wide-ranging and begins, on its own, to reappear in an area it once occupied (as with a few wolves in Yellowstone), should these animals be regarded as a "resident population" for purposes of ESA?
- Should a formerly widely-distributed species (such as bald eagles) warrant protection in parts of its range, when it is still or has again become fairly abundant in other parts of its range?
- Should a species that is possibly "contaminated" with genes from other populations (as with Florida panthers) warrant protection?

More broadly, how should the federal government regulate in the inevitable absence of complete information, and what is the current posture of the ESA in this regard?

Precautionary Principle: The Two-Edged Sword? People who face job loss, or communities fearing economic instability, would probably respond that the federal government should be quite certain that the species is present (as with sturgeons), is validly distinct (as with northern goshawks), is protected over no wider an area than necessary (as with wolves), and is delisted as soon as possible (as with bald eagles and Florida panthers). Representatives of many scientific or environmental organizations would probably counter that the federal government should provide a margin of safety to recognize both the irreversibility of extinction and the frequent lack of complete information. This can best be achieved, they might add, by beginning to protect species when their populations are still sufficient to avoid drastic and expensive measures (e.g., the extensive efforts necessary for whooping cranes and Florida panthers), and by seeking to promote and protect ecological balance wherever possible.

In effect, it is the *precautionary principle* that is being invoked by these various interests. This principle, exemplified in the expression "better safe than sorry," can be loosely defined as applying to situations when potential harm is serious and

irreversible, though full scientific certainty is lacking. The precautionary principle would have regulators act to reduce (or eliminate) the harm while weighing the probable costs and benefits of acting or not acting.⁵² The precautionary principle is not the sole purview of one side of the debate: scientists would invoke it in some debates to be certain of protecting a species or its habitat, while those fearing job loss would invoke it to protect their livelihoods.

At this philosophical level, the scientific questions shade into law and policy: how should regulations be administered and on which side should the “burden of proof” lie for protection? That is, should a project be allowed to go ahead because it cannot be proven harmful to a listed species? Or should it be stopped because it cannot be proven to avoid jeopardy? For example, a dam may be proposed whose reservoir would replace some miles of rapids with still water, thereby substantially altering a large portion of some listed species’ known habitat. All sides may agree that construction of the dam would have this effect. FWS might issue a jeopardy opinion on the dam’s construction — knowing that the listed fish is found only in areas with rapids and that fish rarely tolerate this much change. FWS would argue that not only is it fulfilling its statutory obligation to “ensure” that the action would not jeopardize the species, but also that it is basing its decision on sound science — using the precautionary principle because there is not enough information to show that dam construction would be safe for the species. Supporters of the dam may ask for proof that the listed fish could not survive in the new reservoir or argue that this particular fish might not respond in the same manner as other related species that had been studied more extensively.⁵³ They may further argue that FWS’s decision is based on “bad science” — that in the face of such uncertainty, the precautionary principle would have the agency construct the dam and benefit those dependent on the reservoir’s water, rather than allow the threat to the listed fish to stop construction. Yet the underlying science is the same. In this example, the same scientific information is being used to justify opposite positions, based on different applications of the precautionary principle. And both positions would be based on the (usually false) hope that scientific certainty is even possible in policy decisions.

For many of the species facing extinction, there may be little or no information and insufficient personnel or funds available to study them, especially those species with little charisma or known economic value. What should be done in such instances? Should decisions be weighted in favor of the species, or of the users (e.g., irrigators, ranchers, builders)? The ESA does not expressly address this balancing act (and certainly not quantitatively), but considering the strongly protective purpose

⁵² For discussions of the precautionary principle, see Poul Herremoës, et al. (eds.), *Late Lessons from Early Warnings: the Precautionary Principle 1896-2000*, European Environment Agency, Report No. 22; and Vern R. Walker, “Some Dangers of Taking Precautions Without Adopting the Precautionary Principle: A Critique of Food Safety Regulation in the United States,” *Environmental Law Reporter*, v. 31 (2001): 10040-10047. A significant aspect of the debate on this issue, particularly in the regulation of pollution, is what level of knowledge is needed about potential harm to justify action.

⁵³ Note that studies to answer the questions raised by the supporters of the dam could be quite difficult, might take several seasons, and could even be impossible if the species is sufficiently rare. Yet FWS must, within a limited time, reach a biological opinion on whether the dam would jeopardize the species or adversely modify critical habitat.

of the ESA — to save and recover species — and considering the statutory requirement to use the “best ... data *available*,”⁵⁴ arguably the ESA intends that all declining species should be given the benefit of the doubt and a margin of safety provided. Many scientists feel this is the appropriate stance — that we should apply the precautionary principle to “save all the pieces (species)” since we lack the knowledge to pick and choose among species. Others counter that such protection may prove unnecessary while imposing substantial economic injury. The National Research Council concluded that the current balance between these two views in the agencies leans toward less protection:

the structure of hypothesis testing related to listing and jeopardy decisions can make it more likely for an endangered species to be denied needed protection than for a non-endangered species to be protected unnecessarily....⁵⁵

ESA Provisions on Science

The ESA requires that decisions to list a species be made “solely on the basis of the best scientific and commercial data available”⁵⁶ and after reviewing the status

⁵⁴ See the following section, “ESA Provisions on Science.”

⁵⁵ National Research Council, *Science and the Endangered Species Act* (Washington, DC: National Academy Press, 1995), p.15. Many of the issues under debate were studied, described, and discussed in this publication. (Hereinafter referred to as *Science & ESA*.)

⁵⁶ A committee report on legislation amending the ESA discussed why listing was to be solely a scientific decision and also interpreted *commercial data* as meaning trade data (e.g., landings of fish, skins sold, or export statistics). In discussing the addition of the word *solely*, H.Rept. 97-567 (1982), at pp. 19-20, states:

...The principal purpose of the amendments to Section 4 is to ensure that decisions pertaining to the listing and delisting of species are based solely upon biological criteria and to prevent non-biological considerations from affecting such decisions. To accomplish this and other purposes, Section 4(a) is amended in several instances.

Section 4(b) of the Act is amended in several instances by Section 1(a)(2) of H.R. 6133. First, the legislation requires that the Secretary base his determinations regarding the listing or delisting of species “solely” on the basis of the best scientific and commercial data available to him. The addition of the word “solely” is intended to remove from the process of the listing or delisting of species any factor not related to the biological status of the species. The Committee strongly believes that economic considerations have no relevance to determinations regarding the status of species and intends that the economic analysis requirements of Executive Order 12291, and such statutes as the Regulatory Flexibility Act and the Paperwork Reduction Act, not apply. The committee notes, and specifically rejects, the characterization of this language by the Department of the Interior as maintaining the status quo and continuing to allow the Secretary to apply Executive Order 12291 and other statutes in evaluating alternatives to listing. The only alternatives involved in the listing of species are whether the species should be listed as endangered or threatened or not listed at all. Applying economic criteria to the analysis of these alternatives and to any phase of the species listing process is applying economics to the determinations made under Section 4 of the Act and is specifically rejected by the inclusion of the word “solely” in this legislation.

Section 4(b) of the Act, as amended, provides that listings shall be based solely on the basis of the best “scientific and commercial data” available. The Committee did not change this information standard because of its interpretation of the word “commercial”

(continued...)

of the species and taking into account those efforts being made by states, political subdivisions of states, or foreign nations to protect the species. The word *solely* was added in the 1982 amendments to the ESA, to clarify that the determination of endangered or threatened status was intended to be a biological decision made without reference to economic or other “non-biological” factors which could be considered in fashioning responses once a species is listed. There is no elaboration on the meaning of the phrase elsewhere in the ESA itself or in agency regulations. Incomplete data, different interpretations among scientists, and evolving disciplines in science⁵⁷ can make the consideration of relevant science challenging for the regulatory agencies.

The decision of whether or not to list a species can be compared to diagnosing versus treating cancer: whether a patient *has* cancer should be a strictly medical decision; other factors — whether the patient can afford treatment, whether the cancer can be treated effectively, etc. — can be considered in deciding how (or even whether) to *treat* the cancer. Similarly, Congress provided that scientific data alone should be the basis for listing decisions, but other factors are to be considered in other decisions and actions under the act.⁵⁸

⁵⁶ (...continued)

to allow the use of trade data. Retention of the word “commercial” is not intended, in any way, to authorize the use of economic considerations in the process of listing a species.

The conference report on the same legislation confirms that it was the intent of both chambers that economic factors not play a role in the designation and listing of species for protection. H.Rept. 97-835 (1982) at p. 19, states:

Section 2 of the Conference substitute amends section 4 of the Act in several ways. The principal purpose of these amendments is to ensure that decisions in every phase of the process pertaining to the listing or delisting of species are based solely upon biological criteria and to prevent non-biological considerations from affecting such decisions.

The Committee of Conference (hereinafter the Committee) adopted the House language which requires the Secretary to base determinations regarding the listing or delisting of species “solely” on the basis of the best scientific and commercial data available to him. As noted in the House Report, economic considerations have no relevance to determinations regarding the status of species and the economic analysis requirements of Executive Order 12291, and such statutes as the Regulatory Flexibility Act and the Paperwork Reduction Act, will not apply to any phase of the listing process. The standards in the Act relating to the designation of critical habitat remain unchanged. The requirement that the Secretary consider for listing those species that states or foreign nations have designated or identified as in need of protection also remains unchanged.

The Committee adopted, with modifications, the Senate amendments which combined and rewrote section 4(b) and (f) of the Act to streamline the listing process by reducing the time periods for rulemaking, consolidating public meeting and hearing requirements and establishing virtually identical procedures for the listing and delisting of species and for the designation of critical habitat.

⁵⁷ For example, the science of taxonomy and systematics has been revolutionized by experimental tools acquired from both genetics and computational biology. *Science & ESA*, p. vii.

⁵⁸ For example, economic impacts and other relevant impacts *must* be considered when designating critical habitat under §4(b)(2) of the ESA (16 U.S.C. §1533(b)(2)), and the Secretary may modify a designation based on these considerations.

Science can also play a role in post-listing decisions and procedures under the ESA. For example, scientific information is used in designating critical habitat for listed species. Science also is heavily involved in the “consultation” process under § 7 of the act. During this process, an agency proposing an action ascertains whether the proposed action might affect a listed species. If the proposed action might adversely affect a listed species, FWS or NMFS renders a biological opinion on whether the action might jeopardize the continued existence of a species or result in destruction or adverse modification of critical habitat of a listed species. If so, FWS or NMFS suggests “reasonable and prudent alternatives” to the proposed agency action so as to avoid those outcomes.⁵⁹ The science that underlies these opinions and recommended alternatives must be summarized and frequently has been challenged.

Science also is used to develop habitat conservation plans and incidental take permits under §10 of the ESA, and also is a part of the development of recovery plans to bring the species to the point where the protections of the ESA are no longer needed.

Agency Regulatory Requirements and Policies

The ESA agencies have adopted various policies over the years to interpret the use of science in implementing the ESA. In addition, new policies have been established since the enactment of the IQA. The Department of the Interior promulgated information quality guidelines that are available on the FWS website (see [<http://www.fws.gov/informationquality/>]), along with specific FWS guidelines.

As discussed above, an important issue has been what to do when the available scientific information is not complete. Various FWS documents addressed this and other issues before the IQA guidelines were issued. The precautionary principle “to save all the pieces” is the position taken in the *Endangered Species Consultation Handbook*.⁶⁰ The Handbook states that efforts should be made to develop information, but if a biological opinion must be rendered promptly, it should be based on the available information, “giving the benefit of the doubt to the species,” with consultation possibly being reinitiated if additional information becomes available. This phrase is drawn from the conference report on the 1979 amendments to the ESA,⁶¹ which states that the “best information available” language was

⁵⁹ In very exceptional cases (well under 0.1%), FWS or NMFS may issue a jeopardy opinion without reasonable and prudent alternatives, i.e., the agency cannot offer a reasonable and prudent alternative that would still allow the project to go forward without jeopardizing the species or without adversely modifying its designated critical habitat. In such cases, the action agencies have two or possibly three choices: (a) drop the project; (b) apply for an exemption through §7 (generally considered a very burdensome option by federal agencies and therefore very rarely attempted); or (c) continue anyway, and risk a lawsuit if their actions are discovered.

⁶⁰ *Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities under Section 7 of the Endangered Species Act* (Washington, DC: Fish and Wildlife Service and National Marine Fisheries Service, March 1998), p.1-6.

⁶¹ U.S. House, Committee of Conference, *Endangered Species Act Amendments*, H.Rept. 96- (continued...)

intended to allow FWS to issue biological opinions even when inadequate information was available, rather than being forced by that inadequacy to issue negative opinions, thereby unduly impeding proposed actions. But the conference report also states that if a biological opinion is rendered on the basis of inadequate information, the federal agency proposing the action has the duty to show its actions will not jeopardize a species and a continuing obligation to make a reasonable effort to develop additional information, and that the statutory language “continues to give the benefit of the doubt to the species.”⁶²

In 1994, long before the enactment of the IQA, FWS and NMFS developed several interagency ESA-related cooperative policies on information standards under the ESA.⁶³ Under these policies, FWS and NMFS receive and use information from a wide variety of sources, including individuals. Information may range from the informal — oral or anecdotal — to peer reviewed scientific studies, and hence the reliability of the information can also vary. Federal biologists are to review and evaluate all information impartially for listing, consultation, recovery, and permitting actions, and to ensure that any information used by the two agencies to implement the ESA is “reliable, credible, and represents the best scientific and commercial data available.”⁶⁴ Agency biologists are to document their evaluations of all information and, to the extent consistent with the use of the best scientific and commercial data available, use primary and original sources of information as the basis of recommendations. In addition, documents developed by agency biologists are reviewed to “verify and assure the quality of the science used to establish official positions, decisions, and actions...” The extent to which agency decisions rest on adequate and objective scientific information has usually been debated.

Agencies deal with the scientific bases for decisions in other ways as well. Another joint policy notes that, in addition to the public comments received on proposed listing rules and draft recovery plans, FWS and NMFS are also to solicit expert opinions and peer review to ensure the best biological and commercial information.⁶⁵ With respect to listing decisions, the agencies solicit the expert opinions of three specialists and summarize these in the record of final decision. Special independent peer reviews can be used when it is likely to reduce or resolve a high level of scientific uncertainty.⁶⁶

OMB issued its *Final Information Quality Bulletin for Peer Review* on December 15, 2004.⁶⁷ The *Bulletin* sets out a gradation of peer review procedures depending on the degree to which the information in question is influential — stricter

⁶¹ (...continued)
697 (Washington, DC: U.S. GPO, 1979), p. 12.

⁶² *Ibid.*

⁶³ 59 *Fed. Reg.* 34271 (July 1, 1994).

⁶⁴ *Ibid.*

⁶⁵ 59 *Fed. Reg.* 34270 (July 1, 1994).

⁶⁶ *Ibid.*

⁶⁷ See [<http://www.whitehouse.gov/omb/memoranda/fy2005/m05-03.pdf>].

minimum requirements for peer review of highly influential scientific assessments are required, but significant discretion is still left to the agency in formulating peer review plans.

In some instances, FWS and NMFS procedures instituted before the *Bulletin* were considered to have satisfied the IQA. For example, in publishing its listings of Pacific salmon as threatened or endangered, NMFS referred to the 1994 joint NMFS/FWS policy on peer review,⁶⁸ which requires those agencies to solicit independent expert review from at least three qualified specialists, concurrent with the public comment period. With respect to the proposed salmon listings, NMFS sought technical review of the listing determinations “from over 50 independent experts selected from the academic and scientific community, Native American tribal groups, Federal and state agencies, and the private sector.”⁶⁹ NMFS asserted that the 1994 peer review policy and the comments received from several academic societies and expert advisory panels, collectively satisfy the requirements of the OMB Peer Review bulletin.⁷⁰

Judicial Interpretation of the Use of Science Under the ESA

As a general matter, judicial review can help ensure that agency decisions and use of scientific data are sound. Under the Administrative Procedure Act (APA), a court may set aside an agency’s decision if it is “arbitrary, capricious, an abuse of discretion or otherwise not in accordance with law.”⁷¹ “Normally, an agency rule would be arbitrary and capricious if the agency has relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise.”⁷² The agency must “examine the relevant data and articulate a satisfactory explanation for its action including a rational connection between the facts found and the choice made.”⁷³ In reviewing an agency action, the courts generally are “highly deferential” to the agency.⁷⁴ This is especially true with respect to matters, such as scientific issues, that involve the agency’s

⁶⁸ 59 *Fed. Reg.* 34270 (July 1, 1994).

⁶⁹ 70 *Fed. Reg.* 37163 (June 28, 2005).

⁷⁰ *Ibid.*

⁷¹ 5 U.S.C. §706(2)(A).

⁷² *Motor Vehicle Manufacturers Association v. State Farm Mutual Automobile Insurance Co.*, 463 U.S. 29, 43 (1983); *Okeeffe’s, Inc. v. U.S. Consumer Product Safety Commission*, 92 F.3d 940, 942 (9th Cir. 1996).

⁷³ *Motor Vehicle Mfrs., supra*, at 43; *Dioxin/Organochlorine Center v. Clarke*, 57 F. 3d 1517, 1525 (9th Cir. 1995).

⁷⁴ *Ethyl Corporation v. Environmental Protection Agency*, 541 F. 2d 1, 34 (D.C. Cir. 1976), cert denied, 426 U.S. 941 (1976).

particular expertise,⁷⁵ but the presumption of agency expertise may be rebutted where the agency decision is not reasoned and the agency fails to articulate a rational relation between the facts found and the decision made.⁷⁶ In the ESA context, the APA standards may require that regulations or agency actions be rationally related to the problems causing the decline of a species, especially when other interests are adversely affected.

Courts have elaborated on the use of science in general, and on the “best data available” language — holding, for example, that the statutory phrase does not require, and hence a court cannot order, FWS or NMFS to conduct additional studies to obtain missing data, and that the agency must rely on even inconclusive or uncertain information if that is the best available at the time of a listing decision.⁷⁷ The relevant agency cannot ignore available biological information,⁷⁸ especially if that information is the most current⁷⁹ or is scientifically superior to that on which the decision-maker relied.⁸⁰ A federal agency requesting consultation under §7 of the ESA cannot refuse to provide FWS with the “most relevant scientific data available from reputable scientists on the ground that it was not perfect” or its methodology could be criticized, because doing so would eviscerate the statutory requirement that the best available science be used.⁸¹ However, if there is a lack of science, the agency cannot rely on data that its own scientists unanimously agree is inaccurate.⁸²

Nor can one of the agencies treat one species differently from the way other similarly situated species are treated by relying on previous and inconsistent agency criteria.⁸³ The agency may not postpone listing a declining species until it is on the brink of extinction in reliance on possible, but uncertain, future actions of an agency.⁸⁴ A court also has said that “the ‘best scientific and commercial data available’ is not a standard of absolute certainty, and [is] a fact that reflects Congress’ intent that the FWS take conservation measures before a species is ‘conclusively’ headed for extinction.”⁸⁵ If FWS does not base its listings on speculation or surmise, or disregard superior data, the fact that the studies on which it does rely are imperfect does not undermine those authorities as the best scientific data available — “the

⁷⁵ *Marsh v. Oregon Natural Resources Council*, 490 U.S. 360, 377 (1989).

⁷⁶ *Maine v. Norton*, 257 F. Supp. 2d 357, 389-390 (D. Me. 2003)(internal citations omitted).

⁷⁷ *Southwest Center for Biological Diversity v. Babbitt*, 215 F.3d 58 (D.C. Cir. 2000).

⁷⁸ *Connor v. Burford*, 848 F.2d 1441 (9th Cir. 1988).

⁷⁹ *Southwest Center for Biological Diversity v. Babbitt*, 926 F. Supp. 920, 927 (D. Ariz. 1996).

⁸⁰ *Las Vegas v. Lujan*, 891 F. 2d 927, 933 (D.C. Cir. 1989).

⁸¹ *Natural Resources Defense Council v. Evans*, 279 F. Supp. 2d 1129, 1179-80 (N.D. Cal. 2003).

⁸² *Center for Biological Diversity v. Lohn*, 296 F. Supp. 2d 1223, n.13 (W.D. Wash. 2003).

⁸³ *Southwest Center for Biological Diversity v. Babbitt*, 926 F. Supp. 920, 927 (D. Ariz. 1996).

⁸⁴ *Biodiversity Legal Foundation v. Babbitt*, 943 F. Supp. 23 (D. D.C. 1996).

⁸⁵ *Defenders of Wildlife v. Babbitt*, 958 F. Supp. 670, 680 (D. D.C. 1997).

Service must utilize the best scientific ... data *available*, not the best scientific data *possible*” (emphasis added).⁸⁶

On the other hand, an agency’s response must be appropriate to the problem that agency science indicates needs to be solved; one case struck down regulations that totally banned duck hunting in an area to protect one species of duck.⁸⁷ Another case stated that low numbers of a particular species alone do not necessarily warrant listing — the reasons for the low numbers, whether the numbers are declining, and how experts view the population numbers must be considered.⁸⁸

Another court stated that the bar FWS has to clear in terms of evidence is very low, but it must at least clear it. In the context of issuing Incidental Take Permits under §10 of the ESA, this means the agency must demonstrate that a species is or could be in an area before the agency can regulate it, and must establish the causal connection between the land use being regulated and harm to the species in question; mere speculation as to the potential for harm is not sufficient.⁸⁹ FWS and NMFS basically must rely on existing regulatory mechanisms in their listing determinations,⁹⁰ and not on future, uncertain, or voluntary actions to justify a decision not to list a species,⁹¹ although cooperative efforts may be considered.⁹²

In one case, the court held that if a biological opinion lacks “meaningful analysis” so that the information supporting a determination is not available, the opinion is “inadequate,” although not necessarily invalid. However, in that case too, because the biological opinion was not “coextensive in scope” with the agency action, it necessarily failed to consider important aspects of the problem and was therefore arbitrary and capricious.⁹³ The opinion in this instance did not analyze the available data on cumulative effects of the agency action.

⁸⁶ *Building Industry Ass’n of Superior California v. Norton*, 247 F.3d 1241, 1246-1267 (D.C. Cir. 2001), *cert. denied* 2002 U.S. LEXIS 479.

⁸⁷ *Connor v. Andrus*, 453 F. Supp. 1037 (W.D. Tx. 1978).

⁸⁸ See *Southwest Center for Biological Diversity v. Norton*, Civ. Action No. 98-934, 2002 U.S. Dist. LEXIS 13661, at *35-*38 (D. D.C. July 29, 2002).

⁸⁹ *Arizona Cattle Growers Association v. United States Fish and Wildlife Service*, 273 F. 3d 1229 (9th Cir. 2001).

⁹⁰ Section 4(a)(1)(D); 16 U.S.C. §1533(a)(1)(D).

⁹¹ *Southwest Center for Biological Diversity v. Norton*, Civ. Action No. 98-934, 2002 U.S. Dist. LEXIS 13661 at *27 (D. D.C. July 29, 2002), citing: *Biodiversity Legal Foundation v. Babbitt*, 943 F. Supp. 23,26 (D. D.C. 1996) and *Oregon Natural Resources Council v. Daley*, 6 F. Supp. 2d 1139, 1153-1154 (D. Or. 1998).

⁹² *Defenders of Wildlife v. Babbitt*, 97-CV-2330, 1999 U.S. Dist. LEXIS 10366 (S.D. Cal. 1999).

⁹³ *Greenpeace v. National Marine Fisheries Service*, 80 F. Supp. 2d 1137, 1150 (W.D. Wash. 2000). In this case, data were available on the cumulative effects of the agency action, but were not analyzed.

Congressional Action

In the last decade, several bills have been introduced to address the role of science in ESA decisions. Although committee hearings have been held and some bills have been reported, none have been enacted.⁹⁴ Below are some of the fundamental issues that have been debated in these bills.

Proponents of “sound science” legislation believe that ESA amendments are necessary to rein in the perceived extremism of the ESA that allowed federal agencies to use “shoddy science” (e.g., to prevent Klamath Basin farmers from receiving the irrigation water they needed).⁹⁵ Furthermore, supporters believe amendments are needed to help those who have to deal with an “unreasonable” ESA. They claim that private property rights would be helped by these proposals because a species would have to actually be endangered to be listed and that it would be nearly impossible to use falsified data, which they charged was being done by government agencies.⁹⁶ Also, they see this legislation as improving recreational and commercial access to public lands. They claim that access to public lands is improved when ESA decisions use peer-reviewed science to protect “truly endangered species.”⁹⁷

Opponents voice concerns that “sound science” legislation is a misnomer and would substantially weaken the “best available science” used to implement the ESA and undermine the precautionary approach to protecting imperiled plants and animals.⁹⁸ They are concerned that such legislation might weaken the ESA by putting in place requirements for studies and processes that are impossible to achieve, radically weakening America’s ability to protect its threatened and endangered species and wildlands. They further believe that legislation, using the mask of “sound science,” would result in special rights for industry, and increase the costs, delays, and bureaucracy associated with implementing the nation’s most important wildlife conservation law.⁹⁹ They further claim widespread support among scientists for their views (see below.)

⁹⁴ A detailed analysis of the provisions and feasibility of these measures is beyond the scope of this report. For a list of current ESA bills with a brief description of their provisions, see CRS Report RL33779, *Endangered Species Act (ESA) in the 110th Congress: Conflicting Values and Difficult Choices*.

⁹⁵ See “Bill Challenges Environmental Extremism” at [<http://www.newsmax.com/archives/articles/2002/7/8/193618.shtml>].

⁹⁶ American Land Rights Association, “Endangered Species Bill Protects Property Rights,” press release, July 10, 2002 (available at [http://www.ewire.com/display.cfm?Wire_ID=1239]).

⁹⁷ “Endangered Species Not So Endangered,” *Blue Ribbon Magazine*, February 2003 (available at [<http://www.sharetrails.org/index.cfm?page=42&story=156>]).

⁹⁸ See the Endangered Species Coalition at [<http://www.stopextinction.org/>].

⁹⁹ Sasha Gennet, “New ESA Amendments: Sound Science or Political Shell Game?” *BioScience*, vol. 54, no. 12 (December 2004), p. 1070. Available at [<http://www.bioone.org/perl/serv/?request=get-document&issn=0006-3568&volume=054&issue=12&page=1070>].

FWS raised concerns about “sound science” legislation when testifying before the 107th Congress.¹⁰⁰

[W]e have concerns with the structural and budgetary impacts of enacting this legislation. We also believe that the Department has existing authority to implement improvements that will greatly enhance the science we use.... We believe that the additional processes added by the two bills would be costly to implement.... We are concerned that the considerable new process required in both bills will impact the Fish and Wildlife Service’s ability to provide consultations and other decisions in a timely manner and, in some cases, may compromise the Fish and Wildlife Service’s ability to meet statutory deadlines.

In July 2002, a letter from more than 300 scientists was sent to Members of Congress requesting that the “current debate over science in the ESA not lead to changes that could weaken the ESA’s provisions to stem the loss of biological resources.”¹⁰¹ They were concerned that adding requirements would cause additional delays and increase bureaucratic procedures for crucial decisions, that added peer review requirements were unnecessary, that new statutory limits on the use of scientific methods (e.g., analysis of population viability) for the collection and analysis of scientific data would reduce protection, and that policy-makers should follow the precautionary principle and take “the most prudent course of action by choosing alternatives that are not likely to harm listed species.”

¹⁰⁰ Craig Manson, Assistant Secretary for Fish and Wildlife and Parks, before the House Committee on Resources, March 20, 2002, at [<http://www.fws.gov/laws/Testimony/107th/2002/MansonESA3.20.htm>].

¹⁰¹ Ellen Paul, “Science: The Newest Political Football in the Endangered Species Game,” *BioScience*, vol. 52, no. 9 (September 2002): 792. A copy of the letter, dated July 9, 2002, was posted at [<http://www.earthjustice.org/program/wildlife/science.html>].