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LEGISLATING FOR SCIENTIFIC UNCERTAINTY: PRESERVING ADMINISTRATIVE FLEXIBILITY TO INTERPRET "SPECIES" UNDER THE ENDANGERED SPECIES ACT

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On April 19, 1995, Gerald Brannon and George Hudson, retrieved their catfish trotline on the Alabama River, and discovered they had caught a 30.6-inch, 3.7 pound sturgeon.[2] This catch revived the controversy over the listing of the Alabama sturgeon under the Endangered Species Act (ESA),[3] because the listing could cause, according to its opponents, the loss of 20,000 jobs and $11.3 billion in lost commerce on affected rivers.[4] In December of 1994, the Department of Interior had withdrawn its listing proposal, citing a lack of proof that the species still existed.[5] The recent catch resucitated not only the debate over the listing of the fish, but also the controversy over whether the Alabama sturgeon is actually a protectable "species." Some scientists had previously found that an Alabama sturgeon caught in 1993 was indistinguishable from the more abundant Mississippi River shovel-nose sturgeon.[6] The 1995 specimen has, at least, the physical characteristics of the Alabama sturgeon, but genetic tests have not been completed.[7] The U.S. Fish and Wildlife Service (USFWS) states that, until the scientific community comes to a resolution on the fish's taxonomic classification, it will continue to regard the Alabama sturgeon as a separate and protectable species.[8]

The 104th Congress, dominated by a Republican majority, intends to tackle the reauthorization of many of the key statutes in the federal environmental program. As it examines the ESA, Congress should resist the reactionary temptation to gut the substance of the statute, and should instead analyze and modify those provisions and issues which have confused its application. If Congress clarifies these issues, the political impetus to alter the substance of the Act may dissipate, leaving it to function to the benefit of the environment.

One such issue, illustrated by the controversy over the Alabama sturgeon, derives from scientific uncertainty about the proper definition of a biological species and the role of hybrid populations in ecosystem management. There is no single definition of species that encompassses every organism. Taxonomy is an artistic and interpretive science, highly dependent on one's academic training and intellectual perspective. The inevitable disputes over the classification of a group of organisms hinder sound policy-making. Further complicating the matter, advances in technology have enabled scientists to use genetic material to track the lineage of an organism. This ability has produced scientific theories

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[2]Tom Kenworthy, *One That Didn't Get Away, Catch of Rare Fish May Renew a Fight*, WASH. POST, April 24, 1995, at A1.

[3]The Endangered Species Act of 1973, 16 U.S.C. §§ 1531 - 1543 (1988).

[4]Kenworthy, *supra* note 2, at A11.

[5]*Id.* at A1.

[6]*Id.* at A11.

[7]*Id.*

[8]*Id.*

that clash with traditional notions of classification, which are predominantly based on the use of morphological and physical characteristics. The administrative process is struggling to adapt to these uncertainties, but it cannot always keep pace.

Congress may view this failure as a justification for reform, but, in reality, the administrative agencies have been "muddling through" difficult scientific debates toward a proper resolution, with nearly no legislative guidance. To interfere at this juncture would set back the endangered species program just when it was starting to devise administrative systems to handle the complexity and scientific uncertainty inherent to these decisions. The "species" controversy serves as a paradigm for this fact. Any legislative change should refrain from creating a rigid definition of "species," and should instead be flexible enough to allow the agencies to adapt to changing scientific theories.

In arguing that legislative guidelines on species definition are not the proper relief, this paper presents the scientific debates surrounding the proper definition of "species" to show that the complexity of the issue demands administrative flexibility. Several encyclopedic and noteworthy articles have already approached this subject.[9] This article, in an effort to avoid duplication, highlights those articles to demonstrate that public policy would be best served by allowing the agencies to go forward with their efforts. Because of the many facets of the debate and the ever changing nature of taxonomy, the agencies are simply the only governmental mechanism flexible enough to accommodate the public's many concerns as well as the pervasive scientific uncertainty. With the many issues born of the ESA, Congressional efforts are better spent on matters of policy, not science. If, however, Congress decides that species definition must be addressed legislatively, its mandate should allow the agencies to bend with the scientific current.

I. Reasons to Protect Biological Diversity

To a biologist, a species does not formally exist until its description has been published in a refereed scientific journal.[10] To date, 1.4 million species have been described, named and identified, and some experts estimate that between 1.5 million and 30 million species have yet to be identified.[11] Peter Hoch, of the Missouri Botanical Garden, estimates that some four thousand domestic species, both identified and unknown, are at risk of extinction by 1999.[12] The ESA seeks to provide federal protection for these at-risk species.

Three general arguments support the protection of biodiversity. First, many conservationists possess an almost religious belief that each species has an intrinsic and unquantifiable value which demands protection. This conviction, coined the "Noah

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[9]Karl Gleaves et al., *The Meaning of "Species" Under the Endangered Species Act*, 13 PUB. LAND L. REV. 25 (1992) [hereinafter "Gleaves"]. Kevin W. Grierson, Note, *The Concept of Species and the Endangered Species Act*, 11 VA. ENVTL. L. J. 463, 483 (1992); Kevin D. Hill, *The Endangered Species Act: What Do We Mean by Species?*, 20 B.C. ENVTL. AFF. L. Rev. 239 (1993); Daniel J. Rohlf, *There's Something Fishy Going On Here: A Critique of the National Marine Fisheries Service's Definition of Species Under the Endangered Species Act*, 24 ENVTL. LAW 617 (1994).

[10]Patrick Huyghe, *New-Species Fever*, AUDOBON, March-April 1993, at 92.

[11]*Id.* at 91. *See also* Charles C. Mann and Mark L. Plummer, *The Butterfly Problem: Government Protection of Endangered Species*,THE ATLANTIC MONTHLY, Jan. 1992, at 47.

[12]Mann & Plummer, *supra* note 11, at 47.

Principle" by biologist David Ehrenfield, holds that humans have a moral duty to act as a steward to the Earth and to protect the continuance of every species, down to the lowest microorganism.[13] The fact that the ESA provides a mechanism to protect all species, regardless of their stature with public opinion or economic value, reflects this belief.

Second, self-preservation alone may justify some level of species protection. The interaction among the species creates the complex system upon which humans depend, and any disturbance of this intricate web may create unpredictable and/or cataclysmic results.[14] Important ecological processes, such as air regeneration and watershed protection, rely on the interaction of many different species, and the loss of one agent species may throw off the balance of the process. Given the softness of the ecological sciences, predicting the effects of the loss of a single species proves difficult.

Finally, biodiversity also serves as a storehouse of genetic material, much of which has never been examined for utilitarian value. One example is found in Madagascar, where a plant with pink, five-petaled flowers, the rosy periwinkle (*Catharanthus roseus*), was found to produce chemicals that aid in the cure of Hodgkin's Disease and acute lymphocytic leukemia.[15] The manufacture and sale of drugs using these chemicals generates revenues of $180 million a year, not to mention the intrinsic value and economic benefit of saving human lives.[16] Startlingly, only three percent of the flowering plant species in the world have been tested for similar chemicals, and then only randomly.[17]

Short of cloning, the elimination of any species is an irrevocable occurrence. Because many of the species that will disappear have never been sampled or even identified, even the science fiction of *Jurassic Park* would fail to revive these lost species.[18] The National Biological Survey, unveiled in 1993 and the subject of much controversy, is the federal government's attempt to inventory these species before they disappear.[19] Unexpected

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[13]Mann & Plummer, *supra* note 11, at 51. *See also, Endangered Species Act Reauthorization: Hearings Before the House Subcomm. on Fisheries and Wildlife Conservation and the Envirn. of the House Comm. on Merchant Marine and Fisheries*, 99th Cong., 1st Sess. 3 (1985)(Statement of Cong. Claudine Schneider), *quoted in* Grierson, *supra* note 9, at 469.

[14]One example of this interlinking occurred in Borneo, where the government began a program of DDT spraying to eradicate mosquitos and houseflies. The DDT eliminated not only the targeted pests, but also populations of predatory wasps. The caterpillars that served as the wasps' prey devoured the populace's straw-thatch rooves. In addition, the geckos that ate the pesticide-laden housefly corpses also died; as did the cats that ate the geckos. Because of the removal of the cats from the food chain, rats swept into the villages, threatening bubonic plague. The government was forced to parachute in cats to combat the rats. ANNE & PAUL EHRLICH, EXTINCTION: THE CAUSES AND CONSEQUENCES OF THE DISAPPEARANCE OF SPECIES 93 (Ballantine Books 7th ed. 1992)(1981). *See also*, Mann & Plummer, *supra* note 11.

[15]EDWARD O. WILSON, THE DIVERSITY OF LIFE 283 (1992).

[16]*Id.*

[17]*Id.* at 285.

[18]Gregory Benford, a physicist and popular science fiction author, has suggested a massive sampling drive, at an estimated cost of $2 billion, to preserve the genetic pool. The samples would be stored in liquid nitrogen and gathered by local laborers, not scientists. Benford suggests that the samples not be identified until pulled out of the freezer. John Rennie, *Noah's Freezer; Preserving Endangered Species*, SCI. AM., Mar. 1993, at 30.

[19]Richard Stone, *Babbitt Shakes Up Science at Interior*, 261 SCI. 5124 (Aug. 20, 1993). *See also* Leslie Roberts, *Hard Choices Ahead for Biodiversity*, 241 SCI. 1759 (Sept. 30, 1988), and Timothy M. Beardsley, *Electronic Ark*, 259 BIOSCI., Dec. 1988, at 23. (Editor's note: as of presstime, Congress may not fund the NBS)

discoveries of uses of plant and animal life occur commonly,[20] and will likely continue to occur. With the gene pool diminished by species loss, the occasion for serendipity is disappearing.[21]

II. The Endangered Species Act of 1973

Swept by the green sentiments of the time, Congress passed the ESA in 1973 to strengthen the federal program for the conservation of endangered and threatened species and their ecosystems.[22] President Nixon signed the bill, providing environmentalists with a strong weapon in the fight against development. In 1978, the importance and severity of the ESA became apparent in the seminal case, *TVA v. Hill,* when the U.S. Supreme Court held that the language and purpose of the statute barred the completion of the $100 million Tellico Dam because of an imperiled fish,[23] the infamous snail darter (*Percina tanasi*).[24]

Under the ESA, if a species is listed as endangered or threatened, an array of domestic protective measures begin to operate.[25] Under Section 9, all "persons" are forbidden to "take" a listed species.[26] Section 7 requires that federal agencies "insure" that their acts and permits do not "jeopardize the continued existence" of a listed species.[27] Under Sections 1 and 7, federal agencies must "consult" with the proper lead agency[28] to utilize their powers to affirmatively protect listed species.[29] Section 7(f) further directs the lead agency to create a recovery plan to coordinate the federal agencies efforts.[30]

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[20]The case of the Pacific Yew tree stands as both a testament to the ideals of the ESA and an indictment of its methods. Burned as a scrub plant in the past, the Pacific Yew (*Taxus brevifolia*) gained notoriety after taxol, a chemical found in its bark, needles and roots, was discovered to be an effective cancer-fighting agent. Mann & Plummer, *supra* note 11, at 62. Despite historically diminished numbers and a rash of bark bootlegging, the USFWS denied a petition to list *T. brevifolia* as threatened because of insufficient scientific data and a relative abundance of Pacific Yew acreage. 56 Fed. Reg. 40854 (Aug. 16, 1991). While environmentalists often use *T. brevifolia* to illustrate the genetic pool argument, the ESA in reality fails to protect the species because its purpose "is not to provide needed supplies of drugs for medical research, but to provide for the conservation of endangered and threatened species and their ecosystems." *Id.*

[21]An interesting analogy arose in 1991, when a group of scientists mobilized to collect DNA samples from indigenous populations of humans, which were rapidly disappearing. Leslie Roberts & Ann Gibbons, *A Genetic Survey of Vanishing Peoples*, 252 SCI. 1614 (June 21, 1991).

[22]16 U.S.C. § 1531(b).

[23]Listed as endangered on an emergency basis. 42 Fed. Reg. 47506 (Nov. 10, 1975).

[24]Tennessee Valley Authority v. Hill, 437 U.S. 153 (1978). Senate minority leader Howard H. Baker, Jr., of Tennessee later pushed through legislation creating an interagency committee, the "God Squad," to resolve conflicts between the ESA and federal projects. Ironically, the God Squad found unanimously for the snail darter when first convened. Baker then guided through legislation exempting Tellico from the ESA. Snail darters were later found downstream, 48 Fed. Reg. 33328 (July 21, 1983). The species was then downgraded to "threatened" in 1984, 49 Fed. Reg. 27510 (July 5, 1984).

[25]The ESA also serves as the implementing statute for various treaties on species protection, including the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). These concerns, although important, are beyond the scope of this analysis. For discussion of CITES treatment of hybrid populations, *see* 50 Fed. Reg. 38683 (Sept. 24, 1985).

[26]16 U.S.C. § 1538(a)(1)(B), (a)(1)(C). Section 10 authorizes the Secretary to promulgate regulations providing for certain exceptions to Section 9, including the "incidental take" exception. 16 U.S.C. § 1539.

[27]16 U.S.C. § 1536(a).

[28]The Department of Interior and the Department of Commerce share delegated responsibility. 16 U.S.C. § 1532(15). Memorandum of Understanding Regarding Jurisdictional Responsibilities and Listing Procedures under the Endangered Species Act of 1973 (Aug. 28, 1974).

[29]16 U.S.C. § 1536(a)(1).

[30]16 U.S.C. § 1533(f).

Building Constituencies and Creating Conflict

The decision to list a species as endangered or threatened has far-ranging implications. The endangered species program operates with a limited amount of monetary resources (approximately $83.3 million in fiscal year 1995)[31] and each listing necessarily reduces the amount available to protect other species. Each listed species has a program built around it, with personnel assigned to conserve and rehabilitate the species. The large amounts spent on each program[32] creates a constituency willing to defend the established definition for that species.[33]

While competing among themselves for resources, these constituencies form a community of sorts, to which $4.6 billion will be committed during the 1990s.[34] Despite any internal competition, a government expenditure of this scale galvanizes this professional community against attacks from the outside.

Without a perspective of the context of these expenditures, the public may not appreciate the value of the efforts of these professionals. For example, the federal government spent over $4 million in 1990 to save the desert tortoise (*Gopherus agassizil*).[35] To the average taxpayer, this would be seen as little more than another large sum of money "wasted" by the government. When that average taxpayer discovers that a seemingly trivial "endangered species" will cost them their job because of governmental restrictions, it becomes a personal matter. The collision between the abstract goals of conservation and reality of economics inevitably creates tension.

In addition, endangered species are not always tucked away in the hinterlands. In some cases, the endangered species is found among subdivisions and farms, and the ESA effectively blocks sensible economic development to land already "tamed" by mankind. For example, the discovery of Oregon silverspot butterflies (*Speyria zerene hippolyta*) on land occupied by cows and four-wheel drives allegedly halted the development of a $100 million golf course in Gearhart, Oregon. Because the developer would have to guarantee that construction would not "take" a single one of these finger-sized reddish-brown insects, the project was abandoned, or at least so the popular press claims.[36] The USFWS asserts that its personnel helped the developer obtain an "incidental take" permit which allowed the project to go forward, but that it was abandoned because the developer was unable to satisfy local land use planning laws.[37]

The listing of the northern spotted owl (*Strix occidentalis caurina*)[38] and the determination of its critical habitat[39]dramatically illustrate the economic devastation caused by a

[31]USFWS, *Facts about the Endangered Species Act,* revised April 1995, at 1 [hereinafter "USFWS Fact Sheet"]. This amount includes significant earmarks for projects regarding NAFTA, the Everglades restoration, and the Northwest Forest Plan. *Id.*

[32]$600 thousand was spent on the Red Wolf Recovery Project in 1991 alone. John Rennie, *Howls of Dismay: If Red Wolves are Coyotes, They Could Lose Protection*, SCI. AM., Oct. 1991, at 18, 19.

[33]The system for allocating limited funds among the species is complicated and sometimes does not follow reason. Mann & Plummer, *supra* note 11, at 55-56.

[34]Mann & Plummer, *supra* note 11, at 52.

[35]Suzanne Winckler, *Stopgap Measures*, THE ATLANTIC MONTHLY, Jan. 1992, at 74, 77.

[36]Mann & Plummer, *supra* note 4, at 51.

[37]USFWS Fact Sheet, *supra* note 31, at 12.

[38]55 Fed. Reg. 26114 (June 26, 1990).

[39]57 Fed. Reg. 1796 (Jan. 15, 1992).

decision on the definition of a species under the ESA. While the Clinton Administration claims only nine thousand jobs will be lost because of its determination of the owl's critical habitat,[40] loggers predict as many as eighty-five thousand jobs lost.[41] Of course, either estimate should be added to the losses the industry has experienced in the years prior to the critical habitat designation.[42]

Interestingly, a 1990 scientific study[43] detected "no genetic difference" between the northern spotted owl and the "california" or southern spotted owl (*S.o. occidentalis*), nor a significant genetic difference between the northern and the "mexican" spotted owl (*S.o. lucida*).[44] Because the study only tested 23 genes out of tens of thousands, its value may be questionable. The scientists themselves acknowledge that the physical differences between the subspecies demonstrate some genetic differences.[45] But, as the scientists continue their study, the property rights activists and loggers cling to it as an example of government gone bad.[46]

The Definition of "Species" Under the ESA and its Legislative History

While the ESA's title speaks only to species, in reality it authorizes protection of smaller groupings of organisms, including subspecies and distinct population segments. The Endangered Species Conservation Act of 1969 was the first federal statute to protect biological species, with protection based on threatened worldwide extinction.[47] The 1973 Act added to its predecessor by including threatened as well as endangered species, and covering species in danger of extinction in a significant portion of their range as well as worldwide.[48]

The 1973 Act defined species as:

> . . . any subspecies of fish or wildlife or plants and any other group of fish or wildlife of the same species or smaller taxa in common spatial arrangement that interbreed when mature.[49]

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[40]A plan known as "Option Nine."

[41]57 Fed. Reg. 1796 (Jan. 15, 1992). Ted Gup, *It's Nature, Stupid*, TIME, July 12, 1993, at 38.

[42]According to Option Nine, 119.5 thousand jobs will remain in the Pacific Northwest's logging industry after the plan's implementation. This compares to 125.4 thousand in 1992 and 145.0 thousand in 1990. Gup, *supra* note 41, at 38. Of course, these jobs have already dwindled in the wake of U.S. District Court Judge William L. Dwyer's moratorium on logging in the region's 24 million acres of federal forestland in 1991. John H. Cushman, Jr., *Owl Issue Tests Reliance on Consensus in Environmentalism*, N.Y. TIMES, Mar. 6, 1994, at 28.

[43]Performed by ornithologist George Barrowclough and biologist Ralph Guiteirrez. Ron Judd, *California Study Unlikely to Affect Forest Dispute*, THE SEATTLE TIMES, Dec. 5, 1990, at F2.

[44]The USFWS listed the mexican spotted owl as threatened on March 16, 1993. 58 Fed. Reg. 14248 (Mar. 16, 1993). The Mexican subspecies has the largest geographic range of the three, and the Department of Interior has estimated that some 2,160 members of the subspecies remain the in the United States. Vicki Allen, *U.S. Agency to List Mexican Spotted Owl as Threatened*, REUTERS, Mar. 11, 1993. A petition to delist the mexican spotted owl was denied in 1994. 59 Fed. Reg. 15361 (Apr. 1, 1994)(no issues relating to species definition).

[45]Judd, *supra* note 43, at F2.

[46]As of March 1994, the scientists are reviewing their work using more subtle gene sequencing techniques. Gregg Easterbrook, *The Birds - the Spotted Owl: An Environmental Parable*, THE NEW REPUBLIC, Mar. 28, 1994, at 22.

[47]*See* Pub. L. 91-205 § 3(a), 83 Stat. 275 (1969). The terms "species" and "subspecies" were not defined by the 1973 Act.

[48]Gleaves, *supra* note 9, at 25. See the definition of "endangered species" and "threatened species," *infra* notes 64 and 65.

[49]Pub. L. 93-205 § 3(11), 87 Stat. 884 (1973). This definition is similar to the definition used by the Marine Mammal Protection Act of 1972, 16 U.S.C. §§ 1361-1407. Gleaves, *supra* note 9, at 28.

The Endangered Species Act Amendments of 1978 altered this original definition to its present wording, which reads:

> . . . any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.[50]

This definition allows the protection of any distinct population segments of vertebrate fish or wildlife, but not distinct population segments of plants and invertebrates.[51] The 1978 addition of distinct population segments drew upon a 1973 suggestion by Defenders of Wildlife for a more inclusive definition of species and language subsequently submitted by the National Parks and Conservation Association.[52] The 1978 Amendments failed to define either "subspecies" or "distinct population." Nowhere in the statute is the concept of hybrid populations discussed.[53]

The Endangered Species Act Amendments of 1979[54] while not altering the statutory definition of "species," served as a forum for the discussion of the coverage of "distinct population segments." Officials from the General Accounting Office criticized the possible listing of populations as endangered because of the potential for abuse.[55] While noting this weakness in the Act, Congress declined to make any changes in the statutory definition, choosing instead to rely on the wise use of discretion by the agencies.[56]

The Endangered Species Act Amendments of 1982[57] also did not alter the "species" definition. It did, however, insert a provision for the reintroduction of captured and bred species as "experimental populations,"[58] which generally receive a lower level of protection.[59] The subsection relies on geographic isolation from nonexperimental populations as a primary determinant of experimental status, although it need not be complete.[60] The legislative history of the 1982 Amendments also affirms that any species or subspecies of

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[50]16 U.S.C. § 1532(16). The definition of species under ESA begs the question of the Act's coverage of a biological species that is not broken down into taxonomic subspecies. Although obvious, this question has never been posited.

[51]This is highlighted in the Conference Report. H.R. Rep. No. 1804, 95th Cong., 2nd Sess. (1978), *reprinted in* Cong. Research Service, 97th Cong., 2nd Sess., *A Legislative History of the Endangered Species Act of 1973*, (Comm. Print 1982) at 1208.

[52]*Endangered Species: Hearings Before the House Subcomm. on Fisheries and Wildlife Conservation and the Environment of the House Comm. on Merchant Marine and Fisheries*, 93d Cong., 1st Sess. 87, at 286 (statement of Dr. John Grandy, Washington Representative, Nat'l Parks and Conservation Ass'n) and 307 (statement of Stephen R. Seater, Director of Public Relations, Defenders of Wildlife), *cited in* Grierson, *supra* note 9, at 483, notes 159 and 160.

[53]Pub.L. 95-632, 92 Stat. 3751 (1978). A hybrid population, as used in this article, includes populations of organisms which are cross-breeds between two separate but related taxonomic species or subspecies. Questions regarding the ESA usually involve hybrid populations with one listed "parent" species. The agencies were forced to approach the issue of species definition from this angle because of the particulars of questions posed.

[54]Pub.L. 96-159, 93 Stat. 1225 (1979).

[55]These criticisms were directed at both the 1973 and 1978 definition of "species." Gleaves, *supra* note 9, at 31.

[56]S.Rep. 151, 96th Cong., 1st Sess. (1979), *reprinted* in Cong. Research Service, 97th Cong., 2d Sess., *A Legislative History of the Endangered Species Act of 1973* (Comm. Print 1982) at 1396-1397.

[57]Pub. L. 97-304, 96 Stat. 1420 (1982).

[58]16 U.S.C. § 1539(j).

[59]Further inquiry of the ESA's treatment of experimental populations transcends the scope of this article.

[60]Experimental populations are those authorized for release by the provision, "but only when, and at such times as, the population is wholly separate geographically from nonexperimental populations of the same species." 16 U.S.C. § 1539(j)(1).

fish, wildlife or plants and distinct populations of vertebrate species may be listed.[61] Additionally, this legislative history indicates that only biological information is to be considered in the listing decision.[62]

The 1978 definition of "species" stands as the language guiding the crucial decision of species boundaries. According to some, the 1978 definition removes questions of taxonomy from the ESA. However, as the present debates illustrate, the 1978 attempt did not accomplish its goal.[63]

The ESA protects only those groups of organisms which have been officially listed as endangered[64] or threatened.[65] An organism only merits protection if it is a member of a "species" as defined by the Act. The ESA, however, does not use the term "species" in a purely taxonomic sense.[66] Instead, a statutory species meriting protection includes any subspecies of fish, wildlife, or plants, as well as distinct population segments of any species of vertebrate fish or wildlife which interbreed when mature. The administrative agencies have recently defined the statutory terms via policies and guidances to try to meet the demands of science and ecology. An examination of the many trends and debates in academic circles reveals a scholarly complexity which cautions against the legislative imposition of a rigid definition upon the statute, especially if it undermines the ongoing adminstrative efforts.

III. Taxonomy and Evolutionary Theory

Taxonomy, also known as systematics,[67] is the biological science of naming and classifying organisms, and is inexorably entwined with theories of evolution. Because of this relationship to evolution, the taxonomic waters are always muddied by intellectual debates that complicate a seemingly simple idea.[68] The popular press has labeled taxonomists either "splitters" or "lumpers," depending on their inclination to split various populations into separate species or lump them together into one species.[69] The reality of the intellectual debate goes much deeper.

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[61]H. Rep. No. 567, 97th Cong., 2d Sess., pt. 1 at 10 (1982). Gleaves, *supra* note 9, at 35. The legislative history of the 1988 Amendments, Pub.L. 100-478, 102 Stat. 2306 (1988), reiterates this point. H. Rep. No. 467, Report of the Comm. on Merchant Marine and Fisheries, 100th Cong., 1st Sess., at 4 (1988). Gleaves, *supra* note 9, at 36.

[62]H. Rep. No. 567, 97th Cong., 2d Sess., pt. 1 at 20 (1982). Gleaves, *supra* note 9, at 36.

[63]Grierson, *supra* note 9, at 483.

[64]The ESA defines "endangered species" as:

> any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to constitute a pest whose protection under the provisions of this chapter would present an overriding risk to mankind. 16 U.S.C. § 1532(6).

[65]The ESA defines "threatened species" as:

> any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. 16 U.S.C. § 1532 (20).

[66]Gleaves, *supra* note 9, at 26.

[67]A related area of study is phylogeny, the study of the evolution or lineage of an organism as opposed to the actual classification of the organism. The difference is subtle, but the debate whether classification should mirror phylogeny is eternal. ERNST MAYR, THE GROWTH OF BIOLOGICAL THOUGH: DIVERSITY, EVOLUTION AND INHERITANCE 232 (1992) [hereinafter "Mayr"].

[68]For a more detailed examination of the intellectual history of evolution and taxonomy, *see* ALEC L. PANCHEN, CLASSIFICATION, EVOLUTION AND THE NATURE OF BIOLOGY (1993).

[69]*Endangered Species; Political Taxonomy*, THE ECONOMIST, June 30, 1990, at 31.

Pre-Darwinian Theories

Aristotle classified animals according to certain criteria, but failed to introduce a formal classification system.[70] This distinction fell to Carl Linnaeus, an eighteenth century Swedish botanist,[71] who is recognized as the "father of taxonomy."[72] Linnaeus drew upon the work of his predecessors to formalize what has become known as the essentialist theory of taxonomy.[73] His graded hierarchy has evolved into the following:

KINGDOM
PHYLUM
CLASS
ORDER
FAMILY
GENUS
SPECIES
SUBSPECIES

Organisms are commonly called by their Genus (first letter capitalized) and their species name (eg. *Homo sapiens*). If a member of a subspecies, that name will also be used.[74]

Linnaeus based his taxonomic system on his belief that God had created each species to fit into a divine order of creation, and had created the hierarchy to apply reason to the chaos.[75] Each species was intrinsic and divine, having been "separately created," and their number had been unchanged "from the beginning."[76] The clues to the divine pattern were to be found by "straightforward identification through morphological characteristics."[77] Each species fit into a preordained link or niche in the divine plan, and it was the taxonomist's job to find the essential being of the species and place it into the plan.[78] Variation and hybridization were viewed with disfavor because they threw off the scheme and violated the ideal of the organism.[79] Modern scientific historians note that, in many respects, Linnaeus reflected the theories of natural theology that ruled his age.[80]

While becoming immensely popular because of its ease and portability,[81] the Linnean system fell into disrepute within a century, when a series of Enlightenment philosopher-scientists dethroned Linnaeus. In the place of the essentialist species concept came the

[70]Mayr, *supra* note 67, at 88.
[71]Also known as Karl Von Linne (1707-78).
[72]Hill, *supra* note 9, at 247.
[73]ERNST MAYR, PRINCIPLES OF SYSTEMIC ZOOLOGY 63-64 (1969) [hereinafter "Mayr II"].
[74]A splitter would prefer the use of the subspecies name, while a lumper would be satisfied by the mere use of the broader species name.
[75]Hill, *supra* note 9, at 248-49. PETER J. BOWLER, THE NORTON HISTORY OF THE ENVIRONMENTAL SCIENCES 162-65 (1993) [hereinafter "Bowler"].
[76]Walter J. Bock, *Species Concept*, in 12 MCGRAW HILL ENCYCLOPEDIA OF SCIENCE & TECHNOLOGY 846 (5th ed. 1982).
[77]Hill, *supra* note 9, at 248.
[78]Bowler, *supra* note 75, at 261-62.
[79]Hill, *supra* note 9, at 248-49.
[80]Bowler, *supra* note 75, at 170-72. Mayr, *supra* note 67, at 101.
[81]A taxonomist or a layman alike could open a book to classify an organism, instead of needing access to the great specimen collections found in Europe. Bowler, *supra* note 75, at 164.

"nominalist species concept," which emphasized that man, not God, made the delineation between species and that all that similar species shared was a name.[82] According to the nominalists, all groupings were mere "artifacts of the human mind."[83]

Jean Baptiste Lammarck, a French geologist,[84] revolutionized this intellectual discourse with his "theory of transformation."[85] Through his geologic studies, Lammarck had come to believe that the earth was very old, that conditions on it were ever changing, and that organisms were ever adapting to survive the changing conditions.[86] In 1809, he put forth his theory of transformation, which postulated that organisms have an inherent tendency to seek "perfection" and adapt to fit their environment.[87] Lammarck argued that adaptation resulted from the "inheritance of acquired characteristics," the theory that the characteristics that an organism obtains in its own lifetime is passed on to its offspring.[88] Lammarck was never able to prove this latter theory, but it was later called upon by opponents of Darwin's theory of natural selection.[89]

A third theory of taxonomy, empiricism, also emerged prior to Darwin.[90] This theory held that, if enough characters are ascertained and intelligently processed, no formal method of classification would be necessary because an order would naturally become apparent.[91] While most taxonomists hold to this theory to one extent or another, they cannot adhere to it in practice because the resulting classifications would be meaningless without some sort of theoretical foundation.[92]

Darwin and Evolutionary Taxonomy

Every school child learns of Darwin's theory of natural selection, formulated during a voyage on the HMS Beagle to the islands of the Pacific, including the Galapagos Islands. Beyond the tenets of natural selection, Darwin argued that classification is merely an expression of genealogy and evolution.[93] Instead of a Linnean "chain of being," Darwin asserted that taxonomic classifications should be branched, as in a family tree.[94] The thirteenth chapter of his *Origin of Species* begins:

> From the first dawn of life, all organic beings are found to resemble each other in descending degrees, so that they can be classed in groups under groups. This classification is evidently not arbitrary like the groupings of the stars and constellations.[95]

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[82]Mayr, *supra* note 67, at 263-65.
[83]Mayr II, *supra* note 73, at 68.
[84]b.1744 d.1829.
[85]First articulated in *Discours* in 1800.
[86]He proved this through a study of fossilized mollusks. Mayr, *supra* note 67, at 108.
[87]Mayr, *supra* note 67, at 108. Bowler, *supra* note 75, at 189.
[88] An example is a weightlifter's children being born with the potential to be stronger than if their father had not lifted weights. Bowler, *supra* note 75, at 190.
[89]Mayr, *supra* note 67, at 108.
[90]Mayr II, *supra* note 73, at 69-70.
[91]*Id.*
[92]*Id.*
[93]Bowler, *supra* note 75, at 259.
[94]*Id.* at 261-72.
[95]Mayr, *supra* note 67, at 209-10.

From this point began the development of evolutionary taxonomy.[96] While discarding Linnean theories of preordained niches and the ideal of the organism, evolutionary taxonomy retains the Linnean concept that taxonomy represents more than simply the imposition of names upon populations. Under evolutionary taxonomy, however, evolution has replaced the mystical as the ordering force. However, as evolutionary took hold, squabblings about the relationships between particular taxonomic families multiplied.[97] In many ways, however, today's taxonomic debates are rooted in this philosophical background.

Post-Darwinian Theories

Evolutionary taxonomy examines morphological (physical) characteristics, biogeographical references, and behavioral patterns to classify organisms. During the twentieth century, a general criticism arose that evolutionary taxonomy had become too subjective and, therefore, too random. For instance, one prominent ornithologist might list twenty-five orders in the families of birds, while another might list forty-eight.[98] In response, two new methodologies arose -- numerical phenetics and cladisitics -- to supplement the traditional methods and, ideally, to provide for more objective classifications.[99]

In principle, numerical phenetics resembles nominalism, which focused on the precise observable degree of physical differences between organisms.[100] Numerical phenetics assigns certain values to specific characteristics, so that similarity values between two organisms can be ascertained and compared.[101] Numerical pheneticists differ as to whether different characteristics should receive the same value or whether they should be "phyletically weighted."[102] The school of thought which advocates phyletical weighing further splits into two camps, depending whether the weighing should reflect some fixed criteria, such as physiological importance,[103] or the seemingly natural order.[104] Internal disagreements aside, numerical pheneticists have offered "operational taxonomic units" as a replacement for species, but most taxonomists only use the methodology to supplement more traditional methods of classification.[105] The lack of cohesion among the methodological school may take away from its influence.

Cladistics asserts that an organism should be classified solely on the basis of its "recency of common descent"[106] according to the branching of the evolutionary tree.[107] To determine this splitting point, cladists examine all ancestral and uniquely derived characteris-

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[96]*Id.* at 209.

[97]*Id.* at 262, 268.

[98]Mayr, *supra* note 67, at 220.

[99]*Id.*

[100]Mayr II, *supra* note 73, at 69.

[101]*Id.*

[102]Mayr, *supra* note 67, at 223-24.

[103]This would follow the lead of Aristotle and Georges Cuvier, Lammarck's principal opponent during the Enlightenment. They felt that taxonomic decisions should be based on internal characteristics, such as organ placement and dimension, rather than external ones, such as coloration. Mayr, *supra* note 67, at 223-24.

[104]This would follow the Darwinian concept of species, which in some respects only changes the Linnean theory by supplanting God with nature and survival as the determinant of classification. Mayr, *supra* note 67, at 224.

[105]Mayr, *supra* note 67, at 233.

[106]Mayr II, *supra* note 73, at 70.

[107]Its name derives from the Latin word for branch. Bowler, *supra* note 75, at 476-77.

tics.[108] Branches are determined by tracing uniquely derived characters back to the split, and cladists assume that the parent species ceases to exist upon the split.[109] The tree formed is called a "cladogram," which doesn't necessarily mirror the tree formed using more traditional techniques.[110] The assumptions that the parent species ceases to exist and that each split represents a total separation of the parent species hinder the widespread use of the methodology, but its concentration on complete characteristic analysis makes it a fairly successful classification methodology.[111] However, when looking at the long-term, cladism falters because it fails to recognize the effects of adaptation to the environment over thousands and millions of generations.[112]

Modern taxonomy incorporates all of these philosophies and schools of thought in a complex pattern of discourse and debate. The addition of modern biomolecular genetics to this stream, while spicing up the discourse, has added to the challenges with which the administrative process must strive to overcome.

IV. Biomolecular Techniques to Measure DNA Similarity

Molecular biologists have two general methods available to them to analyze the genetic heritage of an organism -- DNA hybridization and DNA sequencing.[113]

To use DNA hybridization, scientists first extract the DNA of the two organisms to be compared. Then they separate, or dissociate, each DNA double helix into two single strands by applying heat to them.[114] Two strands, one from each organism, are then placed together in a solution, where they naturally combine or anneal.[115] The artificially-combined strands create what is known as a "hybrid" DNA molecule.[116] The greater the correlation between the sequences of the strands, the greater is the attraction between them and the stronger the two strands anneal.[117] Scientists measure this attraction, and therefore the similarity of the strands, as a function of the amount of heat that will subsequently be required to dissociate the artificially-combined strands.

A comparison is made between the amount of heat needed to dissociate the two organisms' native DNA strands and the amount of heat needed to dissociate the artifically-combined strands.[118] The more closely the two amounts of heat match, the more bonds

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[108]Mayr, *supra* note 67, at 227.

[109]Mayr, *supra* note 67, at 229.

[110]*Id.*

[111]*Id.* at 231.

[112]Mayr II, *supra* note 73, at 70.

[113]A version of DNA hybridization has also been used to count the number of bacterial "species" in soil. *See* Wilson, *supra* note 15, at 143. DNA stands for deoxyribonucleic acid, and consists a small molecule of sugar, a phosphorus group and nitrogenous bases, which combine to form nucleotides, the basic structure of DNA. These bases - adenine (A), thymine (T), guanine (G), and cytosine (C) - are arranged in patterns which allow the formation of the well-known DNA double-helix. A only bonds with T and G only bonds with C. *See generally,* Jeffrey L. Gellner and Wendy L. Weaver, *A Glossary of Genetic Terms,* 3 DICK. J. ENVTL. L. & POL'Y 119 (Spring 1994).

[114]JAMES DARNELL ET AL., MOLECULAR CELL BIOLOGY 202 (2d ed. 1990).

[115]*Id.* at 202

[116]Such recombination can also occur between complementary strands of RNA or between an RNA and a DNA strand. *Id.* at 203.

[117]Grierson, *supra* note 9, at 487 (citations omitted).

[118]*Id.*

have formed between the two strands of the artificially-combined molecule, and the more closely related are the two organisms from which the strands are drawn.[119] The dissociation temperature of the artificially-combined molecule is about 1.6 degrees Celsius lower for every one percent difference between the two individual strands.[120]

While an innovative tool, experts have criticized the accuracy of DNA hybridization, saying that it is "best applied to higher taxonomic levels . . . [because] differences within and between closely related species are typically negligible."[121] In addition, some experts assert that DNA hybridization fails to adequately differentiate between linkages that occur because of shared ancestry and those that occur as the result of chance or other non-phylogenetic similarities.[122]

DNA sequencing, on the other hand, directly maps the nucleotide sequence of a gene from the DNA strand and may be performed in one of two ways. The first method, mapping an entire gene sequence, is rarely used because of cost and complexity.[123] This requires analysis of the entire sequence of a well-known gene from the DNA of the two organisms, and a comparison of similarities.[124]

The second method of DNA sequencing called restriction enzyme mapping, is much more common. A specific restriction enzyme will cut a DNA strand wherever it finds a specific sequence of nucleotides.[125] If the two subject organisms have the same DNA sequence, the enzyme will cut the strands at precisely the same point on the strand, resulting in strands of similar size.[126] If not, the remaining strand pieces will vary in size from one another. The greater the dissimilarity between the sizes of the two batches of pieces, the greater the dissimilarity between the DNA of the two organisms.[127]

Molecular biologists disagree among themselves as to the most reliable method of comparing two DNA samples. Besides the question of the proper use of DNA hybridization mentioned above, molecular biologists also argue over whether the DNA used should be taken from the mitochondria (mtDNA)[128] or the nucleus (nDNA) of the cell.[129] In multicellular animals, the mtDNA is a circular, double-stranded molecule.[130] Scientists have found mtDNA to be an effective tool for genetic studies for several reasons, includ-

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[119]*Id.*

[120]*Id.* at 488 (citations omitted).

[121]*Id.* at 488, note 182 (citation omitted).

[122]Geneticists term this failure an inability to distinguish "primary" from "derived" characters. PAUL H. HARVEY & MARK D. PAGEL, THE COMPARATIVE METHOD IN EVOLUTIONARY BIOLOGY, 67-68 (Robert M. May & Paul H. Harvey, eds., 1993). This debate mimics the discourse in taxonomy over whether morphological characteristics alone should determine classification.

[123]Grierson, *supra* note 9, at 489 (citation omitted). Scientists have only recently been able to use DNA sequencing to map the entire genome of a free living organism. Nicholas Wade, *Bacterium's Full Gene Makeup is Decoded*, N.Y. TIMES, May 26, 1995, at A16.

[124]*Id.*

[125]DARNELL ET AL., *supra* note 114, at 206.

[126]Grierson, *supra* note 9, at 488.

[127]*Id.*

[128]The mitochondria are the energy-producing organelles of the cell. The mitochondria produce energy through cellular respiration and distribute it to the various other subcellular bodies so that they may follow the directions issued by the nDNA. ACADEMIC PRESS DICTIONARY OF SCIENCE AND TECHNOLOGY 1393 (Christopher Morris ed., 1992).

[129]Jan DeBlieu, *Could the Red Wolf be a Mutt?*, N.Y. TIMES MAGAZINE, June 18, 1992, at 31.

[130]As opposed to the string-like double helix strands of mammalian nDNA. A. RUS HOELZEL & GABRIEL A. DOVER, *MOLECULAR GENETIC ECOLOGY* 50 (David Rickwood ed., 1991).

ing the stability of its gene order and its simple genetic structure.[131] Also, depending on the organism, the nucleotide sequences within mtDNA genes can evolve up to ten times faster than those within most nDNA genes, which more clearly shows adaption and divergence.[132] In addition, unlike nDNA genes, mtDNA is predominately inherited from the maternal line.[133] These characteristics allow tracing of parentage over hundreds or even thousands of years, and mtDNA has even been used to compare the lineage of individual members of the same breeding population.[134] Some experts, however, claim that nDNA analysis is more persuasive evidence of species definition than mtDNA tests, because nDNA contains the gene sequences which determine an organism's morphological characteristics.[135]

Genetics Versus Characteristics

When molecular biologists began tinkering with gene sequencing in the early 1980s, their discoveries encountered resistance from traditional field biologists and other naturalists, who base species definition on morphological characteristics.[136] Field biologists and other naturalists view the laboratory-bound geneticists as too far removed from nature, and complain that DNA fingerprinting ignores blatant physical characteristics, as well as historical data.[137] The jealous competition between the two camps for students,[138] grant money, and influence with the federal government only fuels the animosity.[139]

The value of genetic studies in wildlife conservation is indisputable. Such information has been used to document inbreeding among cheetahs, resolve the dispute whether giant pandas are raccoons or bears,[140] and uncover a host of other genetic relationships.[141] The conflict between the two camps will inevitably reach some sort of consensus. Taxonomy is a holistic science, which envelops and incorporates new philosophies and information. Because of this, it will inevitably draw upon the tenets of molecular biology to one extent or another, despite initial resistance.

V. The Biological Species Concept

Field biologist Ernst Mayr, the leading authority on speciation,[142] accepts the validity of genetic analysis, but believes that the results should be interpreted by naturalists to ensure that theory coincides with reality.[143] Mayr, a professor of zoology at Harvard Uni-

[131]HARVEY & PAGEL, *supra* note 122, at 63.

[132]*Id.* at 63-4.

[133]Hoelzel & Dover, *supra* note 130, at 50. This maternal legacy derives from the fact that the male sperm contributes DNA only to the nDNA. Paternal "leakage" influencing the mtDNA remains a theoretical possibility, but remains undocumented. *Id.*

[134]Grierson, *supra* note 9, at 488, note 185 (citations omitted).

[135]Rennie, *supra* note 32, at 18.

[136]DeBlieu, *supra* note 129, at 45.

[137]*Id.* at 46.

[138]Beardsley, *supra* note 19, at 6.

[139]DeBlieu, *supra* note 129, at 44.

[140]They are bears. Jeffrey Cohn and Carolyn Strange, *Genetics for Wildlife Conservation*, BIOSCI., March 1990, at 167.

[141] *Id. See also* Peter Steinhart, *In the Blood of Cheetahs; Research into Breeding of Wild and Captive Animals*, AUDOBON, Mar. 1992, at 40.

[142]Speciation is the "splitting up of one species into a number of distinct but related species." Bowler, *supra* note 75, at 469.

[143]DeBlieu, *supra* note 129, at 44.

versity, has published at least 17 books and 600 articles on the subject of speciation, and most of the recent scholarly material written on the subject comes in response to his work.[144] In 1942, he proposed the Biological Species Concept (BSC), currently the most widely accepted definition of species.[145]

The BSC defines species as "**a reproductive community of populations (reproductively isolated from others) that occupies a specific niche in nature**."[146] This definition resolves problems inherited from a morphological-based classification system, whether it be the true Linnean one or an evolutionary model laced with Linnean tendencies. The typical difficulty with such morphological systems occurs when two groups of organisms which look alike do not mate, or when two groups which do not look alike do.[147] Using the BSC, the first two groups would not be considered a single species, while the second would.

The central concept in BSC is reproductive isolation, which requires an isolating mechanism.[148] These mechanisms include geography, temporal differences in the mating cycle, behavioral differences in courtship patterns, mechanical or structural differences in genitalia, and sterility of hybrid offspring.[149] The isolating mechanism protects the gene pool of a BSC-defined species from contamination from other gene pools.[150] These isolating mechanisms are not infallible, and hybrid populations may occur occasionally.[151] Sometimes the hybrid population, or swarm, may completely displace the range of one or both parent species.[152]

Some taxonomists assert that the occurrence of hybrid populations demonstrates that the definition of species should be based solely on the ability of two organisms to produce viable offspring.[153] Most taxonomists, however, refuse to follow a static theory reminiscent of the Linnean niches.[154] While viable offspring may be a legitimate line to draw between species, it does not mean it is the only legitimate one.

Subspecies are merely segments of a species population which are somehow distinguishable from the rest of the species.[155] Subspecies are units of convenience, not actual units of taxonomy.[156] Mayr defines subspecies as:

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[144]*Id.*

[145]The BSC is accepted, with some reservation, by the majority of evolutionary biologists. WILSON, *supra* note 15, at 38. The degree of acceptance by other scientists - botanists, ornithologists, and entomologists - depends on the accuracy of the BSC concept as applied to their area of study, as well as their personal perspective from the field or laboratory. See Mayr, *supra* note 67, at 276.

[146]Mayr, *supra* note 67, at 273.

[147]Hill, *supra* note 9, at 249.

[148]*Id.* at 250.

[149]ERNST MAYR, POPULATIONS, SPECIES, AND EVOLUTION 55-69 (1970) [hereinafter "Mayr III"].

[150]Mayr, *supra* note 67, at 284-85.

[151]Mayr III, *supra* note 149, at 69-81.

[152]*Id.* at 73-76.

[153]Hill, *supra* note 9, at 251.

[154]*Id.* at 251.

[155]A species which contains several subspecies is termed "polytypic," while a uniform species containing no distinguishable subspecies is termed "monotypic." Bock, *supra* note 76, at 846.

[156]Mayr, *supra* note 67, at 289.

> an aggregate of phenotypically [physically] similar population of species, inhabiting a geographic subdivision of the species, and differing taxonomically [usually morphologically] from other populations of the species."[157]

Generally, the rule of thumb is that if you can identify 75% of the organisms of a given population from those of another, you have a subspecies.[158] The primary isolating mechanism which causes the morphological divergence of a subspecies is geography, making the reproductive isolation of a subspecies precarious.[159] Some biologists believe subspecies are an important part of the evolutionary process, because they may, through genetic mutation or drift, become an altogether new species.[160]

VI. The Application of the ESA Species Definition by the Agencies

The intellectual debates surrounding the biological and taxonomic definition of species must be analyzed or assimilated by the agencies in order to implement the ESA. The two federal agencies with responsibility over the ESA, the USFWS and the NMFS, have addressed the uncertainty of the proper statutory definition of species on two fronts, the definition of a "distinct population segment" under the statutory definition of species and the treatment of hybrid populations with one listed parent species. The agencies first approached these issues through legal interpretations emanating from counsel, but have recently begun to work toward flexible joint guidelines and policies to manage the debate. This administrative development is long overdue, but Congress should take note that the agencies' efforts are beginning to show fruits of success. To undermine these efforts not only wastes the energy already expended, but also will demoralize dedicated professionals trying to meet their congressional mandate.

Fish and Wildlife Service The "Hybrid Policy"

Beginning in the late 1970s, the USFWS formulated an amorphous "Hybrid Policy" in a series of unpublished legal opinions issued by the Department of the Interior's Office of the Solicitor General over a period of thirteen years.[161] These opinions were withdrawn in December of 1990, due to confusion they created and challenges from the scientific com-

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[157]*Id.*

[158]Hill, *supra* note 9, at 252 (citation omitted).

[159]Hill, *supra* note 9, at 252.

[160]*Id.* Similar opinions have been advanced about the role of hybrid species populations. Mayr II, *supra* note 73, at 79-80.

[161]Hill, *supra* note 9, at 243. The hybrid policy addressed a series of questions about the appropriateness of extending ESA protection to organisms derived from the mating of one protected and one unprotected species and whether intermating between these species should be encouraged as a method of preserving the protected species. While not directly addressing the statutory definition of species, these opinions distinguished one "species" from another to determine if a population was as a hybrid one.

[162]William Booth, *Entering the Hybrid Zone: U.S. Policy Unclear on Protecting Mixes of Rare Species*, WASH. POST, Mar. 18, 1991, at A9.

munity.[162] The Hybrid Policy, although currently withdrawn, has detrimentally affected several listed species, including the dusky seaside sparrow (*Ammospiza maritima grescens*).[163]

The first memorandum, issued in 1977, concluded that hybrid populations generally were protected by the ESA due to the statutory language.[164] The statute's definition of "fish or wildlife," it suggested, was broad enough to encompass hybrids of these groups, because it included "any offspring thereof."[165] Because of differences in the statutory definition of plant, the Solicitor resorted to legislative history that showed plants were to be given the same protection as animals.[166] The Solicitor General buttressed this decision by arguing that the drain on listed species by intentional crossbreeding demanded it.[167]

The Solicitor General reversed this opinion within a year after reviewing it at the request of the USFWS.[168] The reversal concluded that hybrid populations with one listed parent species threatened the listed parent species in that they may interbreed and dilute or eliminate the protected gene pool.[169] Following the intent to protect only true species, the Solicitor General held hybrid species should not be given the protection of coverage under the ESA.[170]

The Solicitor affirmed this theory in 1983, when he concluded that hybrid individuals parented by two listed species, the red wolf (*Canis rufus*) and the gray wolf (*Canis lupus*), were not entitled to protection.[171] The Solicitor reasoned that the hybrid individuals would never be able to produce pure-breds and, therefore, the genetic heritage would not come through intact.[172] Importantly, the Solicitor did not distinguish between artificial and natural hybridization.[173]

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[163]One of nine subspecies of the seaside sparrow, the dusky was included on the first endangered species list in 1967. By 1979, no female duskies were left, but the USFWS gathered five male duskies in a hope to "back cross" them with Scott's seaside sparrows (*A.m. peninsulae*) to produce a relatively pure dusky. By breeding the offspring hybrids with the remaining duskies successively, the sixth generation would be 98.4 % pure dusky. The initial attempts seemed to be going well. The USFWS, however, changed its mind about the appropriateness of breeding and releasing a hybrid, even if the parent species were totally extinct. By the time private parties were found to pick up the bill, the males had become too old to reproduce successfully. Orange Band, the last of the duskies, died of natural causes on June 16, 1987. *See* Mann & Plummer, *supra* note 11, at 54-59, and Hill, *supra* note 9, at 258-60.

Later, researchers found that the "mtDNA data provide no basis for phylogenetic distinction" of the dusky from other Atlantic coast populations of *A. maritimus*." *Id.* In other words, there was no dusky to begin with, at least if one equates genetic analysis with taxonomy. Indecision, not scientific debates, was the root of the Hybrid Policy's influence and the DNA study had no effect on the bird's treatment.

[164]Memorandum from Asst. Solicitor, *Fish and Wildlife*, to Chief, *Division of Law Enforcement Fish and Wildlife Service* (May 18, 1977) [hereinafter "May 1977 Memo"].

[165]The ESA defines "fish or wildlife" to include

> any member of the animal kingdom, including without limitation any mammal, fish, bird, . . . amphibian, reptile, mollusk, crustacean, anthropod, or other invertebrate, and including any part, product, egg or offspring thereof, or the dead body or parts thereof. 16 U.S.C. § 1432(5)

[166]Hill, *supra* note 9, at 243-44. 16 U.S.C. §1432(9).

[167]May 1977 Memo, *supra* note 164.

[168]Memorandum from Asst. Solicitor, *Fish and Wildlife*, to Deputy Associate Director, Federal Assistance, *Fish and Wildlife Service* (Aug. 2, 1977).

[169]*Id.*

[170]*Id.*

[171]Memorandum from Asst. Solicitor, *Fish and Wildlife*, to Regional Solicitor, Northeast Region, *Fish and Wildlife Service* (Sept. 21, 1984).

[172]*Id.*

[173]Hill, *supra* note 9, at 246.

In 1984, the Solicitor was confronted by a question of whether the ESA allowed the breeding of listed woodland caribou (*Rangifer tarandus caribou*) with members of the same subspecies from Canada.[174] The Solicitor concluded that such a situation was distinguishable from preceding ones, because the breeding would be between members of the same subspecies. As it stood when it was withdrawn in 1990, the Hybrid Policy served as a bastion of preservation of the status quo, granting protection under the ESA and allowing the stimulation of interbreeding only when the protected genetic structure would emerge unscathed.

Scientists Examine the USFWS Policy

The intervention of mankind often disrupts the mechanisms which isolate species and subspecies, creating methods of crossing barriers and forcing together traditionally isolated populations through the destruction of habitat. The ESA seeks to correct part of this problem by ensuring the genetic integrity of the endangered or threatened "species," which includes species, subspecies, and distinct populations of species and subspecies. The Act, while not directly speaking of hybrid populations, implicitly rejects their biological value. As mentioned previously, many scientists, however, disagree with this legislative judgement.[175]

In a 1991 article, Mayr and Stephen O'Brien, a geneticist who heads of the Laboratory of Viral Carcinogenesis at the National Cancer Institute, directly addressed the former Hybrid Policy.[176] They supported the aspects of the former Hybrid Policy that discouraged the stimulation of production of hybrid populations between *species.* However, they argued that it should be changed with regard to listed *species* with sympatric hybrid population zones as long as those zones do not interfere with the genetic pool of the listed parent species. They also proposed to protect hybrid populations between two listed species. Furthermore, they argued that the Hybrid Policy should be dropped altogether with regard to *subspecies* and *populations*, because these groups naturally do interbreed. This argument is based in the theory that subspecies serve as important conduits for evolution, providing the testing grounds for genetic alteration and adaptation.

USFWS Methodology in Analyzing Delisting Petitions

USFWS denials of petitions to delist the gray wolf (*Canis lupus*)[177] and the red wolf (*C. rufus*)[178] provide crucial insight into the methodology used by the agency to reconcile the many scientific and taxonomic debates which confuse this area. These denials, one

[174]Memorandum from Asst. Solicitor, *Fish and Wildlife,* to Associate Director, Federal Assistance, *Fish and Wildlife Service* (Aug. 24, 1984).

[175]With regard to the vitality of hybrid plants as compared to their parent species, see Carol Ezzell, *Ecologists Seek Help for Menaced Hybrids,* 140 SCI. NEWS 102 (Aug. 17, 1991) and Christine Mlot, *The Importance of Being a Hybrid,* BIOSCI., Dec. 1991, at 755. With regard to hybrid birds, *see* Peter R. & Rosemary B. Grant, *Hybridization of Bird Species,* 256 SCI. 193 (April 10, 1992).

[176]Ernst Mayr & Stephen J. O'Brien, *Bureaucratic Mischief: Recognizing Endangered Species and Subspecies,* 251 SCI. 1187-88 (July 19, 1991).

[177]55 Fed. Reg. 49656 (Nov. 30, 1990).

[178]57 Fed. Reg. 1246 (Jan. 13, 1992).

coming before the withdrawal of the Hybrid Policy and one after, demonstrate that the agency must be left with the flexibility to rely on all of the evidence and take in the totality of the debate when deciding on a species definition.

The gray wolf delisting petition[179] claimed that the species should lose its listing because of extensive hybridization with other canids, especially coyotes. This hybridization, the petitioners claimed, that had eradicated the "true" species and made it impossible to distinguish between pure and hybrid wolves. In its delisting denial, the USFWS states that mtDNA studies that showed hybridization between gray wolves and coyotes should not be viewed as conclusive because of the novelty of the technique. Furthermore, it notes that mtDNA, inherited only from the mother, does not "breed out" as long as a maternal line remains intact. Physical characteristics, expressed only in the nDNA, can adapt completely through natural selection over generations without altering the makeup of the mtDNA. Therefore, the service argues, gray wolves can have coyote hybrid mtDNA patterns, but act like and look like gray wolves, and still be considered gray wolves. Infrequent matings between the two species, as evidenced in the hybrid mtDNA, do not mandate delisting, because the nature of the ESA demands a conservative approach in dealing with new biomolecular techniques.[180]

The red wolf delisting petition is the second example of the USFWS' methodology. The red wolf's taxonomic classification was sharpely debated even before the onslaught of modern genetics. Over the years, it has been labeled as a separate species, as a subspecies of the gray wolf, and as several different subspecies of wolf.[181] In 1991, genetic sampling found no distinct "red wolf" DNA pattern.[182] Instead, tests showed only coyote (*C. latrans*) mtDNA[183] in present-day red wolves, and both coyote and gray wolf mtDNA in historical specimens (taken from pelts gathered early 1900s).[184] This only added to the confusion caused by fact that the red wolf physically resembles what one would expect as a midpoint between the *C. lupus* and the *C. latrans*.[185]

This left three possibilities for classifying the red wolf. One, it represented a present-day hybrid cross between the gray wolf and the coyote. Two, it started as an ancient hybrid population, and later evolved into its own species, retaining the imprint of its parent spe-

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[179]The petitions were filed by the Farm Bureau Federations of Wyoming, Montana, and Idaho.

[180]In conclusion, the USFWS states:

> . . . the Service recognizes that recent advances in molecular genetics have made it difficult to interpret such data in light of the classic biological species concept. However, several different species concepts, including a revised biological species concept, are now dominating taxonomic thinking. These alternative concepts incorporate the idea of limited genetic interchange with other recognized species if there are clear selective pressures working against the persistence of intermediate types. 55 Fed. Reg 49656 (Nov. 30, 1990).

[181]57 Fed. Reg 1246, 1249 (Jan. 13, 1992).

[182]57 Fed. Reg. 1246, 1248 (Jan. 13, 1992). *See also*, William Booth, *Questioned Pedigree Clouds Wolf Program; Conservation Law Won't Help Save a Hybrid*, WASH. POST, June 24, 1991, at A3. Anticipation of this study may have motivated the withdrawal of the Hybrid Policy. DeBlieu, *supra* note 129, at 43.

[183]The sources conflict over the fact that only coyote mtDNA was found in live red wolves. The Federal Register denial states only coyote mtDNA in live individuals, while at least one report claimed that the study showed an 80% occurrence of coyote mtDNA and a 20% occurrence of gray wolf mtDNA. *cf.* 57 Fed. Reg. 1246, 1248 (Jan. 13, 1992) and Carol Ezzell, *Conserving a Coyote in Wolf's Clothing*, 139 SCI. NEWS 374 (June 15, 1991). The scientists involved in the study, Robert K. Wayne and Susan M. Jenks, used the restriction enzyme mapping technique described above. *Id.*

[184]57 Fed. Reg. 1246, 1248 (Jan. 13, 1992).

[185]Booth, *supra* note 182, at A3.

[186]*Id.* at A3. DeBlieu, *supra* note 129, at 46.

cies. Three, it began as a distinct species, but infrequently mated with coyotes or gray wolves and lost its unique genetic identity.[186] None of this uncertainty was lost on the American Sheep Industry Association, which filed the petition to delist *C. rufus.*

Following the arguments developed in the gray wolf decision, the USFWS denial of the red wolf delisting petition argued that mtDNA has not been shown to be a conclusive indicator of species.[187] The denial analyzed extensively positions based on fossil records, morphological comparisons, and behavioral analyses. Differences in vocalization, feeding habits, and skull size all found their way into the analysis. The findings and theories of Ronald M. Nowak, the resident taxonomist at USFWS, demonstrated few examples of gradations in the size and habits between the three species, which would be expected if *C. rufus* was a hybrid population.[188] The Service's refusal to rely entirely on genetic evidence comes as no surprise, given that it has reintroduced the red wolf into the wild as an experimental population.[189]

Given these factors, the Service concluded that the genetic studies do not amount to "substantial evidence" justifying delisting.[190] In doing so, the USFWS seems to accept the theory that, even if the red wolf is merely a remnant species with its genetics displaced by interbreeding, its value as a "keystone" species in its ecosystem[191] and as the only available descendent of its line make it worthy of protection.

The USFWS Draft Proposed Vertebrate Population Policy

In June of 1992, the USFWS signaled a change in its approach to dealing with the question of species definition. Instead of relying on case-specific legal analysis to determine the coverage of the definition, the Service issued a proposed policy to provide guidance on the definition of a "distinct population segment" under the ESA definition of "species."[192] This draft population policy, which was later withdrawn by the Service,[193] correctly stated that the USFWS has the authority to make decisions on the listing, delisting, and classification of vertebrate fish and wildlife not only on the basis of their status as species and subspecies, but also as distinct population segments.[194] It noted that, while

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[187]57 Fed. Reg. 1246, 1248 (Jan. 13, 1992).

[188]57 Fed.Reg. 1246, 1247 (Jan. 13, 1992). Nowak, whose work in the area is extensive, is noted as a critic of genetic analysis. DeBlieu, *supra* note 129, at 44. He points to a study of gray wolves on Isle Royale in Lake Superior:

> Those animals are completely wolflike. They weigh 70 to 80 pounds. They kill large moose. If you give me a skull from one, I can show you why its a wolf. But if you give Robert Wayne the genetic material to analyze and nothing more, he'd say the island was populated by a couple of packs of coyotes. I have doubts about any methodology that would reach those kinds of conclusions. It's as if the clock has been turned back a quarter-century. We're going through the same arguments that I thought we put to rest in the 70's. *Id.*

Nowak, however, is willing to entertain theories that the red wolf is a gray wolf subspecies or the remnants of a species that has been genetically displaced. *Id.*

[189]*See* 56 Fed. Reg. 56325 (Nov. 4, 1991); and Vic Banks, *The Red Wolf Gets a Second Chance to Live by its Wits; Seeding a Carolina Refuge with Pairs Bred in Captivity*, SMITHSONIAN, Mar. 1988, at 100.

[190]57 Fed. Reg. 1246 (Jan. 13, 1992).

[191]Due to its role as top predator. *See* 57 Fed. Reg. 1246 (Jan. 13, 1992).

[192]Memorandum (plus attachment) from USFWS Deputy Director to Regional Directors (June 15, 1992) (on file with author) [hereinafter "Draft Vertebrate Population Policy"].

[193]57 Fed. Reg. 51472 (Nov. 3, 1992).

[194]Draft Vertebrate Population Policy, *supra* note 192, at 5.

Congress granted the Service this authority, it cautioned that it should be used sparingly and only when warranted.[195]

For this reason, the USFWS would consider the "biological significance" of a population to the species or subspecies as a whole before making any such decision.[196] Biological significance would be measured by the importance of the population in maintaining the variability inherent in the species or subspecies and the importance of the population in the prevention of the further decline (or in assisting the recovery, if listed) of the species or subspecies.[197] To assist in this determination, the draft vertebrate population policy contains a list of four additional factors to be considered, including:

1. The populations is significantly isolated from other members if the same species or subspecies (i.e., it rarely interbreeds with other populations);

2. The population occupies an ecosystem that is in danger of destruction throughout all or a significant portion of its historical distribution, and the species or subspecies is not present in the surrounding ecosystems;

3. The population is the only occurrence of a species or subspecies within United States' jurisdiction;

4. The population can be defined by geo-political boundaries that delineate an area (representing a significant portion of the species or subspecies range) where existing legal protection is inadequate to ensure its survival.[198]

In order to qualify as a distinct population segment, the population would have to be biologially significant and/or meet at least one of the four factors. The policy would have considered genetic and morphological distinctiveness, but would not consider them essential in making any such determination.[199] When examining such information, the policy expressed that the Service would rely on the best scientific data available.[200]

The draft vertebrate population policy stands as the Service's first attempt to proactively and formally analyze its application of the statutory definition of species. After its withdrawal, the USFWS informally relied on two criteria - discreetness and significance - to determine the eligibility of a population for listing.[201] To be discreet, a population must be

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[195]*Id.* And hence the restriction of the distinct population segments to vertebrate fish and wildlife.

[196]*Id.*

[197]*Id.* at 7.

[198]Draft Vertebrate Population Policy, *supra* note 192, at 1.

[199]*Id.* at 8. The USFWS noted:

> Significant genetic or morphological differences are not necessary for a population segment to be considered distinct from other population segments. If there were significant genetic and/or morphological differences, the population would be likely be judged a separate subspecies or species. *Id.* at 6.

Rohlf notes that this statement stands as a "clear technical swipe" at the NMFS, which had previously proposed a policy of its own. Rohlf, *supra* note 9, at 661.

[200]*Id.* As per 16 U.S.C. § 1533(b)(1)(A).

[201]Rohlf, *supra* note 9, at 661 (citing Telephone Interview with Jim Bartel, Division of Listing and Recovery, USFWS, Portland Field Office (Apr. 12, 1994)).

either reproductively isolated from the rest of the species or "be defined by international borders."[202] To be significant, a population would have to be genetically, physically, or behaviorally unique, or occupy a specific gap in the species' range.[203] One commentator has suggested that the differences between this informal methodology and the draft vertebrate population policy derives from the pressure of the policy developed by the NMFS.[204]

The USFWS Draft Proposed Policy on Hybrid Wildlife and Plants

In October of 1993, the USFWS withdrew a separate proposal to develop a separate policy on the treatment of hybrid wildlife and plants under the ESA.[205] The abstract for the withdrawn proposal stated the following:

> The service proposes to issue a policy that will include within the scope of a listing for a specific taxon "hybrid" individuals that more closely resemble a listed species than they resemble individuals intermediate with another species. The proposed policy is intended to allow the Service to routinely protect and conserve intercross progeny. A second goal is to give the Service the ability to eliminate intercross progeny if their presence interferes with conservation efforts for a protected species. It also allows fostering of intercrossing when this would preserve remaining genetic material from a nearly extinct species. Under the policy, intermediate individuals or populations of direct hybrid origin would not ordinarily be protected or be eligible for listing.[206]

In all likelihood, this policy proposal was formulated to deal with criticisms from evolutionary taxonomists and geneticists. If enunciated according to this abstract, this policy would account for many of the suggestions of Mayr and O'Brien.[207] It would allow the USFWS discretion to follow the prior Solicitor's opinions regarding hybrid populations, which protected hybrid population with a listed parent "species" and an unlisted parent species (as long as the hybrid population resembles the listed species more than the unlisted), or take action to discourage hybrid populations as it sees fit.

National Marine Fisheries Service The Interim Policy on Distinct Vertebrate Population Segments

In 1991, the NMFS, which also has delegated ESA authority,[208] finalized an interim policy describing how it will interpret "distinct population segments" with regard to Pacific salmon stocks.[209] This application is especially interesting because an extremist

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[202]*Id.*

[203]*Id.*

[204]*Id. See* discussion below.

[205]58 Fed. Reg. 56489, 56491-92 (Oct. 17, 1993).

[206]*Id.*

[207]Mayr & O'Brien, *supra* note 176, at 1187.

[208]The ESA's definition of "Secretary" encompasses the Secretary of the Department of Interior, who has assigned his responsibilities of the USFWS, and the Secretary of the Department of Commerce who has assigned his responsibilities to the NMFS. 16 U.S.C. § 1532(15).

[209]56 Fed. Reg. 58612 (Nov. 10, 1991). A stock of salmon is a population differentiated from the rest of the species by the timing of their run (spawning journey upstream from the ocean) and geographical differences in their spawning grounds. Rohlf, *supra* note 9, at 620.

position would classify *every* stock of salmon a distinct population segment, as the timing and destination of a stock's run are inherently unique. The interim policy creates a new classification, called an evolutionary significant unit (ESU), which the NMFS will use to determine if a particular salmon stock constitutes a distinct population capable of protection under the ESA.[210]

Under the interim policy, a salmon stock will constitute an ESU if it meets two criteria: (1) it is substantially reproductively isolated from other populations of the species; and, (2) it is an important component of the evolutionary legacy of the species.[211] The first requirement does not mandate absolute isolation, but allows for some interaction as long as it is not so great as to reduce the evolutionary importance of the stock.[212] This requirement seems to have been crafted to meet the BSC definition of species. The second revolves around whether the stock is of substantial ecological or genetic importance to the species.[213]

NMFS issued this policy not to provide a check list for the identification of distinct population segments, but to narrow the focus of the inquiry for examining the stocks.[214] The NMFS has used the interim policy in determinations of distinct population status for the Snake River sockeye salmon, the fall run of Snake River chinook salmon, and the combined spring and summer runs of the chinook salmon in the Snake River and in the denial of such status for lower Columbia River coho salmon.[215]

In an article published in 1994, Daniel J. Rohlf roundly criticizes the NMFS' interim policy for failing to meet the policy goals of the ESA.[216] First, he notes that the interim policy fails to conserve genetic diversity and creates a "regulatory Catch-22," which requires a genetically-unique *population* to be reproductively isolated from the remainder of the species before protection will be granted to it.[217] Under this approach, the protection granted to a population will not help the listed species to survive.[218]

Furthermore, Rohlf argues that the interim policy fails to account for ecosystem health because its focus on a population's role in its environment is on that role as evidence of genetic differentiation, as an indicator of the "evolutionary significance" of the population instead of on the contribution that it plays to its ecosystem.[219] He reads this to imply that USFWS reads the word, "distinct," to mean solely genetic, not ecological, uniqueness.[220] For example, Rohlf asserted that the sockeye and kokanee salmon which inhabit Redfish

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[210]56 Fed. Reg. 58612 (Nov. 10, 1991).

[211]*Id.*

[212]Evidence such as records of movement of tagged fish, knowledge of recolonization rates, genetic analyses, and evaluations of isolating mechanisms are relevant to this inquiry. Gleaves, *supra* note 9, at 43.

[213]Evidence of the ecological or genetic importance of a stock includes genetic distinctiveness, whether the population utilized distinct or unusual habitat, whether the stock shows signs of distinctive or specific adaptations to its environment, and whether the extinction of the stock would be a significant loss to the diversity of the species. *Id.*

[214]Gleaves, *supra* note 9, at 44.

[215]*Id.* (citations omitted).

[216]Rohlf, *supra* note 9.

[217]*Id.* at 638.

[218]*Id.* This criticism centers around the failure of the NMFS to provide for "metapopulation dynamics," or the interaction of several populations of a species which provides for the vitality of the species as a whole. *Id.* at 634, 638.

[219]*Id.* at 640-642 (*see* especially 641, note 90).

[220]*Id.* at 641.

Lake would not be protected under the interim policy, despite the fact that the first migrates to the sea and the second remain in the lake and its inlet.[221]

Rohlf also notes that the interim policy would not protect imperiled U.S. populations of a species that is abundant in other countries, in contravention of clear legislative intent.[222] In addition, he asserts that the interim policy fails to allow administrative flexibility to allot varying degrees of protection to populations of a species that bear differing degrees of risk.[223]

In defense of the NMFS interim policy, commentators had pointed to the tenet of judicial deference to scientific judgement of an agency.[224] Rohlf analogizes this defense to the smoke and mirrors employed by the Wizard of Oz, as the deferencies being called upon to protect normative judgements, in fact policy judgements, masked with scientific trappings.[225] The interim policy, he argues, fails to acknowledge the pervasive scientific uncertainty inherent to these decisions in an effort to trade "the discretion inherent to historic approaches to listing populations for a more technically complex but equally discretionary scheme."[226]

The Joint USFWS-NMFS Draft Documents on Distinct Vertebrate Population Segments and on Candidate Species

On December 21, 1994, the USFWS and the NMFS released two draft documents for public comment and review - a policy regarding distinct vertebrate population segments,[227] and a guidance on the identification of species eligible for listing ("candidate species").[228] The fact that USFWS and NMFS finally collaborated in the formulation of a government position is in itself a dramatic turn, but even more importantly, these documents work to provide a sound basis for decision-making with regard to species definition under the ESA.

The Joint Draft Policy on Distinct Vertebrate Population Segments

The joint draft policy on distinct population segments of vertebrates fills the gap in the ESA definition of species caused by the non-taxonomic origin of the term, "distinct population segment," as did the 1992 USFWS draft policy and the 1992 NMFS interim policy.[229] The joint draft policy incorporates the best of the previous documents, and mimics the factors informally used by USFWS after it withdrew its 1992 draft policy. In short, the joint draft policy lays out three elements the agencies will use to determine if a vertebrate

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[221]*Id.* at 641.
[222]*Id.* at 642-643.
[223]*Id.* at 643-44.
[224]Gleaves, *supra* note 9, at 45.
[225]Rohlf, *supra* note 9, at 644.
[226]*Id.* at 644.
[227]59 Fed. Reg. 65884 (Dec. 21, 1994).
[228]59 Fed. Reg. 65780 (Dec. 21, 1994).
[229]While the joint draft policy states that it is consistent with the NMFS interim policy, 59 Fed. Reg. 65885 (Dec. 21, 1994), it could be only because it is flexible enough to allow the consideration of reproductive isolation as a component of another enumerated characteristic. See discussion below.

population constitutes a "distinct population segment" and is, therefore, eligible for protection under the ESA:

> (1) Discreteness of the population segment in relation to the remainder of the species to which it belongs;
>
> (2) The significance of the population segment to the species to which it belongs; and
>
> (3) The population segment's conservation status in relation to the [ESA's] standards for listing (i.e., is the population segment, when treated as if it were a species, endangered or threatened?).[230]

The policy defines the *discreteness* factor to require that either:

> (1) the population is "markedly separated" from other populations of the same taxon because of physical, physiological, ecological, or behavioral characteristics;[231] or
>
> (2) the population is "delimited by international governmental boundaries within which differences in the control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant" in light of the statutory provision which allows the agencies to list a species as threatened or endangered if inadequate regulatory mechanisms exist to protect it.[232]

The first alternative criteria specifically includes consideration of "quantitative measures of genetic or morphological discontinuity" to demonstrate the separation required.[233]

Because it uses several undefined characteristics to determine marked separation and therefore discreteness, the first alternative criteria allows the flexibility to avoid the Catch-22 found in the NMFS interim policy's requirement of reproductive isolation. For example, behavioral differences would, it seems, provide discreteness for the salmon species Rohlf used to illustrate the failure of the NMFS interim policy to account for ecological facet of "distinct."[234] This flexibility alleviates Rohlf's criticism of the NMFS interim policy regarding the reproductive isolation of a population.

However, the joint draft policy uses ecological and behavioral factors only to show a population is "markedly separated" from other populations of the species, not to show that the population is distinct due to its unique role in its own ecosystem. If, for example, one population of a vetebrate species played a unique role in its ecosystem, but another population of the same species does not fulfill a similar role in its ecosystem because other

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[230]59 Fed. Reg. 65884 (Dec. 21, 1994).
[231]59 Fed. Reg. 65885 (Dec. 21, 1994).
[232]*Id.*
[233]*Id.*
[234]Rohlf, *supra* note 9, at 641.

organisms provided similar services, would the former population be considered to be distinct under the joint draft policy? The use of ecological and behavioral factors in the marked separation determination do not provide a clear answer. Congress intended that the ESA protect "species" because of their importance to ecosystem health and integrity.[235] The joint draft policy, however, ignores this legislative goal in the preliminary stages of its analysis, and some populations which play crucial roles may never make it beyond this stage if the draft is not altered. The argument that distinctiveness should be found in cases where a population is uniquely important to ecosystem health does not diminish distinctiveness based upon "marked separation" or from the value of using ecological importance as a factor in the use of discretion in listing populations. The agencies, however, must explicitly recognize that distinctiveness includes a population distinguished solely due to its role in its ecosystem, irrespective of actual physical or reproductive isolation.

One important advantage the joint draft policy has over the NMFS interim policy is that it places morphological characteristics on the same level as genetic analysis in the evaluation of discreteness. However, the use of the term "discontinuity" hides a subjective judgement about the magnitude of the gap and the importance of the various components of the inquiry. Like the discussion above regarding the role of a population in its ecosystem, discontinuity ignores the fact that a population can be vital to the health of one ecosystem and not another, and therefore protection of one population may be warranted even when another is not, despite a lack of discontinuity.

The second criteria, written in advanced legalese, could mean either that the population is located solely within another country which fails to provide a regulatory mechanism capable of protecting the population[236] or that the population's range extends over national boundaries from the United States into such a country. This criteria may have been written to approach Rohlf's criticism that the NMFS interim policy did not protect populations endangered within the United States but abundant elsewhere, but the language is sufficiently obtuse to cloud its meaning. The agencies should define the term "delimited" to clarify this uncertainty.

The *significance* issue is addressed only after the discreteness requirement is met.[237] It includes an inquiry into the biological and ecological importance of the population considering the legislative history of the "distinct population segment" term, which indicates that it is to be used "sparingly,"and the goal of conserving genetic diversity.[238] The joint policy enumerates nonexclusive characteristics that may be considered in this examination. This list includes:

> 1. Persistence of the discrete population segment in an ecological setting unusual or unique for the taxon;

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[235]Rohlf, *supra* note 9, at 627-628.

[236]Presumably, this judgement is to be made by the agencies compared to that existing in the United States or in an ideal world.

[237]59 Fed. Reg 65885 (Dec. 21, 1994).

[238]*Id.*

2. Evidence that the loss of the discrete population segment would result in a significant gap in the range of the taxon;

3. Evidence that the loss of the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant as an introduced population outside of its historic range; or

4. Evidence of the discrete population segment differs markedly from the other populations of the species in its genetic characteristics.[239]

This list of particulars is supplied to provide a framework for the analysis of whether the agencies ought to, as a matter of discretion, provide a population with the protection of the ESA. Because each set of circumstances necessarily changes the analysis, the agencies have left themselves with the ability to look into other characteristics which may make a population significant.

This inquiry, while seemingly a good faith effort to inject some certainty into the equation, fails to limit the agencies in any way. Following the lead of the NMFS interim policy, this administrative flexibility is purposefully reserved by the agencies in order to account for the pervasive scientific uncertainty that is inherent to science in general and ecology inparticular.[240]

The tenet of judicial deference to scientific or technical judgements of an agency may protect decisions made under the significance analysis. This defense was severely criticized by Rohlf, possibly because of the audacity of calling upon this deference in advance of being challenged, but primarily because it was being used to defend a policy which chose to focus on genetic instead of ecological distinctiveness. Under the joint draft policy, judicial deference would be appropriate for the review of both the discreteness and significance analyses. With regard to the discreteness test, the document is so ambiguous and undefined that judicial deference is inappropriate unless a decision provides specifics. With regard to the significance test, judicial deference is appropriate because the test has been designed so as to provide some guidelines for the use of discretion in decisions on distinct population segment status. Congress left the agencies with the discretion to protect certain populations, and scientific uncertainty should not impede that discretion.

If a population is found to be both discrete and significant, the agencies will then turn the issue of whether it, if it were a species, a population would be eligible for protection as threatened or endangered as per the factorsenumerated in the ESA.[241] The joint policy asserts that one population of a given species may receive a different classification than another.[242] This meets Rohlf's concern that one population may deserve a different degree of protection than another.[243]

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[239]*Id.*

[240]For a discussion of ecological uncertainty, *see* K.S. SCHRADER-FRECHETTE & E.D. McCoy, METHOD IN ECOLOGY: STRATEGIES FOR CONSERVATION (1993).

[241]59 Fed. Reg. 65885 (Dec. 21, 1994). 16 U.S.C. § 1533(a)(1).

[242]59 Fed. Reg 65885 (Dec. 21, 1994).

[243]Rohlf, *supra* note 9, at 643-44. Threatened and endangered species receive the same statutory protection, but there is more management flexibility and a possibility of a permitted regulatory taking with threatened species. Fact Sheet, *supra* note 31, at 1.

The Joint Draft Candidate Species Guidance

The draft candidate species guidance creates a new series of procedures and forms for the agencies applicable to decision-making with regard to listing, delisting and re-classification of a species. Its discussion of taxonomy is rather limited, but it does provide some insight into how the agencies will review taxonomic debates.

After noting that taxonomic questions and issues of population status should be addressed early in the candidate assessment process,[244] the draft guidance sets out three criteria for the review of taxonomic material regarding the "validity" of a species, subspecies or distinct vertebrate population segment:

> 1. When only one credible taxonomic authority is available, it should be accepted. This applies in cases of findings by scientific societies, taxonomic monographs and revisions, and species descriptions that have not be challenged by knowledgeable scientists.
>
> 2. When informed taxonomic opinion is not unanimous, available published and unpublished information should be evaluated and an adequately documented decision made regarding the validity of a taxon.
>
> 3. When there is credible scientific evidence of the existence of an undescribed taxon that qualifies for listing under the ESA, it should be treated like any other species (i.e., a listing priority number should be assigned and a proposed rule prepared as appropriate).[245]

With regard to distinct vertebrate population segments with insufficient information to determine eligibility, the draft guidance directs the benefit of the doubt go to it being a candidate "population."[246]

The draft guidance wisely anticipates that debates will dominate taxonomic discussions about the status of an organisms. In so doing, the guidance allows for one uncontested opinion to support a candidacy decision, which may allow for the listing of a "species" before the scientific community has time to adequately analyze and respond to such an opinion. In addition, the guidance merely requires that an "adequately documented" decision be made when controversy does exist. Because of the importance of this term, the guidance should more adequately define its parameters. However, if such parameters were more detailed, the agencies would find themselves defending their decisions based upon the parameters, which they would likely prefer to avoid. This preference, however, does not excuse the agencies from providing more certain terms. Hopefully, each decision will be reviewed for the adequacy of its basis without the intrusive use of judicial deference to "scientific" decisions. The mere fact that scientific journals are quoted in an administrative decision does not justify the use of the veil of deference.

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[244]USFWS, *Candidate Species Guidance, Preliminary Draft*, October 19, 1994, at 23. The Draft Guidance was jointly issued with the NMFS.

[245]*Id.* at 25.

[246]*Id.* at 25-26.

VI. Conclusion: The Need For Administrative Flexibility

The merits of which agency policy, opinion or guideline is the most scientifically sound, although debated herein, is not the crucial element of this article. Instead, the many debates, arguments, influences and positions are highlighted in an attempt to demonstrate the complexity and scientific uncertainty which pervades the ESA. Taxonomy does not fall toward the objective end of the range of sciences, and is nearly an art or philosophy, dominated by subjective interpretations of scientific uncertainty. While the classification of a particular population may not unveil any great controversy at the higher taxonomic levels, a classification of a population on the species and subspecies level is flexible enough to give rise to argument, especially with the advent of modern biomolecular analysis.

The ESA currently approaches the statutory definition of species haphazardly, ignoring the pitfalls of the softness of taxonomy but allowing the agencies to adapt as they see fit. The use of taxonomic subspecies as the foundation of the statutory species gives advocates a reasonable basis to argue over the application of the definition. The creation of the "distinct population segment" by the ESA further complicates matters.

Because of these debates, the administrative agencies cannot rely on taxonomy to provide easy answers to the question of which species are worthy of protection. These administrative agencies have been wrestling with these debates for twenty years, and have shown creativity in their attempts to bring order to the chaos Congress handed them. The proposed candidate species policy demonstrates the USFWS and the NMFS are moving to accommodate for the scientific uncertainty inherent to taxonomy and ecology. The USFWS' denials of petitions to delist the red wolf and the gray wolf demonstrate that administrative agencies can approach these issues with a considerable degree of subtlety and depth. If anything, the use of proactive policy statements will only enhance these capabilities.

In the past, Congress has wisely allowed the agencies to use their discretion with regard to species definition. This practice should be continued simply because no other avenue exists which could account for the scientific debates that pervade taxonomy and genetics. To artificially place barriers on the administrative adaptation to these debates would only frustrate the purposes of the Act. If Congress cannot resist politcal demands for change, it should consider reframing the issues to preserve agency efforts and enhance administrative flexibility, while addressing the actual culprit, the economic impact of the Act.