Science, Practice, and Policy: The Committee on Rare and Endangered Wildlife Species and the Development of U.S. Federal Endangered Species Policy, 1956-1973

by

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ABSTRACT

The Committee on Rare and Endangered Wildlife Species (CREWS) of the U.S. Fish and Wildlife Service (FWS) made important and lasting contributions to one of the most significant pieces of environmental legislation in U.S. history: the Endangered Species Act of 1973 (ESA). CREWS was a prominent science-advisory body within the U.S. Department of the Interior (DOI) in the 1960s and 1970s, responsible for advising on the development of federal endangered-wildlife policy. The Committee took full advantage of its scientific and political authority by identifying a particular object of conservation—used in the development of the first U.S. list of endangered species—and establishing captive breeding as a primary conservation practice, both of which were written into the ESA and are employed in endangered-species listing and recovery to this day. Despite these important contributions to federal endangered-species practice and policy, CREWS has received little attention from historians of science or policy scholars.

This dissertation is an empirical history of CREWS that draws on primary sources from the Smithsonian Institution (SI) Archives and a detailed analysis of the U.S. congressional record. The SI sources (including the records of the Bird and Mammal Laboratory, an FWS staffed research group stationed at the Smithsonian Institution) reveal the technical and political details of CREWS's advisory work. The congressional record provides evidence showing significant contributions of CREWS and its advisors and supervisors to the legislative

process that resulted in the inclusion of key CREWS-inspired concepts and practices in the ESA.

The foundational concepts and practices of the CREWS's research program drew from a number of areas currently of interest to several sub-disciplines that investigate the complex relationship between science and society. Among them are migratory bird conservation, systematics inspired by the Evolutionary Synthesis, species-focused ecology, captive breeding, reintroduction, and species transplantation. The following pages describe the role played by CREWS in drawing these various threads together and codifying them as endangered-species policy in the ESA.

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Five years ago I walked into the first of three offices that, though I was unaware at the time, have resulted in the present project. Thankfully when I entered the office of Jane Maienschein, she took a science teacher from Kansas seriously when he came in off the street and asked to be admitted as a graduate student in the history of science.

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I introduced myself in the office of Pamela Henson via an e-mail, asking another seemingly simple question. I received a much more thorough answer, including responses to questions I didn't ask, but should have. Without Pam this project would never have gotten off the ground.

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INTRODUCTION: SCIENCE AND THE ENDANGERED SPECIES ACT

1. Science, Scientists, and the Environment

Policy solutions to environmental problems are not created solely in the confines of the lab, field, government offices, or congressional chambers, but also in larger scientific-socio-political contexts. These contexts are not static moments in time describing the social climate on the particular day a law is passed in Congress, but are composed of diverse historical threads related to science, law, government policy institutions, and social awareness and concern over environmental matters that make the passage of such laws possible. This project addresses a particular historical policy solution to the environmental matter of anthropogenic species extinction. The policy solution was the U.S. Endangered Species Act of 1973 (ESA) and the scientists largely responsible for the act's scientific content were U.S. Fish and Wildlife Service (FWS) biologists and wildlife-managers of the Committee on Rare and Endangered Wildlife Species (CREWS). CREWS operated within this kind of dynamic context to synthesize a set of long-standing conceptual approaches and conservation practices into a federal endangered-species program that had a significant impact on U.S. endangered species policy and legislation, including the ESA. The policy and practices of federal endangered-species conservation to this day, as guided by the ESA, are the legacy of CREWS efforts.

Environmental historian Mark Barrow described this wider sense of the context of the ESA in his recent work *Nature's Ghosts: Confronting Extinction*

from the Age of Jefferson to the Age of Ecology. The passage of ESA, Barrow explains, is often placed in the context of the post-war environmental movement and taken to be a product of widespread environmental-policy enthusiasm. Yet, he warns against the temptation "to view the Endangered Species Act simply as a product of its times." Barrow goes on to claim that "[h]istory is characterized not only by change over time but also by continuity," stressing that, "the Endangered Species Act emerged from a long-standing dialogue about the issue of human-induced extinction." Barrow traces this dialogue from Thomas Jefferson's obsession with fossils of the extinct mastodon in the eighteenth century up to and including the passage of the ESA in 1973.[1]

The present project embraces Barrow's conception of continuity and change to provide a detailed empirical history of the development of the conceptual approach and conservation practices embedded in the ESA and the process by which scientists and policy-makers captured those ideas in the Act. It departs from Barrow's approach, which is primarily an environmental history of responses to the idea of species extinction throughout U.S. history. This study of CREWS is better described as a combination of environmental history, history of science policy, and history and philosophy of science (HPS), which looks at the continuity of a conceptual approach and use of a set of practices across a changing political climate between 1956 and the passage of the ESA in 1973. The science-policy aspect of the project takes a serious look at the members of CREWS as

[1] Mark V. Barrow Jr., *Nature's Ghosts: Confronting Extinction from the Age of Jefferson to the Age of Ecology* (Chicago: The University of Chicago Press, 2009), 1.

scientist-policymakers and examines how the Committee, together with its advisors and supervisors, embedded a particular approach to endangered-species conservation into U.S. federal policy. Pulling from several historical traditions provides a more thorough history of the ESA than any of these approaches taken alone and sheds light on the history of some current conservation practices in the U.S.

2. CREWS and the ESA

CREWS was an internal committee of the U.S. Bureau of Sport Fisheries and Wildlife (BSFW) of the Department of the Interior (DOI), which operated as a science-advisory committee to the Director of BSFW on all matters related to endangered-wildlife protection.[2] Working in this advisory capacity, CREWS developed the first federal endangered-species list, contributed to draft legislation for all three of the U.S. endangered species acts beginning in 1966, and was heavily involved in the development of the federal captive breeding program, a cornerstone of endangered-species recovery efforts to this day. CREWS's contributions to these critical components of the development of endangered-species policy and legislation make it abundantly clear that CREWS is an important and necessary component of a robust history of the ESA and the development of federal endangered-species conservation practice and policy.

[2] The Fish and Wildlife Act of 1956 created within the US Fish and Wildlife Service two bureaus: the Bureau of Commercial Fisheries and the Bureau of Sport Fisheries and Wildlife. Commercial Fisheries was moved to the Department of Commerce in 1970 and the BSFW was renamed the U.S. Fish and Wildlife Service in 1974.

A long-standing tradition of state jurisdiction over wildlife made the notion of comprehensive federal legislation to protect endangered species an unlikely possibility until the middle part of the 1960s. Long before the first endangered-species act was passed, biologists, wildlife managers, and conservation-minded bureaucrats in the FWS had established a tradition of wildlife conservation, primarily on federal lands and with migratory birds—most notably the imperiled whooping crane. Whooping crane conservation in the 1950s and early 1960s was a crucial piece of the context in which federal endangered-species policy developed, as it produced a gathering point for a small core of FWS scientists and conservationists who would later be associated with or become members of CREWS. The connection between whooping cranes and CREWS is further demonstrated by a memo attached to the CREWS charter stating that the Committee was to assume the "duties previously assigned to Bureau personnel and the informal Bureau 'Whooping Crane Committee' concerned with whooping crane propagation."[3]

More than just a continuity of actors, though, there was also a significant overlap in conceptual approach and conservation practice employed in efforts to save the whooping crane and those later used by CREWS. One prominent example lies in the identification of the objects of conservation. Whooping crane conservationists had identified two populations of whoopers—a non-migratory Louisiana population and a migratory population that wintered in southern Texas.

[3] D. A. Janzen, "Administrative Manual, Subject: Committee on Rare and Endangered Wildlife Species." January 30, 1964.

As some crane conservationists turned to captive breeding and reintroduction as a way to potentially bolster the whooping crane population in the wild, they were faced with the dilemma of whether to breed members of the two populations as one species or as two separate populations to be conserved independently. Determining a breeding policy for cranes depended on targeting a particular object of conservation. CREWS would later face this same issue as it set out to develop the first comprehensive federal list of U.S. endangered wildlife. Should endangered-species conservation policy target only full species or should it protect sub-species, populations, or some other kind of group? In answering the object of conservation question CREWS relied on experience taken from whooping crane work and borrowed some theoretical underpinnings from work done in systematics, evolutionary biology, and genetics as part of the Evolutionary Synthesis of the 1930s and 1940s.

In addition to the conceptual commitments related to objects of conservation, the Committee's commitment to captive breeding practices was also born out of 1950s whooping crane conservation. From the early days of FWS involvement in crane conservation, the Service's management approach was but one approach among many held by various private and government wildlife conservationists from the U.S., Canada, and Europe. Captive breeding and reintroduction was a strategy supported and argued for by FWS's crane workers for most of the 1950s. However, conservationists outside FWS, primarily high-ranking members of the National Audubon Society, did not universally support

captive breeding, and argued instead for preservation of crane habitat and public education rather that interfering with the remnant population.

Opposition to captive breeding began to weaken after a proposal by future CREWS member Ray C. Erickson titled "Production and Survival of the Whooping Crane" was circulated among crane enthusiasts. Erickson's proposal marked the beginning of a movement of whooping crane conservation decisions away from the broader conservation community and opponents of captive breeding and toward FWS control. This shift in administrative and decision-making structure was carried over into the formation of CREWS, which was composed entirely of committee members internal to FWS. Representation from outside the service came only in the form of advisors to the Committee, all of whom were invited by FWS to participate. Of those who were invited, all had supported the Service's captive breeding initiatives.

Shortly after CREWS was established, Erickson, with the assistance of South Dakota Senator Karl Mundt, received an appropriation from Congress to establish a federal captive breeding station at the Patuxent facility in Laurel, Maryland, to continue the work outlined in his earlier proposal.[4] Captive breeding research and practice at the Patuxent Wildlife Research Station was to be split into three sections: the section of ecology, the section of propagation, and the section of laboratory investigation. In his papers describing the research units of the Patuxent Station, Erickson helped to establish captive breeding as one of the

[4] Alston Chase, *In a Dark Wood: The Fight Over Forests and the Rising Tyranny of Ecology* (Boston, MA: Houghton Mifflin Company, 1995), 83.

primary tools used by FWS to affect endangered-species recovery for the objects of conservation identified and listed by CREWS.[5]

An accurate and thorough history of the development of the federal endangered-species policy in the 1960s that led to the ESA hinges on understanding the contribution of this small committee of scientists and wildlife managers established in the BSFW in 1964 and the historical contexts in which it operated. CREWS was established as an internal FWS committee following conflicts in the broader conservation community over the captive breeding of whooping cranes. The Committee was given a mandate to develop a federal endangered species program. When CREWS began, it was not clear what federal policy on endangered wildlife should look like, how comprehensive it should be, or exactly what jurisdiction the federal government had in this domain. CREWS addressed these problems by combining a set of theoretical approaches and institutional practices. These entailed a set of ecological assumptions that together specified a set of conservation categories and initiated a tradition of endangered-species recovery. The Committee and its supervisors in the FWS and DOI then set about influencing the legislative process, through bill authorship, consultation with law-makers, and participation in Congressional hearings, to incorporate CREWS's approach into the ESA. Yet despite CREWS's central role in the history of the ESA, the Committee is little studied by historians.

[5] Ray C. Erickson, "A Federal Research Program for Endangered Wildlife," 1968, SIA RU T89021 box 7 folder 8.

3. CREWS in the Literature

Histories and historical analyses of the Endangered Species Act (ESA) are abundant and diverse. Some take the form of case studies such as those on the spotted owl or the snail darter.[6] Others were written as parts of policy analyses of the Act.[7] Still others are contained in edited volumes covering a range of ESA-related topics.[8] Many, if not most, of these works use the history of the ESA's development only as background to inform discussions about the Act's current relationship to science, policy, or both. For instance the National Research Council's (NRC) *Science and the Endangered Species Act* (1995) devotes just three of its over two hundred and fifty pages to the history of the ESA, primarily focusing on the history of federal wildlife legislation, while its larger project tries to articulate how current understandings of species concepts, land use, and conservation biology impact the continuing implementation of the Act. Missing

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[6] See Steven Lewis Yaffee, *The Wisdom of the Spotted Owl: Policy Lessons for a New Century* (Washington, D.C.: Island Press, 1994); Kenneth M. Murchison, *The Snail Darter Case: TVA Versus the Endangered Species Act* (Lawrence, KS: University Press of Kansas, 2007).

[7] See Steven Lewis Yaffee, *Prohibitive Policy: Implementing the Federal Endangered Species Act* (Cambridge, MA: MIT Press, 1982); Richard Tobin, *The Expendable Future: U.S. Politics and the Protection of Biological Diversity* (Durham, NC: Duke University Press, 1990); Brian Czech and Paul Krausman, *The Endangered Species Act: History, Conservation Biology, and Public Policy* (Baltimore: The Johns Hopkins University Press, 2001); Tim W Clark, Richard P. Reading, and Alice L. Clarke, *Endangered Species Recovery: Finding the Lessons, Improving the Process* (Washington, D.C.: Island Pres, 1994)

[8] See Dale D. Goble, J. Michael Scott, and Frank W. Davis (eds.), *The Endangered Species Act at Thirty* (Washington D.C.: Island Press, 2006); Kathryn A. Kohm (ed.), *Balancing on the Brink of Extiction: The Endangered Species Act and Lessons for the Future* (Washington D.C.: Island Press, 1991).

from the canon of ESA history is significant attention to CREWS, the scientist-policy makers who were put in the position of scientific and conservation authorities by the DOI and charged with the development of federal endangered-species policy.

Although CREWS's contribution through listing and captive breeding, both well known to historians and policy scholars, make it clear that CREWS is important to ESA history, little exists about CREWS in the secondary literature.[9] Of the sources cited above, four make some reference to CREWS in their historical treatment of the ESA. The most-cited references in the various discussions of CREWS are environmental-policy analyst Steven Lewis Yaffee's *Prohibitive Policy* (1982) and CREWS's government publication *Rare and Endangered Fish and Wildlife of the United States* (standardly referred to as the 'Red Book').[10] Yaffee, the apparent source of many of the details found in the secondary literature about the Committee, only devotes four pages to the role of CREWS in ESA history. Citing the 1964 Red Book and a few congressional records, he described CREWS as a committee of nine biologists from the BSFW who generated a list of sixty-three vertebrate species thought to be in danger of extinction. Yaffee offers no discussion of the individual committee members, the Committee's organizational structure, its mandate, or the various scientific

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[9] Jan DeBlieu, *Meant to Be Wild: The Struggle to Save Endangered Species Through Captive Breeding* (Golden CO: Fulcrum Publishing, 1991); Tobin, *Expendable Future*, 83-109.

[10] *Rare and Endangered Fish and Wildlife of the United States* was printed as a draft in 1964 and subsequently revised and published as a government document in 1966. A further revised edition was published in 1968.

positions from which the individual members operated. This is not a criticism of Yaffee. His book was focused on the implementation of the ESA and not its scientific development. Nonetheless, Yaffee has become the source for what little information about CREWS exists in the secondary literature.

Mark Barrow's *Nature's Ghosts* has recently added some independent research to the history of CREWS. His 'long-standing dialogue' on extinction addresses the Committee in the book's final chapter. Barrow's analysis deals mostly with then Secretary of the Interior Stewart Udall's role in establishing the Committee and Ray Erickson's work on the federally sponsored captive breeding program for whooping cranes and other endangered birds. Additionally, Barrow draws attention to the influence of international conservation communities, particularly the International Union for the Conservation of Nature and Natural Resources (IUCN), on the work of CREWS. Despite being an important step toward understanding the influence and impact of CREWS, *Nature's Ghosts* gives no insight into the inner workings of the Committee and the scientific commitments held by its members that shaped endangered species policy in the 1960s and 1970s.

Collectively, the various sources containing historical treatment of the ESA present a mostly consistent standard story. The archetype of this standard story of ESA places the Act as the culmination of a long series of attempts to create U.S. federal wildlife conservation policy, beginning with the Lacey Act and

the Migratory Bird Treaty Act in the early decades of the twentieth century.[11] The ESA is then described as the culmination of a series of three endangered species acts passed between 1966 and 1973.[12] In addition to the traditional legislative lineage of the ESA, standard accounts often add a few paragraphs on the rising use of endangered species lists in the 1960s, often citing CREWS's initial Red Book list of 63 vertebrate species thought to be endangered.[13] Another common feature of the story is some discussion of the role of the environmental movement in creating public awareness of the extinction problem.[14]

The claim that the above components of ESA history contributed to the passage and structure of the ESA is not in question. However, a detailed historical analysis of CREWS changes the focus of the standard story of the ESA, downplaying it as a legislative history made possible by the socio-political conditions of its time. The thesis of the present project is that a history of the ESA, in light of CREWS, is more accurately described as one of scientific and political authority and the process by which those identified as the authorities combined a set of conceptual commitments and conservation practices to offer a

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[11] The Lacey Act of 1900, resting on the federal government's authority to regulate interstate commerce, prohibited interstate trade in wildlife taken in violation of state law. The Migratory Bird Treaty Act, passed in in 1918, implemented a 1916 treaty between the U.S. and Great Britian (on behalf of Canada) calling for the protection of migratory birds.

[12] NRC, *Science and the Endangered Species Act*. (Washington D.C.: National Academy Press, 1995), 18-21.

[13] Tobin, *Expendable Future*, 84-87; Yaffee, 1982, 34-35.

[14] Timothy J. Farnham, *Saving Nature's Legacy: Origins of the Idea of Biological Diversity* (New Haven, CT: Yale University Press, 2007), 80-84.

particular approach to endangered-wildlife conservation. The approach offered by CREWS was accepted and incorporated into endangered-species policy, and has had a profound and lasting effect on the shape of the ESA and the subsequent practice of endangered-species recovery to this day.

4. Methods

Given that there exists a rich literature on the ESA and that CREWS significantly impacted the landmark legislation, why have historians and policy scholars largely neglected CREWS as an object of study? One explanation might simply be that much of the literature on the ESA is largely ahistorical, focused on other aspects of the Act, and using the history primarily as background. In Barrow's case it was simply a matter of scope and level of resolution with ESA related history as only a small part of the 'long-standing dialogue' about extinction. A more compelling reason for CREWS's neglect is a perceived lack of available, primary-source documentation on the Committee. As an FWS advisory committee the most reasonable location one would expect to find archival resources on CREWS would be the U.S. National Archives and Records Administration. However, information at the National Archives on CREWS is scarce, potentially leading researchers to the conclusion that CREWS's contributions to endangered-species policy were insignificant, uninteresting, or simply not preserved.

Uncovering documentation on CREWS requires a close look at the individual membership of the Committee. Within the Committee were three researchers from the FWS Division of Wildlife Research, two of whom were

members of a research unit known as the Bird and Mammal Laboratory (BML). The BML was a FWS research group staffed by government employees but housed at the Smithsonian Institution, where it performed taxonomic research and maintained the national collection of North American birds and mammals. The archives of the BML and personal papers of John W. Aldrich, one of the two BML researchers, are located at the Smithsonian Institution Archives (SIA). Those collections, together with a few related record units at the SIA, contain more than six hundred pages of primary source documentation on CREWS including memoranda, meeting notes and transcripts, multiple draft versions of official reports and publication, and other forms of historical data.

In addition to the Smithsonian Archival materials, an extensive Congressional record, containing draft and revised endangered-species bills proposed in both houses of Congress, Congressional hearing transcripts, and subcommittee legislative reports inform the present project. The Congressional record is the main source used in chapter six for tracing CREWS's influence through the legislative process up to and including the ESA. These records reveal contributions from two CREWS committee Chairs and FWS supervisors in the form of bill authorship and consultation, and testimony during congressional debates as the bills moved through the legislative process. Beyond these legislative contributions by individuals, the legal documents show the evolution of the scientific language from one piece of legislation to the next and from bills to laws that strongly corroborates other evidence of CREWS's influence.

It is not the claim that CREWS was the only important influence on the ESA. The Committee did not operated in isolation and pressures were most certainly exerted by such outside influences as the Committee's administrators, colleagues in FWS and in members' scientific fields of study, conservation and scientific societies, lawmakers, and public sentiment. Where the sources described above point out external pressures affecting CREWS's conservation approach, such influences have been addressed. That said, the main focus of this project is a close analysis of CREWS and the ideas and methods it advocated that were incorporated into endangered-species legislation and policy.

Tracking the development of CREWS's conservation approach and its efforts to ground federal endangered-wildlife policy in the 1960s and 70s in "the best scientific data available" requires a diverse set of historical methods.[15] The approach of the present project is to combine environmental history with a history of science-policy and history and philosophy of science (HPS) to describe CREWS's conservation approach. Environmental history as a discipline seeks to describe the dynamic, historical interaction between humans and nature. Human response to anthropogenic species extinction has been a rich area of study in this form of historiography and CREWS's approach, particularly in the context of the whooping crane, fits well within this tradition. CREWS is an obvious case for science-policy analysis, as a historical account of a group of science advisors who directly influenced the formation of public policy. CREWS's conservation approach was drawn from several different scientific fields. Some of the

[15] U.S. Code Title 16, Chapter 35, Section 1533.

Committee's scientific commitments were openly debated, such as the application of systematics to conservation. Others, such as the Committee's ecological approach, were incorporated into the CREWS program as self-evident practices. Broadly speaking, a historiographic approach in the HPS tradition is ideal for exploring commitments to research traditions and the unwritten assumptions in CREWS's attempts to establish a federal endangered-species program. Although all three historiographic approaches will be useful, this project at heart is an empirical history aimed at describing what CREWS was, what it did and how, and why it continues to be important.

5. Structure of the Dissertation

The influences and constraints that shaped the work of CREWS are difficult to disentangle. Rather than isolate and describe each one and its effect on the ESA this project attempts to describe the various interactions of these influences and constraints with respect to individuals on the Committee, CREWS as a whole, and its network of advisors and supervisors. The research is presented primarily in a chronological ordering, first describing conservation work prior to CREWS in Chapter 2. Next, the formation of the Committee and a description of its membership is presented in Chapter 3, followed by Chapters 4 and 5, detailing CREWS's conservation program. Finally, a thorough examination of the congressional record in chapter 6 will show the Committee's involvement in and influence over the ESA legislative process. In each chapter some evidence describing the dynamic contexts of CREWS extends beyond the primary timeframe of the project or of individual chapters. Where this happens I have

erred on the side of depth of the story rather than attempting to follow a strict chronological organization.

Chapter 2 demonstrates a strong connection between CREWS and 1950s whooping crane conservation. This chapter together with Chapter 3, which documents the formation and charter membership of the Committee, highlights Barrow's idea of continuity and change by comparing the conceptual approach and administrative organization used to affect whooping crane recovery and the later attempt by CREWS to establish a more comprehensive wildlife conservation program. The importance of the FWS involvement in whooping crane conservation is demonstrated by the personnel overlap between the Whooping Crane Advisory Group and CREWS as well as the overlap in conceptual approach used by both groups. While there was continuity in scientific approach to wildlife conservation from whooping cranes to CREWS, there was a distinct change in the administrative approach to and political importance of the endangered-species problem. These changes allowed CREWS to articulate and apply certain theories and practices developed in the context of whooping crane recovery in a new political arena—the development of comprehensive federal endangered-species legislation.

With the description of the political and scientific contexts of the formation of CREWS and its immediate pre-history laid out, Chapters 4 and 5 explore the negotiations that took place within CREWS and between CREWS and its advisors, supervisors, and the broader conservation community. Chapter 4 discusses three important questions CREWS addressed in the process of

developing the first U.S. federal endangered species list, the Red Book. These questions relate to identifying the objects of conservation, making sense of conservation categories, and identifying a process of classifying the objects of conservation into categories. Chapter 5 looks at another important CREWS-related project—the FWS captive breeding program under the direction of CREWS member Ray C. Erickson. Erickson's work shows an issue that hovered around the periphery of CREWS's scientific and management negotiations—conceptions of ecological relationships and processes and their role in addressing the endangered-species problem. The ecological approach taken, but not widely debated or precisely articulated by CREWS, had a profound effect on the way endangered-species recovery was practiced in the wake of the ESA, practices that persist to this day.

Chapter 6 immerses the reader in the Congressional record showing the development of federal endangered species policy from a legislative perspective. The chapter examines changes in language in endangered species legislation from the first 1966 Endangered Species Preservation Act through the various bills submitted that were consolidated and revised to become the ESA. This language shows a strong influence from the conceptual approach and conservation practices espoused by CREWS. But the chapter goes beyond the correlations and shows that there are significant causal forces behind the CREWS-like science embedded in the ESA. Authorship of the ESA bills and participation by CREWS and its associates in the legislative negotiations of Congressional hearings and federal

budgets debates place CREWS's conservation approach in the middle of the formation of the ESA's legal and intellectual content.

The intellectual value of the present project lies in a deeper and more complete empirical history of the development of the ESA's scientific content. It rightly depicts CREWS as a science advisory committee that cast a long shadow with respect to U.S. federal endangered-species policy. This shadow likely extends over modern federal conservation policy to this day, further validating a historical look at the origin of those concepts and practices and the process by which they were captured in the legislation. In addition, the CREWS story suggests a basis for recognizing the value of applying historical methods to meaningfully contribute to modern conservation science and the study of science-policy. Managed relocation, the nature of species in conservation, ecological approaches, and causes of extinction were all topics wrestled with by CREWS as the Committee endeavored to develop a policy that would attempt to save endangered species from extinction. Many of these conservation topics are relevant today as conservationists use the policy tools built in part by CREWS to do the same.

Chapter 2

OF POLITICS AND WHOOPING CRANES

1. Conservation in Context

This chapter has two themes—whooping crane conservation in the 1950s and the broader U.S. socio-political context during the same period.[16] These themes are presented as parallel storylines with alternating sections describing the development of federal whooping crane conservation and the emergence of presidential and DOI environmental policy. These storylines proceeded somewhat independently through the 1950s and into the 1960s before converging as the chapter closes in the early 1960s. A discussion of the convergence of federal conservation in the FWS and federal level policy above FWS with the formation of CREWS, which eventually led to legislative changes, is reserved for the next chapter.

Whooping crane conservation in the 1950s and the U.S. environmental movement that emerged in the 1960s stand as important contexts for understanding the development of the ESA. FWS involvement in whooping crane conservation is easily characterized, while post-war environmentalism has a more complicated history and less clearly defined boundaries. Whooping crane conservationists and U.S. presidential and cabinet-level politicians both played

[16] Political context can refer to the political negotiations between the various technical experts that established themselves as stakeholders in whooping crane conservation, or with respect to Cabinet Secretary, Presidential, and/or Congressional level interest in conservation policy. Both will be discussed in the chapter, but the latter description, which involves the heightened interest in federal legislation as a marker of the U.S. environmental movement, is intended here.

important roles in establishing endangered-species legislation. However, the roles played by these two groups of participants developed at different times and under different circumstances. The varying degrees of interaction between them are important factors in tracing ESA history.

Whooping crane conservation provides the conceptual and management practice background that was an important source of CREWS's conservation approach. Beginning with the Whooping Crane Conference of 1956, there exist important overlaps in personnel between those involved in FWS whooping crane conservation and CREWS. Additionally, there was significant carryover in conservation approach from cranes to CREWS. CREWS member John Aldrich, for instance, applied a conceptual approach which relied on taxonomic theory to analyze the conservation management needs of two separate populations of whooping cranes. Aldrich's approach was later used to justify the identification of a particular object of conservation used to generate the first federal list of endangered species (see chapter 4). Ray Erickson, also a CREWS member, first suggested the application of captive breeding as an approach to endangered species conservation in a proposal calling for a whooping crane propagation program (see chapter 5). Erickson's efforts resulted in the establishment of the Patuxent Wildlife Research Center in 1965, which to this day still houses a captive flock of whooping cranes.

FWS's efforts to save the whopping crane have been described as "the most sustained and wholehearted it has ever undertaken."[17] CREWS members were aware of and participated in a number of other conservation projects within FWS. Whooping crane efforts, however, were one of the most publicized and more importantly heavily documented within the archives describing CREWS's conservation efforts. With respect to CREWS, whooping crane conservation of the 1950's is not simply an example that demonstrates CREWS's conservation approach. Whooping crane conservation is 'the' example that best informs the administrative and conservation context that brought important members of CREWS and CREWS's advisors together. Additionally, it was in the context of whooping crane conservation that CREWS's members and advisors began to apply a set of concepts and practices to a specific endangered-species 'problem'—concepts and practices later used to develop the federal endangered species program.

Although, documentation of whooping crane conservation extends to the early part of the twentieth century, recovery efforts underwent reorganization in 1956 following the Whooping Crane Conference. The Conference, organized by the U.S. Department of the Interior, established a science-advisory group for whooping crane conservation and an official line of communication in the form of the FWS produced Whooping Crane Advisory Group Memoranda. The 1956

[17] Faith McNulty, *The Whooping Crane: The Bird that Defies Extinction* (New York: E. P. Dutton & Co., Inc., 1966), 15.

Conference minutes and the memoranda series are the primary resources used here to characterize federal involvement in whooping crane conservation.

The second, parallel theme of this chapter will rely on secondary sources to describe the shift in federal environmental policy in the context of the so-called environmental movement. As the walls between the politicians and technical experts began to come down the administrative approach to addressing endangered-species changed, as evidenced by the formation of CREWS, yet the conceptual approach and conservation practices were largely carried over from the crane experience.

2. Toward A Federal Management Policy

In 1964, when CREWS was established, the FWS was engaged in a three-decade-old battle to save the whooping crane from the threat of extinction. Crane life-history studies, field population counts, education campaigns directed at hunters and the general public, and captive breeding were the main strategies employed by FWS in its efforts to protect whooping cranes. The crane project, however, did not have as part of its agenda an attempt to establish federal legislation directed at protecting endangered wildlife more generally. The legal authority for FWS involvement in crane protection came from existing legislation, namely the Migratory Bird Treaty Act of 1918 and the Duck Stamp Act of 1934, the latter legislation resulting in the 1935 purchase of the Aransas National Wildlife Refuge, the whooping crane's wintering grounds.

Well-established precedent predominantly left wildlife management in the U.S. to individual states, rather than the federal government until the middle part

of the twentieth century. Around the turn of the twentieth century, conservation groups, including private associations of hunters and sportsmen, expressed some concerned that state regulations were too inconsistent and fragmented to protect the U.S.'s rich wildlife heritage effectively. Primarily concerned with game animals, these conservation groups pushed for the first federal legislation directed at wildlife conservation to ensure the long-term survival of the targets of their recreational activities.

In an effort that many saw as stretching the bounds of federal authority under the constitution, the federal government entered the arena of wildlife conservation through the regulation of interstate commerce and the signing of international treaties. The Lacey Act and the Migratory Bird Treaty Act were the main tools used by the federal government and the U.S. FWS to engage in wildlife conservation until the passage of the first U.S. endangered species act in 1966.[18] Whooping crane conservationists in the 1950s, perhaps viewing interstate commerce and international treaties as the extent to which states' rights advocates would yield to federal intrusion into wildlife management, were content to rely on these tools, combined with an authority to purchase land for federal wildlife refuges.[19]

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[18] See note 11, Chapter 1.

[19] Federal purchase of lands to establish national parks and wildlife refuges are in fact the earliest signs of a federal policy on endangered species, with the purchase of Yellowstone National Park established as a buffalo refuge in 1872.

If those involved in whooping crane conservation in the late 1950s and early 1960s did not have new federal wildlife legislation as a high priority, it was even less so for the political figures who would go on to play a critical role in the proliferation of environmental legislation in the decades to follow. The 1960 presidential campaign was all but devoid of environmental issues. Likewise, environmental legislation, including wildlife protection, was not an agenda item in the first years of Stewart Udall's tenure as the Secretary of the Interior under President Kennedy.[20] In the years leading up to the formation of CREWS, wildlife conservation was practiced by FWS, but was not part of a policy agenda at the presidential or cabinet level.

Although not solely responsible for launching the so-called environmental movement in the U.S., the 1962 publication of Rachel Carson's *Silent Spring* is often seen as the point at which the movement began to take root in both the U.S. government and the general public. Environmental concerns began to catch the attention of President John F. Kennedy and to an even greater degree his successor Lyndon Johnson. It is even more historically significant that Interior Secretary Stewart Udall became involved in the new environmentalism, publishing in 1963 his own call for conservation in *The Quiet Crisis*. From a policy standpoint, Udall placed the DOI at the center of what would become a massive proliferation of federal environmental legislation, including three endangered species acts, over the next decade.

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[20] Barrow, *Nature's Ghosts*, 318; Transcript, Stewart Udall oral history interviews, 1969, by Joe Frantz, LBJ Library.

Prior to Udall's setting of an environmental agenda in the early part of the 1960s, federal wildlife conservation and presidential and congressional politics operated on largely independent trajectories with little to no interaction. As environmental policy and legislation became a public and hence a political priority, these separate trajectories began to converge. This new political and public support for federal wildlife conservation provided an opportunity for FWS scientists, already engaged in endangered wildlife conservation with the whooping crane, to apply their research program to a new area, namely the development of federal endangered species policy and legislation.

3. Save the Cranes!

Grus americana, a member of the Gruidae or crane family, is the largest and only pure white North American crane. Its rather conspicuous size and color inspired John J. Lynch, a U.S. Fish and Wildlife biologist involved in crane conservation in the 1950s and 1960s, to bestow on it the moniker 'GWB' or great white bird. In his more glib moments, Lynch would also refer to the birds as 'LSTs,' large slow targets, as a way of not so subtly hinting at one of the possible causes of their endangered status.[21] In the 1950s, when the U.S. FWS became an active force in whooping crane conservation, the extant population's range consisted of its wintering grounds at Aransas National Wildlife Refuge in southern Texas, its summer breeding grounds in northern Alberta, Canada, and the flight path between. In 1956, U.S. Interior Secretary Fred Seaton claimed that

[21] Transcript, Ray Erickson oral history interviews, 2006, by Mark Madison, FWS digital media.

this migratory population of less than thirty total birds had come to "symbolize to a significant number of people in Canada and the United States the impelling necessity of adequate knowledge and plans for the conservation of wildlife."[22] The cranes' status as one of the symbols of wildlife conservation also made them the focus of intense debate on what constituted an 'adequate' plan. An attempt to resolve the major debates in crane conservation would be addressed in the usual way: the experts held a meeting.

The Secretary's conference room in the Washington D.C. offices of the U.S. Department of the Interior was the site for the Whooping Crane Conference held on October 9, 1956. The conference organizers (U.S. FWS) cast a wide net to attract participants, having sent invitations to "all national ornithological and conservation organizations and to those international organizations that have offices or representatives in the United States."[23] The invitations drew an enthusiastic response and the conference was attended by a broad spectrum of professionals including museum curators, zoo directors, and private and government conservationists from the U.S., Canada, and as far away as Morges, Switzerland, where the International Union for the Conservation of Nature's (IUCN) was headquartered (see table 2.1). They gathered to address a number of issues related to whooping crane conservation, but primarily to generate a consensus on what degree of intervention and management was necessary to save the whooping crane from extinction.

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[22] Minutes of the Whooping Crane Conference October 29, 1956, SIA RU T89021 box 1 folder 42.
[23] Ibid.

Table 2.1
Attendees of the Whooping Crane Conference - October 29, 1956

Robert P Allen, National Audubon Society
John H. Baker, National Audubon Society*
Fred G. Bard, Saskatchewan Museum of Natural History*
Richard Borden, Massachusetts Audubon Society
Charles H. Callison, National Wildlife Federation
Harold J. Coolidge, International Union for the Conservation of Nature (IUCN)*
Dr. Clarence Cottam, Welder Wildlife Federation, Texas Ornithological Society*
Lee S. Crandall, The Conservation Foundation, New York Zoological Society
Dr. David E. Davis, The Wildlife Society
Malcolm Davis, National Zoological Park
Albert M. Day, The Arctic Institute of North America
Dr. Jean Delacour, International Committee for Bird Preservation
George Douglas, Audubon Park Commission*
George B. Fell, Nature Conservancy
Col. M. J. Fitzgerald, Ducks Unlimited
Joseph T Flackne, The Arctic Institute of North America
Dr. Ira N. Gabrielson, Wildlife Management Institute*
C. R. Gutermuth, Wildlife Management Institute
Dr. W. K. J. Harkness, Intl. Assn. of Game, Fish, and Conservation Commissioners
Lou Klewer, Outdoor Writers Association
Dr. J. P. Linduska, Intl. Assn. of Game, Fish, and Conservation Commissioners
Col. W. Winston Mair, Canadian Wildlife Service
Frank Mulkern, Izaak Walton League
Dr. D. A. Munro, Canadian Wildlife Service*
Robert L Perkins, Jr., Wildlife Preservation Inc.
Richard H. Pough, Nature Conservancy
Dr. S. Dillon Ripley, International Committee for Bird Preservation*°
Carl D. Shoemaker, Intl. Assn. of Game, Fish, and Conservation Commissioners
Fred W. Stark, San Antonio Zoo and Aqurium*
Melvin O. Steen, Central Flyway Council*
Dr. L. H. Walkinshaw, Wilson Ornithological Society*
Richard W. Westwood, International Union for the Conservation of Nature
Howard Zahniser, The Wilderness Society

Attendees of the U.S. Fish and Wildlife Service

John W. Aldrich*†	W. Lester Bagley	Iva M. Caswell	Jack C. Culbreath
Ray C. Erickson†	John D Findley	Bernard L. Flanagan	Paul Hickie
Julian Howard	Robert H. Johnson	Wesley F. Kubichek	C. H. Lawrence†
Frederick C. Lincoln*	John J. Lynch	Alastair MacBain	J. Clark Slayer
Edna N Sater	Robert A. Wells		

* member of the Whooping Crane Advisory Group
° advisor to CREWS
†charter member of CREWS
From meeting minutes of the Whooping Crane Conference, SIA RU T89021 box 1 folder 42.

The U.S. FWS had become involved in whooping crane conservation in 1945 at the request of the National Audubon Society (NAS). The NAS was seeking the support and authority of the FWS to back its whooping crane efforts. What it received was an unofficial exchange of letters between Audubon Society President John Baker and FWS's Chief Ira Gabrielson that was dubbed The Cooperative Whooping Crane Project (CWCP). FWS supplied neither money nor manpower for the project; it merely bestowed unpaid observer status on NAS researchers. The Project did, however, allow NAS researchers to accompany FWS staff during waterfowl census flights, and granted them access to federal wildlife reserves.[24]

As the U.S. FWS became more actively involved in crane conservation a tension developed between the conservation-management approach of the FWS and the more preservation-minded members of the NAS. The NAS approach to saving the cranes had been primarily focused on research and public education. By the 1950s a growing collection of biologists and conservationists were becoming concerned that a strictly preservationist approach was insufficient and that without intervention the whoopers would be doomed to extinction.[25] The

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[24] Thomas Dunlap, "Organization and Wildlife Preservation: The Case of the Whooping Crane in North America," *Social Studies of Science* 21 (2) (1991): 197-221.

[25] The conservation-preservation distinction has been used in different ways as an effective analytical tool in the study of environmental history. The distinction here lies with preservationists who advocated for habitat acquisition and public education as the sole means of crane conservation and opposed the conservation minded wildlife managers who supported interventionist strategies, such as captive breeding.

chief American proponent of an interventionist strategy, which primarily involved the taking of eggs and birds from the wild for the purpose of developing a captive flock, was U.S. FWS biologist John J. Lynch. His main Canadian ally was Fred Bard of the Saskatchewan Museum of Natural History. Bard and Lynch both attended the 1956 Whooping Crane Conference as staunch advocates of a captive breeding program and argued vehemently on its behalf.[26]

Attendees of the 1956 conference resolved the degree-of-intervention problem to crane conservation in the usual way for a conference of experts: they formed a committee of experts to further consider the problem. The Whooping Crane Advisory Group (WCAG), which supplanted the previous and less official CWCP, was established via a resolution of the Whooping Crane Conference. The Advisory Committee consisted of thirteen members, twelve of whom had attended the 1956 conference, having the same broad representation with respect to scientific field and government versus private affiliation, but geographically limited to those mainly working in the U.S. and Canada. The WCAG's charge was to "make a thorough study of all methods of protecting and propagating the Whooping Crane."[27] Upon completion of the study, the WCAG was to make a recommendation on whether or not a captive breeding program was the way forward in whooping crane conservation and if so how such a program should proceed. It is not entirely clear to whom WCAG was to direct its

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[26] Minutes of the Whooping Crane Conference October 29, 1956, SIA RU T89021 box 1 folder 42.
[27] Ibid.

recommendations, in part because in 1956 the ownership status of the birds, which migrated across international boarders, had yet to be determined.

The WCAG was established to try to resolve a scientific and management dispute over how best to manage the wild whooping crane population in an effort to prevent the complete loss of the species. The whooping crane episode is particularly illustrative of 1950s wildlife conservation work—one-off projects directed toward particular species. This type of work stands in contrast to the endangered-species program of the 1960s, which sought comprehensive federal legislation for the protection and management of all species subsequently listed as endangered. But this should not be surprising. The political landscape of the 1950 was drastically different than the decade that followed, particularly in that federal environmental legislation was not yet in vogue.

The 1950s wildlife conservation approach, especially in the case of the whooping crane, was negotiated in the context of scientific meetings and government wildlife conferences. The debates and negotiation, the details of which are discussed in a later section, lasted well into the 1960s and the outcome was more the result of shifting political authority than any consensus reached by the WCAG. A decade later parts of the management practices that emerged would be repackaged and directed toward the creation of a new wave of federal wildlife legislation. For this to be effective, politicians and the general public would have to become more aware of and sympathetic to the plight of North America's great white bird and other wildlife on the brink of extinction. At the time of the 1960 presidential election that sympathy was not yet apparent.

4. Udall, the Environment, and the 1960 Presidential Election

When John Fitzgerald Kennedy became the 35th President of the United States, he appointed Stewart Udall to the post of Secretary of the Interior. The dearth of environmental issues taken up in the previous year's campaigning left Kennedy and his newly appointed Interior Secretary with few promises to keep and no discernible agenda with respect to federal environmental policy. Whooping crane conservation in the U.S. FWS was in full swing by this time, however the details of FWS efforts did not appear to be an immediate concern for either Kennedy or Udall. Nonetheless, Udall's appointment was important because under his leadership the Department of the Interior would become the initiator of much of the coming decade's environmental policy by developing research programs, compiling data, drafting legislation, and finally playing an instrumental role in the implementation of much of the environmental legislation of the 1960s and 1970s. Therefore, understanding the context in which Udall's Interior Department took shape and how his environmental program evolved is key to understanding the development of the conceptual approach and conservation practices written into the ESA, including the impact of the whooping crane conservation efforts on the form of the concepts and practices.

The pervasive environmental consciousness of the 1960s had not yet awakened at the time of 1960 U.S. presidential election. Experts and special interest groups had raised conservation and other environmental concerns in the post-war years, but these concerns had not reached a critical mass of public or political concern. Consequently, environmental issues were scarcely raised by

either candidate during the course of the tightly contested presidential race. The only environmental issue that arose during the five televised debates between then Senator John F. Kennedy and Vice President Richard Nixon came during Kennedy's opening statement in the first debate. There, in the context of U.S. economic growth, Kennedy stressed the need to increase hydroelectric power production to keep up with the Soviet rate of power production.[28] At the time of the debates, the candidates took dam building to be primarily an economic issue, the concern being about whether the federal government should be financing dam projects. Even though post-war citizen-conservationists had organized legal opposition to federal dams going back to the 1940s, it was not deemed of significant political concern for the candidates to take an environmental stance on the issue.[29] Only later in the 1960s and 1970s would dams more generally take on the tenor of an environmental controversy rather than a debate over federal spending.

A second issue that arose just prior to the 1960 presidential campaign was, like hydroelectric dams, only an environmental issue in retrospect. In early November of 1959 Arthur Flemming, Secretary of the Department of Health, Education, and Welfare, announced in a news conference that several batches of cranberries from Washington and Oregon had been found to be contaminated with the herbicide aminotriazole. Flemming urged "housewives" to avoid cranberries

[28] Sidney Kraus (ed.), *The Great Debates* (Indiana University Press, 1962), 349-351.
[29] Karl Boyd Brooks, *Before Earth Day: the Origins of American Environmental Law, 1945-1970* (Lawrence, KS: University of Kansas Press, 2009), 40-60.

unless they could be sure that they did not come from a tainted source. The cranberry crisis rippled through the extensive U.S. cranberry market, affecting growers nationwide and especially Ocean Spray Cranberries, Inc., which at the time had a controlling interest in 75% of U.S. cranberry production.[30]

Neither of the soon-to-be presidential hopefuls responded to the cranberry crisis as part of a larger environmental issue to be taken up as they campaigned for the presidency over the following year. Both Senator Kennedy and Vice President Nixon responded to the incident as an economic crisis, concerned about the devastation to what was, particularly in the month of November, a high profile U.S. agricultural industry. Kennedy publicly threw back a few glasses of cranberry juice, while elsewhere Nixon polished off four helpings of cranberry sauce in an attempt to restore consumer confidence and curry favor with voters in growing regions.[31] It would be three more years before Rachel Carson would view the cranberry crisis as an environmental issue and list aminotriazole as one of her 'elixirs of death.'[32]

Stewart Udall was appointed Interior Secretary by Kennedy following the latter's 1960 presidential victory by a historically narrow margin. Udall, a junior Congressman from Arizona, had put himself on the radar with Kennedy's advisors during the race for the Democratic presidential nomination, when in

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[30] "Some of Cranberry Crop Tainted by a Weed-killer, U.S. Warns," *New York Times* Nov 10, 1959.
[31] "Bureaucracy: The Cranberry Boggle," *Time*, Nov 23, 1959.

[32] Rachel Carson, *Silent Spring* (Boston MA: Houghton Mifflin Company, 1962).

something of a coup, Udall secured all seventeen of Arizona's delegates to the 1960 Democratic National Convention for Kennedy.[33] In addition to his pre-convention activities, Udall had geography in his favor. For the first half of the twentieth century the Department of the Interior was seen as a western department because of its historical associations with western issues including development of the frontier, Indian affairs, and public lands.[34] Western states were not particularly kind to Kennedy in the general election, turning overwhelmingly red as election maps were shaded in over the course of a Tuesday night in November 1960. The way the election was won left Kennedy with few debts to pay in the west. The Arizona Congressman was selected from a small pool of candidates and took office on January 21, 1961.[35]

By Udall's own admission he was not appointed to the cabinet to initiate a revolution in federal environmental policy[36]. Kennedy's lone message directed toward western voters was his intent to reverse the Eisenhower administration's policy of 'no new starts' and build more hydroelectric dams in the west. The only environmental agenda facing Udall when he took his cabinet post, other than the general maintenance of federal lands largely under the Interior's purview was to

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[33] Theodore H. White, *The Making of the President 1960* (New York: Atheneum Publishers, 1961), 143.

[34] Deane and David Heller, *The Kennedy Cabinet: America's Men of Destiny* (Freeport, NY: Books for Libraries Press, 1961), 89-99.

[35] Transcript, Stewart Udall oral history interviews, 1969, by Joe Frantz, LBJ Library.

[36] Ibid.

address the status of the Wilderness Bill that had been before Congress since the end of the previous administration, and finally passed in 1964. Those two items were, according to Udall, "really the only initial impetus that I was given. It was up to me pretty much working along [sic] to develop policies."[37] Later in the same interview, Udall expounded on the theme of environmental policy development.

> Each success led to more expansive thinking and more expansive goals… So I have to say in all honesty it did just evolve by sort of an a*d hoc* approach, moving where we had things lined up. One success then led to another, new demands, new enthusiasm in the country. And that's the way it really developed.[38]

Following this *ad hoc* approach the DOI and FWS began to line up resources to address the role of the federal government in the preservation of rare and endangered wildlife.

5. Breed the Cranes

In 1960 a new decade brought with it a new President, a new Secretary of the Interior, and "a new moral consciousness called environmentalism."[39] Although the exact beginning and characterization of the U.S. environmental movement is difficult to pinpoint, one marker that can be used to make a distinction between the movement and post-war conservation more generally was a new heightened interest in federal environmental legislation. Yet, despite key changes in leadership and social awareness concerning endangered species, FWS's whooping crane activities continued into this new era much as they had

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[37] Ibid.
[38] Ibid.

[39] Donald Worster, *Nature's Economy: A History of Ecological Ideas, Second Edition* (Cambridge: Cambridge University Press, 1977), 343.

since the mid 1950s. Debates concerning whooping cranes were still primarily about conservation practice and mainly between the scientists and wildlife managers; the debates did not involve high-level politicians or include federal legislative action. In fact, in the new decade, the primary disagreement over the cranes—whether or not to proceed with a captive breeding program—had remained unchanged since the formation of the Whooping Crane Advisory Group in 1956. Preservationists continued to hold their ground against wildlife managers intent on saving the cranes through captive breeding.

Conditions would conspire to delay the full resolution of the captive breeding debate for almost another decade.[40] First, a whooping crane population that had dropped below twenty adults in 1952 had begun to rebound toward the end of the decade with education and habitat protect as the only conservation strategies. The population increases offered some ammunition to detractors of intervention and captive breeding. Furthermore, advocates of the captive breeding approach had avenues of research open to them that did not require interfering with the wild whooper population, namely the use of surrogates and cripples to test their avicultural methods. The somewhat limited captive breeding program provided a first glimpse of the theories and practices that would be refined and put forth by CREWS as the political establishment became increasingly interested in the wildlife conservation work of FWS.

[40] Whooping Crane Memoranda, SIA RU T89021; DeBlieu, *Meant to Be Wild,* 105-127.

The administration of the FWS whooping crane program is best traced through the official WCAG memoranda; a series of sixteen enumerated memos circulated on a semi-regular basis between 1957 and 1970 to advisory group members and other interested parties. Despite the WCAG's mandate that a "thorough study of all methods of protecting" whooping cranes was to be pursued, the memos quickly became a record of captive breeding efforts and became the FWS's main tool for advocating for such methods.[41] Memorandum No. 1, dated March 11, 1957 described the first stage of the program involving three whooping cranes already in captivity: Crip and Josephine, a mated pair housed at the Audubon Park Zoo in New Orleans, and a single bird at the San Antonio Zoo and Aquarium who would later be named Rosie by the media. For the next four years all captive breeding efforts involved only these birds and their progeny.[42]

As coordinators of breeding efforts with the three captive cranes continued to adapt and develop their avicultural methods, they advocated for an expanded program that would introduce more wild birds into their captive population, in order to increase the genetic diversity of the captive flock. Their efforts would get a significant boost at the hands of Ray C. Erickson of the FWS Branch of Wildlife Research. Erickson had earned his Bachelor's degree in biology from Gustavus Adolphus College in Minnesota. A year later, in 1942, he completed his Master's

[41] Minutes of the Whooping Crane Conference October 29, 1956, SIA RU T89021 box 1 folder 42.

[42] Whooping Crane Advisory Group Memorandum No. 1, March 11, 1957, SIA RU T89021 box 1 folder 6.

degree in wildlife management at Iowa State University through a cooperative program between the university and FWS. His doctoral dissertation, completed in 1948, was on the life history and ecology of the canvasback duck, the same species on which he had written his master's thesis. Erickson joined FWS in 1955 a year before the establishment of the WCAG.[43] Although not an official member of WCAG in the beginning, Erickson's ideas concerning crane propagation would result in his name appearing throughout the WCAG Memoranda.

Responding to a 1961 all-agency memo from President Kennedy that called for innovative ideas, Erickson drafted a proposal entitled *Production and Survival of the Whooping Crane*.[44] The report summarized previous whooping crane studies independently carried out by Robert Porter Allen of the NAS and John Lynch of the FWS and then went on to make a series of observations and suggestions. Erickson observed that over a twelve-year period, wet seasons on the Canadian summer breeding grounds of the cranes generally resulted in a low survival rate of young cranes, while a dry season resulted in a significantly higher survival rate measured by the number of young arriving back at the winter grounds at Aransas National Wildlife Refuge. On the basis of these data Erickson recommended removing young cranes from the breeding ground during wet seasons (which could be predicted by expected snow melt, among other indicators) and adding those birds to the captive stock held by FWS. Erickson went on to weigh the merits of bolstering the captive population by taking or

[43] Barrow, *Nature's Ghosts*, 302-303.

[44] Ibid., 301.

'robbing' eggs from whooper nests which had been proposed by others advocating avicultural methods. Erickson seemed to be ambivalent about taking eggs, clearly preferring the capture of young during wet breeding seasons, suggesting the latter was less disruptive to the adult breeding population. Finally, Erickson, recognizing that crane breeding was at that point an uncertain practice and that he would have to wait for a favorable year (above average wet season) to gather young whoopers, recommended the capture and rearing of the closely related and more abundant sandhill crane for the "development of reintroduction procedures which may be used when and if propagated whooping cranes become available for this purpose."[45]

The Erickson proposal was attached to Memorandum No. 7 and circulated to the members of the WCAG for comment. Concerns and comments with respect to the Erickson proposal were reported a year letter in the next edition of the Memoranda and best summarized by the memo writer and the FWS's Bureau of Sport Fisheries and Wildlife Director Dan Janzen: "Numerous other useful and interesting thoughts are expressed by various members according to their principal interest in the program."[46] There was a general consensus among WCAG members concerning the "precariousness of the whooping cranes

[45] Ray C. Erickson, "Production and Survival of the Whooping Crane." June 2, 1961, SIA RU T89021 box 1 folder 5.

[46] Whooping Crane Advisory Group Memorandum No. 8, July 25, 1962, SIA RU T89021 box 1 folder 5.

continued survival."[47] Additionally, most agreed to immediate initiation of captive breeding and reintroduction studies on sandhill cranes. Consensus began to thin beyond those two points. One member agreed to sandhill propagation studies with the stipulation that if successful it in no way committed FWS to the capturing of wild whoopers. At the heart of the issue little had been resolved by the passage of time and the presentation of a new and more clearly articulated captive breeding proposal. Whooping crane conservation was still a highly polarized endeavor. One was either for intervention and captive breeding or not, and the balance of power was shifting towards those who were for.

Despite variation in opinion about captive breeding among the WCAG, the Erickson proposal marks the beginning of the FWS takeover of whooping crane conservation and the marginalizing of opponents to captive breeding, mainly outside FWS.[48] Congressional funding of Erickson's proposal to establish a federal captive breeding facility was one of the main drivers of the FWS takeover (see Chapters 3 and 5). The appropriations gave FWS funds and the political authority to carry out its research and conservation program, even in the face of opposition from within the WCAG. Any remaining opposition to captive breeding simply lacked the resources to mount an alternative campaign.

The 1964 WCAG Memorandum No. 11 best demonstrates the marginalization of the non-interventionist sentiment. The Bureau writer of the Memorandum lists eight "objections [to captive breeding of whooping cranes]

[47] Ibid.
[48] Dunlap, "Wildlife Preservation," 197-221.

raised by certain members of the [WCAG]," following up each objection "with our comments so that all may have an opportunity to appraise them and assist us in their evaluation."[49] The objections ranged from skepticism over the level of sophistication of aviculture methods, to the comparable value of wild versus captive birds, to captive breeding advocates unfounded dismissal of the effectiveness of noninterventionist strategies. The so-called comments were actually rebuttals dismissing each objection in turn as unfounded, irrelevant, or incorrect. The opposition was being pushed aside. FWS used funding and political authority to gain control in whooping crane conservation and control of one of the main lines of communication in the Memoranda to communicate its authority. FWS and certain other members of the WCAG were finally getting what they had wanted all along, a plan for a comprehensive program for the captive propagation of whooping cranes (although first tested on sandhills).

Environmental historian Thomas Dunlap has characterized whooping crane conservation in the first half of the twentieth century as a shifting from the work of individual, private conservationists to the work of federal agencies.[50] Well underway by 1960, that shift was accelerated by the increased public and political interest in endangered-species policy associated with the U.S. environmental movement. Yet, the new social and political awareness had no apparent effects on the conceptual approach taken by FWS with respect to crane conservation. Any changes in the whooping crane conservation landscape in the early years of the

[49] Whooping Crane Advisory Group Memorandum No. 11, November, 1964, SIA RU T89021 box 1 folder 5.
[50] Dunlap, "Wildlife Preservation," 197.

1960s were the result of the shifting of power away from the WCAG, with its broad representation of interests and methods, toward FWS control. What did come with 1960s environmentalism was a greater political interest in rare and endangered wildlife, including the symbolic whooping crane, and a new area of application for crane research and practice: federal environmental legislation.

6. Implicit in the Conservation Thesis

"The age of ecology," as described by historian Donald Worster, began in the New Mexico desert, the Marshall Islands, and in the currents of air that carried dust from Nevada to Colorado, and still further east.[51] The sites of the early atomic (and later hydrogen) bomb tests were also the points of origin for massive amounts of radioactive fallout that dispersed and later settled far from the site of the detonation. The effects of atomic weapons testing on the environment had begun to be studied not long after World War II, but the ecological effects of fallout did not become a widespread concern for scientists until the late 1950s.[52] Although scientists were increasingly concerned over fallout, the public concern was not yet pervasive enough to become a political issue for the presidential candidates in 1960 or the newly appointed Secretary of Interior in 1961.

If concern over radioactive fallout was the first spark of an emerging environmental movement, Rachel Carson's *Silent Spring* (1962) would fan that spark into a flame. The fortieth anniversary edition of *Silent Spring* proclaims the book as "[t]he classic that launched the environmental movement."

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[51] Worster, *Nature's Economy,* 342.

[52] Ibid.

Environmental historian Mark Barrow rightly downplays the overstatement of Carson's impact while recognizing her pivotal role in encouraging an already developing environmental consciousness: "It would be a mistake to credit Carson with single-handedly launching the modern environmental movement; but in popularizing ecological concepts, raising concerns about chemical contamination, and motivating the public to act, she clearly changed how Americans thought about their relationship to the natural world."[53] One of those Americans influenced by the message of *Silent Spring* was Udall, who recalled Carson as responsible for encouraging "a crystallization of thinking that took place in the 60s."[54]

A month after a preview of Carson's research appeared in a series of *New Yorker* articles, the President's Science Advisory Council (PSAC) organized an interagency panel, which included DOI representatives, to conduct a scientific analysis of the pesticide problem.[55] That PSAC was assigned to report on the validity of Carson's study revealed a growing acknowledgment of the authority of science in the realm of environmental policy. Carson herself was a scientist by training, so who better than PSAC to evaluate the merits of her work? President Kennedy also affirmed the place of science as the foundation of good

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[53] Barrow, *Nature's Ghosts*, 310.

[54] Transcript, Stewart Udall oral history interviews, 1969, by Joe Frantz, LBJ Library.

[55] Zuoyue Wang, *In Sputnik's Shadow: The President's Science Advisory Committee and Cold War America* (New Jersey: Rutgers University Press, 2008), 199-218.

environmental policy in his March 1962 message on conservation to Congress, in which he argued that "implicit in this conservation thesis of wise use, improvement, preservation and restoration of our resources is the basic requirement of greater scientific knowledge and improved resource management."[56]

In the wake of *Silent Spring*, the DOI began developing scientific research programs on a broad range of environmental issues. Udall would later refer to this work as the "total environment approach."[57] The results of this research led the DOI to push for and often submit draft legislation to Congress on such issues as air quality, water quality, waste disposal, and wilderness preservation, among other topics. The plight of endangered species began to appear on the 'total environment' agenda of Udall and the DOI in 1962, with action coming shortly after the fall of 1963.

7. From Cranes to CREWS

In the early part of the 1960s wildlife conservation became a significant part of Interior Secretary Udall's emerging environmental agenda. Here he turned to the DOI experts on the subject of endangered wildlife in the FWS. FWS had wrestled control of whooping crane conservation from the broader group of wildlife experts that had directed efforts in the 1950s and was beginning to put its program into place even as a social environmental movement was gaining

[56] United States Department of the Interior, "President Kennedy's Message on Conservation to the Congress of the United States, March 1, 1962.

[57] Transcript, Stewart Udall oral history interviews, 1969, by Joe Frantz, LBJ Library.

momentum and as it was garnering new attention from the larger political community. Although the conceptual approach and conservation practices as they had been employed by FWS changed very little, the audience to which they must explain and justify those practices changed dramatically. Debates and discussions about endangered wildlife were no longer solely among scientists, conservationists, and wildlife managers, but now also included Cabinet Secretaries and Undersecretaries, Presidents and presidential advisors, Congress and a broader cross-section of the general public. Furthermore, there was a shift from individual programs for particular species toward an approach that would address all endangered wildlife as a single policy category (although the resulting policy would individually list each species and design individual recovery plans). In short, wildlife conservation in FWS and in Washington politics, which had operated separately from one another before the middle part of the 1960s began to converge as an environmental movement took hold. The point of their convergence was the Committee on Rare and Endangered Wildlife Species.

Chapter 3

A COMMITTEE ON ENDANGERED SPECIES

1. Conceiving of CREWS

The current federal endangered-species list classifies threatened and endangered species under two broad categories: U.S. and foreign. But the wildlife itself rarely pays much attention to such political distinctions used in all manner of colorful cartography. Over the course of a year whooping cranes spend significant portions of time in both the U.S. and Canada, and yet probably never consider their citizenship status. The Canada goose crosses two international borders, some ranging as far south as Mexico each winter. On a more localized scale and in spite of its name, the Florida sandhill crane can also be found in parts of southern Georgia in addition to its namesake state. The discontinuity between political borders and wildlife ranges at times during the twentieth century produced a tension between biology and federal wildlife policy.

In the first half of the twentieth century, federal legislation directed at wildlife conservation regulated primarily across political boarders. The Lacey Act prohibited interstate commerce in illegally taken wildlife. The Migratory Bird Treaty Act on the other hand regulated avifauna that migrated across international boarders.[58] Prior to the formation of CREWS, many FWS conservationists also operated across political boarders, viewing wildlife conservation as primarily an international endeavor. This was especially apparent when it came to pre-CREWS

[58] On exception was the purchase of wildlife refuges, which was a policy that created political boundaries of wildlife conservation rather than working across them.

endangered-species lists. Before the 1964 U.S. Red Book list, soon-to-be CREWS members and other FWS conservationists showed little interest in developing a comprehensive list of endangered U.S. wildlife. They did, however, readily contribute their knowledge of North American species to the development of the international list of endangered wildlife being compiled by the IUCN.[59] The shift toward a U.S. centered endangered-species list in the mid 1960s came not from FWS biologists, but as an administrative directive from the office of the Secretary of the Interior.[60] The shift toward a more nationalistic wildlife-conservation approach was a critical point in the development of U.S. federal wildlife legislation. The formation of CREWS marks the beginning of a move in federal wildlife policy from regulating across political boarders to regulation within the borders of the U.S.

This chapter lays out the details of the formation and early months of CREWS, beginning with the administrative push to establish the Committee following Stewart Udall's trip to Nairobi, Kenya to attend an international IUCN conference. An examination of the documents that were used to officially establish the Committee within the FWS provides a statement of CREWS's mandate and an introduction to its charter members. CREWS was composed of a

[59] Richard Manville memo to Noel Simon of the IUCN October 24, 1963, SIA RU 7407 Box 4 folder 1.

[60] There were a number of lists of rare and endangered wildlife known to and circulated among FWS conservationists. Rather than claiming to be comprehensive in approach these lists more closely resembled short lists of species in need of research and management. See memo from CREWS Chair Charles Lawrence to CREWS members May 7, 1964, SIA RU T89021 box 7 folder 12.

number of department heads and thee biologists from the Division of Wildlife Research. By and large, the Wildlife Research biologists contributed the bulk of the conceptual approach and conservation practices that became the CREWS program. Brief biographies of the wildlife researchers present a way to track the various scientific and conservation commitments that were brought to the table when CREWS was formed. Finally, a description of the early drafts of the Red Book, produced in the first year of CREWS's existence, demonstrate the influence of the wildlife researchers and begin to show how the different conceptual approaches came together.

In contrast to the separation between socio-political interests and wildlife conservation efforts described in the previous chapter, the formation of CREWS marks the convergence between the two in the early 1960s. The increased socio-political concern with wildlife conservation produced a change in stakeholder demographics and dramatically altered the organization and administration of federal wildlife conservation efforts. Still, CREWS drew heavily on the conceptual work of the whooping crane program, while distancing itself from the organizational approach of the WCAG.

One of the more obvious departures from the WCAG was the degree of inclusiveness, or lack thereof, with respect to the Committee membership. CREWS made a drastic departure from the days of the WCAG by drawing its entire membership from within the FWS. Although CREWS sought advice from a broad range of specialists while constructing the endangered-wildlife list and developing endangered-species legislation, all decision-making concerning list

membership and conceptual approach to wildlife conservation rested entirely on the shoulders of CREWS and its immediate supervisors in the FWS. The FWS had wrestled control over endangered-wildlife recovery away from private conservation interests such as the NAS. In doing so it eliminated some of the conflict that resulted from the broad representation present in the WCAG, therein streamlining the process of policy formation.

2. The Nairobi Connection

Conservationists from all over the world converged on Nairobi in September of 1963 for the biennial conference of the International Union for the Conservation of Nature. Stewart Udall not only attended the conference, but was invited to address the general assembly.[61] Udall had previously attended two international conferences in the U.S. in 1962—a meeting of International Committee for Bird Preservation and the World Conference on National Parks. These brought a concern over endangered wildlife more squarely into his view, yet it seems to have been the Nairobi conference that finally stirred Udall and the FWS to action.[62]

It was not the case, of course, that the FWS was entering the endangered wildlife conservation arena for the first time. Even before the whooping crane, FWS and the Bureau of Biological Survey, the predecessor agency to FWS, had a

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[61] The general tenor of Udall's message was a call for global cooperation in natural resource management and did not directly address endangered wildlife except when referring to the near extermination of the buffalo in the nineteenth century in the U.S. as "the greatest wildlife slaughter in history." See Stewart Udal Papers, University of Arizona Archives AZ 372 box 111, folder 1.

[62] Barrow, *Nature's Ghosts*, 317-322.

long history in this area. What the 1963 conference produced in the U.S. was not a change in the direction of endangered-wildlife research, but a renewed push for federal involvement in the development of endangered-wildlife policy. Furthermore, the approach that would be taken up by FWS in an attempt to implement new U.S. federal wildlife regulation bore a striking resemblance to the International Union for the Conservation of Nature's (IUCN) approach and can almost certainly be traced back to the 1963 conference.

Among the many proceedings at the Nairobi conference was the meeting of the IUCN's Survival Service Commission, under the leadership of a newly appointed Peter Scott, wildlife artist, aviculturist, and one of the architects of the World Wildlife Fund. Among the many programs implemented by Scott was the IUCN Red Data Book project, a collection of loose-leaf pages—one for each species considered rare or endangered by the IUCN. These pages contained critical biological and ecological information on each endangered species and were intended to assist the IUCN in setting its agenda for wildlife conservation. The Red Data Book also proved to be an effective model for developing the U.S.'s new and more comprehensive endangered-species program.

Shortly after the Nairobi conference, CREWS was established in the Bureau of Sport Fisheries and Wildlife of FWS. The Committee almost immediately set about developing its own list of U.S. rare and endangered species, which revealing the high degree of influence of the IUCN on their work, was commonly referred to in the FWS as the 'Red Book.' Furthermore, as CREWS began its work, Charles Lawrence, the Committee's first Chairman

circulated a blank IUCN Red Data Book sheet as a template to be used as the Committee compiled its list.[63] Given that the IUCN was an international conservation organization, it is not surprising that North American conservationists, including FWS employees, were also involved in the IUCN and that they would borrow from the IUCN's endangered-species program to establish their own domestic program. Developing a list, in the style of the Red Data Book, was the primary responsibility of CREWS as described in the documents that established the Committee.

3. Documenting CREWS

Two documents announced the arrival of CREWS onto the endangered-species conservation scene. Appearing six months apart, these two documents served very different purposes. The first document established CREWS as an official working committee within the BSFW. The second, a DOI news release, served a public relations role. Together these documents provided CREWS with both an administrative and public identity. They also bestowed upon the Committee the scientific authority its creators hoped would guide federal decisions on endangered wildlife policy.

The first of the two documents listed CREWS as one of seven BSFW committees established by the release of a supplement to the Department of Interior's Administrative Manual on January 30, 1964. The Committee Information Sheet, also filed with the DOI shortly after, was an expanded

[63] Charles H. Lawrence, "Briefing book, rare and endangered species – preparation of data sheets." SIA RU T89021, box 7 folder 12.

description of the Committee as listed in the supplement. The purpose of CREWS, as described in these documents, was "[t]o advise the Director [of the BSFW] on: (a) Rare and Endangered Species of Birds, Mammals, Fish (including mollusks and crustacea), reptiles, amphibians, and biotic communities of the United States, including: (1) official designation of rare and endangered species and biotic communities [sic]."[64] Following the listing mandate, the charter document specified three more topics on which CREWS was to advise: the issuance of permits for captive breeding programs; conservation directed federal land acquisition; and finally the ubiquitous 'all other' issues as they related to endangered-species conservation. Additionally CREWS was to develop a list of undesirable wildlife whose importations should be controlled.

The second document, the DOI press release, was issued almost six months later on July 6, 1964. The press release, echoing Kennedy a few years earlier, asserted the authority of science in matters of conservation by referring to the Committee as a "special scientific team" and by quoting Udall who asserted "[t]he scientific study, we believe, is essential if we are to reverse the trend that has witnessed such a heavy toll of some of our most valuable species since the turn of the century."[65] After describing the Committee's responsibilities in much the same manner as the official committee information sheet, the Committee members were formally introduced to the press.

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[64] United States Department of the Interior Committee Information Sheet, SIA RU T89021 Box 7 folder 12.

[65] Department of the Interior press release, "Interior Department Steps up Fight to Save Near-Extinct Wildlife," July 6, 1964.

Table 3.1
CREWS Charter Members

Charles H. Lawrence (Chair), Assistant Chief of Management and Enforcement
John W. Aldrich, Bird and Mammal Laboratory
Ray C. Erickson, Wildlife Research
Richard H. Manville, Bird and Mammal Laboratory
Gale W. Monson, Wildlife Refuges
Willis King, Chief of Fishery Management Services
Lynn H. Hutchens, Fish Hatcheries
Samuel E. Jorgensen, Chief of Office of Foreign Activities
Clifford C. Presnall, Chief of Predator and Rodent Control

From the introduction to the 1964 Red Book

The most striking feature of CREWS's role call was the conspicuous departure from the organization of the WCAG. Rather than a broad and diverse representation of the scientific and conservation communities on the committee, the nine charter members of CREWS were drawn entirely from inside the ranks of FWS, composed mostly of division administrators. According to the report of the WCC, the WCAG was set up under the assumption that the FWS "had no preconceived plan of what should and must be done" about an endangered species like the whooping crane.[66] But, eight years and a little controversy had provided the FWS with a little clarity and a few preconceptions. Experience with the whooping crane, documented in the Whooping Crane Memoranda, had given FWS biologists a growing sense of confidence about what should and must be done to manage endangered wildlife. One certainty was that such a management plan should, if possible, include captive breeding.

[66] Minutes of meeting, Whooping Crane Conference, October 29, 1956, SIA RU T89021 box 1, folder 6.

In addition, having encountered a correlation between the diversity of representation on a science advisory committee and the likelihood and degree of controversy over management decisions, FWS administration departed from the broad representation of the WCAG in establishing CREWS. There exists no smoking gun to provide direct evidence that the decision to form an advisory committee internal to FWS was an intentional move away from broad representation as a result of conflict over captive breeding between the NAS and FWS. Whatever the reason, that CREWS was formed from a rather narrow cross-section of scientists, naturalists, and wildlife managers interested in conservation significantly constrained the shape of federal endangered-wildlife policy. Yet, even as FWS departed from the WCAG administrative approach, it turned to those in the Service who had participated in efforts to save the cranes.

CREWS Chair Charles Lawrence had attended the Whooping Crane Conference in 1956 as a representative of the FWS Division of Management and Enforcement. At the time of CREWS's formation, Lawrence was serving as Chief of the same division. A trio of researchers from the Division of Wildlife Research (DWR), John Aldrich, Ray Erickson, and Richard Manville, made up the intellectual core of the Committee, especially with respect to endangered birds and mammals. Willis King, Chief of Fishery Management Services, was brought in to help develop the list of endangered fish. Clifford Presnall, Chief of Predator and Rodent Control, was included presumably because his department had extensive data on population declines for particular forms of wildlife 'controlled'

at the time through ongoing poisoning campaigns. Gail Monson from the Division of Wildlife Refuges, Lynn Hutchens from Fish Hatcheries, and Samuel Jorgensen, Chief of the Office of Foreign Activities, rounded out the Committee. Although CREWS experienced membership changes, including a significant leadership change in 1966, the initial nine, particularly the three DWR researchers who would remain throughout the Committee's nine-year run, set the intellectual tone that would carry over into endangered-species legislation and the ESA.

4. Intellectual Drivers and Advisors to CREWS

The influence, power, labor, and credit in collaborative efforts are rarely distributed evenly. The work of CREWS is no exception. FWS records collected from both the U.S. National Archives and Records Administration and the Smithsonian Institution Archives make it abundantly clear that of the nine-member committee the three wildlife researchers, Aldrich, Manville, and Erickson, had a disproportionate influence, relative to their fellow committee members, on the early conceptual development of CREWS's work. One reason for the disproportionate influence was that the three wildlife researchers were all stationed in a department (the DWR) that already had a primary concern with wildlife conservation. No other members of CREWS held this distinction with the possible exception of Gail Monson. Beyond department affiliation, their influence is demonstrated in memos from CREWS's supervisors in the DOI and FWS that consistently addressed the three researchers as a subset of the larger committee when technical clarification on the endangered-species program was required. Many of the positions taken by Aldrich, Manville, or Erickson on such technical

issues would become the position of the Committee as it advised the BSFW on federal wildlife policy.

The three wildlife researchers exerted their influence in slightly different ways; yet their association in the same FWS division gave them a certain sense of cohesion separate from CREWS as a whole. Erickson's influence was exerted through his previous and ongoing experience with FWS's captive breeding programs (especially whooping cranes). FWS's captive breeding researchers, including Erickson, had already developed a short list and listing criteria for wildlife whose numbers were either low or in rapid decline and therefore targeted for research and intervention. Many of FWS's practices carried over to the work of CREWS.[67] The other two wildlife researchers had a significant impact through CREWS's primary mandate, compiling a U.S. endangered-wildlife list, which began immediately after its formation in early 1964. Aldrich and Manville were specifically named as responsible for developing and submitting preliminary lists of birds and mammals respectively.[68] This put the two in a position to establish precedents with respect to how, what, and by what authority particular forms of wildlife would be included in the Red Book list (see Chapter 4). Willis King was also listed by name in early Committee communications as responsible for the list of endangered fish; however, he had much less impact than either Manville or Aldrich mainly because birds and

[67] Chapters 4 and 5 will provide the details of CREWS's conceptual approach and the role of captive breeding in that approach.

[68] Charles H. Lawrence, "Briefing book, rare and endangered species – preparation of data sheets." SIA RU T89021, box 7 folder 12.

mammals outnumbered fish in the early Red Book list by a ratio of about five to one and because King rarely involved himself in the conceptual debates over scientifically informed endangered-wildlife conservation.[69]

That the three biggest influences on CREWS's early intellectual trajectory came from the same working group of a single bureau of the DOI had some constraining effects on the Committee's conceptual development. The three were not of one mind, however, and the varied skills and experiences each brought to the table often generated discussions and negotiations that helped shape the Committee's approach to research and practice. Differences in education, field of expertise, and professional work history all contributed to the differences of opinion that were to be found among the Committee's wildlife researchers.

Throughout the decade-long run of CREWS, John Warren Aldrich was by far its most enduring and outspoken member. Like Lawrence and Erickson, he had attended the '56 Whooping Crane Conference and was deeply involved in the FWS's whooping crane efforts, officially gaining membership in the WCAG in 1962. Aldrich had received his Bachelor's degree in biology from Brown University in 1928. After Brown he held two museum jobs, first at the Buffalo Museum of Science and then as Biological Assistant in Charge of Birds at the Cleveland Museum of Natural History. The museum work provided Aldrich with a solid foundation in bird taxonomy while collecting, identifying, classifying, and

[69] The reptile and amphibian list was farmed out to James A. Peters of the Smithsonian Institution.

Table 3.2
CREWS Changing Membership

1964	1968	1971
Charles H. Lawrence (C), ME	Harry A Goodwin (C), OES	Earl Baysinger (C), OES
John W. Aldrich, BML	John W. Aldrich, BML	John W. Aldrich, BML
Ray C. Erickson, DWR	Ray C. Erickson, DWR	Ray C. Erickson, DWR
Richard H. Manville, BML	Richard H. Manville, BML	Richard H. Manville, BML
Gale W. Monson, WR	Gale W. Monson, WR	John L. Paradiso, BML
Willis King, FMS	Willis King, FMS	Willis King, FMS
Lynn H. Hutchens, FH	Ronald Schulz, FH	R. C. Banks, BML
Samuel E. Jorgensen, OFA	Jack Berryman, DWS	Wayne Gueswel
Clifford C. Presnall, PRC	Charles H. Lawrence, ME	Charles H. Lawrence, ME
	James A. Peters, SI	Hawthorn, DWS
		Clyde Jones, BML
		Kinney, FMS
		Harvey Willoughby, FH
		James A. Peters, SI Clinton Lostetter, PRO

ME – Division of Management and Enforcement
DWR – Division of Wildlife Research
FMS – Division of Fishery Management Services
OFA – Office of Foreign Activities
OES – Office of Endangered Species
SI – Smithsonian Institution
PRO – Portland Regional Office
BML – Bird and Mammal Laboratory
WR – Division of Wildlife Refuges
FH – Division of Fish Hatcheries
PRC – Division of Predator and Rodent Control
DWS – Division of Wildlife Services

The 1964 and 1968 lists were taken from the introduction to the Red Book as written or revised in the respective year. The 1971 list comes from meeting notes of a CREWS meeting held in August of that year. Though a small contingent of members remained constant throughout the Committees existence, it is the continuity of the DWR/BML trio of Aldrich, Manville, and Erickson that provided the conceptual framework of CREWS approach.

preparing specimens for the museum's bird collection. While in Cleveland, Aldrich attended Western Reserve University where he received his M.A. in 1933 and his Ph.D. in 1937, both in biology. His doctoral dissertation on ecological succession and community dynamics was influenced by the ecological principles of Victor Shelford. Aldrich joined FWS in 1941 as an ornithologist. He would be promoted to Chief of the Section of Distribution and Migration of Birds in 1947. A 1957 reorganization within FWS resulted in Aldrich's appointment as Staff

Specialist for Distribution, Classification, and Life History Studies in the DWR. In addition, he held an office in the Bird Section of FWS's Bird and Mammal Laboratories (BML) at the National Museum of Natural History in Washington, DC. His training in ornithology, experience in museum taxonomy, ecological influences during his graduate education, and involvement in whooping crane conservation would help form Aldrich's approach to endangered-wildlife research and policy. He would use his training, experience, and position to exert a heavy influence on the approach taken up by CREWS and FWS.[70]

When Richard Hyde Manville was appointed Chief of the Mammal Section in 1958 he initially worked on the opposite side of the biological division from Aldrich in the BML. Befitting his diverse expertise, he would ascend to the directorship of the BML in 1960. Manville received his Master's degree from the University of California Berkeley for his work on postembryonic changes in the mandibles of termites. Influenced in part by then Berkeley professor Joseph Grinnell, Manville switched his focus to mammalogy and took up his doctoral research at the University of Michigan, where he received his Ph.D. in 1947. After receiving his degree he was hired at Michigan State University, where he rose to the position of Associate Professor before a year-long stint as the Curator of Mammals for the New York Zoological Society. In 1956 Manville became an editorial Assistant at McGraw-Hill Company and at the same time became the

[70] Richard C Banks, "In Memoriam: John W. Aldrich, 1906-1995," *The Auk* 114 (4) (1997): 748-751.

editor of the *Journal of Mammalogy*, a position he held until 1961. Manville joined FWS in 1958, and worked there until his retirement in 1972.

Manville's list of memberships in professional organizations covers a diversity of disciplines that reads like a course listing of any major university biology department. The American Society of Mammalogists, American Ornithologists Union, Ecological Society of America, and American Society of Ichthyologists and Herpetologists are just a sampling of the areas in which Manville endeavored to stay current with his fellow biologists. In addition, like Aldrich and Erickson as well as a few other CREWS members, Manville was an active member of the Washington Biologists Field Club, an exclusive group of professional biologists famous for their oyster roasts and clam bakes.[71] With his diverse and eclectic training and experiences, Manville even more so than Aldrich, was in an ideal position to advise on the development of an extensive conservation program that would address the extinction problem across a broad taxonomic range.[72]

Ray C. Erickson was the third of the three wildlife researchers that exerted a considerable influence on the early conceptual development of CREWS. Erickson's whooping crane proposal, so prominently featured in the crane recovery efforts since its 1961 submission, earned him a voice in endangered wildlife discussions and ultimately a seat on CREWS. By the time of CREWS's

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[71] SIA RU 7171 box 5 folder 1 contains a list assigning food and service ware responsibilities for a late spring WBFC meeting on Plumbers Island, Maryland.

[72] William H. Burt, "Richard Hyde Manville, 1910-1974," *Journal of Mammalogy*, vol. 57, no. 1 (1976), 206-209.

formation Erickson was already dreaming bigger than just cranes. On behalf of FWS, Erickson became a liaison between the Service and the office of Senator Karl Mundt of South Dakota. The Republican Senator, through one of his aides, had acquired a growing interest in the fate of the whoopers. Erickson endeavored to foster Mundt's support through regular updates on crane recovery efforts, and the presentation of colored photographs of the majestic great white bird.[73] Mundt responded by attaching a $350,000 allocation to an appropriations bill to help fund an Erikson proposal to set up a FWS endangered wildlife propagation center at Patuxent, Maryland.

The Patuxent station opened its doors in 1965 and soon after the Erickson-proposed sandhill crane propagation experiments were moved to the new station.[74] As the first head of the new propagation facilities, Erickson would have a tremendous influence on the direction of the federal endangered-wildlife program that would employ the propagation and reintroduction methods, begun on the cranes, on other species identified in the U.S. Red Book.

In addition to the nine charter members of CREWS, four other names that were prominent in conservation circles appeared in the 1964 press release. S. Dillon Ripley of the Peabody Museum of Natural History at Yale University[75], Jack M. Kiracofe, President of the Whooping Crane Conservation Association,

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[73] Ray C. Erickson, "Telephone conversation with Mr. Kreger of Senator Mundt's Office," May 12, 1964, SIA RU T89021 box 1 folder 47.

[74] Barrow, *Nature's Ghosts,* 322.

[75] Ripley would begin his tenure as the Secretary of the Smithsonian Institution later that same year. He would serve in that capacity from 1964 until 1984.

John A. Griswold, Curator of Birds for the Philadelphia Zoological Garden, and Carl W. Buchheister, President of the National Audubon Society, were each sent identical letters requesting their assistance with the new endangered species program, especially with respect to the propagation of migratory game birds.[76] All four accepted, and in the July press release announcing CREWS their names were prominently displayed and used as exemplars of "experts outside government" that CREWS would consult in making its recommendations.

The make-up of the four advisors to CREWS provides a few confirmations about the organization of and influences on FWS's endangered-wildlife committee. First, the influence of the whooping crane experience on FWS and therefore CREWS was indeed significant. Three of the four had participated in some form with the WCC or the WCAG and each of those three were in favor of the captive breeding of cranes. Ripley had participated in the 1956 Whooping Crane Conference and also served on the WCAG from its inception.[77] Griswold and the staff at the Philadelphia Zoo had experience raising cranes in captivity and were used as a resource in establishing protocols for breeding captive whoopers at the Audubon Park Zoo.[78] Buchheister became a member of the WCAG when he replaced John Baker as President of the NAS in 1959, a position he held until his retirement in 1967. At one time Buchheister would have been the

[76] Copies of these letters can be found in SIA RU T89021 box 6 folder 19.

[77] See Table 2.1.

[78] Whooping Crane Advisory Group Memorandum No. 5, April 11, 1958, SIA RU T89021 box 1 folder 6.

lone exception with respect to support of captive breeding, advocating for the typical NAS position of non-intervention strategies in the early days of the WCAG. His enthusiasm for FWS captive breeding grew slowly following the Erickson proposal, however.[79] Kiracofe was the only one not directly involved in the WCC or the WCAG, but as the President of a private whooping crane conservation society he maintained correspondences with FWS officials, receiving copies of the Whooping Crane Memoranda and regular updates on captive breeding efforts. Not only does the selection of these individuals as advisors demonstrate the importance of whooping crane conservation in the FWS, but it also demonstrates the commitment FWS conservationists had made to captive breeding as part of an endangered-wildlife conservation program.

The second point of interest with respect to the CREWS advisors was what their role demonstrated about the shifting power structure in the area of wildlife conservation. Three of the four advisors had played central roles in previous whooping crane conservation efforts as members of a WCAG that was broadly representative of scientific and conservation interests. With the formation of CREWS the sphere of influence in wildlife conservation had shrunk and those outside of government—outside the FWS—had been pushed to the second tier, merely advisors to those inside government. The final decision on what formal recommendations would be made with respect to federal wildlife-conservation policy would rest with CREWS. The first of those decisions was to identifying and list the targets of their conservation efforts.

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[79] Dunlap, "Wildlife Preservation," 197-221.

5. Making the List: The U.S. Red Book

Although Udall's Nairobi trip seems to have produced the administrative push for action that resulted in the formation of CREWS, it was not the first those inside the DOI or FWS had heard of the Survival Service Commission or the IUCN Red Data Book. In fact, FWS employees had a history of collaboration with the IUCN and were consulted on the Red Data Book project. Noel Simon, who had been charged with compiling the mammal volume of the IUCN list, sent preliminary drafts of both the bird and mammal volumes to John Aldrich as early as May of 1963. Aldrich responded with praise for the IUCN's work in this area and suggested additional North American species of birds and mammals that should be considered for inclusion. Aldrich also recommended Manville as an authority on North American mammals capable of preparing the IUCN write-ups for the additional species he recommended.[80]

In addition to the general feedback solicited from Aldrich by Simon, the latter also asked more specific questions concerning scientific authority on South American mammals and field data on mountain lions. To the first inquiry Aldrich consulted Manville, sending along four names recommended by the BML's mammal expert. To the mountain lion question Aldrich again offered up Manville as an authority but also suggested that Simon contact the FWS's Branch of Predator and Rodent Control who would be "in a position to supply some

[80] John W. Aldrich, Correspondence with Noel Simon, SIA RU 03-132 box 1 folder 1; for Manville's response to Simon on these topics see SIA RU 7407 box 4 folder 1.

information on mountain lions, particularly as to numbers which are killed in the course of sport hunting and predator control."[81] This same advice with respect to the valuable data in the possession of the Branch of Predator and Rodent Control was followed in the process of forming CREWS when the Branch Chief, Clifford Presnall, was included as a member of the Committee.

This exchange between Aldrich and Simon serves to demonstrate the rather porous barrier between FWS and the IUCN that allowed for the flow of both information and personnel. FWS wildlife conservationists were aware of and even contributed to the Red Data Book, but did not seem to be inclined toward producing a U.S. list until after Nairobi, possibly because those in FWS familiar with the IUCN project were confident that it would cover the relevant U.S. species. Furthermore, in the absence of federal endangered-wildlife legislation, a separate U.S. list would simply be redundant. Whatever the exact administrative push to form CREWS and start the U.S. Red Book was, once the project was put into motion it moved quickly.

The Red Book, officially titled *Rare and Endangered Fish and Wildlife of the United States*, was circulated as a draft in July of 1964. This preliminary effort listed sixty-two North American vertebrate species: thirty-six birds, fifteen mammals, three reptiles, two amphibians, and six fish.[82] These numbers reveal both the distribution of expertise within CREWS and the development of

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[81] Ibid.

[82] Yaffee refers to the Red Book draft as containing 63 species. The eastern and peninsula fox are both listed on the same page under the same species name. Yaffee, I presume, chose to count them as separate listings. I take it to be one listing since there is a single data page for the two populations.

particular fields of biology at the time. Ornithologists were heavily represented on the Committee and among its advisors, and bird conservation studies and policy had a much more established tradition than other forms of wildlife.[83] Plants and invertebrates were not included in the draft primarily because FWS employed few if any experts in those areas. Plants did not become part of the policy discussion until the Congressional hearings for the ESA in 1972.

This initial list was sent to over 300 of the relevant wildlife experts for comments and suggested additions.[84] It should be pointed out that what made one a relevant expert was entirely determined by CREWS and this was one way in which CREWS was responsible for the direction of U.S. endangered-wildlife policy. The relevant wildlife authorities made recommendations for inclusion on the list, but it was through CREWS that authority was evaluated, the recommendations were filtered, and the final decisions on inclusion were made.

The expert comments and recommendations were compiled and a revised Red Book was published under the same title as a government publication in 1966. The new list had grown to over 400 species and subspecies of vertebrates and the categories had expanded from a single rare and endangered category to a three-tiered system that included the categories 'rare and endangered', 'peripheral,' and 'status undetermined.' Later versions would designate the degree

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[83] For example the Migratory Bird Treaty Act of 1918; See also Kurkpatrick Dorsey, *The Dawn of Conservation Diplomacy: US-Canadian Wildlife Protection Treaties in the Progressive Era* (Seattle, WA; University of Washington Press, 1998), 165-237.

[84] United States, *Rare and Endangered Fish and Wildlife of the United States* (1964).

of concern over a particular species by the addition of a less severe 'threatened' category. In the process of evaluating recommendations from experts, expanding the list, and adding new conservation categories, CREWS members openly discussed conceptual issues related to the proper objects of conservation, the meaning of conservation categories, the nature of scientific authority, and ecological considerations of endangered-wildlife conservation. Through this process, the science of the federal endangered species program continued to take shape.

While the Red Book continued to evolve, public concern over the plight of endangered wildlife grew to a point where CREWS and the DOI could begin to turn their attention to federal conservation policy and work toward protective legislation on the federal level. In drafting legislation that would be sent to Congress and become the Endangered Species Preservation Act of 1966, CREWS incorporated aspects of the conceptual approach and conservation practices that evolved in the process of drafting and revising the Red Book. The details of the concepts and practices that guided the operation of CREWS and were used to construct one of the most significant pieces of environmental legislation in U.S. history will be addressed in the next two chapters.

6. Constraints on Wildlife Conservation

Even though endangered wildlife conservationists in FWS were not only aware of but contributors to the IUCN's Red Data Book project, it took Udall's prodding for the FWS to import the practice from Switzerland by way of Nairobi. Once CREWS was formed and given the task of devising the first federal list of

endangered wildlife species, it worked quickly to construct the list and lay the foundation for a new attempt to place wildlife conservation under the control of the U.S. federal government. Emboldened by the recent successes with whooping crane recovery,[85] empowered by newfound political, public, and hence financial support, and freed from the opponents of interventionist wildlife management, FWS and CREWS experienced a fertile confluence of circumstances in which to set about building a scientifically sound, comprehensive, and enduring federal endangered-wildlife program.

The lack of political commitment in the election year of 1960 immediately followed by an increasing socio-political interest in conservation in the early part of the same decade gave Udall, FWS, and CREWS rather wide latitude in developing environmental policy in general and wildlife policy in particular. But CREWS did not operate carte blanche. Working within FWS, CREWS was entrenched in FWS bureaucracy and constrained by an institutional history that had been engaged in wildlife conservation going back to the Service's predecessor agency, the Bureau of Biological Survey. More specifically CREWS was heavily influenced by the work of the Division of Wildlife Research and the Bird and Mammal Laboratories within the DWR by way of the three biologists who had the most significant impact on the early conceptual work of the Committee. The DWR and BML likewise had institutional histories that brought with them certain conceptual approaches to wildlife conservation more or less

[85] By 1964 whooping crane numbers were still critically low but clearly rebounding.

shared by the researchers in the respective units. A legislative tradition that favored state regulation of wildlife also impacted what CREWS and the DOI could do when it came to advocating for federal legal protection of endangered wildlife. Finally, the history of American efforts to save endangered wildlife would conjure images and tales of the American bison, the passenger pigeon, the Carolina parakeet, and other classic conservation stories and influence how CREWS perceived and addressed the endangered-species problem. The operation of these various constraints can be seen in the arguments put forth by CREWS, especially the wildlife researchers, as it negotiated the scientific, political, and legislative landscape of wildlife conservation beginning in 1964 and culminating in the ESA.

Chapter 4

NEGOTIATING THE PARAMETERS OF FEDERAL ENDANGERED-SPECIES POLICY I: THE RED BOOK

1. Listing Endangered Species

On August 12, 1973, while surveying a section of the Little Tennessee River, David Etnier identified what he thought to be a previously undiscovered species of darter. *Percina tanasi*, the snail darter, was to play a pivotal role in the first significant test of the Endangered Species Act, signed into law in December of that same year. After hearing of Etnier's discovery, Hiram Hill, a law student at the University of Tennessee, chose the snail darter, the ESA, and the ongoing legal battle between the Tennessee Valley Authority (TVA) and the opponents of the TVA's Tellico Dam project as the subject for a ten-page term paper for a course on environmental law. Hill and his professor, Zygmunt Plater, eventually became plaintiffs in *Tennessee Valley Authority v. Hill*, and argued before the Supreme Court for an injunction against the TVA's completion of the Tellico Dam on the grounds that the project would flood the section of the Little Tennessee River that was the only known habitat of the newly discovered snail darter.[86]

In order to invoke the protection of the ESA as grounds for halting the Tellico project, the plaintiffs would first have to get the Fish and Wildlife Service and the Secretary of the Interior to list the snail darter as an endangered species and publish their findings in the Federal Register. The legal history of the Tellico

[86]Murchison, *Snail Darter,* 80-107.

Dam project is a long and complicated story that began years prior to the passing of the ESA and concluded when congress passed the Energy and Water Development Appropriation Act of 1980, which contained a rider exempting the Tellico Dam project from compliance with the ESA. The snail darter chapter of the Tellico saga is used here to illustrate two points; the central role of the endangered-species list in the formulation of the ESA and the nature of the types of objects CREWS sought to capture on the list as described in the ESA.

When listed by the DOI during the height of the Tellico Dam controversy, the snail darter was but one of dozens of known species in the genus *Percina* of the perch family. One of the TVA's objections to the listing of the snail darter was to claim that it had "never been classified as a new and distinct species."[87] The FWS response to the TVA's complaint was first to point out that there was scientific consensus, within and outside the FWS, that the snail darter was indeed a distinct species. FWS conceded to the TVA, acknowledging "the lack of a published formal description of the snail darter," while setting the TVA straight on the intent of the ESA. "The Service also recognizes the fact that the snail darter is a living entity which is genetically distinct and reproductively isolated from other fishes."[88] In the decade before the snail darter was listed, CREWS, relying on theoretical underpinnings borrowed from work done as part of the Evolutionary Synthesis, had identified a particular object of conservation to be

[87] Ibid., 85-89.

[88] The formal complaints of the TVA with respect to the listing of the snail darter as an endangered species and the FWS response is published in the *Federal Register*, Vol. 40, No. 197, pp 47505-47506.

used in federal wildlife policy; namely, genetically distinct populations that had unique evolutionary trajectories. In the snail darter one finds an example of the exact type of biological object of conservation described in CREWS's work.

Captive propagation and conservation below the species level are the two most enduring products of CREWS's work, found in the ESA. The conceptual approach and conservation practices used to build these products are best traced through two areas of CREWS's work: the CREWS Red Book list and the establishment of the Erickson-led captive-breeding program. This chapter examines the negotiations and developments that characterized the production of the Red book list, for it is there that debates over objects of conservation took place. Chapter 6 explores the conceptual approach used in the FWS's captive breeding program. Upon examining these practices it becomes clear that listing and captive breeding along with their attendant practices and theoretical underpinnings are at the heart of the science of the ESA.

2. Drafting the Red Book

The FWS committee information sheet that brought CREWS into existence listed as the Committees first duty: to advise the director of the BSFW on the official designation of rare and endangered species.[89] This advisory mandate is a bit misleading since the official designation, the Red Book, was a CREWS product. CREWS discussed methodology and final inclusion on the list in memos and during meetings between Committee members. When questions

[89] United State Department of the Interior, "Committee Information Sheet." SIA RU T89021 box 7 folder 12.

from outside the Committee were presented to the Director of the BSFW related to the endangered-wildlife program those questions were forwarded to CREWS or selected members of the Committee for response.[90] With respect to the Red Book list, CREWS presented the Director with a product, rather than advising him on a process. The process was more or less contained in and controlled by CREWS.[91] In the wake of the passage of the Endangered Species Preservation Act in 1966, the Red Book became the recommendation for species to be listed by the Secretary of the Interior in the Federal Register and therefore afforded protection under the new Act.[92]

Signs of the beginning of the first draft of the Red Book appear in FWS communications around March of 1964. CREWS Chair Charles Lawrence presented the Committee with a partial list of rare and endangered birds and mammals taken from the January 1964 report of the SSC, which CREWS was to use as a launching point.[93] The SSC list of U.S. species had been created with the assistance of CREWS members Aldrich and Manville, whose work had now

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[90] An example of this can be seen in the Fred Evenden memo discussed in Section 4 of the present chapter.

[91] Part of CREWS's process was evaluating an enormous volume of expert recommendations, from inside and outside the FWS, for the listing of individual species. Although this represents a significant external influence on the Committee, CREWS was given broad administrative discretion on final listing decisions.

[92] Notes on Meeting of Endangered Species Committee August 6, 1971. SIA RU 85-186 box 1 folder 1.

[93] Memorandum to CREWS members from Charles Lawrence, March 27, 1964. SIA RU T89021 box 7 folder 12.

circled back to them (see Chapter 3). By July, assignments had been handed out to prepare data sheets, single loose-leaf page descriptions of each endangered species (see Figure 4.1). Aldrich and Erickson, the two ornithologists, were assigned the bird sheets. Manville was given the mammal sheets with the assistance of Presnall of Predator and Rodent Control. King compiled the data sheets of endangered fish.[94] And finally, James Peters of the Smithsonian Institution, who was already working with CREWS by this time, though not yet officially a committee member, was assigned the preparation of the reptile and amphibian data sheets. The working draft of the Red Book was completed in September and sent out to over 300 wildlife experts in November of the same year[95]. As the expert comments began pouring into FWS, communications between members of CREWS, especially the DWR and BML group, increased steadily.

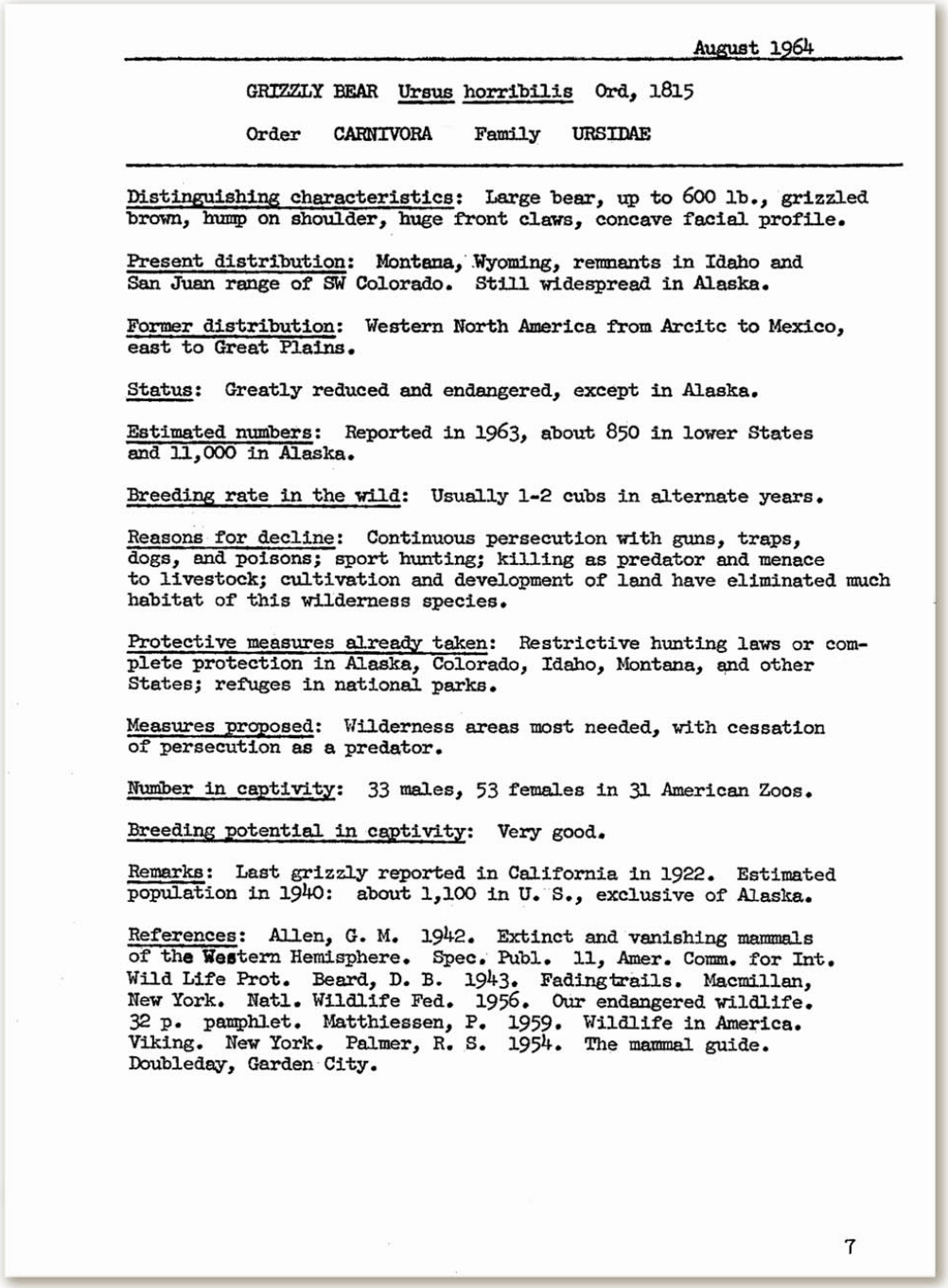
3. The Bird and Mammal Laboratory

A common feature of the communications related to the technical details of compiling the Red Book is found at the end of nearly every FWS memo on the subject. Three names appear ubiquitously on the list of individuals copied on each memo: Aldrich, Manville, and Erickson. The contributions from these three

[94] Memorandum to CREWS members from Charles Lawrence, July 16, 1964. SIA RU T89021 box 7 folder 12.

[95] List of wildlife experts that were sent a copy of the Red Book draft for comment SIA T89021 box 7 folder 12. The 10-page list consists of state and federal fish and game departments, several private conservation society presidents, natural history and zoology museum workers, and university professors of zoology.

Figure 4.1
Sample Red Book Data Sheet



August 1964

GRIZZLY BEAR Ursus horribilis Ord, 1815

Order CARNIVORA Family URSIDAE

Distinguishing characteristics: Large bear, up to 600 lb., grizzled brown, hump on shoulder, huge front claws, concave facial profile.

Present distribution: Montana, Wyoming, remnants in Idaho and San Juan range of SW Colorado. Still widespread in Alaska.

Former distribution: Western North America from Arcitc to Mexico, east to Great Plains.

Status: Greatly reduced and endangered, except in Alaska.

Estimated numbers: Reported in 1963, about 850 in lower States and 11,000 in Alaska.

Breeding rate in the wild: Usually 1-2 cubs in alternate years.

Reasons for decline: Continuous persecution with guns, traps, dogs, and poisons; sport hunting; killing as predator and menace to livestock; cultivation and development of land have eliminated much habitat of this wilderness species.

Protective measures already taken: Restrictive hunting laws or complete protection in Alaska, Colorado, Idaho, Montana, and other States; refuges in national parks.

Measures proposed: Wilderness areas most needed, with cessation of persecution as a predator.

Number in captivity: 33 males, 53 females in 31 American Zoos.

Breeding potential in captivity: Very good.

Remarks: Last grizzly reported in California in 1922. Estimated population in 1940: about 1,100 in U. S., exclusive of Alaska.

References: Allen, G. M. 1942. Extinct and vanishing mammals of the Western Hemisphere. Spec. Publ. 11, Amer. Comm. for Int. Wild Life Prot. Beard, D. B. 1943. Fadingtrails. Macmillan, New York. Natl. Wildlife Fed. 1956. Our endangered wildlife. 32 p. pamphlet. Matthiessen, P. 1959. Wildlife in America. Viking. New York. Palmer, R. S. 1954. The mammal guide. Doubleday, Garden City.

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Scanned from *Rare and Endangered Fish and Wildlife of the United States*, 1964

scientists and their research unit (the BML of the DWR) to the endangered-wildlife program were disproportionately large in comparison to the rest of the CREWS, and as time went on their representation on the Committee became so as well (see Table 2.2).[96] A transcript of a CREWS meeting from 1971 shows that of the fifteen in attendance, five had a BML affiliation, up from just two of nine when CREWS began in 1964. Furthermore, the transcript shows that the discussion on that day was to a large degree carried by the BML group.[97] To understand what this contribution amounts to, one must understand the function and history of the BML.

The Biological Survey Unit (BSU) of the United States Geological Survey (USGS) is today administratively housed at the Patuxent Wildlife Research Center in Laurel, Maryland, although much of the unit's work is done at the Smithsonian Institution. The BSU represents the most prominent extant descendant of the BML, but it is the ancestors of the BML more than the descendants that are of interest here.[98] A historical account of the National Fish and Wildlife Laboratory written by John Aldrich in 1973 claims that the roots of the BML can be found in the Division of Economic Ornithology, within the Division of Entomology, of the Department of Agriculture, under the leadership

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[96] Erickson was not a member of the BML, but was in the DWR and maintained regular contact with Aldrich.

[97] Notes on Meeting of Endangered Species Committee August 6, 1971. SIA RU 85-186 box 1 folder 1. Significant contributions also came from Ray Erickson of the DWR, the administrative department under which the BLM operated.

[98] "USGS Patuxent Wildlife Research Center: Biological Survey Unit History," accessed April 16, 2010, http://www.pwrc.usgs.gov/history/bsphist2.htm.

of C. Hart Merriam. In 1905, Merriam's division, as a result of its increasing importance, became the Bureau of Biological Survey (BBS). In the BBS, writes Aldrich, can be found "the beginning of those lines of research that have continued to the present as one of the special responsibilities of the National Fish and Wildlife Laboratory."[99] Among these lines of research were scientific studies of wildlife diversity and geographical distribution as well as studies of wildlife-environment interactions, all for the purpose of informing conservation and management of wildlife.[100]

As the BBS grew, the museum and field research, central to the operations of the earlier Section of Economic Ornithology, were placed in the BBS Division of Wildlife Research. In 1939 the BBS was moved to the DOI, and combined with the Bureau of Fisheries in 1940 to form the U.S. FWS. The museum section went through a series of reorganizations and re-namings, during the various administrative realignments, before being dubbed the Bird and Mammal Laboratories in 1958.[101]

The defining characters of this lineage from Economic Ornithology to BML are a somewhat continuous research program and a physical presence at the U.S. National Museum, what is now the Smithsonian Institution National Museum of Natural History. In 1959 that research program was described in a

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[99] Aldrich, John W. "History of the National Fish and Wildlife Laboratory". SIA RU 89-003 box 1 folder 4. The BML was renamed the National Fish and Wildlife Laboratory in 1973, about the time this document was produced.

[100] Ibid.

[101] Ibid.

FWS report as "the determination of the identity and the distribution of species and populations of birds and mammals which are of concern to the Bureau of Sport Fisheries and Wildlife and conducting the basic research necessary for their more critical and accurate identification…toward the specific management need."[102] In addition, the BML maintained, in collaboration with Smithsonian staff curators, the national collection of museum specimens of North American birds and mammals housed at the Smithsonian Institution. SI museum staff saw FWS's personnel and collections at the museum as part of the museum and thus they did not duplicate BML work.[103]

In 1963 the BML museum staff consisted of 14 biologists, museum aids, and clerks.[104] In 1964 the staff expanded to 19, at which time, a small arm of the mammal section established a research station in Seattle, under the direction of Karl Kenyon, to study sea otters.[105] A 1964 BML research report gives an idea of the types of research that were being done by BML staff and the kinds of experience the BML researchers brought to CREWS. The report lists nine projects and thirty-two work units filed under them. For example, under the project titled "Sea Otter Studies" were work units for "Natural history and behavior,"

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[102] "The Function of the Bird and Mammal Laboratories of the Bureau of Sports Fisheries and Wildlife" SIA RU 7171 box 3 folder 3.

[103] Ibid.

[104] Manville, Richard H. "List of Branch Employees in the U.S. National Museum" SIA RU 7407 box 4 folder 1.

[105] "Annual Report 1964 Bird and Mammal Laboratories at the U.S. National Museum Washington, D. C." SIA RU 7171 box 8 folder 14.

"Population surveys," "Studies in captivity," and six others. The "Faunal Survey" project included a number of regional wildlife surveys, e.g. "Birds of Idaho" and a joint Aldrich-Manville project describing "life areas" in the tradition of C. Hart Merriam's life zones. The largest project, containing eleven work units was "Bird Classification and Distribution," which was largely taxonomic descriptions and revisions.[106] Project seven of nine, of particular interest to the present study, was titled "Distribution and Taxonomy of Endangered Wildlife Species." What is most obvious from the project descriptions was that the overarching theme of the BML work at this time, including its work on endangered species, was a focus on wildlife at or below the species level.

In the years immediately preceding CREWS and even more so as the Committee began to take shape, one of the primary 'management needs' toward which the BML directed its work was conservation. Due to the nature of the work done at the BML, conservation-focused research was done from the point of view of museum taxonomists and zoologists. An example of this can be seen in a talk given by John Aldrich in 1961 titled, "Taxonomic Approach in Wildlife Biology," in which Aldrich describes the need for "critical study of variation within the species at the subspecific level or below [which] may give a clue to the characteristics which are being selected by the environment."[107] This focus, below

[106] "Research at the Bird and Mammal Laboratories December 1964" SIA RU 7407 box 3 folder 51.
[107] Aldrich, John W. "Taxonomic Approach in Wildlife Biology." Talk given to Cooperative Wildlife Research Unit leaders, March 4, 1961. SIA RU 89-003 box 2 folder 11.

the species level, became part of CREWS's approach to conservation as it sought to identify those subspecies and populations that were threatened with extinction as a result of human interference. Aldrich's so-called taxonomic approach, with its focus below the species level, was but one of many possible groundings for conservation policy that could have been employed by CREWS. As we shall see, others were suggested, but were not seriously considered.

Determining a policy for wildlife conservation is what has been called a wicked problem.[108] There are multiple scientific, philosophical, and value positions to consider and any course of action is often fraught with uncertainty concerning possible outcomes.[109] In 1964, just as today, there were a number of approaches one could subscribe to for setting policy for saving America's wildlife.[110] The whooping crane episode more than demonstrates the diversity of values held and approaches espoused by different members of the broader scientific and conservation communities. By selecting the members of CREWS from entirely within FWS and the conservation experts from the BML, the DOI

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[108] M. M. Webber and H. W. J. Rittle, "Dilemmas in a General Theory of Panning," *Policy Science* 4 (2) (1973): 155-169.

[109] CREWS wrestled with scientific issues related to conservation, such as what is the proper object of conservation, which is the topic of the current chapter. Some of the philosophical issues related to conservation are concerns about the nature of extinction, man's place in nature, and what makes an extinction process natural rather than unnatural, particularly in the case of human caused extinction. Man's ethical responsibilities to wildlife and nature as a whole have been extensively discussed within the field of environmental ethics.

[110] Conservation of biodiversity hotspots, protecting ecosystem services, identifying and protecting endangered ecosystems are just a small sample of suggested groundings for current conservation policy.

exchanged administrative control in the forms of simplicity and efficiency for broad representation of conceptual approaches and value positions in wildlife conservation decisions. Whether intentional or not, this trade-off established a small group of workers within a rather narrow research group as scientific authorities on endangered-species policy.

Although the Committee would go on to have a significant impact on the ESA, it is not the case that administrators in the DOI and FWS set up CREWS to write or even develop a conceptual approach for legislation. In fact, federal wildlife legislation did not appear anywhere in CREWS's charter documents. The architects and members of CREWS could not have known the degree to which their work would have a lasting impact on endangered-species policy. CREWS's primary responsibility was to advise the Director of BSFW on issues related to endangered wildlife, so on one hand it is not surprising that its membership was drawn from the ranks of the Bureau. On the other hand, as we have seen with the WCAG and the CREWS's advisers, FWS was not shy about seeking advice from "experts outside government."[111] Whatever the reason, the decision to form CREWS as an in-house advisory committee has significantly influenced the shape of wildlife legislation and policy to this day. That legacy began with the writing of the Red Book.

[111] United State Department of Interior News Release. July 6, 1964, P.N. 48719-64.

4. Objects of Conservation

The two main conceptual issues that were addressed in the production of the Red Book were the identification of the objects of conservation and the meaning of the conservation categories employed in the document. BML research methods and especially John Aldrich's taxonomic approach undergirded many of CREWS's decisions related to objects of conservation. Conservation categories, on the other hand, provide an interesting case of tension between science and politics in the development of federal endangered species policy. Related to the objects of conservation and conservation categories was the issue of classification: once the objects had been identified and the categories defined, how was one to go about classifying the objects into the categories? Drafting and revising the Red Book would force CREWS to confront these issues and the negotiations that took place offer insight into the science of the endangered-species program and its legislative products. This section examines the objects of conservation, while Section 6 takes up the issue of conservation categories.

In 1965 President Lyndon Johnson appointed Stanley Adair Cain Assistant Secretary of the Interior for Fish and Wildlife and Parks.[112] Cain had received his Ph.D. in Botany at the University of Chicago in 1930. He had held faculty positions at Butler, Indiana University, the University of Tennessee, and the University of Michigan. During his tenure at Michigan, from 1950 until his retirement in 1972, Cain founded the Department of Conservation, the first

[112] In the chain of command, The Director of the BSFW reported directly to the office held by Cain in the DOI.

academic department of its kind in the U.S. In 1953 he served as the Vice President of the Ecological Society of America. His qualifications for his federal appointment were beyond reproach.[113]

In 1968, Cain submitted a memo that found its way onto the desk of the then head of the Office of Endangered Species and CREWS Chair, Harry A. Goodwin.[114] Goodwin forwarded the document to Aldrich and Manville for comment. The exchange over this memo was demonstrative of a thread of discussion in the DOI and BSFW over the objects of conservation that were to be listed in the Red Book and captured by federal conservation policy.

According to Cain, his memo was to address "two problem areas that [he had] been mulling over": natural area preservation and endangered species. With respect to natural areas, Cain extolled the benefits of national parks and monuments for protecting the nation's most valuable wild lands. "Each is a complex of natural areas. While helping to avoid complete loss of certain plant-animal communities, they provide habitat for species that would otherwise become endangered."[115] He recognized, however, that there were smaller local natural areas that were individually of no national significance but might be of

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[113] "Chrono Biographical Sketch: Stanley A. Cain." Accessed January 5, 2010. http://web2.wku.edu/~smithch/chronob/CAIN1902.htm.

[114] Stanley A. Cain, Memo to Director of Endangered Specie Committee. May 19, 1968. SIA RU, T89021 box 6 folder 19. The Office of Endangered Species was established in 1966. Harry A. Goodwin served as head of the Office of Endangered Species and CREWS chairman from 1966-1971.

[115] Ibid.

importance to the people of those local areas, presumably for the same reasons given above, but on a smaller scale. By parallel reasoning, Cain suggests that small, endangered populations of an otherwise healthy and sizable species might have significance and be worthy of protection.[116] Again, his concern was that these smaller populations were not protected or addressed by the current listing procedures and conservation policy of the federal government.

In attempting to draw an analogy between local natural areas and local populations, Cain's memo overlooked a more fundamental problem that faced CREWS. The question of how to protect local areas and local populations did not point to two different problems, but two different ways to approach the same problem. The problem characterized in Cain's memo was one of identifying the proper objects of conservation. The memo recognized the issue of resolution, i.e., how inclusive should a community of organisms be to be worthy of conservation? Should federal policy protect populations, varieties, species, or perhaps even some more inclusive group? What was not stated in Cain's message was that plant-animal communities and species were both ways to carve up nature for the purpose of creating conservation policy. Why should one be favored over the other? The objects of conservation that should be singled out for protection were

[116] Cain gave no indication in the memo of what he meant by "significant" or "importance."

not obvious. The Cain memo raised an issue that CREWS had been dealing with since the first draft of the Red Book in 1964.[117]

Aldrich's response to Cain's memo is interesting both for what was said and for what was not. Aldrich said nothing about the protection of natural areas and plant-animal communities, directing all his comments in agreement with Cain's position that it was "a mistake to think of a species as a whole."[118] Aldrich then went on to provide additional justification for practicing endangered-wildlife conservation on the level of subspecies and populations. For Aldrich, practicing conservation below the species level was clearly the best scientific approach, but as the Cain memo demonstrates, it was no clearer then than it is today.[119] A subspecific approach to conservation made sense from a certain point of view. Aldrich was brought to that position as a result of his understanding of the relationships between taxonomy, evolutionary theory, and conservation.

Aldrich was the only member of CREWS who presented a well worked-out theoretical rational for preferring a particular object of conservation, and it so

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[117] For some of the questions discussed in the context of current environmental policy decisions see B. A. Minteer and J. P. Collins, "From Environmental to Ecological Ethics: Toward a Practical Ethics for Ecologists and Conservationists," *Science and Engineering Ethics*. 14 (4) (2008): 483-501.

[118] Cain, Stanley A. Memo to Director of Endangered Specie Committee. May 19, 1968. SIA RU, T89021 box 6 folder 19.

[119] Ecosystem management, for example, is an attempt to address conservation at a higher level of organization than species. See for example Richard L. Knight, "Aldo Leopold, the Land Ethic, and Ecosystem Management." *The Journal of Wildlife Management*, Vol. 60, no. 3 (1996). More recently Michael Soule, et. al. "Strongly Interacting Species: Conservation Policy, Management, and Ethics," *BioScience*, Vol. 55, no. 2 (2005) has raised the issue of levels of resolution in identifying objects of conservation.

happened that his object of conservation became CREWS's object as well.[120] Of course, it was not as though the rest of the Committee needed much convincing; the range of viewpoints was narrow. Within CREWS, Aldrich did not have to engage in an argument between the full spectrum of conservation objects from organisms to plant-animal communities. The main players among CREWS, mainly from the DWR and BML, were already predisposed to working at or below the species level. Aldrich only had to argue in favor of operating below, rather than at, the species level.[121]

Erickson's response to the Cain memo closely followed Aldrich's position. Erickson praised Cain for the thought he had given "these problems at the decision-and-policy-making level."[122] Like Aldrich, Erickson focused mostly on a commitment to identify populations as well as species in need of federal protection and management. Unlike his fellow CREWS ornithologist, Erickson attempted to address Cain's concern over natural areas and plant-animal communities. Using his own terminology, Erickson asserted the preservation of "representative ecosystems" as an important goal, in so far as they represent habitat for relic population or endangered species. Even as Erickson considered the conservation of objects above the species level it was only with respect to how

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[120] Section five will explore Aldrich's scholarly papers describing the "taxonomic approach."

[121] The topic of conservation and ecology at the species level is discussed in greater detail in Chapter 6.

[122] Erickson, Ray C. "Endangered Wildlife Populations." Memo to Chief, Office of Endangered Species. June 13, 1968. SIA RU T89021 box 7 folder 12.

it would impact individual species and populations.[123] Not surprisingly, Erickson's interest in natural ecosystems was mainly in relation to his captive breeding program, especially in the identification of 'suitable habitat' for transplanting captive-bred endangered species.

The Cain memo was reminiscent of a similar exchange between CREWS members not quite two years before Cain began mulling things over. In September of 1966 Fred Evenden, of the Wildlife Society, sent a few criticisms of the pending Endangered Species Preservation Act to John S. Gottschalk, the Director of the BSFW. Gottschalk in turn sent the suggestions on to his endangered-species committee.[124] Although Evenden was mostly concerned with how the categories 'endangered' and 'rare' were being used in the Red Book (see section 6), Richard Manville's response to Evenden sparked a further response from Aldrich, who himself had already written on Evenden's comments.[125] In the conclusion to his response memo Manville changed the subject away from conservation categories by stating his personal feelings all along as having been to "[g]ive primary consideration to full species, and eliminate considerations of subspecies, except in special cases."[126]

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[123] This topic will be more fully explored in the next chapter in the context of Ray Erickson's approach to captive breeding.

[124] Evenden, Fred G. Memo to John S. Gottschalk. September 2, 1966. SIA RU T89021 box 7 folder 12.

[125] Manville, Richard H. "Comments on Red Book." Memo to CREWS. October 5, 1966. SIA RU 7171 box 6 folder 19.

[126] Ibid.

Aldrich addressed Manville's personal feelings, writing that he considered the inclusion of subspecies in the Red Book to be of "fundamental importance to our endangered species program."[127] He began his argument by admitting that public interest in endangered wildlife was based on sentiment rather than taxonomy. Aldrich went on to list a number of high profile endangered 'species' listed in the Red Book (American ivory-billed woodpecker, Florida everglade kite, Key deer, etc.) and then called attention to the fact that they are all subspecies or distinct populations. Aldrich argued that listing subspecies was already the practice, a practice that if abandoned would eliminate some of the very symbols of American wildlife conservation from eligibility on the list. But it was more than institutional momentum that made listing subspecies the right conservation approach. Aldrich had a biological reason for arguing so strongly on behalf of the inclusion of subspecies and populations as the correct objects of conservation.

Darwin had pointed out in 1859: "no clear line of demarcation has as yet been drawn between species and subspecies."[128] In 1966, in his response to Manville, Aldrich brought the same worry to bear on wildlife conservation. "Biologically the only difference between populations which we call full species and those we consider subspecies (race) is the degree of reproductive

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[127] Aldrich, John W., "Inclusion of subspecies in rare and endangered lists." Memo to CREWS. November 7, 1966. SIA RU T89021 box 7 folder 7.

[128] Charles Darwin, *On the Origin of Species: A Facsimile of the First Edition.* (Cambridge, MA, Harvard University Press, 1975), 51.

isolation."[129] The distinction, continued Aldrich, "is far from sharp."[130] Aldrich wanted policy directed at wildlife populations that were distinct (morphologically, physiologically, or behaviorally) and endangered, "irrespective of whether taxonomists classify them as full species or subspecies."[131] "A subspecies," claimed Aldrich, "is the first step in the evolutionary creation of a new species."[132] If protection only comes after taxonomists have labeled populations of concern as full species there may be nothing left to protect.

Aldrich's commitment to distinct populations with unique evolutionary trajectories as the proper objects of conservation stems from his expertise as an ornithologist and a commitment to certain theoretical aspects of the Evolutionary Synthesis, especially those of fellow ornithologist and Synthesis architect Ernst Mayr. Aldrich had begun to work out his taxonomic approach to conservation with its Evolutionary Synthesis underpinnings in the 1940s. That work would become of vital importance to his participation on CREWS.

5. Aldrich and the Taxonomic Approach

A 1946 article in *The Journal of Wildlife Management* titled "The Significance of Racial Variation in Birds to Wildlife Management" offers one of the earliest print versions of Aldrich's conceptual approach to wildlife

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[129] Aldrich, John W., "Inclusion of subspecies in rare and endangered lists." Memo to CREWS. November 7, 1966. SIA RU T89021 box 7 folder 7.

[130] Ibid.

[131] Ibid.

[132] Ibid.

management and conservation. His conceptual approach was well articulated and more importantly, in the debates concerning the objects of conservation, some form of Aldrich's conservation approach became the prevailing position in CREWS. The impact of Aldrich's approach is demonstrated by the ESA species definition, which defines a species as any subspecies or distinct population segment. Additionally the 1968 revision of the Red Book contained a section on classification that extolled the virtues of considering both species and subspecies for the "purpose of achieving greater precision" in conservation decisions.[133] This section of the 1968 introduction shows the progression toward Aldrich's position from the 1964 draft in which there is no mention of subspecies, through the 1966 revision that defines the categories in terms of both species and subspecies, to a full rationale for practicing conservation below the species level. The following lays out Aldrich's approach as described in manuscripts, talks, correspondences and published articles.

While the *Wildlife Management* article is one of the first glimpses of Aldrich's understanding of the conceptual foundations of conservation, a later paper details his more mature views. In a paper titled "Population Systematics in Bird Conservation" that was presented at the XIIIth International Ornithological Congress held in Ithaca, New York in 1962, Aldrich credits evolutionary biologist and ornithologist Ernst Mayr with the conception of population systematics used in the paper, defined as "the recognition and classification of geographical and

[133] United State, *Rare and Endangered Fish and Wildlife of the United States.* (1968).

ecological variation within populations of species." Aldrich leans on Mayr's biological species concept, relying on geographic and therefore reproductive isolation as the primary means of identifying populations as species, just as he would four years later in his exchange with Manville over the proper objects of conservation. But for Aldrich, diagnosing species rarely identifies what matters for bird conservation, at least as practiced by FWS.

Many species exist as a collection of distinct populations adapted to differing conditions across the range. "Wildlife conservation… should utilize clues which may be discovered through the study of varying adaptations within species and apply them to the study of population management." This study of variation, says Aldrich, is of particular interest to one of FWS's favored conservation practices—transplanting wildlife into new or historic habitat. By paying attention to variation within a species and careful analysis of life-areas (one of Aldrich's other major projects) wildlife managers can select stock for transplantation that has the best chance of thriving in the newly selected habitat.[134]

Around the same time as the population systematics talk, Aldrich was engaged with another problem as a member of the WCAG. Although opponents of the captive breeding of whooping cranes had limited the scope of FWS captive breeding efforts, advocates were able to operate on a small scale with a few

[134] John W. Aldrich, "Population Systematics" in Bird Conservation. Unpublished draft. SIA RU T89021 box 4 folder 14. Aldrich was heavily involved in extending C. Hart Merriam's Life-zone work. He used interchangeably the terms life-zone and life-area and constructed a number of life-area maps. See, SIA RU 89-033 Box 2 Folder 15.

whoopers already in captivity at various zoos. Josephine, the female and sole surviving member of the southern sedentary population, and Crip, an injured member of the northern migratory population, were the primary specimens used by FWS. By 1965 the pair had produced four offspring and two additional adults had been acquired. Breeding the only male and female in captivity was an easy decision, but the next step in the captive breeding experiment was not as clear. Aldrich, on behalf of the WCAG, sought out expert advice.

Aldrich composed a letter asking for assistance on "a problem in practical ecological population genetics."[135] Identical copies of this letter were sent to several university geneticists and a collection of biologists best known for their contributions to the Evolutionary Synthesis: E. B. Ford, Theodosius Dobzhansky, Ernst Mayr, and David Lack.[136] The problem was how to go about breeding the whooping cranes in captivity with the objectives to retain "whatever genetic adaptations that may have resulted from natural selection," and to "maintain or enhance the genetic diversity by crossing, thus avoiding as far as possible the undesirable effects of inbreeding."[137] Conceptually, Aldrich was posing the question; how genetically diverse does a population have to be to avoid the threat of extinction through genetic deterioration as a result of too much inbreeding? If

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[135] Aldrich, John W., Letter to Dr. Ernst Mayr. January 27, 1965. SIA RU T89021 Box 1 folder 2.

[136] David L. Hull, *Science as a Process: An Evolutionary Account of the Social and Conceptual Development of Science* (Chicago: University of Chicago Press, 1988), 57-72.

[137] Ibid.

the migratory strain were in danger of falling below that threshold of genetic diversity, infusing the migratory whooping crane population with genes from the sedentary strain, through captive breeding and reintroduction, would increase the genetic diversity of the resulting population. Alternatively, Aldrich was trying to determine what portion of Josephine's genetic make-up her decedents would require if they were to be successfully bred in captivity and reintroduced as a sedentary population in southern Louisiana. Breeding the captive whoopers "without regard to their source" would mean that the genetic characteristics of the non-migratory population would be lost (a fate that some could argue would come to pass upon Josephine's death). Should FWS keep the lone female, from the sedentary population, and her progeny separate from the captive stock of migratory whoopers, to maintain each population in a nearly pure form? Or, should it integrate the non-migratory and migratory populations in the interest of maximizing the genetic diversity in the critically endangered whooping crane species as a whole?

Aldrich received a range of responses to his letter. Many suggested procedures for backcrossing Josephine with her offspring to maintain the best approximation of a pure sedentary population genetic make-up for potential repopulation in Louisiana. Others had little to offer, claiming that they didn't work on birds. Mayr and Aldrich exchanged several letters on this issue and on the whooping crane project as a whole. Mayr praised Aldrich and the FWS for their excellent work in the area of whooping crane recovery, remarking that he had even cited Aldrich's work in his recent book *Animal Species and Evolution*,

published in 1965.[138] With respect to the captive breeding problem, Mayr suggested, similar to other respondents, segregating the pure migratory birds from Josephine and her progeny to conserve the sedentary genes as much as possible for future reintroduction.

The preceding analysis illuminates two aspects of Aldrich's focus on conservation below the species level. On the one hand he seems concerned with protecting potentially selectable variation wherever it can be identified and named. The protection of course is from human interference, such as habitat destruction or pollution, that might force populations into extinction before natural selection can operate, potentially interrupting the natural process of species formation. He demonstrates this in whooping crane conservation when he advocates the protection of particular gene combinations, as in the non-migratory population of which Josephine was the last surviving member. On the other hand, in contrast to protecting wildlife against the effects of human interference such as habitat destruction, Aldrich offered up the study of within-species variation as a means to guide the transplantation of endangered populations and captive reared stock to new and suitable habitats. The two uses of Aldrich's approach are in contradiction and involve an arbitrary line between beneficial human intervention and deleterious human interference.[139]

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[138] Ernst Mayr, *Animal Species and Evolution*. (Cambridge, MA: Belknap Press of Harvard University Press, 1965), 318.

[139] A further discussion of this contradiction will be examined in the next chapter as it plays out in the FWS captive breeding program.

It is not the claim that the entire conceptual apparatus of Aldrich's taxonomic approach was taken up by CREWS and used in full to undergird the ESA. As a BML biologist and influential member of the Committee, he was able to bring his conceptual approach to bear on an important debate with CREWS and FWS related to identifying objects of conservation. In the end, Aldrich and likeminded researchers on CREWS and in the BML were successful, not only in influencing the wording of legislation in the ESA, but ultimately affecting the practice of endangered-species recovery and captive breeding. The Red Book and the objects of conservation contained therein represent a significant component of the science behind the federal endangered species program and the ESA.

6. Conservation Categories

Negotiations involving conservation categories took on a far less technical air than those over objects of conservation. Often discussions concerning conservation categories were more concerned with their policy implications than with their scientific meanings. In a very real sense, a species, subspecies, or population could not be considered endangered from a policy standpoint until the Secretary of the Interior officially listed it in the Federal Register. "Until an animal makes the Federal Register, we cannot buy land for it, prohibit import or export, or take other actions under the Endangered Species Conservation Act," were the opening words spoken by CREWS Acting Chair Earl Baysinger during an all-day CREWS meeting on August 6, 1971. "In discussing endangered species in official correspondence or as related to Bureau policy," Baysinger

continued, "we should stick to those species in the Federal Register."[140] Making sense of conservation categories was not strictly a policy matter, and there were attempts by CREWS to come to terms with what biological sense it could make out of the idea of an endangered wildlife species.

The 1964 draft of the Red Book was for the most part unproblematic with respect to conservation categories for two reasons. First, the list contained a single category, 'rare and endangered,' and many of the listed species had a conservation management history, whether justified or not, leaving them generally considered to be legitimately imperiled. The conservation histories of many of these species, such as the whooping crane, also contributed to a lack of problematizing of the very notion of endangered biological entities. One might not have been able to give a precise definition of 'endangered' but whatever it was, the whooping crane was it. Second, there was no federal legislation for the protection of endangered wildlife to give the list policy significance, allowing the Committee to make its recommendations "with complete independence of bureau policy or management and administrative restrictions." "Only in this way" the document continues, "could the committee evaluate each individual problem objectively and submit recommendations solely on a biological basis oriented toward the goal of survival of each species as part of our native fauna."[141]

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[140] Notes on Meeting of Endangered Species Committee August 6, 1971. SIA RU 85-186 box 1 folder 1.
[141] United States, *Rare and Endangered Fish and Wildlife of the United States*. (1964).

With the massive proliferation in listed species, from the first draft to the first published list, came a lesser proliferation in conservation categories. The single category of 'rare and endangered' was separated into a two-tiered system with 'endangered' being the most critical and 'rare' designating species in danger of becoming endangered. Two other categories were added in 1966—'peripheral' and 'status undetermined.' Peripheral species were those species that occurred in the U.S. along the margins of their range. They were rare in the U.S. but not in their range as a whole. The final category, status undetermined, was simply the ubiquitous, and that which does not neatly fit into one of the previous three categories. The nature of the additional categories combined with the parallel development of endangered species legislation during the publishing of the first Red Book in 1966 caused some to begin to problematize the categories being employed by CREWS.

The Fred Evenden memo from 1966 that sparked one of the species/subspecies debates within CREWS, interestingly enough had nothing to do with the inclusion of subspecies on the CREWS list. Evenden's primary complaint was with the categories being used in the Red Book. He first took aim at the 'status undetermined' category, suggesting that if the document was to be plastic, requiring constant revision as species' status changed, little was to be gained in confusing the public with the category of 'status undetermined.' Evenden had even less flattering comments with respect to peripheral species. "Peripheral should be abandoned, for it does not fit the program's own

criteria."[142] CREWS was apparently already aware of one of the contradictions the peripheral category created in their document, as the claim that recommendations would be made solely on a biological basis was dropped from the 1966 introduction to the Red Book in favor of the phrasing that it would "evaluate the status of each animal objectively."[143] Evenden's final suggestion, replacing what he considered to be the ambiguous category 'rare' with the more useful designation of 'vulnerable,' was one that received support from Manville and Aldrich as well as a host of other individuals associated with CREWS. Reconciling conservation categories with CREWS's original goal of developing a biologically grounded endangered species program continued to be an issue for the committee.

Category concerns were raised again in a 1970 memo exchange initiated by Eley Denson of the Office of Endangered Species on behalf of its Chief, Harry Goodwin. Denson posed a question that his respondents claimed had been considered numerous times. "Can we define 'endangered' and 'rare' more specifically?"[144] Goodwin raised three concerns with this question. First, he wanted a more technical definition for 'rare' that could be applied more objectively from case to case. His suggestion was to assign numerical or

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[142] Evenden, Fred G. Memo to John S. Gottschalk. September 2, 1966. SIA RU T89021 box 7 folder 12.

[143] United States, *Rare and Endangered Fish and Wildlife of the United States* (1966), ii. Emphasis in original.

[144] Denson, Eley. "Thoughts on Endangered and Rare Species." Memo to CREWS. August 24,1970. SIA RU 85-186 box 1 folder 4. Emphasis in original.

geographical limits, such that when a population dropped below a certain number or within a predetermined geographic range it would be considered rare. Similarly, Goodwin wondered if a greater sense of urgency could be captured by defining endangered as so rare that it was likely to become extinct within a certain number of years or generations. Second, Goodwin raised an important distinction between two kinds of endangered species, "those which are vulnerable to natural disaster and those which are actually declining."[145] Finally, he posed the reoccurring question—what useful purpose does including peripheral species in the Red Book serve?

Responses to Denson and Goodwin came from the usual suspects with some familiar responses. Erickson enthusiastically endorsed solving some of the confusion over the 'rare' category by replacing it in the Red Book with a 'vulnerable' category, just as had been done four years before by Evenden. Erickson was less enthusiastic about the prospect of placing numerical limits on rarity. 'Rare,' or 'vulnerable' as Erickson preferred, applied specifically to an individual species and its environment and therefore resisted generalization. "Arbitrary quantification could be a very serious trap and any attempt to do so with these qualitative terms could greatly handicap the Bureau's management program and the functions of our committee."[146] On the final point of the value of peripheral species, Erickson endorsed the controversial category as having

[145] Ibid.
[146] Erickson, Ray C. "Thoughts on Endangered and Rare Species." Memo to Eley P. Denson, Office of Endangered Species. August 31, 1970. SIA RU T89021 box 7 folder 12.

important heuristic value, pointing to potential problems in the peripheral species environment that might be contributing to decline and alerting neighboring countries of potential future problems for the species as a whole.

Erickson's sentiments again lined up well with those of Aldrich, who for some time had also endorsed the replacement of the term 'rare' with 'vulnerable' and confirmed CREWS's heuristic view of peripheral species. As for the prospects of a quantitative definition of 'rare' and 'endangered,' Aldrich was also clearly opposed, scribbling "not practical" in the margins of his copy of the Denson memo.[147] Aldrich's position was that quantitative criteria for 'endangered' did not translate well across taxonomic groups and therefore the best approach was to rely on the opinions of the best experts in the field. Experts to Aldrich were the ornithologists, mammalogists, herpetologists, and other specialists that worked on the individual groups that were listed by CREWS. This position was confirmed by the list of experts that received copies of the 1964 Red Book draft for comment. A few outliers aside, an overwhelming majority of CREWS's designated experts could be easily classified into three categories: museum curators and taxonomists, biologists in university zoology departments, and government conservation units.[148] In this response Aldrich and CREWS express their view on the classification of the objects of conservation into the conservation categories. Expert opinion would lead the way, but it would be

[147] Denson, Eley. "Thoughts on Endangered and Rare Species." Memo to CREWS. August 24,1970 SIA RU T89021 box 7 folder 12.
[148] List of advisors for *Rare and Endangered Fish and Wildlife of the United States*. November 6, 1964. SIA RU T89021 box 7 folder 12.

CREWS who made all final decisions on who qualified as an expert and whether or not the so-called experts' recommendations warranted listing a particular species, subspecies, or population as endangered. It is here that CREWS made one of its biggest impacts on the ESA and federal endangered-species policy. By insisting that endangered species be evaluated on a case-by-case basis rather than according to a quantitative definition, CREWS established a trajectory for endangered-species policy in which validation of expert status was to be judged by the standards of the Committee, FWS, and the DOI.

7. The Red Book and Endangered-Species Policy

The DOI and FWS made a deliberate move in 1964 to put together a completely internal FWS committee to advise the Director of the BSFW on federal endangered-wildlife policy. In doing so they traded administrative control for broad representation of scientific approaches and value positions on the committee, effectively constraining the potential outcomes with respect to endangered-species policy and legislation. The small committee had an even smaller collection of members whose primary concern was wildlife conservation—the wildlife researchers of the BML and DWR. The BML researchers brought with them to CREWS the viewpoint of the taxonomist and zoologist, a view most fully conceptualized by John Aldrich in his taxonomic approach and the objects of conservation it endorsed. Although the other BML researchers were not always in full agreement with Aldrich (differences often split along the bird and mammal line), department communications demonstrate that his opinions were well respected in the group and throughout the FWS.

Furthermore, his work was conceptually robust, facilitating the uptake of some of the conclusions of his approach if not the whole technical apparatus by others in the BML and more importantly CREWS. Aldrich's success in directing federal conservation policy toward a particular object of conservation is demonstrated in the species definition of the ESA and the rewording of the Red Book introduction from draft to published document to emphasize the importance of distinct populations in conservation.

The FWS could not have known that CREWS's work would have such a profound influence on the ESA—legislation that it had not nor could not have conceived of in 1964. It was, however, aware that the U.S. political environment was becoming environmentally friendly and that other efforts to compile endangered-species lists had received enthusiastic support and were expected to be influential in directing conservation decisions. In this respect, the constraining factors that were the result of CREWS's narrow membership had a real effect on decisions related to objects of conservation, conservation categories, and methods of classification of species listed as endangered in the Red Book.

There is no direct evidence that the FWS was intentionally shielding segments of the scientific and conservation communities from the development of federal policy. However, in light of the controversy over the captive breeding of whooping cranes and given the drastic administrative differences between the WCAG and CREWS, that the BSFW deliberately set out to keep the final scientific authority on endangered-species inside the Bureau is a reasonable possibility.

It should also be pointed out that other scientific and policy considerations might explain CREWS's commitment to a species-focused (or population-focused) conservation approach rather than communities. The boundaries around species appear, on the surface at least, to be better defined than those around communities, and therefore easier to present in list form. On a similar note listing only full species would keep the list more manageable than multiplying it by adding subspecies and populations. As CREWS settled in on an object of conservation science was not the only consideration, but Aldrich and CREWS made sure it was considered.

The adoption of key components of Aldrich's taxonomic approach was one outcome of CREWS's administrative organization. A significantly expanded captive breeding program for managing the objects of conservation listed in the Red Book was another. Stacking CREWS with BSFW administrators and biologists excluded community-minded conservationists in scientific fields not well represented in the ranks of FWS, leading the Committee in the direction of conservation at or below the species level. Additionally, preservation-minded members of the NAS who had opposed captive breeding were also excluded, leaving the door wide open for CREWS to apply captive breeding in an effort to rescue its newly identified conservation targets.

Chapter 5

NEGOTIATING THE PARAMETERS OF FEDERAL ENDANGERED-SPECIES POLICY II: CAPTIVE BREEDING

1. The Cranes of Patuxent

About ten miles northeast of Washington D.C. on the Baltimore-Washington Parkway in Laurel, Maryland, a colony of over sixty captive whooping cranes is maintained on a 13,000 acre tract of land at the Patuxent Wildlife Research Center.[149] Signed into existence by an executive order of President Franklin D. Roosevelt on December 16, 1936, the Patuxent Center, originally named The Patuxent Research Refuge, was primarily established "to effectuate further the purposes of the Migratory Bird Conservation Act."[150] In 1965, Patuxent became the site of federal whooping crane captive breeding efforts as part of the U.S. Fish and Wildlife endangered species program initiated by Ray C. Erickson. Erickson's ambition was to establish a comprehensive federal program for research and captive breeding of cranes and other endangered wildlife listed in the U.S. Red Book. Today's Patuxent whooping cranes together with others at facilities around the country, totaling more than 150 captive cranes, are a significant part of the legacy of Erickson's vision.

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[149] Whooping Crane Restoration Ecology Team, Patuxent Wildlife Research Center, United State Geological Survey. accessed December 13, 2010, http://www.pwrc.usgs.gov/products/factsheets/29sm.pdf.

[150] Matthew C. Perry, "The Evolution of Patuxent as a Research Refuge and a Wildlife Research Center," accessed December 8, 2010, http://www.pwrc.usgs.gov/history/cronhist/PatuxentHistory_Perry.pdf.

The practice of captive breeding and the scientific problems of endangered species conservation had at times a tenuous relationship. This chapter examines that relationship in the documents that describe the organization and conceptual approach of Erickson's endangered species program at Patuxent and documents describing how captive breeding was applied to specific conservation problems in the 1960s and later. In particular, wildlife conservation in the context of Hawaii generated a number of interesting questions related to the relationship between conceptual justification and conservation policy and what it meant to preserve something or someplace in its 'natural' state.

The Patuxent center was a significant piece of the infrastructure that allowed captive breeding to play a central role in federal endangered-species science and policy, and CREWS was a significant influence in the increasing support of the practice. Outside of the FWS, support for captive breeding in the decade before the ESA is demonstrated by a 1962 International Council for Bird Preservation (ICBP) statement on endangered species in the Islands of Mauritius, which recommended the transplantation of endemic birds to nearby islands.[151] CREWS's role in helping to promote captive breeding can be found in a 1970 endangered-species position statement of the Wildlife Society, a non-profit, professional, conservation society. The statement, drafted for the society by John

[151] J. Vinson, "On the Extinction of Endemic Birds in the Islands of Mauritius, with a Possible Way of Saving Some of the Remaining Species." SIA RU T89021 box 7 folder 5. Many FWS researchers were ICBP members including Aldrich and Erickson. Although transplantation of specimens to establish new breeding populations did not involve breeding in captivity, the practice of transplantation was closely tied to captive breeding, especially the stage of reintroduction of captive bred stock.

Aldrich, had as its third goal, to "[e]ncourage research on the biology of endangered species to provide a sound basis for appropriate management including habitat acquisition and rehabilitation, captive propagation, and transplantation."[152]

One of the critical determining factors in shaping how CREWS developed captive-breeding strategies to deal with conservation problems is the conception of ecology it relied on. This ecological approach was described by Erickson and practiced by FWS and CREWS as part of the captive-breeding program. Section 4 explores a brief history of the development of ecology, drawing out two traditions in ecological practice. CREWS's ecological approach was built on the tradition that favored the study of individual species or organisms over holistic or historically intact communities. This kind of atomistic ecology led CREWS to favor a single-species approach to endangered-species conservation.[153] However, even as the Committee's conceptual approach and conservation practices keyed in on species, subspecies, and populations it often spoke of the need to protect natural areas. Though both approaches were seen as important, conservation of single-species and communities came into conflict when CREWS addressed real-world conservation problems. When faced with such conflict, the Committee's

[152] Draft of Wildlife Society position statement on endangered species, January 1, 1970. SIA RU 03-132 box 1 folder 1.

[153] For a discussion of atomistic versus holistic conservation approaches and the associated comparison of autecology with synecology see Bryan G. Norton, "Biological Resources and Endangered Species: History, Values, and Policy," In Lakshman D. Guruswamy and Jeffrey A. McNeely. *Protection of Global Biodiversity: Converging Strategies*. (Durham, N.C.: Duke University Press, 1998).

ecological approach and commitment to captive breeding led it to universally prefer the atomistic, single-species approach to the conservation of holistic communities.

CREWS's use of captive breeding as a conservation tool brings up a common theme in this study of CREWS. The narrow membership of the Committee, all drawn from a similar institutional background, predisposed it to a particular tradition of ecology and therefore narrowed the potential approaches it was likely to follow in the development of endangered-species policy. Captive breeding, as a practice that approached conservation on a species-by species basis, fell squarely within the Committee's narrowed conceptual approach to conservation. Together with John Aldrich's taxonomic approach, which picked out the objects to be conserved, captive breeding was one of the major contributions to federal endangered-species policy advocated for by CREWS.

2. Proposing a Federal Program

Ray Erickson's full vision for the organization and administration of the federal endangered species program is best described in a paper he delivered at the Thirty-Third North American Wildlife Conference in 1968, three years after Patuxent opened its doors to endangered-species research. His first attempt at drafting a proposal to extend efforts directed at whooping cranes to other species of endangered wildlife came in the form of a "Prospectus for Rare and Endangered Species Program," presented to BSFW Director Janzen in 1963. Although Erickson was the sole author of the prospectus and the 1968 paper, it is not surprising that he conferred and collaborated with colleagues in FWS and

CREWS. John Aldrich made extensive notes on a copy of the earlier prospectus.[154] A draft of the 1968 paper was distributed for comment to several colleagues in the BML including Aldrich, Manville, John Paradiso, and Richard Banks.

Written five years apart, Erickson's two documents concerning the federal captive-breeding program exhibit important differences. These differences illuminate important developments in federal endangered species policy during the 1960s. The most significant of these is that by the time the 1968 document was written, the Patuxent research center was already in operation, but more importantly was operating under the authority of new federal endangered species legislation passed in 1966.[155]

The lack of concrete legislative authority in 1961 was an obvious source of difficulty for the author throughout the document. Erickson opened the prospectus by claiming the duty and authority of the BSFW to engage in comprehensive conservation efforts under the Migratory Bird Treaty Act of 1918. This legislation, however, applied only to migratory birds and so, he struggled throughout the rest of document with the issue of how to include all endangered wildlife in a program whose strengths, both historically and legislatively, were primarily focused on birds. He attempted to extend the BSFW's authority by claiming that "[i]t may be appropriate to interject also that the preservation of some species of bird is merely a special case of preserving the diversity and

[154] SIA RU T89021 box 6 folder 29.

[155] Public Law 89-669, Endangered Species Preservation Act of 1966.

integrity of the entire North American biota."[156] Despite Erickson's convictions concerning the need for comprehensive federal wildlife conservation the document carried a rather conspicuous bird bias. This bias was most obvious in an included list of endangered species that contained only North American birds.

John Aldrich, also sensitive to the issue of federal authority in wildlife conservation, made several notes on a copy of the Erickson's prospectus suggesting other laws and treaties that might collectively provide the kind of comprehensive authority both he and Erickson sought. In the opening paragraph Aldrich added the Fish and Wildlife Service Act of 1956 as possible justification for extending federal wildlife conservation efforts to all wildlife species. Later in the document Aldrich pointed to the Lacey Act of 1900 as another possible legislative justification for a more comprehensive federal program. Aldrich continued to push Erickson toward a more wildlife inclusive proposal, handwriting "wildlife species" above Erickson's less inclusive "migratory birds" in the "Program Proposal" section that originally began, "[f]or the many reasons already mentioned it seems desirable for the Bureau to establish a program, including captive propagation, for the preservation of rare and endangered migratory birds."[157] What is clear from the Erickson prospectus and Aldrich's notes is that if a comprehensive federal endangered species program were to be

[156] Prospectus for Rare and Endangered Species Program, SIA RU T89021 box 6 folder 29.

[157] Ibid.

established it should be built on a reliable legislative foundation and should definitely include a captive-breeding program.

In addition to legal authority, Erickson wrestled with a second issue in justifying his captive-breeding proposal. As the Whooping Crane Memoranda of the first half of the 1960s demonstrate, at the time the prospectus was written captive breeding was not embraced by all or even most of the whooping crane conservationists. Erickson "recognized that some people are apprehensive of captive propagation as a means of improving the status of endangered species."[158] However he "believed that all such reservations about this particular propagation program will disappear as familiarity is attained with the needs, objectives, proposals, and approaches as outlined in this prospectus."[159]

By the time of the 1968 North American Wildlife Conference, the passage of the Endangered Species Preservation Act and the establishment of CREWS had redirected federal conservation decisions away from the broader conservation community and toward the DOI, FWS, and CREWS. The new legislation addressed the federal authority problem from Erickson's earlier document by allowing FWS to make decisions on wildlife conservation practice and programs without seeking consensus with conservationists outside the Service. These developments, from the early part to the later half of the 1960s are apparent in the Erickson conference paper which was in 1968 less concerned with, but certainly not devoid of, justification for the existence of a federal captive-breeding

[158] Ibid.

[159] Ibid.

program. Instead the document became more tightly focused on the operation of the program Erickson was instrumental in establishing.

3. The Patuxent Station

Having settled into his new position in his third year as the Assistant Director of Patuxent and head of the new endangered-species research program, Erickson, in his 1968 conference paper, could turn his attention to familiarizing the broader conservation community with his program rather than primarily justifying its existence. One significant difference between Erickson's earlier prospectus and the 1968 conference paper shows important strides made by FWS and CREWS, as they worked to redraw the boundaries of endangered-wildlife-policy advisory and decision-making authority. The legislative justification for the Patuxent program that was the primary focus in the prospectus was barely mentioned in the conference paper. A single mention of the Endangered Species Preservation Act in the final paragraph was all that remained. The new legislation also allowed a more balanced treatment of wildlife conservation that included mammals, reptiles, fish, amphibians, and birds. While the need for legislative justification of a federal endangered-wildlife program had diminished, the conceptual justification was a different story. Of all the endangered species research activities described in Erickson's paper, captive propagation was

"presented in greater detail…because of its more controversial position in wildlife management."[160]

Captive breeding was still a hot-button issue, but with the sandhill crane experiments well underway, solid funding for the Patuxent research program in hand, and the establishment of CREWS, support for captive breeding as a useful and necessary conservation tool was becoming the majority position among conservationists in FWS who were now in the best position to influence policy. The 1968 paper maintained a focus on justification, but some of the attention that the earlier draft had given to that topic was turned to a discussion of the objectives of the federal endangered species program and the three research sections that would carry out those goals.

The Endangered Wildlife Research Station, established for the scientific study and captive propagation of endangered wildlife, had two objectives. The first was "to obtain needed information on the distributional, behavioral, ecological, physiological, genetic, and pathological characteristics of threatened species in the wild…"[161] The second objective was "to maintain captive populations of [endangered] wildlife species for study and for the production of suitable stock needed to restore or bolster population in the wild."[162] To carry out

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[160] Ray C. Erickson, "A Federal Research Program for Endangered Wildlife." *Transactions of the Thirty-Third North American Wildlife Conference*, (1968): 423.
[161] Ibid., 418.

[162] Ibid., 418.

these objectives the research station was organized into three research sections: The Section of Propagation, the Section of Laboratory Investigations, and the Section of Ecology.

The Section of Propagation was at the nexus of the twofold objective of the Patuxent program. On the one hand the Section of Propagation would provide for the immediate needs of imperiled species like the whooping crane, breeding cranes in captivity at Patuxent and then releasing them into the wild flock. Habitat preservation and strict enforcement of regulations had not produced rapid enough increases in crane population. Captive breeding of cranes would help augment nature's slower pace. In addition, carrying out captive breeding experiments on a wide variety of endangered species and their close relatives, as with the whooping and sandhill cranes, not only provided insurance against "calamitous loss of the wild population" but also provided a supply of data and techniques available for use on related species that might become endangered in the future. The propagation section simultaneously preformed the objectives of active conservation practice and endangered-species research.[163]

Erickson was committed, and had been for almost a decade, to the use of captive breeding in wildlife conservation. He was well aware that not all those who claimed to have a stake in conservation policy decisions shared his commitment. He took great care to place propagation into its proper context, marking it as just one aspect of wildlife management. Propagation was a tool,

[163] Ibid.

"not advanced as a substitute for the study, preservation, or management of natural ecosystems, refuges, or limited sanctuary areas, protective regulations, and their strict enforcement, or effective public information and education programs."[164] What Erickson did not seem to acknowledge is that the resources that were being committed to captive propagation had a profound effect on what kind of study was done, what it meant to preserve, which ecosystems were managed and how, and other fundamental issues. The Patuxent station and its connection to CREWS through Erickson were defining what science would be included in federal endangered-species policy. That science was in no small part the science of captive propagation and it was the focal point of all endangered species research at Patuxent.

To support the Section of Propagation, the Section of Laboratory Investigations relied on existing expertise in veterinary medicine, animal nutrition, genetics, and related disciplines to carry out studies on the basic biology of endangered species and their close relatives. This research was carried out on site at Patuxent providing an analytical resource for captive breeding efforts. The starting point for research came from poultry studies, mainly the breeding of domestic chickens and turkeys, what John Lynch had referred to as "a high-intensity period of 'poultry husbandry'" in his call for crane breeding a decade earlier.[165] Erickson recognized the well-documented, weak connection between the breeding of domestic poultry and wild birds commenting that in the literature

[164] Ibid., 425.
[165] Thomas Dunlap, "Wildlife Preservation," 207.

on the captive breeding of wild birds "information hiatuses are the rule, fruitless searches commonplace, and cautious extrapolation often a necessity."[166] One of the primary goals of the Laboratory section was to close the information gap on the breeding of wild species through experimentation on threatened species when possible and close relatives as proxies when numbers were critically low. While the laboratory section collected data in the lab the Section of Ecology would investigate wildlife species in their natural habitats.

The Section of Ecology was the "field arm of the Station, staffed by research biologists to study threatened and endangered species wherever they occur in the wild." According to Erickson the ecology section operated in the tradition of the FWS and NAS cooperative monographic studies, headlined by the whooping crane, but including other well-known studies at the time such as those on the California condor and ivory-billed woodpecker. The specific duties of the ecology section biologists were to "investigate the ecology, behavior, and physical characteristics" of endangered species *in situ*. In addition they were to identify wild populations in the field that should be targeted for management as well as populations that might serve as sources for captive stock. On the reintroduction side of the process, the ecology section was to identify what was commonly referred to as 'suitable habitat' for the release of captive stock, and on the basis of their monographic studies, the "most effective method, times and

[166] Erickson, "Federal Research Program," 427.

places" for release.[167] Erickson went on to provide examples of work in progress by FWS biologists on particular wildlife species in various regions of the U.S.[168]

An illuminating feature of the paper's discussion of the Section of Ecology was Erickson's choice of wording, in that the ecology section was to be staffed by 'biologists' rather than ecologists. The choice of wording raises the question of what Erickson intended by evoking the name of ecology as one of three foundations of his captive breeding program. By 1968 environmentalism as a social and political movement had gained increased prominence, a movement that has been well documented as carrying ecology before it as a scientific banner that would provide the authority and technical insight to make sound environmental policies.[169] Erickson's commitment to captive breeding, however, preceded this social and political, ecological infatuation that coupled with an increased interest in federal legislation of environmental issues. Erickson's reference to ecology was likely not what the average environmentalist citizen or perhaps even the well-informed environmentalist congressman might have understood ecology to be, which was still almost certainly different from the ideas of many of Erickson's contemporaries in academic ecology. Understanding Erickson's deliberate word choice—biologist rather than ecologist—is key to understanding one of the

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[167] "Suitable habitat" could refer to introduction into current or historic ranges or novel habitats that simply met the ecological needs as determined by the Section of Ecology. See section five for a discussion of some of the problems of introducing species into novel habitats.

[168] Ibid., 420-422.

[169] Worster, *Nature's Economy,* 350-359

central conceptual foundations of the Patuxent Research program and CREWS's approach to endangered species science and policy as a whole.

CREWS's understanding of ecology set the stage for much of what it hoped to accomplish in wildlife conservation through listing endangered species and the application of captive-breeding practices. The Patuxent endangered-species research program and its network of field stations, most notably in Hawaii and Seattle, leaned on that ecological approach to establish a tradition of endangered-species research and recovery.[170]This ecological approach, described in the following section, can be traced back to a particular tradition in ecological study. To understand how Erickson- and FWS-inspired captive breeding was to operate requires an understanding of how ecological study was brought to bear on the practice of endangered species recovery.

4. A Brief History of Ecology

"Ecology," historian Robert McIntosh began his treatise on the history of the discipline, "in its early years was sometimes decried as not a science at all but merely a point of view."[171] Fellow historian Sharron Kingsland in *The Evolution of American Ecology* echoed McIntosh's sentiment.

> I start with the assumption that the existence of ecology as a discipline should not be taken for granted. Ecology is a broad subject; its scope and definition have vexed its practitioners since its origins about a century

[170] The Seattle station headed by Karl Kenyon was well known for sea otter conservation studies. The work of the Hawaii station will be discussed in section five.

[171] Robert McIntosh, *The Background of Ecology: Concept and Theory* (Cambridgeshire: Cambridge University Press, 1985), 1.

> ago… [R]cognizing the value of adopting an ecological perspective on a problem does not imply that there should be a separate discipline called ecology.[172]

That ecology's roots are often identified by a point of view taken on a diverse set of biological topics rather than a particular approach to a particular set of problems complicates attempts to identify ecology's origins and trace traditions of ecological practice. Furthermore, potential origins of ecology are found in a number of disparate biological traditions that developed ecological ideas more or less independently of one another. Tracing the rich complexity of this intriguing discipline is far beyond the scope of this project, but a brief description of some significant conceptual developments and historical roots of ecology is relevant to understanding the particular ecological point of view taken by CREWS and federal captive breeding. The different and distinctive uses of the term and approaches to ecological study did not evaporate as the discipline began to coalesce in the first half of the twentieth century. Ecology as a science and practice is not and has never been monolithic and to evoke the name of ecology does not immediately call out a particular set of practices or theoretical structure.[173]

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[172] Sharon Kingsland, *The Evolution of American Ecology: 1890-2000* (Baltimore, MD: The Johns Hopkins University Press, 2005), 2.

[173] James Collins, John Beatty, and Jane Maienschein, Between Ecology and Evolutionary Biology," *Journal of the History of Biology* 19 (2) (1986): 169-180. This article describes some of the complexities of the history of ecology and is the introduction to an excellent issue of JHB that includes a number of articles that take a historical view of the intersection of ecology and Darwinian evolution.

Ecology owes its name to the German zoologist Ernst Haeckel who first used the neologism in 1866. The label did not catch on immediately and when it did, in the late nineteenth and early twentieth century, it lacked consistent usage. In 1949 W. C. Allee, the University of Chicago zoologist, defined ecology "broadly as the science of the interrelation between living organisms and their environment, including both the physical and the biotic environment, and emphasizing interspecies as well as intraspecies relations."[174] By this definition ecology had been practiced piecemeal for centuries by natural historians and emerging biologists in the nineteenth century, many of whom McIntosh has described as the antecedents of ecology.[175] Alexander Von Humboldt, who endeavored to determine "in what manner the geographic environment exerts its influence on animals and plants," is often mentioned as an important ecological precursor.[176]

In the Humboltian tradition Clinton Hart Merriam, the founder of the U.S. Bureau of Biological Survey, worked out his life zone's theory, which bore a striking resemblance to aspects of what would later be called ecology. Gregg Mitman described the research program of Allee and his University of Chicago colleagues; geographers, botanists, and zoologists who became leaders in the

[174] W. C. Alee, *Principles of Animal Ecology* (Philadelphia, PA; W. B. Saunders Company, 1949), 1.
[175] McIntosh, *Background of Ecology*, 1-19.

[176]Worster, *Nature's Economy,* 133.

nascent field.[177] Kingsland's history of American ecology attributes significant contributions to the development of ecology in the U.S. to Nathaniel Britton, the New York Botanical Garden, and the Desert Botanical Laboratory in Tucson, Arizona.[178] Other ecological roots have been recognized in the practice of natural resource management in the early twentieth century producing some of the most significant contributions through the ideas of Aldo Leopold.[179] Yet another source of ecological development was the land-grant colleges and agricultural experiment stations where Frederic Clements produced one of the first and historically well-known comprehensive ecological theories[180]. This brief survey of ecology's many beginnings confirms that ecology is neither conceptually nor historically monolithic. When investigating the application of ecology to conservation problems, as in the case of CREWS and endangered species, one must take care to identify which of the many voices from ecology's past are being called upon.

Ecology's antecedents were spread out over time and space, and a number of intellectual traditions. There is little hope of identifying a precise point in time when ecology became a formal scientific field, but some key markers of

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[177] Gregg Mitman, *The State of Nature: Ecology Community and American Social Thought, 1900-1950. Science and its Conceptual Foundations* (Chicago: Chicago University Press, 1992).

[178] Kingsland, *American Ecology*.

[179] Worster, *Nature's Economy, 268-290.*

[180] Worster *Nature's Economy, 205-220*; McIntosh, *Background of Ecology, 76-85*.

discipline formation can narrow a best guess. The formation of professional societies, including the British Ecological Society in 1913 and the Ecological Society of America in 1915 are two such clues. Specialized journals such as the *Journal of Ecology* (1913) and *Ecology* (1919), both associated with the new societies, provides further evidence that ecology as a science was staking out academic territory. McIntosh offered a third clue in the form of practitioners who began to refer to themselves as 'ecologists' and their work as 'ecology.' "Self-conscious ecology," as he called it, began to flourish in the early part of the twentieth century. Two important centers of this early awareness of ecology forming as a discipline were the University of Nebraska and the University of Chicago. McIntosh points to two discernable philosophical traditions developed in these institutions, derived in part from two European sources, Carl Georg Oscar Drude and Eugenius Warming, who were also self-conscious about their ecological ideas.[181]

Frederic Clements was born, raised, and educated in the heart of the Great Plains. He arrived at the University of Nebraska at the age of sixteen, acquired his bachelor's degree in 1894 at the age of nineteen and completed his PhD in botany in 1898 under the direction of C. E. Bessey.[182] After receiving his PhD, Clements remained at Nebraska as a professor of botany for another decade. While at Nebraska, Clements formulated his theory of plant succession and climax

[181] McIntosh, *Background of Ecology,* 21-27.

[182] Worster, *Nature's Ecomonmy,* 208-209.

communities. For this work he was "early recognized and often acclaimed, even by his critics, as the formulator of the first logical system of vegetation commonly described as a theory."[183]

Clementsian climax ecology was a dynamic approach to the study of ecology. He predicted that particular regions, defined by climate and physical conditions, would develop over time to produce a characteristic climax, or stable, self-sustaining plant community. Clements viewed these climax plant formations as holistic communities that existed in nature; they could be identified, predicted, and classified. If a climax community were disturbed, for instance a forest community by a fire, the damaged area would be repopulated by a series or succession of communities that would replace each other until a new climax was produced. Clements borrowed from the German plant geographer Carl Georg Oscar Drude, one of the major European sources of early plant ecology, who is also credited with laying the foundation for British and American ecology. Influenced by Drude's brand of holistic ecology, Clements viewed climax communities as a kind of superorganism. This organismal view of ecological communities became a widespread and often criticized aspect of ecology's early development.[184] It was in fact one of Arthur Tansley's main points of contention

[183] McIntosh, *Background of Ecology*, 42.
[184] J. P. Collins,"Evolutionary Ecology and the Use of Natural Selection in Ecological Theory," *Journal of the History of Biology* 19 (2) (1986): 257-88.

with general ecological theory when he introduced the Ecosystem concept to replace Clements's superorganism.[185]

In contrast to Durde's holistic approach which inspired Clements's community-as-superorganism tradition, Danish botanist and plant geographer Eugenius Warming offered, in his *Plantesamfund : Grundtræk af den økologiske Plantegeografi,* a different approach to ecological study. Warming was skeptical of the organismal analogies and directional analysis that had been applied to units larger than the organism, such as plant formations. Warming's approach to the study of communities and succession put more emphasis on individual plants, comparing the physiological adaptations of the various plants existing in a particular environment. For example, a community of hydrophytes might be described as the collection of algae, mosses, and possibly flowering plants sharing certain structural elements and existing in a particular set of abiotic conditions. Warming's atomistic approach emphasized the collection of data from the analysis of individual plants and the abiotic condition in which they existed in order to offer descriptions of plant communities and to answer questions about plant distribution.[186]

Warming found his most significant adherent in a University of Chicago graduate student in geology, Henry Chandler Cowles. Cowles was exposed to

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[185] Joel Hagen, *An Entangled Bank: The Origins of Ecosystem Ecology* (New Jersey: Rutgers University Press, 1992), 79.
[186] McIntosh, *Background of Ecology*, 43. William Colman, "Evolution into Ecology? The Strategy of Warming's Ecological Plant Geography," *Journal of the History of Biology*, 1986, 19 (2): 181-196.

Warming's ideas through Chicago botany professor John M. Coulter. Cowles went on to write one of the early important studies in plant succession: "The Ecological Relations of the Vegetation of the Sand Dunes of Lake Michigan." The details of Cowle's exposure to Warming and its impact on the development of ecology at Chicago are the subject of Gregg Mitman's important contribution to the history of ecology. The significance of Mitman's work to the present study is its description of one of the two emerging traditions in ecology. McIntosh points out that Cowles, himself, was aware of the two developing approaches and made reference by name to the Warming-Drude distinction in a review of one of Clements's early writings.[187]

The Chicago school, which drew its influence from Warming, and the Drude inspired Clementsian approach at Nebraska were two important, but certainly not the only, traditions that developed during ecology's infancy. There were other important differences between the two schools besides their respective European influences. Ecology at Chicago involved the likes of Warder Clyde Allee, Henry Cowles, Victor Shelford, Charles Davenport, and Charles Otis Whitman. Clements joined C. E. Bessey and Roscoe Pound to help guide the development of the Nebraska Program. Chicago followed what has been considered the pure research approach, whereas Nebraska, as a land-grant university, was more concerned with direct application of ecological study,

[187] McIntosh, *Background of Ecology*, 43-44.

particularly as it related to agriculture.[188] Although both had early botanical influences, Nebraska's agricultural emphasis maintained its primary focus on plant communities, while at Chicago the zoology faculty exerted an increasing Influence on the program as it developed over the first half of the twentieth century.

Setting up the single organism and community approaches to ecological study as a strict dichotomy does not withstand much scrutiny. Victor Shelford, for instance, operated freely across the two conceptual approaches performing a number of physiological studies of individual organisms as a means to gather enough data to describe and analyze larger animal communities. Shelford is also well known for his collaboration with Clements to integrate animal species into Clements's climax theory.[189] But, even though a strict dichotomy does not hold, the above distinction between community and single-organism approaches is useful as a general classification of ecological approaches early in the twentieth century.

Viewing the two approaches to ecology as historical traditions of practice is perhaps more helpful in the present case than to use the McIntosh description of philosophical conceptions. It is often the case that in the course of the day-to-day practice of science the big philosophical picture is lost as the details of particular projects and experiments are executed. Broadly speaking the tradition of practice associated with the Warming-Chicago influence would tend to select single

[188] It is not clear that there is any hope of drawing a sharp line between pure and applied research. The distinction here is used in the broadest sense.
[189] McIntosh, *Background of Ecology*, 88.

species or individual organisms as study objects and recognize a conceptual divide between organism and environment. The Nebraska-Drude tradition, by contrast, would tend to be more holistic, identifying communities of plants, animals, or both with little use for sharp lines that divide the part from the whole. Over time, practice can become disassociated from the conceptual decision to prefer single-species to communities in the first place. The result can be that the line that separates organism and environment might be conceived of as more concrete than experience justifies. Or the boundaries that define a particular community might be thought more real and definite than current data permits.

CREWS and the federal captive breeding program's species-focused conservation approach generally followed the single-organism tradition, with its associated organism-environment distinction. The conceptual commitment to single organisms over communities was never stated but nonetheless it can be identified in the practice of captive breeding and by Erickson's description of ecology in his prospectus.

It is perhaps not surprising that CREWS, of the FWS with its BML influence, operated primarily from ecology's zoological, single-organism tradition. The narrow representation within CREWS meant that it rarely had to confront other ecological points of view from competing research traditions. The common practice was to identify individual species or populations of animals and carry out research on the particular animal's environment to determine how best to apply conservation practice. Community ecology would be used to raise some concerns about the *status quo* in key instances. Practice is in fact built on theory

and someone is likely to point it out eventually when one does not line up with the other or if a particular practice comes in too sharp a conflict with a competing theory. This became most apparent in the efforts to save Hawaiian species.

5. Hawaiian Birds

Hawaii, in the words of FWS biologist Winston Banko, "calls for recognition of certain facts which may not always be apparent under more general conditions prevailing on the mainland."[190] The small islands of Hawaii are home to a number of equally small populations of species and subspecies, many of which are found nowhere else in the world. The surge in human activity during the first half of the twentieth century threatened to drastically alter the Hawaiian landscape and eradicate Hawaii's vulnerable species.[191] Even those species that existed on the more isolated islands were of concern to CREWS and the FWS, for fear that a natural disaster or some new pathogen would wipe out the small isolated populations over night. CREWS was clearly sensitive to the special case of Hawaii listing sixteen Hawaiian species among its 1964 draft list of sixty-three endangered species—over twenty-five percent. The FWS Division of Wildlife Research saw fit to send a number of researchers to Hawaii to study endangered species including Winston Banko in 1965.

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[190] Winston Banko, "Comments on proposed introductions, endangered species, Hawaiian Islands National Wildlife Refuge." Memo to director Patuxent Wildlife Research Center, May 27, 1967. SIA RU T89021 box 7 folder 12.
[191] John Aldrich, "Preservation of Unique Plant and Animal Life of Hawaii." Memorandum to James Salyer, Division of Wildlife Refuges, May 22, 1967. SIA RU T89021 box 7 folder 12.

Banko, known as 'Win' by his friends and colleagues, arrived in Hawaii as the first federal field biologist assigned exclusively to the study of endangered wildlife on the Hawaiian Islands. In taking the Hawaii assignment, Banko was returning to FWS duty following a two-year stint on loan to the Smithsonian Institution as the assistant to the Director of the SI's Pacific Ocean Biological Survey Program. He would remain on the islands studying rare and endangered species until his retirement from government service in 1977. Banko continued after his retirement to write extensively on endangered Hawaiian species, primarily the avifauna.[192]

After two years in the field studying Hawaii's endangered birds, Banko drafted a memorandum to the Patuxent director that began by referencing a series of memos written by several other FWS researchers (including Aldrich and Erickson) all addressing the subject of introducing species on the islands of Hawaii. A proposal on the table within the ranks of the FWS was to transplant endangered Hawaiian species to neighboring islands to create multiple populations that might protect against catastrophic loss. Banko in his memo wished to address four points that he felt "important to the subject but, so far as [he] was informed, may not have been considered."[193] His concern was that important practical concerns were being lost in the practice of captive breeding

[192] Biographical entry: Winston Banko, Washington Biologists Field Club. Accessed January 10, 2011, http://www.pwrc.usgs.gov/resshow/perry/bios/BankoWinston.htm

[193] Winston Banko memorandum May 27, 1967. SIA RU T89021 box 7 folder 12.

and introduction, a practice that was gaining momentum following the recent opening of the Patuxent center.

Banko's first worry was that an overemphasis on the individual species or population was causing researchers to lose sight of the selective factors in their environments, factors that led to adaptations defining the species in question. "No species can be 'preserved' outside its natural range for any extended period of time, the role of natural selection in the evolutionary process being what it is."[194] One of the memos Banko was responding to was written by Aldrich, who claimed that the "[p]reservation in a natural state [was to be] emphasized," as part of conservation efforts on the Hawaiian islands.[195] Banko was putting some of FWS's and CREWS's basic assumptions back on the table. What exactly was the distinction between managed conservation, including the transplantation of animals, and preservation in a natural state? If transplantation to 'suitable habitat' on adjacent islands was a means of preserving endangered species, what exactly was being preserved?[196] For Banko any attempt to "'preserve' species via the

[194] Ibid.

[195] John Aldrich memorandum May 22, 1967. SIA RU T89021 box 7 folder 12.

[196] This same issue has become a concern today with respect to managed relocation under threats due to climate change. See BA Minteer and JP Collins. 2010. "Move it or lose it? The ecological ethics of relocating species under climate change". *Ecological Applications : a Publication of the Ecological Society of America*. 20 (7): 1801-4.

technique of establishing isolated breeding populations outside natural ranges is therefor [sic] unrealistic—in fact, impossible."[197]

Banko's second point was to temper an overenthusiastic commitment to species introductions in the face of global, historical records of far more failures than successes. Here he called for introductions outside natural ranges only after a thorough ecological analysis. As Erickson had done before, Banko interestingly suggested that these studies be carried out by competent biologists rather than ecologists.[198]

The third point in the Banko memo, although the shortest by word count, most profoundly addressed the underlying assumptions related to traditions of ecological practice.

> The successful introduction of a species into an area outside its native range unavoidably alters the existing ecology—often to a degree unforeseeable at the time of introduction. There is wide agreement both in and outside the Bureau that the natural ecology of islands in the National Wildlife Refuges should be preserved insofar as possible.[199]

In essence, government conservationists could not have it both ways. They could not protect endangered species by transplanting them to other islands in the refuge and preserve the natural state of the refuge at the same time. A choice had to be made: was the conservation emphasis to be placed on the individual species or the preservation of whole natural communities? Science could not tell conservationists which to prefer. The decision between species and communities

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[197] Winston Banko memorandum May 27, 1967. SIA RU T89021 box 7 folder 12.
[198] Ibid.

[199] Ibid.

was about how to conceive of nature and how to set priorities for the different scientific approaches to carving-up and classifying the natural world.

CREWS and FWS favored a single-species approach to ecology and conservation, built on a conceptual divide between organism and its environment. Their collective experience with single-species projects prior to the 1960s, training in various zoological fields (primarily ornithology), and the emergence of a greater emphasis placed on captive breeding research pushed them toward single-species and the associated historical tradition of ecological practice. That tradition when applied to conservation pushed CREWS to prefer introductions of endangered species into 'suitable habitat' to the preservation of the natural state of the habitat receiving the refugees. In addition it allowed it to move from species to species concerning itself with the ecology of each particular animal rather than the ecology of places.

Banko was aware of FWS's predispositions and merely wanted to encourage all involved to lay all the cards on the table before proceeding with "inadequate or unenlightened management." He wanted it to be clear that in introducing species outside their natural ranges, certain ideological choices were being made, ideologies that could not, by any objective scientific means, be considered the best practice. Banko's fourth and final point was to make clear that aggressive pursuit of a policy of introductions would unequivocally alter the ecology of the islands. To follow the path of species introductions without acknowledging that fact was naïve; to be aware and do so without deliberate care and planning was reckless.

Banko concluded his memo, "[e]ach of the foregoing points seems to point toward a negative, or at least a very conservative policy of introducing species of endangered wildlife on Islands outside their natural range with the objective of 'preserving' the species." Despite his negative conclusion with respect to introductions he was aware that it had wide support within FWS and he himself shared some adherence to the conceptual approach that lead to the commitment to the practice in the first place. He set forth some criteria for determining when introduction was warranted and he recommended that CREWS review and approve each proposal for introduction on an individual basis. In his criteria he conceded that introductions were warranted "when there is a clear danger that the species will be lost in its natural habitat." Even for Banko when it came down to a choice of one over the other he too chose the individual species, despite his claim that in such a case it is not the species per se that is being preserved.

Banko's memo was read widely within the DWR and CREWS. Aldrich, as he often did, made thorough notes in the margins of his copy of the Banko memo. John Sincock, who also studied Hawaiian species for the DWR from 1967 to 1984, gave his own take on the issue of Hawaiian introductions in his January, 1968 project outline, submitted to Ray Erickson for approval. Erickson, as he frequently did, forwarded the proposal to Aldrich for comment. Sincock's document was a bit loquacious and somewhat stream-of-consciousness stylistically. After a lengthy introduction he dove into the same conceptual waters that Banko had seven months earlier but with different results. Sincock claimed, "maybe I'm just not a purist, but [transplanting only a small portion of a

population's gene pool that is subsequently changed by evolution] doesn't shake me up."[200]

Sincock was not convinced that introductions resulting in new populations whose genetic makeup was different than the populations from which the introduced stock came were qualitatively different from natural changes in gene frequencies over time. Neither was he concerned with preserving natural areas, claiming that the very concept of natural areas was a convention of man. He rightly pointed out that both concerns with the nature of species and the condition of naturalness were judgment calls. Sincock was not interested in making that call, although he did suggest that a formal position statement should be made. His research responsibility, he explained, was to determine the feasibility of transplants by studying the habitat requirements, food sources, competition, and disease (what Erickson described as the ecology of an endangered species). Sincock was focused on the conservation of individual species through the practice of captive breeding and introduction. He claimed it would have been difficult to make the case that captive breeding and release or direct transplantation didn't guarantee some measure of protection and he did not find arguments against convincing enough not to seek out that sort of relief.

The Banko and Sincock documents together with at least five others directly referenced by Banko show a general concern for perceived special conditions with respect to protection of endangered Hawaiian species. Examples

[200] John L. Sincock, "Research project and Work Unit Outlines." Report to the Assitant Director, Patuxent Wildlife Research Center, January 3, 1968. SIA RU T89021 box 7 folder 12.

in the next section demonstrate that captive breeding and the associated practice of reintroducing species into historic habitat or transplanting to novel, 'suitable habitat' outside their natural range were becoming a common conservation policy and practice. In Hawaii, captive breeding practice came into minor conflict with other, community-centered ecological approaches. Despite these attempts to reconcile practices that had become associated with captive breeding with certain ecological points of view, little headway was made in identifying why one point of view was chosen over another or in identifying the exact nature of the transplanted population.

Aldrich's taxonomic approach identified evolutionarily significant populations as objects of conservation. In Hawaii, Banko pointed out that transplanting populations did not so much conserve old population as create new ones. These two views present a tension in the CREWS program that went unaddressed even as Banko's memo was discussed. Interestingly these questions seemed to disappear outside of the island context and listing and captive breeding went forward with little controversy until the passing of the ESA.

6. Back on the Mainland

Banko's memo on Hawaii closed by stating that the problems of introduced species were more apparent on islands than on the U.S. mainland. While there was some truth to the notion that population or environmental changes on small islands with small populations would probably be more noticeable, it is clear that all four of Banko's points of concern were just as applicable on the mainland. Yet little attention was paid to Banko's conceptual

counterpoints to species introductions on a number of cases in the continental United States.

In 1966, a proposal claiming that the population of endangered trumpeter swan at the Red Rock Lakes Refuge had reached the saturation point was circulated among a few FWS administrators and three members of CREWS. The main problem was that the excess population was resulting in depressed reproductive rates. The proposed solution to dealing with the trumpeter's excess population involved providing permits allowing birds to be loaned to zoos for display and requesting a FWS-administered transplant program. The document suggested making birds from Red Rock available to be transplanted into other refuges in the national system with 'suitable habitat' meeting basic trumpeter swan requirements. The five-page memo raised no concerns for how the introduction of trumpeters into other refuges would affect the character of the existing land and biotic communities therein. The focus of the proposal was again on a single species, the trumpeter swan, and not on protecting the character of the existing community of the refuges targeted as introduction sites.[201]

Nowhere has the commitment to captive breeding and the practice of single-species conservation been more apparent than with crane conservation. From the moment CREWS was established the Committee assumed the role as advisors on FWS crane policy. As early as May, 1964 CREWS met to discuss a proposal to reintroduce non-migratory sandhill cranes on the Gulf Coast of

[201] Abram Tunison, memo to Regional Director, Portland, Oregon. April 14, 1966. SIA RU T89021 box 6 folder 19.

Louisiana by taking eggs from Florida and Mississippi population to raise and breed in captivity prior to reintroduction.[202] Special care was to be taken to keep the Mississippi and Florida stocks separate, because there was no evidence to suggest they belonged to the same subspecies. There would have been even less evidence that either population was the same subspecies as the one that had once roamed the Louisiana coast, CREWS found it unproblematic that it was not replacing was lost, but creating a new and distinct population of cranes through introduction.

Whooping crane introductions further demonstrate captive breeding's grasp on conservation practice and policy established by CREWS in the 1960s and extending to today. After a decade of discussion and breeding in captivity the first whooping crane introduction, separate from the Aransas population, was made. A crane population was established that was subsequently trained to migrate between New Mexico and Colorado in 1975. A non-migratory flock was established in Florida in 1993. And finally in 2001, having perfected their methods, FWS established a third migratory flock that winters each year in Florida and migrates north to Wisconsin to breed.[203] But what of the lands and associated communities that received the transplanted whooping cranes?

The successes of whooping and sandhill crane introduction do little to answer Winston Banko's basic questions. How should introduced species be

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[202] Charles Lawrence, "Region 4 proposal re introduction of the Florida sandhill crane into southwest Louisiana. May 18, 1964. SIA RU T89021 box 6 folder 24.
[203] International Crane Foundation, "Historic Whooping Crane Numbers." 2009. Accessed January 10, 2011. http://www.savingcranes.org/images/stories/pdf/species/historic_wc_numbers.pdf

understood? What exactly is being saved through captive breeding and introduction? And what happens to a particular practice when faced with a conceptual approach other than the traditions used to establish the practice, particularly when that practice is strongly tied to environmental policy?

7. Captive Breeding: Science, Practice, and Policy.

The practice of captive breeding and reintroduction as a central tool in federal wildlife conservation policy gained adherents starting in the early 1960s, particularly within FWS and CREWS. Later in the same decade the infrastructure to support reintroductions was built in the form of Patuxent and other research stations. In this context practice began to take precedent and the relationship between policy and conceptual justification was not well specified. This is not to say that captive breeding as practiced by FWS and CREWS was not grounded in science. Historical traditions of single-species ecology, aviculture, animal behavior, and the like supported the practice. But the practice was rarely evaluated against these conceptual foundations as it was being carried out and even less so by alternative conceptual approaches such as some form of community based ecology. The practice established in part by the work of CREWS has persisted in federal endangered species policy, yet Banko's conceptual concerns go unanswered.

Chapter 6

PUTTING A POLICY IN PLACE

1. Legislating Endangered Species Protection

In describing the formation of CREWS, environmental policy analyst Steven Lewis Yaffee claims that "[w]ho first defines 'the problem' in a controversy heavily influences the nature and direction of subsequent debate."[204] CREWS, Yaffee explains, defined the endangered-species problem as a technical one to be solved by a particular conceptual approach and set of practices. CREWS's specific technical approach has been the subject of previous chapters of the present work, but as historian Mark Barrow has demonstrated, concern over extinction and endangered species throughout U.S. history has resulted in multiple definitions of and proposed solutions to the endangered species 'problem.'[205] A slight amendment to Yaffee's sentiment might read: the most recent authority to define 'a problem' heavily influences the nature of subsequent debate and in the case of CREWS and the ESA the shape of federal environmental policy.

Although CREWS's impact on endangered-species legislation and policy has been a constant theme throughout the present project, this chapter explores in more detail the proximate connections between the committee, its advisors and supervisors, and the ESA legislation. The primary means of establishing these connections is an examination of congressional records containing draft endangered-species bills, public laws, congressional committee reports, and

[204] Yaffee, *Prohibitive Policy, 36.*

[205] Barrow, *Nature's Ghosts.*

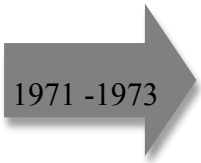
transcripts of congressional hearings. These records together with other primary and secondary sources provide four broad forms of evidence of CREWS's significant influence on the legislative process. Among these forms of evidence are authorship of bills including consultation in the drafting of legislation, congressional testimony at legislative hearings, concepts and practices referred to in the text of the legislation, and the continuity of language from one piece of legislation to the next.

This chapter is organized to highlight these various forms of evidence of CREWS's input and identify the movement of CREWS's inspired ideas in the legislative process. As such the sections are organized to highlight particular forms of evidence over the relevant time span for each. The chronologies of each section are overlapping, moving the reader back-and-forth through time as each form of evidence is explored. Table 6.1 compares the overlapping time-spans of each of the sections. Table 6.2 lists the different forms of evidences as it relates to the different Congressional episodes described in the following sections.

Direct authorship of endangered-species legislation by CREWS and close associates is a significant piece of evidence supporting CREWS's importance as a contributor to the ESA. The legislative process of amending, rewriting, consolidating, and compromising during the process of passing proposed bills often obscures these kinds of individual contributions to legislation. Furthermore, authorship is rarely included as part of the process of proposing congressional resolutions, leaving records on specific contributions to the ESA at times unclear. Complexities of the legislative process aside, there is ample evidence to connect

Table 6.1
Timeline of Chapter Sections

Section 2. A Resolution the House
Topic: Drafting the ESA bills
Evidence: authorship



Section 3. Policy in Progress
Topic: Language of the 1966 and 1969 Acts
Evidence: language, concepts and practices

Section 4. The Legislative process
Topic: Revisions of the ESA bills in House and Senate committees and House conference report.
Evidence: authorship, language, concepts and practices

Section 5. Congressional Hearings
Topic: Members of CREWS, FWS, and DOI who directly negotiated with members of Congress on the structure of the bills.
Evidence: testimony, concepts and practices

Section 6. Implementing the ESA
Topic: Conservation as practiced under the ESA from 1973 to present.
Evidence: concepts and practices

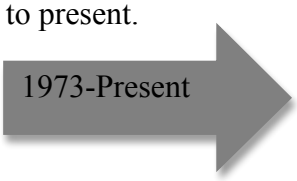


Table 6.2
Kinds of Evidence of CREWS's influence on Endangered Species Legislation

Endangered Species Preservation Act of 1966
- Bill Authorship – Office of the Secretary of Interior
- Language – became a template for future bills.
- Concepts – no mention of the term subspecies, but Key Deer (a subspecies) directly referred to as a conservation target.
- Practices – propagation in preamble, purpose, and throughout law
- Testimony – Stewart Udall, Secretary of the Interior
  David Finnegan, DOI Solicitor
  Lansing Parker, Director, BSFW

Endangered Species Conservation Act of 1969
- Bill Authorship – Office of the Secretary of the Interior
- Language – conditions of endangerment carried over from ESPA
- Concepts – term "subspecies" used to identify conservation target
- Practices – propagation as a valid reason to import listed endangered species
- Testimony – Dillon Ripley, Secretary of the Smithsonian, CREWS advisor
  Lee Talbot, SI ecologist, ESA bill author
  Stanley Cain, Asst. Sec. of the Interior for Fish and Wildlife and Parks
  Harry Goodwin, Chief, Office of Endangered Species and CREWS Chair
  Joseph Linduska, Asst. Director, BSFW

1971 House of Representatives Appropriation Hearings
- Authorship – scientific papers entered into the Congressional Record authored by Harry Goodwin, Chief, Office of Endangered Species and CREWS Chair; Eley Denson, Office of Endangered Species
- Language – N/A
- Concepts – list of endangered Hawaiian birds contained several subspecies
- Practices – propagation, transplantation
- Testimony – Spencer Smith, Director, BSFW
  Harry Goodwin, CREWS Chair

Endangered Species Act of 1973
- Bill Authorship – E. U. Curtis Bohlen - Deputy Assistant Interior Secretary
  Earl Baysinger – Chief, Office of Endangered Species; CREWS Chair
  Lee Talbot – Council on Environmental Quality
- Language – pre conference report bills carried nearly identical preamble to the 1966 Act and conditions of endangerment.
- Concepts – subspecies or smaller taxa, "interbreeding" populations.
- Practices – propagation, transplantation
- Testimony – Nathaniel Reed, Asst. Sec. of the Interior for Fish and Wildlife and Parks
  E. U. Curtis Bohlen, Deputy Asst. Sec. of the Interior, ESA bill author
  Earl Baysinger, Chief, Office of Endangered Species and CREWS Chair
  Spenser Smith, Director, BSFW

CREWS and its conservation approach to the drafting and final form of the ESA as passed in 1973. Archival records from the BML, transcripts of Congressional hearings, and interviews of key actors described in secondary sources demonstrate the influence of the DOI, FWS, and CREWS to varying degrees throughout the process of drafting and revising the ESA into its final form passed in 1973.

Extending the analysis to the two endangered-species acts that preceded the ESA provides a second means of tracing CREWS's influence. The concepts and practices embedded in the ESA and preceding legislation were the very approaches advocated by CREWS and put into action as part of the federal endangered species research and recovery at Patuxent, Hawaii, and in other locations with numerous species around the U.S. While each new act demonstrated increasing detail in the articulation of CREWS-inspired themes there is a clear sense of continuity in each piece of legislation, often taking the form of whole sections of text transferred from one bill to the next. This cut-and-paste form of evidence is referred to as "language" in tables 6.1 and 6.2.

The endangered-species bills that were brought before Congress in 1972 and again in 1973 underwent a lengthy process of politically negotiated revision. The primary means of determining the nature of the first round of revisions were the House and Senate subcommittee hearings charged with evaluating bills related to wildlife conservation. The same process of Congressional hearings also took place during the passing of the 1966 and 1969 acts. DOI and FWS Secretaries, Undersecretaries, and Directors as well as two CREWS Committee Chairs played

important roles in those hearings, helping to shape the final ESA legislation.[206] The congressional hearings represent the most thorough and well-documented evidence of CREWS's involvement in shaping the details of the ESA.

Implementation is an important aspect of the legislative process; hence the final focus of the chapter is on some of the practices that became a part of the implementation of the ESA after it became law in 1973. Like a sailor who must plug a hole in his boat while he is adrift at sea, CREWS attempted to influence the direction of and advocate for endangered species policy at the same time it was trying to identify which conceptual approach and set of practices should be applied to conservation problems on the ground. While engaged in research, conservation, and policy advocacy, CREWS and FWS laid the foundation for the implementation of the ESA and also anticipated several issues that have again become controversies in current efforts to align science, conservation, and federal policy.

2. A Resolution in the House

There is a certain amount of redundancy in the three-branch, two-congressional house organization of the U.S. federal government. In the case of the ESA this redundancy took the form of a multitude of bills proposing increased protection for endangered species in 1972. Despite the large volume of proposed legislation introduced in both houses by senators, congressmen, and one via

[206] U.S. House of Representatives Subcommittee on Fisheries and Wildlife Conservation, Hearings, Serial No. 92-22, 92nd Congress (Washington D.C.: Government Printing Office, 1972); U.S. Senate Subcommittee on Environment, Hearings, Serial No. 93-67, 93rd Congress (Washington D.C.: Government Printing Office, 1973).

President Nixon, the various bills differed little, in part because each of the bills was in some way constructed on the foundation of the existing endangered-species legislation.[207] Congress failed to enact any of the 1972 bills and after endangered species legislation was reintroduced in 1973, only three bills were seriously considered: House Resolution (H.R.) 37 introduced by John Dingell (D-MI), the administrative bill H.R. 4758 also introduced by Dingell, and Senate Resolution (S.) 1983 introduced by Harrison Williams (D-NJ). The authorship of the Senate bill is unclear, but both the Dingell bill and the administrative bill have traceable connection to the DOI, FWS, or CREWS.

The relatively ease with which the 1966 and 1969 endangered-species acts passed emboldened FWS and the DOI to continue to push the boundaries of federal wildlife regulation. President Nixon supported the initiative, publicly calling in 1972 for a stronger law to protect endangered wildlife.[208] Walter J. Hickel, Stewart Udall's successor as Interior Secretary, continued to follow Udall's aggressive approach to endangered-species policy. Hickel, however, had no opportunity to put his stamp on DOI endangered-species efforts, having been fired by Nixon in 1970 for publicly criticizing the President's Vietnam policies. In the wake of his firing, his senior Assistant Secretary, E. U. Curtis Bohlen made the next move regarding endangered species. Bohlen and DOI lawyers

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[207] Shannon Petersen, *Acting for Endangered Species: The Statutory Ark*. (Lawrence, KS: University of Kansas Press, 2002), 54; Mann, Charles C. and Mark L. Plummer, *Noah's Choice: the Future of Endangered Species* (New York: Knopf, 1995), 151; An examination of the similarities and differences between the three endangered species acts will be carried out in the next section.

[208] Petersen, *Acting for Endangered Species*, 27.

experimented with drafting amendments to existing endangered-species legislation before finally preparing a new bill that was submitted to the House and Senate by Nixon, eventually labeled H.R. 4758 and S. 1592.[209]

H.R. 37 came before the House by way of Congressman Dingell, chairman of the House Subcommittee on Fisheries and Wildlife Conservation. Dingell, holding the same chairmanship in 1968, had also introduced the resolution that became the Endangered Species Conservation Act of 1969.[210] The initial round of House subcommittee hearings in 1971 alerted Dingell to some deficiencies in H.R. 37. Before reintroducing the bill in the next congressional session, Dingell directed Frank M. Potter to gather a small group to reconsider certain sections of the proposed bill. Potter at the time served as counsel to the Merchant Marine and Fisheries Committee, the umbrella under which the Dingell subcommittee operated. He conferred with Frank Bavin, head of the FWS Law Enforcement Division, and Earl Baysinger, Chief of the FWS Office of Endangered Species and International Activities and CREWS Chair, and together the three drafted some comments and suggestions on the Dingell bill.[211]

The Baysinger group's recommendations, including restrictions against the destruction or modification of critical habitat by federal departments or

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[209] Mann and Plummer, *Noah's Choice*, 155-156; U.S. House of Representatives Subcommittee on Fisheries and Wildlife Conservation, Hearings, Serial No. 92-22, 158.

[210] House Report 93-412 as printed in *A Legislative History of the Endangered Species Act of 1973.*

[211] Chase, *In a Dark Wood,* 79.

agencies, were incorporated into a revised Dingell bill. In July of 1973, House Report no. 93-412 recommended that an amended H.R. 37, which combined "features of the administrative bill (H.R. 4758), and the original H.R. 37," be passed by the House. The recommendation was carried out and H.R. 37 passed easily.[212]

The House Report listed nine principal changes to existing endangered-species legislation that would result from the passage of H.R. 37. Among these changes was the addition of a threatened category, allowing the Secretary of the Interior to list species that could become endangered in the near future. Another change was to permit "protection of animals which are in trouble in any significant portion of their range, rather than threatened with worldwide extinction." This last point echoed CREWS's subspecies and population approach to identifying objects of conservation. The bill also made "taking" a listed species a federal offense; to that point doing so had only been prohibited on federal lands.[213] Several other changes were related to the use of funds to purchase habitat. Endangered flora got their first mention in endangered species policy in a change that solicited the assistance of the Smithsonian Institution. A few other administrative changes rounded out the list. There were, however, significant

[212] House Report 93-412 as printed in *A Legislative History of the Endangered Species Act of 1973.*

[213] The Bill defined "taking" to include "harass, pursue, hunt, shoot, wound, kill, trap capture, or collect, or to attempt to harass, pursue, hunt, shoot, wound, kill, trap capture, or collect."

changes not mentioned in the House report—one of which Frank Potter had been adamant about making.

The previous endangered-species acts had charged federal agencies to make some effort to protect endangered species while carrying out federal projects. The Baysinger triad that assisted Dingell in amending H.R. 37 had inserted habitat protection as part of the federal project mandate. Even more significant though, the previous legislation directed federal agencies to protect endangered species only in so far as 'practicable.' The language of the earlier laws left the door wide open for government agencies' concern for endangered species to be afterthoughts, once all aspects of their primary objective had been considered. Frank Potter was determined to tighten the language. Potter worked with the Baysinger group on the House bill and coordinated efforts with Lee M. Talbot, senior scientist of the Council on Environmental Quality, who worked on the administrative bill to eradicate the use of the term 'practicable' from the policy. When the bills were reintroduced in 1973 Potter and Talbot had accomplished their goal. The result of their efforts was to extend all federal agencies responsibilities to protect endangered species leaving no 'practicable' way out.[214]

On July 24 of 1973, S. 1983 was passed in the Senate. The amended H.R. 37 was passed in the House almost two months later on September 18. The two bills then went into a joint conference committee to be reduced to a single bill. The Senate and the House agreed to the conference report on December 19 and 20

[214] Mann and Plummer, *Noah's Choice*, 160.

respectively. Although the bills were quite similar, it was a slightly reworded S. 1983 that emerged from the conference committee and was signed by President Nixon on December 28, 1973.[215]

Few of the changes to endangered-species policy discussed in the Senate and House reports were closely related to the conceptual approach and conservation practices established by CREWS. For the most part, the changes were extensions or clearer articulations of the work CREWS was already engaged in, or extensions of DOI's discretion to use funds. Much of CREWS's conceptual work had already been captured and become part of the foundation of endangered-species policy in the first two endangered species acts and that foundation was largely carried over into the ESA with one exception. Talbot and Potter were able to influence a minor adjustment in the joint conference bill that introduced a more ecological perspective into the legislation. The nature of the change is best understood in light of the legislative foundation established in the first two laws.

3. Policy in Progress: from 1966 to 1969

"A BILL To provide for the conservation, protection, and propagation of species or subspecies of fish and wildlife that are threatened with extinction or are likely within the foreseeable future to become threatened with extinction, and for

[215] House Conference Report No. 93-740 as printed in *A Legislative History of the Endangered Species Act of 1973.*

other purposes."[216] So stated the preamble for both H.R. 37 and S. 1983 as passed by the House and the Senate respectively. The words rang familiar as they bear a strong resemblance to the preamble of the first endangered-species act passed by Congress and signed into law in 1966, particularly the identical nature of the first three provisions: conservation, protection, and propagation. It is of particular interest for the present study that propagation played such a high priority all through the process of developing endangered-species legislation, as it received equally high attention from CREWS. However, much more that opening statements tie the three legislative works together.

The Endangered Species Act of 1966 was in some ways a housekeeping act. Starting with Ray Erickson's prospectus for a federal endangered-species program in 1963, CREWS had been marshalling a convincing case for federal involvement in endangered-species policy that was composed of a list of previous legislative actions. The Lacey Act of 1900, The Migratory Bird Treaty Act of 1918, The Convention on Nature Protection and Wild Life Preservation in the Western Hemisphere of 1940, The Fish and Wildlife Service Act of 1956, and the Land and Water Conservation Fund Act of 1964 combined to give FWS broad authority to procure habitat and engage in wildlife protection. The 1966 act would "consolidate, restate, and modify the present authorities relating to administration by the Secretary of the Interior."[217]

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[216] Senate Report No. 93-307 and House Report No. 93-412 as printed in *A Legislative History of the Endangered Species Act of 1973*.

[217] Yaffee, *Prohibitive Policy*, 39.

The DOI and FWS had been working on endangered-species legislation as early as 1964 as evidenced by a set of typed comments by Richard Manville titled "Comments on proposed bill," in which he offered suggestions on both the wording of the bill and the draft of a letter that would accompany the introduction of the proposed legislation to Congress.[218] Manville was concerned with the DOI bill's use of the term 'rare.' Many species, he explained, were and had always been rare, but that had no direct bearing on their status as threatened or endangered. The term 'rare' as used in the bill would later be re-termed 'threatened' in the ESA and used to denote a status less severe than endangered. There is no indication that any member of CREWS, prior to Baysinger, took up pen and paper and personally drafted legislation either in 1966 or 1969, but CREWS members clearly influenced versions of the legislation as it was drafted out of the office of the Secretary of the Interior, as evidenced by Manville's comments and the admission of CREWS's advisory role by John Aldrich in interviews.[219]

After consulting with his FWS experts, the draft legislation that Udall finally sent to Congress in June of 1965 was meant to achieve two immediate goals. In addition to the consolidation of authority, Udall was trying to bypass certain restrictions in the use of funds provided by the Land and Water Conservation Fund Act. In particular, Udall was concerned with a clause that

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[218] Richard Manville, "Comments on proposed bill" SIA 7407 box 3 folder 51.

[219] Transcript, John W. Aldrich oral history interview, April 18, 1977, by Pamela Henson, Smithsonian Institution Archives.

required FWS to have purchases made with funds provided by the Act authorized by a law other than the Act itself. Udall and FWS Director John Gottschalk had divided efforts to purchases of refuge lands. Udall pursued the legislative angle and Gottschalk followed the approach of feigned ignorance attempting to purchase land without additional legislative authorization.[220] When hauled before a House subcommittee, Gottschalk was questioned on the wisdom of using public funds to purchase land for the few remaining whooping cranes at an estimated expense of $35,000 per bird. Chairman Winfield Denton (D-IN) having apparently not considered Aldo Leopold's land ethic, was thinking of conservation in purely economic terms. Gottschalk attempted to make the point that the payoff was the prevention of the extinction of a species. His arguments, however, did not fall on sympathetic ears, making Udall's legislative efforts all that more critical. The occasion for Udall and Gottschalk to advocate for endangered-species legislation was a push for administrative control of the use of funds. The legislative by-product of that administrative effort allowed CREWS to influence the scientific content and management practices that became the focal point of the first federal endangered-species legislation.

When passed, Public Law 89-669, The Endangered Species Preservation Act of 1966, achieved both primary goals of consolidation of authority and discretion over funds. The very wording of the law produces corroborating evidence of CREWS's influence on the legislative process, this was most apparent in the stated purpose of the Act, which was primarily a restatement of the

[220] Mann and Plummer, *Noah's Choice,* 152-153.

preamble—to provide for the "conservation, protection, restoration, and propagation of selected species…"[221] In fact the use of propagation as a means of conservation appeared six times in the five pages of the law. In addition the law directed the Secretary of the Interior to publish a list of species threatened with extinction and provided some criteria to be used by the Secretary of the Interior in identifying the species to list. A species should be listed when it was determined that "its habitat is threatened with destruction, drastic modification, or severe curtailment, or because of overexploitation, disease, predation, or because of other factors, and that its survival requires assistance."[222] The bill's emphasis on biological factors and a call in the very next passage for reliance on expert opinion in identifying species to list mirrored the criteria for selection described in the introduction to the CREWS Red Book. The first list published by the DOI in 1967, as mandated by the 1966 act, was nearly identical (within a few species) to the CREWS 1966 Red Book.

Most of the remaining text of the law covered the use of The Land and Water Conservation Act funds and cooperation between state governments and federal agencies—where the qualifying statement "in so far as is practicable" can be found. The final page listed repeals and amendments to certain sections of previous wildlife law that required clarification in light of the new legislation—

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[221] Endangered Species Preservation Act of 1966, P.L. 89-669, as printed in *A Legislative History of the Endangered Species Act of 1973*.

[222] Ibid.

one of which offers some insight into one of the legislation's unwritten assumptions.

Although it contains no definition of species or mention of the term subspecies the CREWS approach of identifying subspecies and populations as well as species as the objects of conservation was clearly assumed in the legislation. The first clue is that the Secretary's list published in the Federal Register was virtually identical to the Red Book list, a list that contained almost as many subspecies as full species.[223] A more telling clue that conservation at the subspecies level was the intent of the 1966 act is found in one of the Act's proposed amendments to a previous statute, amended to direct the Interior Secretary to purchase refuge lands in efforts to conserve the Key Deer (*Odocoileus virginianus clavium*) a Florida subspecies of white-tailed deer.

The 1966 act set the stage and became the template for federal endangered-species legislation. The Endangered Species Conservation Act of 1969 expanded the 1966 act producing two primary changes to federal endangered-species policy. The new legislation, Public Law 91-135, aimed at recognizing endangered-species conservation as a global problem. It was established to prevent the importation of any species considered to be threatened with worldwide extinction. The phrase "worldwide extinction" was a compromise written into the 1969 act aimed at appeasing commercial interests, mainly the fur industry, which claimed that the legislation would produce an unreasonable

[223] Richard Tobin, *The Expendable Future: U.S. Politics and the Protection of Biological Diversity* (Durham, NC: Duke University Press, 1990), 87.

economic burden on the industry in the U.S.[224] The qualifying condition of threatened worldwide was later corrected in the ESA to more closely align with CREWS's population approach to conservation. In addition the 1969 act expanded the definition of 'wildlife' in the Lacey Act; extending prohibitions of interstate commerce in species 'taken' in violation of state law to include reptiles, amphibians, mollusks, and crustaceans whereas it previously had applied only to fish, birds, and mammals.[225]

While the 1969 act produced significant extensions of federal endangered-species policy, the language of the science and practice of endangered-species conservation was largely carried over from the previous legislation. The conditions indicating endangerment were carried over virtually word for word from the previous act. In addition, propagation was still explicitly listed as an important conservation tool, specifically in the context of providing exemptions for qualified scientists who wished to import endangered species for the purpose of captive breeding. The act explicitly identified subspecies as well as species as possible conservation targets, but this was merely a change in language as it was the accepted practice within FWS by 1969. The provisions and language, first developed in the Endangered Species Preservation Act and later extended and clarified in the Endangered Species Conservation Act, provided a viable

[224] Yaffee, *Prohibitive Policy, 44*.

[225] Endangered Species Conservation Act of 1969, P.L. 91-135, as printed in *A Legislative History of the Endangered Species Act of 1973*.

framework used by the authors of the various bills that attempted to strengthen federal policy in 1973.

4. The Legislative Process: From Congressional Resolutions to the ESA of 1973.

As with the preamble, the primary stated purpose of both S. 1983 and H.R. 37, in the form originally submitted to Congress was largely carried over from the Endangered Species Preservation Act of 1966. Furthermore, although each purpose statement was a slight alteration of the 1966 act, the 1973 bills were identical in stating that the purpose of the act was "to provide a program for the conservation, protection, restoration, and propagation of species and subspecies of fish and wildlife and flora that are threatened with extinction, or are likely within the foreseeable future to become threatened with extinction."[226] The purpose statements show the carry-over of the subspecies category from the most previous legislation as well as the emphasis on propagation, which appears over a half dozen times in the text of each bill. In addition, each bill carried over the extended definition of wildlife introduced in the 1969 bill (see page 150). The bills also used the same causes of endangerment described in both the 1966 and 1969 laws (see page 149). Despite the similarities to previous legislation in the Senate and House bills, both in the originally submitted and amended forms, they contained many novelties in conceptual content and policy implementation.

[226] H.R. 37 and S. 1983 as printed in *A Legislative History of the Endangered Species Act of 1973*.

The policy novelties in the House and Senate bills and particularly in the final form of the ESA with respect to such issues as jurisdiction and extended definition of 'taking' are well documented.[227] Of more interest for the present discussion are the conceptual novelties that appeared in the bills and in the act signed by Nixon in 1973, and to what degree these novelties appear to reflect the conservation approach set forth by CREWS in the Red Book and in the federal captive breeding program. Potter and Talbot, who claimed that they exerted considerable effort to infuse a more ecological approach into the wording of the ESA bills, used their connections in Congress and the White House to produce a restatement of the bill's purpose in the amended forms of both the House and Senate resolutions.[228] The new purpose in the House bill read: "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, protected, or restored…"[229] The statement then continued with the familiar line about conservation and propagation. The revised Senate bill contained a similar purpose statement, but numbered and separated into four parts. The first contained a nearly identical provision for ecosystem conservation. The second numbered purpose contained the conservation-propagation program. The third, also part of the H.R. 37 purpose statement, provided for implementation of the various international treaties related to species

[227] Yaffee, *Prohibitive Policy*; Petersen, *Acting for Endangered Species*; Mann and Plummer, *Noah's Choice*.

[228] Chase, *In a Dark Wood,* 94.

[229] H.R. 37 as printed in *A Legislative History of the Endangered Species Act of 1973*.

conservation. Finally, the fourth purpose was the federal mandate for all agencies "within the scope of their authority" to protect endangered and threatened species, at all times and not just when practicable.[230]

Talbot and Potter's successful introduction of ecosystem-conservation language in the Congressional bills creates a bit of a contradiction for the close reader of the ESA. Ecosystem conservation brought some of the holistic ecological approach into federal policy that up to that point had been dominated by the atomism of single-species conservation employed by CREWS. However, the reference to propagation, which entailed reintroduction and transplantation as a primary conservation tool continued to dominate the wording of the legislation appearing multiple times in the final draft of the law. So on the one hand the wording of the policy became more concerned with ecosystems, but only with those upon which endangered-species depended. Other ecosystems could, without concern for ecological preservation, be altered by introduction of endangered species in order to carry out the bill's second stated purpose.

The next set of conceptual changes in the wording of endangered species policy came in a much-expanded section on definitions. Primary among these was the first legislative articulation of the Evolutionary Synthesis inspired population approach to conservation (see Chapter 4) in the form of a policy definition of species. The 1973 ESA definition of species, which closely followed both the House and Senate bills, defined the term to "include any subspecies of fish or

[230] H.R. 37, S. 1983 as printed in *A Legislative History of the Endangered Species Act of 1973*.

wildlife or plants and any other group of fish or wildlife of the same species or smaller taxa in common spatial arrangement that interbreeds when mature."[231] A second new definition of interest was a formal definition of 'conserve,' 'conserving,' or 'conservation' that included "all activities associated with scientific resource management" and listed among these not just propagation but transplantation as well. These definitions cemented CREWS's most prominent conceptual approach and conservation practice in the most expansive endangered-species legislation to date.

Once H.R. 37 and S. 1983 were passed in the House and the Senate respectively, the two bills were sent to a joint conference committee to hammer out the differences between them. The changes in the purpose and definitions had also produced a simplification of the preamble. The ESA was presented as an act "to provide for the conservation of endangered and threatened fish, wildlife, and plants and for other purposes."[232] House Conference Report 93-740 presented each house with the agreed-upon final form of the bill and four additional pages describing the differences between the two bills and the conference resolutions on each. Most of the differences were minor, so the conference report sailed through each house with only four dissenting votes in the House and no opposition in the Senate. The Act, according to President Nixon's official statement upon signing the ESA, granted "the Government both the authority to make early identification

[231] Endangered Species Act of 1973, P.L. 93-205, as printed in *A Legislative History of the Endangered Species Act of 1973*.

[232] House Conference Report 93-740 as printed in *A Legislative History of the Endangered Species Act of 1973*.

of endangered species and the means to act quickly and thoroughly to save them from extinction." The precedent for identification had been set by CREWS and adopted by the DOI even before the bill was passed. The means to act had been laid out by Erickson a decade earlier when he first proposed a federal endangered-species research center.

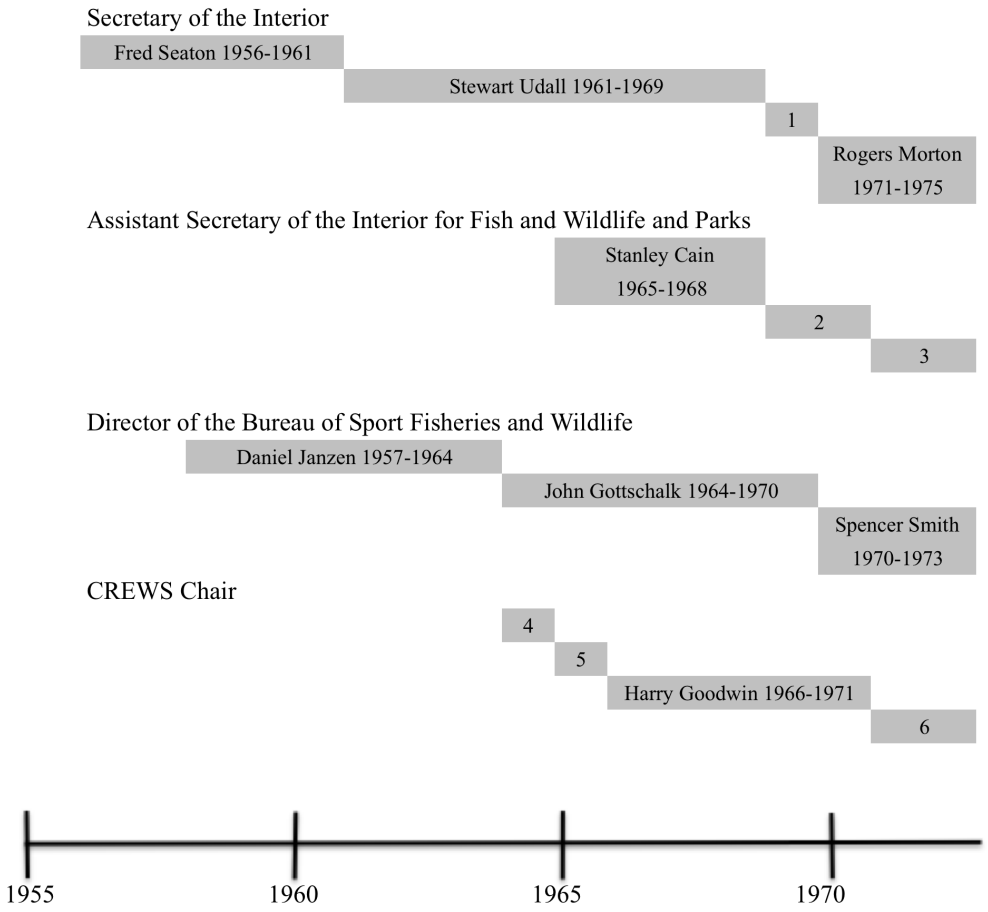
5. Congressional Hearings

The previous section omitted a critical step in the legislative process—Congressional hearings. Congressional actions often rely on the testimony of experts both within and outside the government as part of the evaluative process of the action in question. The three endangered-species acts passed by Congress between 1966 and 1973 were subject to this process. An examination of the testimony recorded in the congressional record reveals CREWS members and DOI administrators and staff participation in hearings and provides another means to demonstrate CREWS's influence on the ESA. Table 6.3 shows the tenures of several key DOI and FWS administrators from 1955 to 1973 providing a guide of who held important positions during congressional hearings for each piece of legislation.

5.1 The Endangered Species Preservation Act of 1966

In the summer of 1965 the House Committee on Merchant Marine and Fisheries held a series of hearings printed in the Congressional record as *Miscellaneous Fisheries and Wildlife Legislation*. On July 15 two House

Table 6.3
Administrators of the Department of the Interior



1. Walter Hickel 1969-1970
2. Several Acting Assistant Secretaries
3. Nathaniel P. Reed 1971-1977
4. Charles Lawrence 1964-1965
5. Sam Jorgensen 1965-1966
6. Earl Baysinger 1971-1973

resolutions on endangered species were addressed as part of these hearings. These resolutions, one submitted to the House by the Department of the Interior, were the beginnings of what would become the Endangered Species Preservation Act of 1966. Secretary Stewart Udall considered the bills of sufficient significance to

go himself to Capitol Hill and testify on behalf of the proposed legislation. He was accompanied by DOI solicitor David Finnegan and Associate Director of the BSFW Lansing Parker. Udall read a prepared statement reviewing the recent history of federal conservation efforts on individual species and lauding the proposed bills for offering a more "systematic approach [to the endangered species] problem." After his testimony the Interior Secretary was asked to provide a report to the convening committee of the views of his department on revisions of the bills suggested by testimony from earlier in the day. Udall agreed, was excused, and attention was turned toward Parker and Finnegan who were questioned on some of the finer points of the proposed bills. Much of the testimony centered on the continuing issue of state versus federal authority over wildlife management. The bill shaped by these hearings was passed into law in the next session of Congress in 1966.[233]

5.2 The Endangered Species Conservation Act of 1969

Amendments to the 1966 Act were proposed a year after the Act was passed. After Congressman Dingell introduced H.R. 6138, proposing an extension of the 1966 act, Udall began to line up DOI testimony for Congressional hearings on behalf of the Dingell and related bills. Udall reached out to Smithsonian Institution (SI) Secretary Dillon S. Ripley.[234] As President of the International

[233] U.S. House of Representatives Subcommittee on Fisheries and Wildlife Conservation, Hearings, Serial No. 89-11, 89th Congress (Washington D.C.: Government Printing Office, 1965).

[234] Stewart Udall, memo to S. Dillon Ripley, SIA RU 99 box 11 folder 3.

Council for Bird Preservation (ICBP), member of the Executive Board of the IUCN, and advisor to CREWS as well as his position as head of the Smithsonian, Udall was relying on multiple conservation authorities in one man by soliciting Ripley's help. As it turned out Ripley was unable to attend the hearings and instead sent Lee Talbot, SI Field Representative for International Affairs in Conservation and Ecology. Talbot read a prepared statement on Ripley's behalf and made himself available to answer the questions of the House subcommittee. Ripley's statement described the threats to endangered species generated by economic demand and, as Udall had hoped, offered his endorsement of the proposed legislation as President of the ICBP and Executive Board Member of the IUCN.[235]

Talbot's testimony on Ripley's behalf secured support outside FWS and the DOI for the new bills. As for DOI support, Udall this time sent Dr. Stanley Cain, DOI Assistant Secretary for Fish and Wildlife and Parks. Accompanying Cain were Harry Goodwin, Chief of the Office of Endangered Species, David Finnegan, who had testified for the 1966 law, and Joseph Linduska, Associate Director of the BSFW. Of the three bills under consideration the DOI group testified in support of the administrative bill, H.R. 6138, with a few suggested amendments. The testimony revolved around issues of enforcement, the ever-present and complicated issue of state and federal jurisdiction, and inquiry into a detailed list of the species covered by the bill. With respect to listing, Dr. Cain

[235] U.S. House of Representatives Subcommittee on Fisheries and Wildlife Conservation, Hearings, Serial No. 90-12, 90th Congress (Washington D.C.: Government Printing Office, 1967).

referred to the CREWS Red Book as the authority on domestic species covered by the extended definition of wildlife and the IUCN list as the authority on species in danger of worldwide extinction.

As with the 1966 act, little of the testimony was concerned with the conceptual details of the bills. The listing of subspecies and reliance on propagation as a primary purpose of the act was not examined or discussed during the hearings. A few years later, the next round of endangered species legislative hearings would begin to question some of the concepts and practices that had been captured in the first two pieces of legislation. Some of that questioning would begin even earlier as the BSFW went before Congress in 1971 to discuss the Bureau's Fiscal-Year 1972 budget.

5.3 Goodwin and the Appropriations Hearings of 1971

The Committee on Appropriations of the House of Representatives convened in March of 1971 to discuss budgetary issues of the various agencies of the Department of the Interior. Third on the agenda for the day was the Bureau of Sport Fisheries and Wildlife. Acting Director of BSFW Spencer Smith, Harry Goodwin, and Walter McAllester of the Division of Realty appeared as witnesses for the BSFW. To open the testimony Goodwin had entered into the record a paper delivered at the recent North American Wildlife and Natural Resource Conference, co-authored by him and Eley P. Denson, also of the Office of Endangered Species. The paper, titled "Status of Endangered Species Program," in nine sections covered seven pages of the Congressional record. In it Goodwin

and Denson spelled out the conceptual approach and conservation practices developed over the last decade by CREWS in the BSFW. The submission of the paper into the Congressional record presented a point of conceptual transfer from the BSFW to Congress that captured the technical aspects of the federal endangered species program in a way that the legal language of previous legislation and associated testimony had not.[236]

The stated goals of the federal endangered species program according to the Goodwin-Denson paper were to "protect and preserve endangered fish and wildlife in their natural environment. Success will require dispersed, self-sustaining wild populations. If propagation is undertaken to produce animals for reintroduction, the inherent wild qualities of appearance and behavior must be retained."[237] Two sections later the paper describes the guiding principles of captive propagation and reintroduction. The familiar tension between species and ecosystem appear on the pages of the propagation section. "[W]e do not intend to introduce species into habitat [sic] outside their natural range—unless such action is necessary for their survival," wrote Goodwin and Denson before listing the cases in Hawaii in which it had been necessary to do so. The next paragraph described a program to reintroduce masked bobwhite quail into a historic habitat in Arizona from which it had been extirpated around the turn of the twentieth century. It is interesting that the paper recognizes the quail reintroductions as

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[236] Department of the Interior and Related Agencies Appropriations for 1972, U.S. House of Representatives Committee on Appropriations, Hearings, 92th Congress (Washington D.C.: Government Printing Office, 1971).

[237] Ibid., Goodwin and Denson, "Status of Endangered Species Program."

different in kind from the Hawaiian transplantations. After over half a century, the community dynamics of the former quail habitat must have changed and so would again be changed by the quail introductions. Underlying tensions and all, the Goodwin-Denson paper represented the most complete articulation of the CREWS/FWS program to date. The document also laid bare in the Congressional record, even if it were not recognized at the time, some of the programs unresolved tensions, particularly with respect to holism versus atomism or whether to put the conservation priority on the individual species or the ecosystem.

Goodwin had two more documents inserted into the Congressional record as part of his testimony. Both related to the special case of conservation in Hawaii. The first was a list of endangered and extinct birds of the Hawaiian Islands. Although the Goodwin-Denson paper did not address directly conservation at the subspecies and population levels, the list of Hawaiian birds included ten subspecies in the list of twenty-three endangered Hawaiian birds and an equal number of subspecies on the list of extinct birds.[238] The second document, a Goodwin authored paper on the FWS conservation program for Hawaii, referred directly to "species and subspecies of our native fauna urgently in need of help…"[239] The Hawaii paper went on to highlight again the necessity of transplanting some Hawaiian species to 'suitable habitat' on nearby islands. Goodwin explained the need for research and sound practices in the process of

[238] Ibid., Goodwin, "Endangered and Extinct Wildlife of Hawaii."

[239]Ibid., Goodwin, "The Endangered Species Conservation Program for Hawaii."

selecting and preparing sites for transplantation. He remarked that "[a]s yet, only fragmentary information is available on either the ecology of the species or the ecology of their habitat. These details are needed as a basis for habitat management."[240] Here Goodwin made his own distinction between two ecological approaches, yet did not quite escape the CREWS/FWS tradition of single-species ecology as his ecology of habitats still referred to the habitats in terms of individual species.

After brief questioning on some of the content of Goodwin's documents the hearings turned to a series of justifications for specific amounts that had been requested for particular land-acquisition projects. Whatever monies he received, Goodwin's greatest victory at the appropriations hearings was his successful injection into the Congressional record of a precise articulation of the CREWS/FWS conceptual approach and conservation practices with respect to endangered species conservation. Much of the language of the endangered species bills that emerged in the next session of Congress that was not taken from previous legislation had hints of the Goodwin documents. In addition to legislative hearings, the appropriations hearings in the Congressional record provides yet another plausible source through which CREWS was able to influence the legislative process during the passing of the ESA.

[240] Ibid., Goodwin, "The Endangered Species Conservation Program for Hawaii."

5.4 The Endangered Species Act of 1973

Although some names had changed, a predictable lineup of witnesses appeared before the House and the Senate to testify on behalf the various endangered species bills submitted starting in 1972, including H.R. 37 and S. 1983. Nathaniel Reed stepped in for Cain as the new Assistant Interior Secretary for Fish and Wildlife and Parks. Accompanying Reed was E. U. Curtis Bohlen, Reed's Deputy Assistant Secretary. Earl Baysinger testified as the Chief of the Office of Endangered Species in place of Harry Goodwin who had moved on to become part of the IUCN Survival Service Commission. The BSFW was headed by acting Director Spencer Smith who testified instead of John Gottschalk, though Gottschalk did testify at the Senate hearings, this time as a representative of state and private conservation agencies. Two DOI solicitors also participated in the hearings.

Reed, Bohlen, Smith, and Baysinger sat opposite the House Subcommittee on Fisheries and Wildlife Conservation on March 21, 1972 to testify on behalf of the seventeen House resolutions related to endangered species, one of which was the administrative bill drafted out of the DOI under the direction of Bohlen.[241] The group was grilled on various sections of the administrative bill beginning with issues of enforcement and preemption of state authority. The hearings also included questions on a number of conceptual and conservation practice concerns that had been addressed by CREWS in the prior decade. Ned P. Everett, counsel

[241] U.S. House of Representatives Subcommittee on Fisheries and Wildlife Conservation, Hearings, Serial No. 92-22, 158.

for the House Committee on Merchant Marine and Fisheries, engaged Bohlen in a discussion over the additional conservation category of 'rare' used to denote species that might become endangered in the near future. Just as Richard Manville had done in 1965, Bohlen argued against the use of 'rare' for this purpose, preferring instead 'likely to become threatened with extinction.'[242] The use of particular terminology, however, was a minor issue. The hearings soon turned toward one of the foundational issues of CREWS's conceptual approach to conservation; the identification of objects of conservation.

Frank Potter, who would a year later collaborate with Baysinger on revisions of the Dingell bill, addressed Bohlen:

> I talked with Mr. Baysinger on the identity of subspecies, as differentiated from population stocks. My question, is this bill, which relates to 'species and subspecies,' sufficiently fine-tuned to let you reach the situation where somebody goes in, say, and wipes out one entire population, even though it may not be a subspecies?[243]

Bohlen replied by reading the bill's definition of 'endangered' which was meant to be more restrictive than the 1969 requirement that a species be threatened with worldwide extinction before it could be listed and action taken. The new bill allowed for the listing of a species or subspecies if it were facing extinction throughout or in a significant portion of its range. Bohlen interpreted species endangerment in a portion of its range to refer to the populations that Baysinger had gotten Potter to worry about. This particular exchange demonstrates that the House Committee, the DOI, and, FWS were coming to a consensus about what

[242] Ibid.

[243] Ibid.

objects the ESA should be targeting for conservation—some form of John Aldrich's evolutionarily significant populations.

Although the House failed to enact any of the bills over which the hearings had been held, the debates and negotiation that took place as part of the House hearings were nonetheless productive. Much of what was discussed as part of the hearings found its way into the bills that were reintroduced in Congress the following year by way of the bills' various authors as described in previous sections. In June of 1973 the Senate Subcommittee on Environment convened its hearings on two bills, S. 1592, the Senate version of the administrative bill and S. 1983, the bill that after modification would become the ESA.

Bohlen and Baysinger returned to Capitol Hill for the Senate Hearings, joined by Douglas Wheeler who had attended the House Hearings as DOI legislative counsel. The hearings began in almost predictable fashion with Senator Adlai Stevenson (D-IL) questioning the manner in which the bill extended federal authority into an area that had traditionally been state jurisdiction. Senator Marlow Cook (R-KY) later broached another issue related to legal responsibilities imposed by the bill, engaging Bohlen and Wheeler in a discussion over strengthening the language of the bills with respect to federal agencies' responsibilities to protect endangered species while carrying out federal projects. Cook's position paralleled Potter's and Talbot's later attempts to eradicate the use of 'practicable' from the legislation.

Like the House hearings before, testimony from the DOI group eventually became focused on conceptual aspects of the bill. Senator Stevenson addressed

Baysinger, asking, "[c]an you tell me what criteria have been developed by your agencies for identifying these categories of species and subspecies?"[244] The Senator quickly added to his list of categories the identification of what he called 'stocks.' Baysinger responded by first requesting clarification on the Senator's question, asking if by stocks he meant 'isolated populations.' Subspecies and species were easily handled in the taxonomic literature, replied Baysinger. He went on, "[t]hese animals are identified and presumably identifiable."[245] As for populations, Baysinger admitted that identification was less obvious and called for a reliance on the best scientific information from experts in FWS and in state conservation agencies as well as the scientific community at large. The reliance on expert judgment was a recurring theme throughout Baysinger's testimony. The ones who would evaluate the merit of that expert judgment were, of course, to be found in his Office of Endangered Species.

As with the House hearings in the previous Congressional session the Senate hearings and in particular the DOI/FWS testimony helped shape the legal and conceptual content of the endangered-species bills and ultimately the ESA. Although reference to propagation was scattered throughout the bills, it was barely a topic of discussion in either the House or the Senate Hearings. Propagation had become a self-evident practice in federal endangered-species policy, and—together with a focus on subspecies and populations and deference to scientific authority—became the conceptual content of the ESA. But more than

[244] U.S. Senate Subcommittee on Environment, Hearings, Serial No. 93-67.

[245] Ibid.

showing CREWS's influence over language through DOI and FWS agents, the Congressional hearings demonstrated that, at least with respect to the relevant Congressional subcommittees, Congress understood on some level and was willing to embody in legislation CREWS's conservation approach.

6. Implementing the ESA

Legally, The ESA went into effect immediately after being signed by President Nixon, and although the more stringent legal prohibitions provided the most comprehensive federal protection for endangered wildlife to date, the conceptual content and practices of federal endangered-species conservation continued on much as they had before. FWS continued to propose candidates for listing to the Secretary of the Interior using the same criteria developed by CREWS beginning in 1964. Patuxent continued to breed endangered-species and closely related species for reintroduction and research purposes, following a tradition established in the wake of the whooping crane controversy. Just as these concepts and practices became part of the legislative foundation for federal policy, they also became part of the Act's implementation. As such, vestiges of the CREWS approach can found in the practice of federal endangered-species conservation to this day.

Today, the Federal endangered species list is maintained in digital format on the FWS Threatened and Endangered Species System (TESS).[246] Currently, TESS lists 1241 animals and 796 plants, which includes both foreign and domestic species. Focusing on listed animals, since the protocol for plants was not

[246] Threatened and Endangered Species System, fws.gov.

established until the late 1970s by the Smithsonian Institution, one finds that the list contains primarily, but not exclusively, full species. However, scattered throughout the list are a significant number of subspecies demonstrating a continuity of CREWS's more fine-grained taxonomic approach to listing. Further down the list one encounters nine separate listings for the Chinook salmon, each under the same species name. Each of the nine listings for Chinook refers to a separate population, designated as such by the river system in which they spawn. The current approach to listing echoes a tradition of practice that picks out particular objects of conservation that can be found in the first draft of the CREWS Red Book.

Just as for the conceptual approach to listing, the commitments to propagation, reintroductions, and transplantations remain a significant part of federal endangered species policy. The most recent evidence for this can be found in the Louisiana Department of Wildlife and Fisheries's (LDWF) plans, now in their final stages, to use Patuxent-hatched Whooping Cranes to reestablish a non-migratory population in southern Louisiana. Whoopers have been absent from Louisiana for more than sixty years, but the reintroduction of the birds into a part of their historic range and establishment of a self-sustaining population has been an FWS goal since Ray Erickson first proposed the formation of the Patuxent center. In the words of present day FWS biologist Bill Brooks, "[w]ild-born

animals that are raising their own chicks are going to be the measure of recovery."[247]

The present day continuation of the whooping crane saga is but one example of CREWS's approach to conservation being played out in the present. But just as Richard Banko asked in the context of Hawaiian species, the question still remains the recovery of what? Is 'introducing' a new population the same as replacing what was there before? Furthermore, the cranes are to be introduced into an ecosystem that has not seen whooping cranes in over half a century. Why should conservationists favor a community in which a crane population is present to the existing dynamic developed over time in the absence of cranes?[248]

That the conceptual approach and conservation practices of CREWS can still be found in the present day reauthorized and amended ESA and in federal endangered-species conservation practice is not to say that science and conservation have stood still. The solidification of conservation biology as a discipline and the emergence of the biodiversity movement in the 1980s have changed the dynamics of species conservation.[249] The policy and federal practice have, however, held onto objects of conservation and a commitment to

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[247] Gwyneth Dickey Zakaib, "Whooping Cranes Head Back to Louisiana", Nature Publishing Group, Accessed February 19, 2011, http://www.nature.com/news/2011/110211/full/news.2011.88.html?WT.ec_id=NEWS-20110215

[248] See Matthew K. Chew and Andrew L. Hamilton, "The Rise and Fall of Biotic Nativeness: A Historical Perspective," in D. M. Richardson. *Fifty Years of Invasion Ecology: The Legacy of Charles Elton*. (Hoboken, NJ: Wiley-Blackwell, 2011).

[249] Bryan G. Norton, "Biological Resources."

propagation consistent with CREWS's established tradition of federal conservation. The endurance of the ESA and its associated practices, should give cause to resist a premature declaration of the legislative mandate as an antiquated approach. However, with the carryover of CREWS-like concepts and practices have come CREWS's unanswered questions—what is being saved and at what expense? As conservation-biologists, policymakers, and perhaps emerging ecological ethicists devise means to address these questions, scientifically, politically, and in terms of conservation values, a better evaluation of the usefulness of CREWS and ESA practices can perhaps be achieved.

7. Conclusion and Extension

Official documentation signaling the disbanding of CREWS has yet to be discovered. The committee charter from 1964 established the Committee for a two-year period. Its charter was obviously renewed. It continued to operate into the early part of the 1970s, but by 1973 documentation begins to thin out. Three versions of the Red Book from 1964 to 1968 list the Committee on the byline. In 1973, a new Red Book version was published under a new title: *Threatened Wildlife of the United States*. CREWS's byline was replaced by The Office of Endangered Species and International Activities. By this point most of the CREWS's advisory and listing responsibilities seemed to have been absorbed into the Endangered Species Office. 1973 seems to have been the culminating point of the Committee's efforts to influence federal endangered-species policy and the conclusion of their nearly decade-long run.

The goal of the present project has been to make the case that during their nine-year existence CREWS, having been established as a scientific authority by the federal government, used its status to influence the legislative process and capture a particular conceptual approach and set of practices into federal endangered-species policy and legislation. The historical case is an important contribution to the environmental history and science-policy history of one of the most important pieces of environmental legislation in the United States. The archival materials convincingly demonstrate that although the political environment was not conducive to the passage of federal endangered-species legislation until the late 1960s, the CREWS conservation approach was a synthesis of scientific and wildlife management methods developed decades earlier and combined in the context of 1950s whooping crane conservation. Furthermore, the Congressional record shows significant involvement in the legislative process on the part of CREWS and its advisors in shaping CREWS's conservation approach into law.

STS scholars Steven Shapin and Simon Schaffer suggest that one reason for taking up a study of Thomas Hobbs and Robert Boyle was that it represented an episode of scientific controversy. Historical controversies, they explained, "often involve disagreements over the reality of entities or propriety of practices whose existence or value are subsequently taken to be unproblematic or settled." The controversy once 'settled' results in a set of "self-evident methods" that become part of the culture of science.

For late twentieth-century endangered-species conservation, captive breeding, reintroduction and transplantations, and population-level conservation have become the self-evident methods of conservation science and policy. Whooping-crane conservation in the 1950s and 1960s and CREWS represent the points of scientific and policy controversy that lead to the ESA and its mandated self-evident methods. The controversy 'settled' by legislation has left unanswered some of the questions raised during the controversy. Many of those questions have been raised throughout the present project; not to provide answers but merely to begin to encourage consideration of the underlying assumptions embedded in current conservation practice.

This project is the beginning of rather than a self-contained research program. It has provided an empirical history of CREWS and its influence on the ESA, deliberately focused on individuals and groups directly involved in the conservation-policy deliberations in the 1960s and leading up to the ESA. Additionally, the project has claimed that a certain continuity of approach exists from the practices made into policy in 1973 to the current practice of species conservation. The passing of the ESA is nearly half a century removed from conservation practices of today. The next phase of the research program might ask how CREWS's approach has been transmitted after the passage of the ESA?

While some of the same methods applied here might be applicable to the next set of research questions, the continuity of actors will certainly give way to some form of institutional momentum and conservation of ideas as the next wave of conservation and political authorities addressed the endangered species

problem. The ESA was reauthorized and amended several times in the late 1970s and early 1980s. Tracking the new set of actors and continuity of ideas through the reauthorization process, in light of the present study, presents a promising next step in connecting CREWS to current conservation policy. A final question for extending the study of CREWS: in what ways if any has CREWS's approach, as practiced by ESA mandate, come up against conservation biology and biodiversity science as scientists have through these fields reframed to varying degrees the endangered-species problem?

Extending the historical work describing CREWS's influence on conservation legislation and policy beyond 1973 is one logical next step in the CREWS research program. A second is to look at the CREWS-ESA episode as a case study and ask the question: What role can the historical methods used here play in the study of contemporary fields, related to topics in the CREWS-ESA history, that do not typically rely on history or do so in a limited manner. The following sub-sections suggest two such fields of study: science-policy and conservation-science

7.1 Science-Policy Advisory Committees

The CREWS-ESA history provides a case for analysis in several related fields that explore the relationship between science and society. One of these is the study of science-advisory committees within the field of science policy studies. CREWS was situated between two significant pieces of federal legislation related to executive departments and advisory committees: the Administrative

Procedures Act (APA) of 1946, and the Federal Advisory Committee Act (FACA) of 1972. Both pieces of legislation were intended to provide some degree of administrative decision-making transparency and a means for public participation in the federal policy process. In addition, both acts encouraged, and in the case of the FACA mandated, a balancing of diverse viewpoints in the policy process and on advisory committees. Much has been written on the issue of 'balanced' representation on advisory committee, both descriptive and normative.[250] CREWS provides an excellent case study for this area of investigation. CREWS is the archetype of the unbalanced advisory group. It is also interesting that the Committee came on the heels of the Whooping Crane Advisory Group, which was much more balanced with respect to scientific background and approach, and furthermore, contained some of the same members as CREWS.

Karl Boyd Brooks points out in his "environmental history of environmental law" that the explosion of environmental policy most associated with the environmental movement of the 1960s and 1970s was actually part of a growing movement that dates back to the 1940s at both the state and federal levels. Brooks points to the passing of the APA, public opposition to federal dam projects, and public involvement in California air pollution and water pollution polices as some of the evidence to support his claim. Many of the episodes

[250] Shelia Jasanoff, *The Fifth Branch: Science Advisers as Policymakers.* (Cambridge, Mass: Harvard University Press, 1990). Roger A Pielke, Jr., *The Honest Broker: Making Sense of Science in Policy and Politics.* (Cambridge, Cambridge University press, 2007); Daniel Sarewitz, "How Science Makes Environmental Controversies Worse," *Environmental Science and Policy* 7 (5) (2004): 385-403.

Brooks describes illustrate collaboration of stakeholders with multiple viewpoints and active public participation in the development of modern environmental law. CREWS, which falls in the middle of Brooks's time frame for study, provides an interesting contrast to broad participation in environmental policy. Instead, CREWS was composed as an elite group of scientists drawn from only a small segment of the spectrum of the scientific community concerned with conservation. Why and how did CREWS escape Brooks's trend?

A feature of the original Senate bill, S.1983, adds a further wrinkle to the CREWS story. The bill had a provision for the formation of an advisory group to advise the Interior Secretary on candidates for the endangered species list. In the same vein as the FACA, discussions of the advisory group in the Senate hearings for S. 1983 included a form of broad representation and public participation.[251] In the conference report that produced the ESA the advisory group was written out in favor of a requirement that the Interior Secretary consult with potentially affected states before listing a species. Why was the advisory group section dropped from S. 1983 and what effects if any did the passage of the FACA have on endangered-species policy advising in the years after the ESA was passed? CREWS is an ideal case study for getting at some of the question that arise in the study of the dynamics of science-advisory groups as a fifth branch of the federal government.

[251] House Conference Report 93-740 as printed in *A Legislative History of the Endangered Species Act of 1973.*

7.2 Conservation and Climate Change

Managed relocation has recently emerged as a proposed solution to conserving species threatened with extinction because of habitat modification due to climate change.[252] Although the reasons have changed some of the questions that advocating for managed relocation generate are the very same questions that faced CREWS and FWS in the context of transplanting Hawaiian species to islands with 'suitable habitats.' Ecological ethics is an emerging field that aims at building a tool kit for field biologists, ecologists, and conservationists to address question related to different conservation practices.[253] With respect to managed relocation the tools developed should assist in evaluating the impact on the transplanted species as well as the habitat receiving the refugees. In addition, a program of managed relocation must also answer the identity question. What is a species out of the context of its environment? And is a relocated species the 'same' thing as the species in its previous environment? In short, what is being conserved?

Historical methods in the form of a more detailed analysis of CREWS's involvement in Hawaiian conservation in the 1960s and 1970s could contribute to the ecological ethics toolbox. A number of Hawaiian species were in fact relocated under CREWS's recommendation and FWS direction. If further documentation can shed some light on how relocation decisions were made, the

[252] B. A. Minteer and J. P. Collins, "From Environmental to Ecological Ethics: Toward a Practical Ethics for Ecologists and Conservationists," *Science and Engineering Ethics*. 14 (4) (2008): 483-501.

[253] Minteer and Collins, "Move it or Loose it."

questions asked as well as those that were not might be of value for cases of relocation today. Finally the history of Hawaiian conservation may provide a heuristic for study of managed relocation. Following whatever FWS records can be recovered should identify populations of Hawaiian species that were previously transplanted to other islands. Studying changes in the transplanted populations relative to the native stocks, researchers might be able to acquire some data useful to making decisions related to cases of relocation today.

REFERENCES

Alee, W. C. *Principles of Animal Ecology*. Philadelphia, PA: W. B. Saunders Company, 1949.

Banks, Richard C. "In Memoriam: John Warren Aldrich, 1906-1995." *The Auk* 114 (4) (1997): 748-751.

Barrow, Mark V. *Nature's Ghosts: Confronting Extinction From the Age of Jefferson to the Age of Ecology.* Chicago: University of Chicago Press, 2009.

Brooks, Karl Boyd. *Before Earth Day: the Origins of American Environmental Law, 1945-1970.* Lawrence, KS: University of Kansas Press, 2009.

Burt, William H. "Richard Hyde Manville, 1910-1974," *Journal of Mammalogy* 57 (1) (1967): 206-209.

Carson, Rachel. *Silent Spring.* Boston: Houghton Mifflin Co, 1962.

Chase, Alston. *In a Dark Wood: The Fight over Forests and the Rising Tyranny of Ecology*. Boston, MA: Houghton Mifflin Company, 1995.

Chew, Matthew K. and Andrew L. Hamilton. "The Rise and Fall of Biotic Nativeness: A Historical Perspective," in Richardson, D. M. 2011. *Fifty Years of Invasion Ecology: The Legacy of Charles Elton*. Hoboken, NJ: Wiley-Blackwell, 2011.

Clark, Tim W., Richard P. Reading, and Alice L. Clarke. *Endangered Species Recovery: Finding the Lessons, Improving the Process.* Washington, D.C.: Island Pres, 1994.

Collins, J. P. "Evolutionary Ecology and the Use of Natural Selection in Ecological Theory." *Journal of the History of Biology* 19 (2) (1986): 257-88.

Collins, James, John Beatty, and Jane Maienschein. "Between Ecology and Evolutionary Biology." *Journal of the History of Biology*, 19 (2) (1986): 169-180.

Colman, William. "Evolution into Ecology? The Strategy of Warming's Ecological Plant Geography." *Journal of the History of Biology* 19 (2) (1986): 181-196.

Czech, Brian and Paul Krausman. *The Endangered Species Act: History, Conservation Biology, and Public Policy.* Baltimore: The Johns Hopkins University Press, 2001.

Darwin, Charles. *On the Origin of Species: A Facsimile of the First Edition*. Cambridge, MA: Harvard University Press, 1975.

DeBlieu, Jan. *Meant to Be Wild: The Struggle to Save Endangered Species Through Captive Breeding*. Golden CO: Fulcrum Publishing, 1991.

Dorsey, Kurkpatrick. *The Dawn of Conservation Diplomacy: US-Canadian Wildlife Protection Treaties in the Progressive Era*. Seattle, WA: University of Washington Press, 1998.

Dunlap, Thomas R. "Organization and Wildlife Preservation: The Case of the Whooping Crane in North America." *Social Studies of Science* 21 (2) (1991): 197-221.

Farnham, Timothy J. *Saving Nature's Legacy: Origins of the Idea of Biological Diversity*. New Haven, CT: Yale University Press, 2007.

Goble, Dale, J. Michael Scott, and F. W. Davis. *The Endangered Species Act at Thirty, vol. 1 & 2*. Washington DC: Island Press, 2006.

Hagen, Joel. *An Entangled Bank: The Origins of Ecosystem Ecology*. New Jersey: Rutgers University Press, 1992.

Hull, David L. *Science as a Process: An Evolutionary Account of the Social and Conceptual Development of Science*. Chicago: University of Chicago Press, 1988.

Jasanoff, Sheila. *The fifth branch: science advisers as policymakers*. Cambridge, Mass: Harvard University Press, 1990.

Kingsland, Sharon. *The Evolution of American Ecology: 1890-2000*. Baltimore, MD: The Johns Hopkins University Press, 2005.

Knight, Richard L. "Aldo Leopold, the Land Ethic, and Ecosystem Management." *The Journal of Wildlife Management* 60 (3) (1996): 471-474.

Kohm, Kathryn A. *Balancing on the Brink of Extinction: The Endangered Species Act and Lessons for the Future*. Washington, D.C.: Island Press, 1991.

Kraus, Sidney, John F. Kennedy, and Richard M. Nixon. *The Great Debates: Background, Perspective, Effects.* Bloomington: Indiana University Press, 1962.

Mann, Charles C. and Mark L. Plummer. *Noah's Choice: The Future of Endangered Species*. New York: Knopf, 1995.

Mayr, Ernst. *Animal Species and Evolution*. Cambridge. MA: Belknap Press of Harvard University Press, 1965.

McIntosh, Robert. *The Background of Ecology: Concept and Theory*. Cambridgeshire: Cambridge University Press, 1985.

McNulty, Faith. *The Whooping Crane: The Bird that Defies Extinction.* New York: E. P. Dutton & Co., Inc., 1966.

Minteer, B. A. and J. P. Collins. "Move It or Lose It? The Ecological Ethics of Relocating Species Under Climate Change." *Ecological Applications: A Publication of the Ecological Society of America* 20 (7) (2010): 1801-4.

Minteer, B. A. and J. P. Collins. "From Environmental to Ecological Ethics: Toward a Practical Ethics for Ecologists and Conservationists." *Science and Engineering Ethics* 14 (4) (2008): 483-501

Mitman, Gregg. *The State of Nature: Ecology Community and American Social Thought, 1900-1950: Science and its Conceptual Foundations*. Chicago: Chicago University Press, 1992.

Murchison, Kenneth M. *The Snail Darter Case*. Lawrence, KS: University Press of Kansas, 2007.

National Research Council. *Science and the Endangered Species Act*. Washington, DC: National Academy Press, 1995.

Norton, Bryan G. "Biological Resources and Endangered Species: History, Values, and Policy," In Lakshman D. Guruswamy and Jeffrey A. McNeely. *Protection of Global Biodiversity: Converging Strategies*. Durham, N.C.: Duke University Press, 1998.

Perry, Matthew C. "The Evolution of Patuxent as a Research Refuge and a Wildlife Research Center." http://www.pwrc.usgs.gov/history/cronhist/PatuxentHistory_Perry.pdf (accessed December 8, 2010).

Petersen, Shannon. *Acting for Endangered Species: The Statutory Ark*. Lawrence, KS: University of Kansas Press, 2002.

Pielke, Roger A. *The Honest Broker: Making Sense of Science in Policy and Politics*. Cambridge: Cambridge University Press, 2007.

Sarewitz, D. "How Science Makes Environmental Controversies Worse." *Environmental Science and Policy*. 7 (5) (2004): 385-403.

Smithsonian Institution Archives. Record units: T89021, 03-132, 7171, 7407, 85-186, 89-003, 99.

Soule, Michael, et. al. “Strongly Interacting Species: Conservation Policy, Management, and Ethics.” *BioScience* 55 (2) (2005): 168-176

Special to The New York Times. "Some of Cranberry Crop Tainted by a Weed-Killer, U. S. Warns: CRANBERRY TAINT REPORTED BY U. S." *New York Times (1923-Current File),*1959, http://login.ezproxy1.lib.asu.edu/login?url=http://search.proquest.com/docview/114808338?accountid=4485 (accessed January 7, 2011).

Time. 1959. “Bureaucracy: the cranberry boggle”. http://www.time.com/time/magazine/article/0,9171,865035,00.html (accessed Janurary 7, 2010).

Tobin, Richard J. *The Expendable Future: U.S. Politics and the Protection of Biological Diversity.* Durham NC: Duke University Press, 1990.

Transcript, John W. Aldrich oral history interview, April 18, 1977, by Pamela Henson, Smithsonian Institution Archives, Record Unit 9511.

Transcript, Ray Erickson oral history interviews, 2006, by Mark Madison, FWS digital media.

Transcript, Stewart Udall oral history interviews, 1969, by Joe Frantz, LBJ Library.
Online: http://www.lbjlib.utexas.edu/johnson/archives.hom/oralhistory.hom/UDALL/Udall.asp (accessed August 31, 2008).

United States. *Threatened Wildlife of the United States*. Washington: Bureau of Sport Fisheries and Wildlife, 1973.

——. *Rare and Endangered Fish and Wildlife of the United States* Washington, D.C.: Bureau of Sport Fisheries and Wildlife, 1968.

——. *Rare and Endangered Fish and Wildlife of the United States*. Washington, D.C.: Bureau of Sport Fisheries and Wildlife, 1966.

——. *Rare and Endangered Fish and Wildlife of the United States*. Washington, D.C.: Bureau of Sport Fisheries and Wildlife, 1964.

United States, & John F. Kennedy. *Presedent Kennedy’s Message on*

Conservation to the Congress of the United States. Washington DC: U.S. Dept. of the Interior, 1962.

United States Geological Survey. "Patuxent Wildlife Research Center: Biological Survey Unit History," http://www.pwrc.usgs.gov/history/bsphist2.htm (accessed April 16, 2010).

United States, and Library of Congress. *A Legislative history of the Endangered Species Act of 1973, as amended in 1976, 1977, 1978, 1979, and 1980: together with a section-by-section index.* Washington: U.S. G.P.O., 1982.

University of Arizona Archives: Record Unit AZ 373.

Wang, Zuoyue. *In Sputnik's Shadow: the President's Science Advisory Committee and Cold War America*. New Brunswick, N.J.: Rutgers University Press, 2008.

Webber, M. M. and H. W. J. Rittle. "Dilemmas in a General Theory of Planning." *Policy Science* 4 (2) (1973): 155-169.

White, Theodore H. *The Making of the President, 1960*. New York: Atheneum Publishers, 1961.

Worster, Donald. *Nature's Economy: A History of Ecological Ideas, 2nd ed.* Cambridge: Cambridge University Press, 1997.

Yaffee, Steven Lewis. *The Wisdom of the Spotted Owl: Policy Lessons for a New Century.* Washington, D.C.: Island Press, 1994.

Yaffee, Steven Lewis. *Prohibitive Policy: Implementing the Federal Endangered Species Act.* Cambridge: MIT Press, 1982.

Zakaib, Gwyneth Dickey. Whooping Cranes Head Back to Louisiana, Nature Publishing Group, http://www.nature.com/news/2011/110211/full/news.2011.88.html?WT.ec_id=NEWS-20110215 (accessed February 19, 2011).