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Red-cockaded woodpecker (*Picoides borealis*).
Drawing by Robert Savannah, U. S. Fish and Wildlife Service

Note: This issue of the *UPDATE* does not include an *Endangered Species Bulletin*. The *Bulletin* staff is preparing a special anniversary issue that will appear in the July/August issue of the *UPDATE*.

Correction: Jay W. Tischendorf should have been credited for the puma photograph on page 23 of the March/April issue.

Endangered Species UPDATE

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Cover: Piping plover chick. Photograph by Bill Byrne, Massachusetts Division of Fisheries and Wildlife.

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Northern Assateague Island Restoration Project and the Piping Plover: A Case Study in Endangered Species Act Inter-Agency Consultation

Anne Hecht and
G. Andrew Moser

Abstract

Between September 1995 and May 1997, the U.S. Army Corps of Engineers, National Park Service, and U.S. Fish and Wildlife Service engaged in informal and formal consultation regarding effects on the piping plover of a proposed project to artificially nourish beaches on the northern end of Assateague Island, Maryland. Key factors contributing to the success of this consultation included: (1) early and active participation in the consultation process by all federal parties, as well as the Maryland Department of Natural Resources, Worcester County, and Ocean City, (2) availability of extensive high quality baseline information on piping plover habitat use in the project area, (3) explicit inclusion of plover conservation in the project objectives, (4) formulation of a biological assessment, containing detailed assessments of six project alternatives, early in the consultation process, (5) adoption of a relatively restrained project design, and (6) incorporation of a monitoring and response plan in the project design. This monitoring and response plan is intended to detect and correct any deleterious effects of the project on piping plover habitat due to lower-than-anticipated overwash frequency. The project, scheduled for construction over a two to three year period, may not be initiated until the autumn of 1999, and actual project impacts may not be determinable until several years after completion.

Often heard before they are seen, piping plovers (*Charadrius melodus*) blend into the pale background of their open, sandy nesting habitats along the Atlantic Coast beaches. These small, well-camouflaged shorebirds are easily overlooked on the beach. Since the species' 1986 listing under the Endangered Species Act, however, piping plovers have attracted the attention of beach managers, recreationists, and government agencies at all levels. When federal agencies, such as the National Park Service, U.S. Army Corps of Engineers, or the U.S. Coast Guard, are active in piping plover habitat, the Endangered Species Act prescribes "Section 7 consultation." The purpose of this paper is to discuss a complex consultation for a potentially controversial project to identify the factors that contributed to a project design predicted to be considerably more benign than similar projects elsewhere.

Section 7 of the Endangered Species Act (ESA) mandates federal agencies to consult with the U.S. Fish and Wildlife Service (FWS) prior to authorizing, funding, or carrying out activities that may affect threatened or endangered species (16 U.S.C. §1536 and its implementing regulations 50 CFR Part 402). The requirement to discuss planned activities with the FWS provides opportunities to anticipate adverse effects. Agencies often elect to engage in informal consultation with the FWS to determine if all impacts will be beneficial or benign; if adverse effects are foreseen, informal consultation may also be used to develop project modifications that will reduce or eliminate the detrimental impacts (50 CFR Part 402.13). Formal consultation is required if the final project design may adversely affect listed species, and, at its conclusion, the FWS provides the agency with a written Biological Opinion stating whether the activity is likely to jeopardize the continued existence of the species and furnishing discretionary recommendations on how the agency can use its authority to further the species' conservation (50 CFR Part 402.14).

Section 7 assures that (1) federal actions affecting listed species will be reviewed by the FWS, (2) anticipated adverse effects will be documented in writing, and (3) those activities likely to jeopardize the continued existence of any endangered or threatened species will not be implemented. The opinion may also include non-discretionary "terms and conditions" implementing "reasonable and prudent measures" to minimize the impacts of "incidental take." The process, however, does not guarantee that potential project modifications to reduce impacts (short of those causing "jeopardy" to species) will be adopted, nor that agencies will implement conservation recom-

Table 1. Piping plover abundance and productivity on Assateague Island National Seashore and the Atlantic Coast, 1987-1996.

Year	*1987*	*1988*	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*
Assateague Island [a]										
Breeding Pairs	*23*	*25*	*20*	*14*	*18*	*24*	*20*	*32*	*44*	*61*
Chicks Fledged/Pair	*1.17*	*0.52*	*0.90*	*0.78*	*0.41*	*1.00*	*1.70*	*2.41*	*1.73*	*1.49*
Southern Recovery Unit [b,c]										
Breeding Pairs	*160*	*171*	*199*	*201*	*194*	*172*	*181*	*186*	*217*	*188*
Chicks Fledged/Pair [d]	*NA*	*0.85*	*0.88*	*0.72*	*0.68*	*0.62*	*1.18*	*1.37*	*1.06*	*1.36*
U.S. Atlantic Coast [c]										
Breeding Pairs	*567*	*648*	*724*	*751*	*751*	*790*	*877*	*968*	*1150*	*1161*
Chicks Fledged/Pair [e]	*1.04*	*1.11*	*1.28*	*1.06*	*1.22*	*1.35*	*1.47*	*1.56*	*1.35*	*1.31*
Atlantic Coast Total										
Breeding Pairs [c]	*790*	*886*	*957*	*980*	*987*	*1026*	*1113*	*1150*	*1349*	*1347*

[a] *Data from NPS and Maryland DNR 1997.*

[b] *Delaware, Maryland, Virginia, and North Carolina comprise the Southern Recovery Unit.*

[c] *Data from USFWS 1997c.*

[d] *Productivity data for the Southern Recovery Unit reflects approximately 62% of breeding pairs, 1988-1996.*

[e] *Productivity data for U.S. Atlantic Coast reflects approximately 79% of breeding pairs, 1987-1996.*

mendations to off-set project impacts or otherwise contribute to species recovery. Thus, outcomes of consultations, in terms of effects on species' vulnerability to extinction are highly variable. When opportunities to reduce impacts of a given project on a precarious species are foregone and the species status is unnecessarily moved closer to the jeopardy threshold, the options for future federal projects to avoid jeopardy may also be substantially diminished or foreclosed.

Piping plovers and shoreline stabilization

Piping plovers were added to the list of threatened and endangered species in January 1986. Three distinct breeding populations are recognized: Great Lakes, Northern Great Plains, and Atlantic Coast. The birds found along the Great Lakes are designated as endangered, while those nesting on the Atlantic Coast and Northern Great Plains are considered threatened. The Atlantic Coast population breeds on ocean beaches from Newfoundland to North Carolina (very occasionally in South Carolina). These small shorebirds winter primarily along the Atlantic Coast from North Carolina to Florida, although some migrate to the Bahamas, West Indies, and the Gulf Coast (FWS 1996).

The Atlantic Coast piping plover population increased from around 800 pairs at the time of its 1986 listing to approximately 1350 pairs in 1995 when this consultation began. Biologists attribute most of the 1986-1989 increase in plover numbers to intensified survey efforts in two states and not to an actual population increase. Expanding population figures between 1989 and 1995, however, represent bonafide population growth, but the increase was very unevenly distributed. Most growth occurred in New England, where productivity was high and the population increased 168%, from 206 to 552 pairs. During this time period, the Mid-Atlantic (NY, NJ) and Southern (DE, MD, VA, NC) subpopulations gained 62 and 18 pairs respectively, and the Atlantic Canada subpopulation declined by 34 pairs. The Revised Atlantic Coast Piping Plover Recovery Plan (FWS 1996) established four recovery units—Atlantic Canada, New England, New York-New Jersey, and Southern (DE, MD, VA, NC)—and assigned a portion of the recovery population goal to each. The recovery plan expressed particular concern about the status of plovers in the Southern and Atlantic Canada recovery units because of their small numbers and sparse distribution over relatively large geographic areas.

Loss and degradation of habitat due to development and shoreline stabilization has been a major cause of the plover's decline on the Atlantic Coast, along with human disturbance and predation. Destruction of beach habitat by residential, resort, and seawall development constitutes irrevocable habitat loss for piping plovers. By 1974, 47% of coastal

barrier acreage in New Jersey was classified as "urbanized," 42% in Connecticut, 35% each in Rhode Island and New York (Coastal Barriers Task Force 1983).

While "urbanized" barrier beaches probably represent the most extreme alterations of coastal habitats, less conspicuous changes also impair large amounts of current and potential piping plover habitat. The wide, flat, sparsely vegetated barrier beaches preferred by the piping plover are an extremely dynamic habitat, almost instantly renewed by overwash from large storm events, but their attractiveness to piping plovers can decline after even a few years' hiatus in these overwash events. Especially in the mid-Atlantic and southern portions of the plover's range, recently overwashed beaches where plover chicks are afforded ready-access to unvegetated bayside flats, shorelines of coastal ponds, or interdunal patches of wet or moist sand support the highest densities of productive breeding pairs (Elias-Gerken 1994; Loegering and Fraser 1995; Houghton et al. 1998). Roads, summer homes, parking lots and other recreation facilities are often situated just behind the foredunes on Atlantic Coast barrier beaches, and a wide variety of beach "protection" strategies, including the planting of vegetation and erection of snowfences, have been employed to accelerate the growth of tall vegetated "mature" dunes and prevent overwash and formation of "breaches" (new inlets along the barrier beach system). The higher and wider the beach and dunes become, the larger the magnitude of the storm needed to overwash the beach and re-create early successional habitats. The Revised Recovery Plan (FWS 1996) discourages interference with natural processes of inlet formation, migration, and closure, as well as beach stabilization projects including snowfencing and planting of vegetation at current or potential plover breeding sites.

Not surprisingly, the plight of the piping plover is not unique along Atlantic Coast beaches. Since the plover's listing, two other beach-dwelling species native to the Atlantic Coast, the northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) and the seabeach amaranth (*Amaranthus pumilus*), a plant, have been listed as threatened under the Endangered Species Act. Both count stabilization and fragmentation of natural beach habitats among their primary threats.

The Assateague Island, Maryland situation

Assateague Island is a 61 kilometer (38 mile) long barrier island straddling the Maryland-Virginia state line (Figure 1). The southern jetty of the Ocean City Inlet in Maryland forms Assateague Island's northern terminus, and a large recurved spit known as Toms Cove Hook lies at its southern end. The entire island is within the Assateague Island National Seashore, which overlays the Chincoteague National Wildlife Refuge on the Virginia section of the island. Ocean City, north of Assateague and sited on the balance of Maryland's ocean shoreline, epitomizes the urbanized barrier island. The Maryland portion of Assateague Island, and the subject of this consultation, is managed by the National Park Service (NPS).

Intensive monitoring of piping plovers has been conducted on the Maryland portion of Assateague Island since 1986, and almost all plovers breeding there during that time have been located on the northernmost 9 kilometers, referenced hereafter as "northern Assateague Island." South of this area, extensive artificial dunes were constructed beginning in the 1930's and later planted with American beach grass (*Ammophila breviligulata*). The NPS ended maintenance of these dunes after the 1970's and adopted a policy of allowing coastal processes to reclaim this portion of the island, but effects of the old artificial dunes on island topography remained visible until very recently.

The generally declining plover population on northern Assateague from 1988-91 is reflective of the poor productivity there and in the Southern subpopulation (Table 1, Figure 2). Low productivity on Assateague during this time period was attributed to depredation of eggs by red foxes (*Vulpes vulpes*) (Patterson et al. 1991) and, especially during 1987-90, to increasing vegetation and corresponding lack of access for flightless chicks to interior and bayside foraging habitats (Loegering and Fraser 1995; MacIvor 1996).

During the winter of 1991-1992, several large Nor'easters overwashed much of northern Assateague Island, removing dense vegetation and creating large expanses where the island was very sparsely vegetated from ocean to bay. Beginning in 1993, red fox numbers on the island also plummeted due at least in part to disease (NPS and Maryland Department of Natural Resources 1993, 1994), although there is some speculation that the 1991-92 storm events may have played a role in further depressing fox numbers, either by increasing mortality in an already disease-ridden population and/or by making habitat less hospitable. Piping plover productivity reached a five-year high in 1992 and substantial additional gains occurred in 1993 and 1994. In turn, the northern Assateague piping plover population grew rapidly. By 1995, the piping plover population was more than double the 1988-91 average, and by 1996 it had tripled. In that

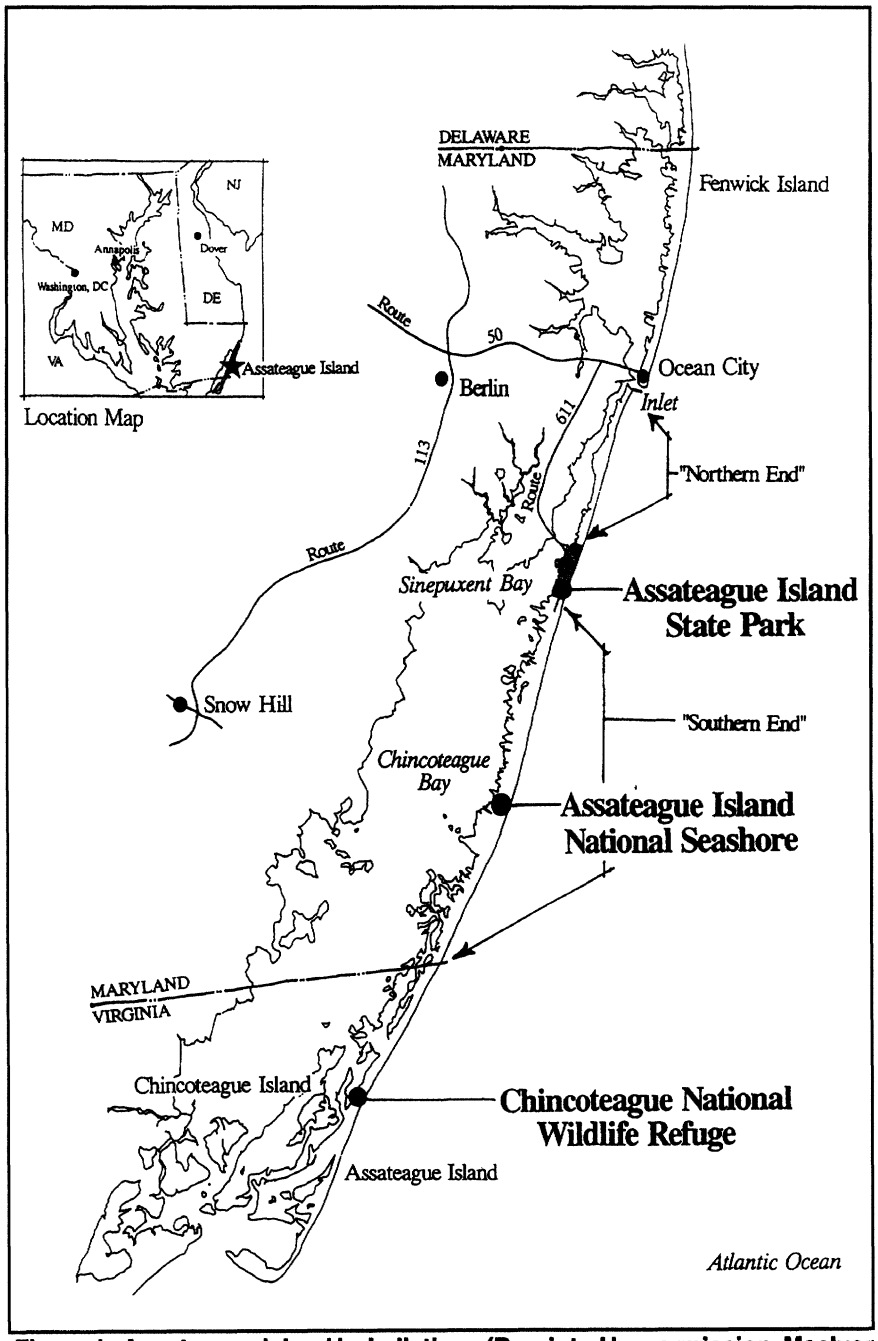

Figure 1. Assateague Island jurisdictions (Reprinted by permission, MacIvor and Motivans 1998).

year, Assateague piping plovers comprised nearly a third of the Southern Recovery Unit.

Changes in the topography of northern Assateague Island also stimulated concern from the National Park Service and nearby local jurisdictions that the northern end of the island was becoming increasingly vulnerable to breaching. As part of a larger reconnaissance study reviewing water resource problems in the vicinity of Ocean City, the U.S. Army Corps of Engineers (Corps) identified concerns about the accelerated, landward recession of northern Assateague Island and vulnerability to breaching due to cumulative effects on the natural sediment drift system from inlet stabilization (Corps 1994). Concomitant issues included potential for increased flooding of the adjacent mainland during storm events and accelerated sedimentation of the Corps-maintained inlet. Five projects were identified for further investigation during a feasibility study, including a one-time short-term restoration of the northern end of Assateague Island and long-term supply of sand to both Ocean City and Assateague Island.

The Section 7 consultation discussed in this paper focused on short-term solutions to the perceived shortage of sand on northern Assateague, with the understanding that a long-term plan to rectify the sand budget would follow within five years. The crux of the consultation lies in the following dilemma: available evidence suggests that current vulnerability of northern Assateague Island to overwash and breaching is linked to the effects of the jetties. At the same time, however, shoreline stabilization activities, including beach fills and dune construction, have severely impeded natural overwash and inlet formation processes elsewhere, including at nearby Ocean City itself, at the Assateague Island State Park only a few miles to the south, and at countless other Atlantic Coast beaches. Coastal "protection" projects almost always seek to stabilize beaches, and rarely, if ever, to conserve natural overwash processes that form and maintain preferred piping plover habitats.

The Section 7 consultation

The Corps, NPS and FWS all recognized that presence of the plovers and federal agency involvement would trigger Section 7 consultation requirements. It was clear that the large number of plovers on the site within an otherwise precarious portion of the species' range and the important link between plover breeding success and island topography posed the potential for major conflicts and controversy. The relatively satisfactory resolution of this consultation is attributable to at least six factors: (1) early and active participation by all parties, (2) availability of high quality biological information, (3) inclusion of piping

plover conservation in the project objectives, (4) biological assessment preparation prior to alternative selection, (5) a restrained project design, and (6) provisions for adaptive management.

(1) Early and active participation by all parties

Section 7 of the ESA makes it clear that consultation requirements are incumbent on the involved federal agencies. FWS policy mandates that state wildlife agencies will be informed of on-going consultations and their input and comments will be sought (FWS 1994a). Other non-federal entities, especially local project sponsors, may be allowed to participate at the discretion of the agency initiating the action. While the Corps, NPS, and FWS certainly anticipated that consultation would take place prior to project approval, credit must be accorded to the Maryland Department of Natural Resources' (DNR) Natural Heritage Program for bringing all interested parties together for an early discussion of endangered species issues. Following a September 1995 meeting hosted by Maryland DNR, the Corps assumed leadership for scheduling further interactions among agencies. Several face-to-face meetings were held during the following year, but informal consultation, facilitated by the Corps, also included exchange of published and gray literature and summaries of telephone conversations with various experts. Review and refinement of a critical project component, the Monitoring and Action Plan (described below in factor 6), was accomplished largely through exchange of electronic mail over a three to four month period. The Corps, NPS, and FWS were the official federal parties to the consultation, but active participation by Maryland DNR and local project sponsors, Worcester County and Ocean City, was key to its resolution.

Overburdened staff and personnel from FWS and other agencies often find themselves deferring consultation during the early stages of project planning, "until the project has been clearly defined." Project proponents both in and outside the agencies may encourage this tendency, on the theory that, as a particular project design gathers momentum and supporters, it will "acquire a life of its own" that is resistant to modification. As the discussion that follows illustrates, however, it was the serious engagement in early informal consultation that made several other important ingredients of this consultation possible.

(2) Availability of high quality biological information

Immediately following the plover's 1986 ESA listing, Assateague Island National Seashore initiated the first of two studies conducted by researchers from Virginia Polytechnic Institute. Work conducted in 1986-87 took a fairly broad look at piping plover breeding activity and reproductive success with a view to identifying major limiting factors (Patterson 1988; Patterson et al. 1991). The second study built on the first through a more detailed three-year investigation of piping plover foraging ecology and especially the relationship between brood-rearing habitats and chick survival (Loegering 1992; Loegering and Fraser 1995). When "outside" research ended after the 1991 breeding season, the NPS and Maryland DNR pooled their resources to maintain an intensive high quality monitoring program. In addition to col-

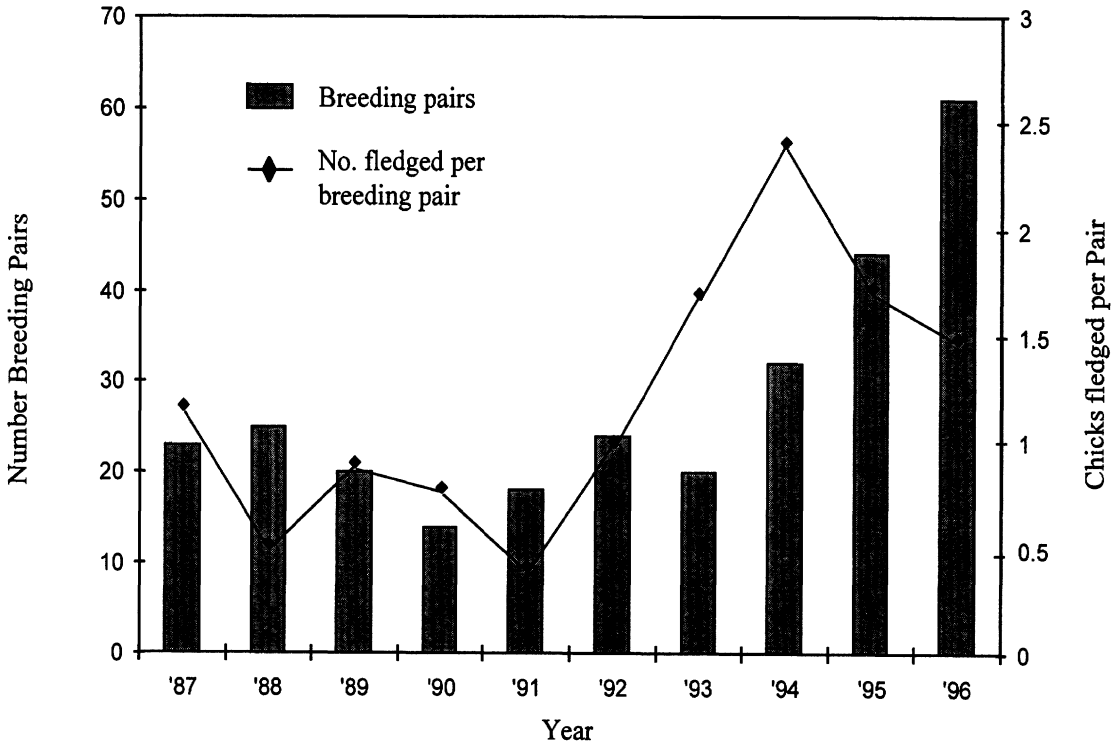

Figure 2. Piping plover abundance and productivity on Assateague Island, Maryland (courtesy of S. von Oettingen, FWS).

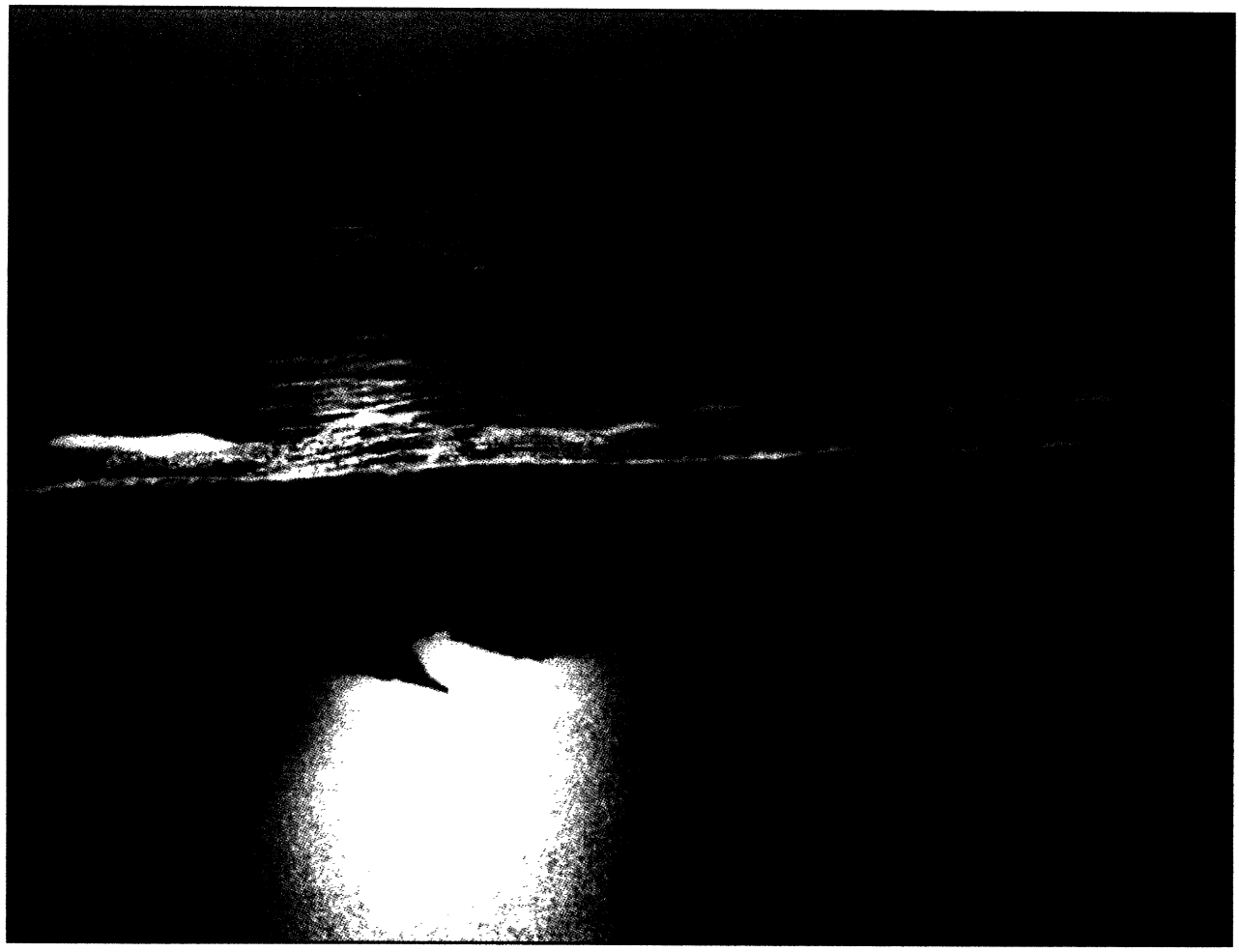

Figure 3. Sparsely vegetated barrier beaches furnish excellent piping plover breeding habitat, but are also susceptible to formation of new inlets. Photograph by Laurie H. MacIvor.

lection and documentation of pair numbers, nest locations, and hatching and fledging success, detailed annual reports continued to document such information as brood movements and use of foraging habitats (Maryland DNR 1993; NPS and Maryland DNR 1993-95). This information in turn, facilitated the preparation of the biological assessment discussed under (4), below.

(3) Piping plover conservation included in the project objectives

As a "restoration project" to mitigate for adverse effects of past Corps projects (i.e. the Ocean City jetties) and because it involves land managed the NPS, it is logical that project planning would accord relatively prominent consideration to impacts on species listed under the ESA. However, piping plover conservation has usually not been an integral a part of project design for similar projects along the Atlantic Coast, even those affecting NPS lands (Corps 1996, FWS 1995, 1997a) "Minimizing impacts to the piping plovers" was one of seven objectives laid out in the Draft Integrated Feasibility Report and Programmatic Environmental Impact Statement (Corps 1997). Perhaps more significant, the Corps' discussion of the alternative selection process focused almost exclusively on trade-offs between two objectives, minimizing impacts to piping plovers and reducing the likelihood of breach, and stated, "The Corps and sponsors all felt strongly that we needed to select a plan that met both the mitigation [for risk of breaching] objective and the piping plover constraint."

(4) Biological assessment preparation prior to alternative selection

Regulations implementing Section 7 require the action agency to prepare a biological assessment if it is planning a "major construction activity," and the nature and scope of the northern Assateague restoration project clearly triggered this requirement. The biological assessment must be completed before formal consultation can be initiated. The contents are at the discretion of the agency taking the action, though potential items for inclusion are listed in the Section 7 regulations (50 CFR Part 402.12). For the Northern Assateague Restoration Project, the Corps hired a highly knowledgeable consultant to prepare a detailed biological assessment. Maps prepared by the consultant depicted changes in study area vegetation between

1985 and 1995 and juxtaposed plover nest and brood-rearing locations with current vegetation and topography to illustrate the extreme sensitivity of plovers to habitat characteristics. The biological assessment provided analyses of six potential project alternatives, and, most importantly, the draft biological assessment was completed prior to final consideration of those alternatives by the Ocean City Executive Committee. Thus, the biological assessment played an active role in shaping the project, rather than simply describing its effects.

(5) A restrained project design

The fundamental project design dilemma was to decrease the vulnerability of northern Assateague Island to breaching, without interrupting overwash processes that maintain sparse vegetation. Exchanges with a variety of outside experts on coastal formation processes and coastal plant communities led to a consensus that an overwash frequency of one event every two years would probably be sufficient to preclude the establishment of woody vegetation, while one or more overwashes per year may be required to favor annual over perennial herbaceous vegetation. Modeling by the Corps' Coastal Engineering Research Center was conducted to determine berm crest elevations that would still allow significant overwash events, occurring over time intervals on the order of days, on a frequency of approximately one per year. The selected project design included addition of 1.4 to 1.55 million cubic meters of sand along 5.4 miles of beach. Most of this sand will be used to widen the beach up to 100 feet at an elevation of not more than 8.2 feet (2.5 meters) National Geodetic Vertical Datum (NGVD). In addition, a low storm berm, not to exceed 10.8 feet (3.3 meters) NGVD, with a crestwidth of 16 feet will be constructed. All construction work will be done outside the plover breeding season, which may run from April 1 to August 31, although work could commence earlier if plover breeding activity ends before August 31. Importantly, no vegetation planting or snowfencing will take place. This project design contrasts significantly with those commonly proposed elsewhere along the Atlantic Coast, involving construction of artificial "dunes" up to 15 or 18 feet NGVD and planted with dune grass and snowfencing (FWS 1994b, 1997a, 1997b).

Figure 4. Access to unvegetated bayside flats is a characteristic of the most suitable habitats in the southern portion of the piping plovers' Atlantic Coast range. Photograph by David Brinker.

(6) Provisions for adaptive management

While the Corps' modeling results indicate that this project design will reduce vulnerability to breaching and allow maintenance of annual overwash, participants in the consultation recognized that these results were based on long-term average storm frequency distributions. Actual short-term storm patterns are quite uneven (Dolan et al. 1988; Jones and Davis 1995), with multi-year periods of low or high frequency of storms large enough to overwash the planned project. A period of low storm activity post-project could promote vegetation establishment and dune-building that would further increase the magnitude of the storm needed to overwash the island. Conversely, several large storms could erode the island much faster than predicted, causing a breach before the long-term project could be implemented. Hence, both piping plover advocates and shoreline stabilization interests retained fundamental uneasiness with the plan.

The solution lay in incorporation of a monitoring and action plan to detect and respond to island changes that might depart substantially from those intended. This plan specifies monitoring, including island topography, overwash activity, plover distribution and productivity, vegetation, and fox distribution to be conducted until the long-term restoration is implemented. Quantitative "performance indicators" were established to define unacceptable impacts to both piping plovers and breach risk, and fundamental principles regarding the mitigation strategies that might be employed were outlined. While it is hoped that additional manipulation of the island will be unnecessary, the extreme sensitivity of overwash processes to small changes in topography, the substantial reductions in naturally functioning coastal processes over the plover's range, and the concerns for protection of shoreline property make this adaptive management plan an essential project component.

Conclusions

Given uncertainties about future storm patterns and effects on the island, it is likely that all participants in this consultation retain some apprehensions about the project plan. From a piping plover conservation perspective, these concerns are magnified by the coastwide practice of artificially creating and maintaining mature dunes, thereby inducing a widespread shortage of preferred plover breeding habitat. While we believe that this plan minimizes the probability of accelerating succession of plover habitat on northern Assateague, the residual risk would be considerably less worrisome from a species' survival perspective if other projects incorporated similar restrained design and provisions for adaptive management. Unfortunately, this project is the exception, not the rule in that regard.

It is critical to recognize that the efficacy of the above described six factors is profoundly dependent on the *quality of implementation*. The fundamental underlying determinant of this Section 7 consultation's outcome was the good faith participation of all agencies. Collecting, exchanging, reviewing, and discussing baseline information and draft documents represented a major time commitment. We are hopeful that consultation on alternatives to provide long-term restoration of the Assateague Island sediment budget will be able to build on the short-term restoration consultation.

This project, scheduled for construction over a two to three year period, may not be initiated until fall of 1999, and actual project impacts may not be determinable until several years after its completion. As the ultimate "success" of this Section 7 consultation lies in the post-project impacts on the plovers, full evaluation is not yet possible. We are cautiously optimistic that this project will achieve its objectives, including conservation of the piping plovers on northern Assateague Island.

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Perspective

Going Through the Motions: Fish & Wildlife Service's Critical Habitat Moratorium

Heather Weiner

Abstract

Critical habitat is an unused but potentially powerful tool to achieve recovery of endangered species. Unfortunately, none of the almost 180 species listed in the last 2 years has had its critical habitat identified or even proposed. The U.S. Fish and Wildlife Service is using every excuse to avoid designating and protecting critical habitat as intended by Congress. Service officials have come out of the closet and admitted that they have no intention of designating critical habitat, unless under court order. But even court orders may have limited influence since Service officials convinced Congress to limit funding for new listings and critical habitat designations. With adequate funding, enforcement, and good public relations, critical habitat designation could provide both public and private resource managers with the clear guidance needed to recover our nation's declining wildlife.

The Endangered Species Act (ESA) equips us with tools to combat habitat loss and encourage habitat restoration, but one tool, critical habitat designation, sits rusting in the toolbox while the U.S. Fish and Wildlife Service (FWS) uses every rationale to avoid implementing this potentially powerful section of the law. FWS's self-imposed moratorium on the designation of critical habitat has become painfully obvious. None of almost 180 species listed in the last two years has had its critical habitat identified or even proposed.

Behind closed doors, FWS officials successfully lobbied Congress to zero-out appropriations for critical habitat designations in the 1998 and 1999 budgets. The Clinton Administration is now coming out of the closet and admitting that it has no intention of designating critical habitat for any species unless under court order (FWS 1998). FWS's excuses for its critical habitat moratorium—impossibility, no added benefit, increased threat, and expense—are weak justifications for avoiding politically difficult but ecologically important decisions.

How critical is critical habitat?

How critical is critical habitat? Habitat is food for breeding Steller sea lions (*Eumetopias jubatus*) in the Gulf of Alaska and the Bering Sea. The National Marine Fisheries Service (NMFS) designated critical habitat for this highly endangered marine mammal in 1993. Critical habitat is a zone around key islands where the sea lions mate, feed, and raise pups (see Figure 1). A published map detailing critical habitat zones alerts the public, commercial fisheries, and the agencies that regulate them, that those areas are of great biological importance to the sea lion.

Critical habitat designation includes, however, much more than just lines on a map. Congress defined critical habitat as "the specific areas within the geographical area occupied by the species... on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection" (16 U.S.C. §1532 (5)(A)). In this case, the sea lion's food sources–pollock, Atka mackerel and Pacific cod–are essential features of its habitat. Environmentalists are now arguing in Greenpeace v. NMFS that industrial trawlers are netting too many fish within the designated zones, thus adversely modifying critical habitat and undeniably hindering the recovery of the Steller sea lion.

The overall purpose of critical habitat is to provide a safe and healthy area for the recovery of a declining species. Even if an area is not currently occupied by a species, it may still be protected if the area is "essential for the conservation [i.e. recovery] of the species" (16 U.S.C. §1532 (5)(A)). For instance, when the U.S. Forest Service (USFS) wanted to allow a mine near designated critical habitat for salmon in Idaho, it argued that because no salmon were currently in the critical habitat streams

the proposed mine would cause no harm. The court in Idaho Rivers United v. NMFS disagreed. "[T]he temporary absence of the species (due to water quality problems associated with the [previous] Blackbird Mine) does not provide a basis for allowing further degradation of critical habitat. Were that the case, the species would never be able to return."

The court was correct. Without designating, protecting, and revitalizing critical habitat, we confine dangerously low numbers of endangered wildlife to degraded areas. Without protecting areas in which growing populations may expand, endangered species recovery becomes much more difficult and unlikely

Going through the motions

Despite the crucial nature of critical habitat, FWS has refused to provide habitat protection unless under court order. Few terrestrial species have had critical habitat designated in the last few years, even though the ESA requires the Secretary of Interior to designate critical habitat at the same time as a species is listed as endangered or threatened.

The ESA allows only two exceptions: (1) designation may be postponed for one year if critical habitat is not immediately "determinable," or (2) critical habitat designation may be denied if the designation is "not prudent." FWS itself explained that "not prudent" would occur in either of two rare situations: (1) identification of critical habitat is expected to increase the degree of threat to the species (such as through poaching by collectors or deliberate vandalism); or (2) such designation of critical habitat would not be beneficial to the species (50 CFR §424.12(a)(1)).

The Federal Register shows that all of the 178 species added to the endangered species list by FWS from April, 1996 through April 1998 have fallen into one of these two categories. Of the 178 newly listed species, 112 are supposedly in danger of over-collection or vandalism, and the other 66, according to the Service, would receive no added conservation benefit from critical habitat designation (see Table 1).

It seems unlikely that 100% of all newly listed species truly deserve to be in these two limited categories. Congress intended that these loop-

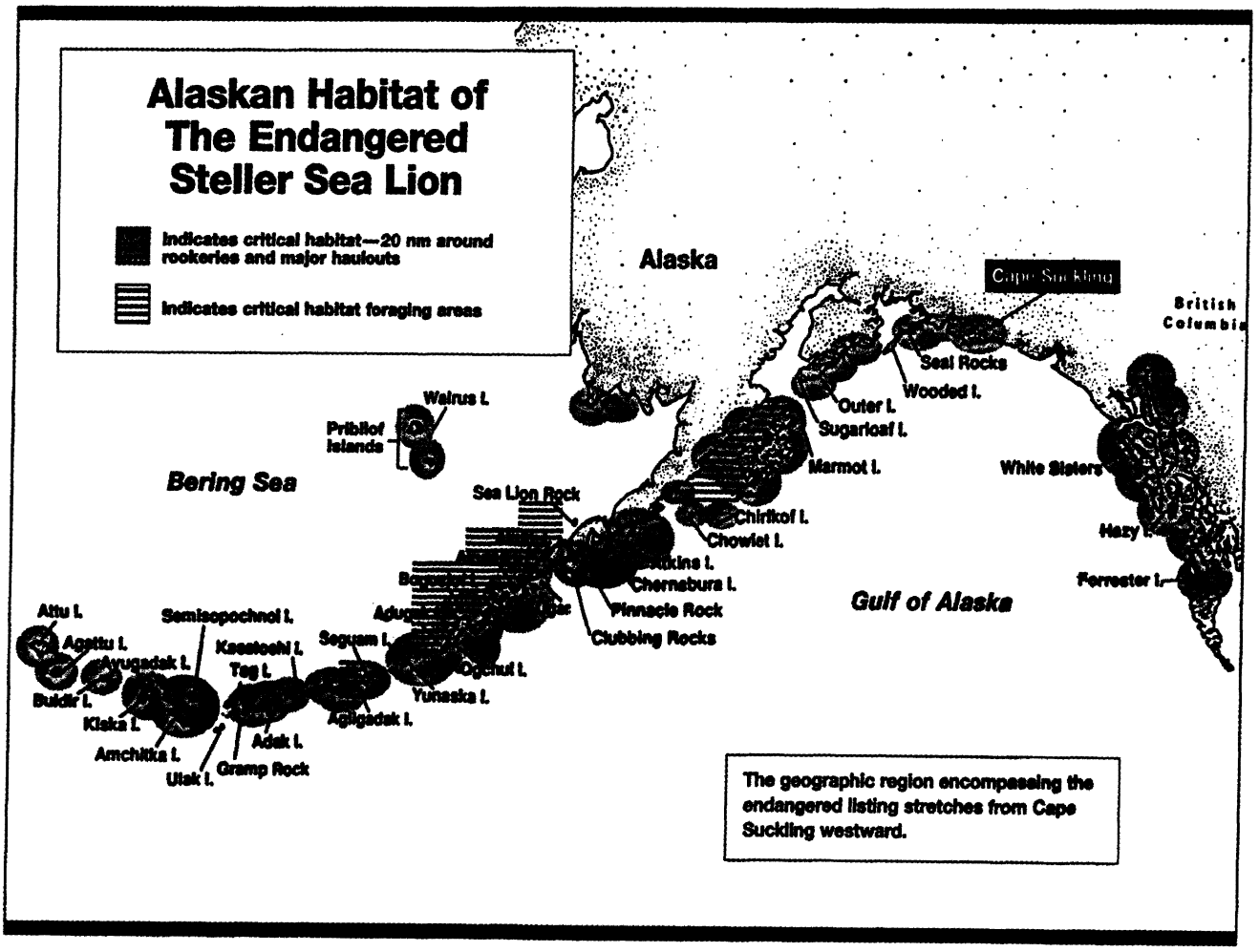

Figure 1. Alaskan habitat of the endangered Steller sea lion (*Eumetopias jubatus*) (reprinted with permission from Greenpeace).

Table 1. Reasons for not designating critical habitat for the last 178 newly listed species.

Species type	*Vandalism/ collection*	*No conservation benefit*
Mammals	*7*	*1*
Birds	*1*	*0*
Aquatic/fish	*7*	*13*
Plants	*95*	*52*
Insects	*2*	*0*
TOTAL	*112*	*66*

holes be used sparingly: "It is only in rare circumstances where the specification of critical habitat concurrently with the listing would not be beneficial to the species" (U.S. House Report 1978). FWS has stretched the rare exceptions into the rule as it goes through the motions of barely implementing the law.

The FWS "impossibility" rationale

FWS officials often blame funding constraints for their 0-178 record. For example, in Southern Utah Wilderness Alliance v. Babbitt, the FWS is refusing to comply with a three-year-old court order to make final critical habitat decisions for two species of fish, the woundfin minnow (*Plagopterus argentissimus*) and Virgin River chub (*Gila seminuda*), in Utah's Virgin River. FWS contends that its scarce funding is already dedicated to listing decisions, and that Congress prevents the court from ordering the agency to spend more money on the program, making new critical habitat designations impossible. Few people realize that FWS, itself, manufactured this "impossibility."

The impossibility rationale originated when Congress first prohibited the expenditure of *any* money for final listing decisions or critical habitat designations from April 1995 through April 1996. (Critical habitat, like listing, is a "Section 4" activity and is funded under the same line item.) Initiated by Sen. Kay Bailey Hutchison (R-TX), the listing and critical habitat "moratorium" was in part a reaction to the proposed designation of critical habitat for the golden-cheeked warbler in Texas. The Service quickly withdrew the proposal in October 1994, after public allegations that 20 million acres in 33 Texas counties would be condemned by the designation (FWS 1995). (In fact, golden-cheeked warbler habitat is actually a fraction of this area, and critical habitat designation has no direct impact on private lands). Despite the withdrawal, Congress brought all final listings and designations to a screeching halt.

When the listing and critical habitat moratorium was lifted, FWS had accrued a backlog of proposed listings for 243 species. With a mere $5 million appropriated by Congress for the 1997 fiscal year, FWS scrambled to come up with a solution to the backlog. The short-term answer was to develop a priority system for the listing program. According to FWS, which recently continued this priority system through fiscal year 1999, the guidelines are necessary to "guide the allocation of limited listing resources" (FWS 1998). The Service's most recent guidelines prioritize all listing activities into three tiers. Emergency listings are in Tier 1; final listing decisions, candidate decisions, petition processing, and down-listing and delisting species are in Tier 2. Critical habitat designations are alone in the third and last tier. Because FWS's limited listing funds are spent on the first two tier activities, the critical habitat backlog swells with each new listing decision. As of April 1998, the Federal Register showed that only 118 of 1135 species listed in the U.S. have designated critical habitat.

For the fiscal year 1998 budget, rather than ask for more money to repair the ailing listing and critical habitat program, FWS exacerbated its own funding situation. First, the Service asked for a tiny budget increase of $0.19 million for the listing program, for a grand total of $5.19 million for the entire year - less than 7% of the entire endangered species budget, and less than any other agency budget request since the Bush years (see Figure 2). Second, the Service's own officials actively lobbied for a legislative cap on that money. The result is legislative language prohibiting the Department of Interior from spending more than $5.19 million on all listing and critical habitat activities in fiscal year 1998. The intention of the cap is to prevent courts from ordering the Service to transfer money from other Department of Interior (DOI) programs—such as travel or construction line items—into the listing and critical habitat program.

FWS officials have candidly admitted that they requested the cap to prevent a "critical habitat meltdown." Their explanation is that court orders from the many active and pending critical habitat lawsuits could impinge upon DOI's budget. By tying its own hands, the Service hopes the courts will consider critical habitat designations legally "impossible."

According to staff of the Interior Subcommittee for the House Appropriations Committee, Congress initially resisted the legislative funding cap. A late night phone call from FWS officials to the chairman of the subcommittee did the trick, but Con-

gress noted its misgivings in the Congressional Record. "As requested by the Department of Interior, the managers reluctantly have agreed to limit statutorily the funds for the endangered species listing program" (Congressional Record 1997).

To make matters worse, for fiscal year 1999, FWS has requested cap language that limits funding only for protective activities. FWS has moved politically popular activities such as delisting and down-listing, as well as listing of foreign species, to other line items with much greater and uncapped funding. The politically difficult decisions, such as listing, up-listing and critical habitat designation, would be capped at a measly $7.41 million (U.S. Department of Interior 1998).

FWS officials believe that this one-two punch—the priority system plus a legislative cap on grossly inadequate funding—knocks out any chances for critical habitat designation for those listed species still without critical habitat and for any species newly listed in the next year.

The "no added benefit" rationale

If FWS has tied its own hands by lobbying for less funding, then it has built its own guillotine with the "no added benefit" excuse. As mentioned above, 66 of the 178 newly listed species have no critical habitat because FWS decided critical habitat would not be beneficial, and therefore "not prudent." FWS's explanation of its decisions is a classic "heads I win, tails you lose" shell game.

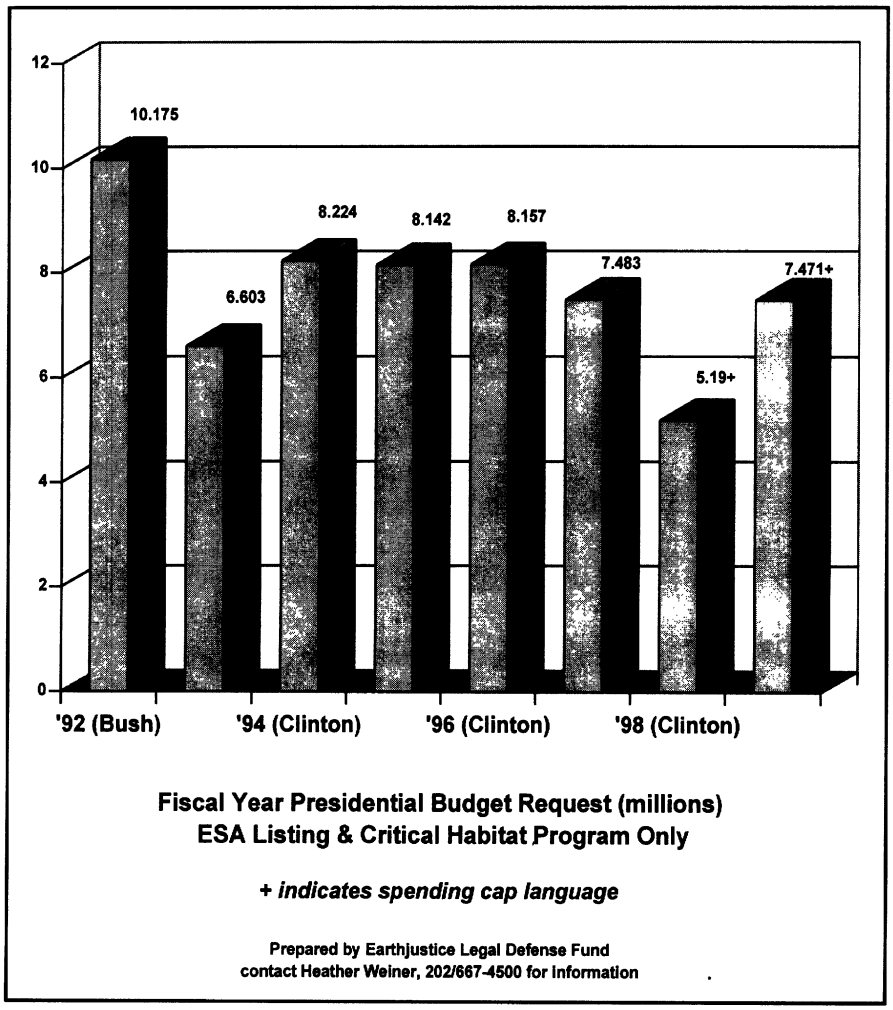

Figure 2. Endangered Species Listing and Critical Habitat Program–Presidential budget requests.

Not On Our Federal Lands

In about half of these critical habitat decisions, FWS concluded that the species occur primarily on federal lands, so that critical habitat provisions duplicate the protections already provided by Section 7 of the ESA. Section 7 of the ESA prohibits federal agencies from doing two things: "adversely modifying or destroying critical habitat" and "jeopardizing the continued existence" of a listed species. Congress intended these to be two different legal standards, but in 1986 the Reagan Administration issued new regulations giving them similar definitions:

JEOPARDY: An action that would "reduce appreciably the likelihood of *both the survival and recovery* of a listed species."

ADVERSE MODIFICATION: "A direct or indirect alteration that appreciably diminishes the value of critical habitat for *both the survival and recovery* of a listed species" (emphasis added, 50 CFR §402.02).

These standards did not meld into one immediately. When it designated critical habitat for the northern spotted owl in 1992, the Bush Administration explained that the standards were still different:

"The Act's definition of critical habitat indicates that the purpose of critical habitat is to contribute to a species' conservation, which by definition equates to recovery. . . Thus, the adverse modification standard may be reached closer to the recovery end of the survival continuum, whereas, the jeopardy standard traditionally has been applied nearer to the extinction end of the continuum" (FWS 1992).

As recently as 1994, FWS asserted that protection of critical habitat "may shorten the time needed to achieve recovery" (FWS 1994).

For the last few years, however, the Clinton Administration has changed course and argued that any

Figure 3. Stellar sea lion (*Eumetopias jubatus*). Photo courtesy of Greenpeace.

federal action that would meet the adverse modification standard would also trigger the jeopardy standard. The collapse of the two prohibitions into one low standard plainly ignores the intent of Congress and emasculates several sections of the statute which Congress clearly viewed as important.

The 9th U.S. Circuit Court of Appeals is currently considering a legal challenge to this regulatory collapse in American Rivers v. NMFS. Conservationists are suing NMFS for ignoring the adverse effects of hydroelectric dams on salmon critical habitat in the Columbia River Basin. In its analysis of whether the dams "jeopardize" the these salmon species, NMFS asserts that immediate survival is an adequate standard (NMFS gives salmon in the Columbia River Basin as low as a 50% chance of recovering). Although the agency analyzed how many fish would survive the trip around the dams, often in barges or trucks, NMFS ignored the impacts of the dams and their reservoirs on many essential features of salmon critical habitat (water quantity, substrate, cover/shelter, food, vegetation, space, and spawning gravel). Environmentalists argue that consideration and protection of critical habitat is needed to recover, and eventually delist, the salmon.

Not on our private lands either

FWS declined to designate critical habitat for the rest of the 66 "no added benefit" species because those species occurred primarily on private lands. FWS claims that because critical habitat protections apply only to federal activities, critical habitat designation would result in little benefit for species found on private lands. The court recently rejected this argument in Conservation Council of Hawai'i v. Babbitt, in which FWS refused to designate critical habitat for 245 plant species in Hawai'i: "[E]ven if no federal activity currently occurs on the land, there may be such activity in the future."

Indeed, the newest and most common federal activity in endangered species habitat on private lands is FWS's approval and issuance of Habitat Conservation Plans (HCPs, or incidental take permits). HCPs authorize private landowners to modify and destroy endangered species habitat through timber harvesting, agriculture, development, mining, or other land uses. Fish and Wildlife Service estimates that "By 2002, 27 million acres of habitats for endangered and threatened species, and species of concern, [will be] included in Habitat Conservation Plans" (FWS 1997).

The only existing lawsuit concerning an HCP challenges a luxury condominium resort for adversely modifying Alabama beach mouse (*Peromyscus polionotus*) critical habitat. Although the condominiums do not rest directly on top of the frontal dunes designated as critical habitat, they do open the fragile dunes

up to foot traffic from thousands of visitors. In addition, four huge condominium towers are being constructed between the frontal dunes and secondary dunes blocking beach mouse passage between these areas during and after storm flooding. In effect, the beach mouse's critical habitat is rendered useless by the construction permit. Although FWS argues in Ft. Morgan Civic Association v. Babbitt that the beach mouse can survive a few months of construction activity, scientists are now wondering if the mouse will ever be able to recover without use of critical habitat.

The "increased threat" rationale

The most often-used excuse, increased threat of vandalism or overcollection, is difficult to argue - few want to increase the possibilities for poachers or collectors. In Conservation Council of Hawai'i v. Babbitt, the District Court for Hawai'i threw out this rationale for not designating critical habitat for 245 highly endangered plant species, stating that FWS needed to provide more than just speculation of increased vandalism or collection. In the court's mind, critical habitat has both benefits and drawbacks. "FWS must consider whether designation may prevent an inadvertent act of destruction as well as whether it may encourage a deliberate act of destruction." The imagined threat of vandalism must be weighed against the known benefits of notification to the public and to federal agencies.

FWS has generated internal policy guidance for the "increased threat rationale" because it is so heavily used. Responding to the 9th Circuit Court's directions in NRDC v. U.S. Department of Interior to reconsider designating critical habitat for the California gnatcatcher, FWS recently began requiring better documentation of increased threats. But little documentation, beyond unconfirmed anecdotes, really exists. For example, one of the few plant species with designated critical habitat in Hawai'i, Carter's panicgrass (*Panicum carteri*), is located on a small island in Oahu that is easily accessible to the public. Despite the fact that this habitat has been designated for over 14 years, there have been no reports of increased vandalism or collection. In fact, FWS regional staff admit that, at the very least, critical habitat designation alerts private landowners that they may need an incidental take permit and helps prevent unauthorized habitat loss.

The expense excuse

Why has the Clinton Administration made an unofficial policy decision to stop funding and implementing the critical habitat requirements of the Endangered Species Act? One mythical mantra repeated throughout the departments and Congress is that critical habitat designations are prohibitively expensive. As FWS explains in its 1999 budget justification, "Critical habitat designations are extremely costly, and many more species could be protected and conserved through listing actions." The Service has imagined that "a single critical habitat designation could consume up to twenty percent of the total listing appropriation," i.e., $1 million (U.S. Department of Interior 1998).

In truth, critical habitat designations are usually quite light on the agency's budget. NMFS has made considerable progress in designating critical habitat in the last 18 months, either proposing or finalizing critical habitat designations for wide-ranging species like the Umpqua River cutthroat trout (*Onchorhynchus clarki*), green and hawksbill sea turtles (*Chelonia mydas* and *Eretmochelys imbricata*, respectively), and coho salmon (*Onchorhynchus kisutch).* NMFS officials have privately confirmed that the cost of critical habitat designation may involve only internal staff time. The math is simple: two months of time from a $90,000 full time employee is a mere $15,000.

In some cases critical habitat designation can be costly, especially when the agency uses outside consulting firms or universities to survey and map species habitat and to conduct the legally required economic analysis. The northern spotted owl (*Strix occidentalis caurina*) critical habitat designation has been estimated to cost about $1 million, but few species provoke the incredible public scrutiny that the spotted owl did. In addition, the 10th Circuit Court of Appeals recently affirmed that an environmental assessment (or, in some cases, Environmental Impact Statement) must be completed for critical habitat designations pursuant to the National Environmental Policy Act. (Catron County v. FWS).

Nevertheless, occasionally high price tags are not reasonable justifications for shirking the law. Simply put, FWS should stop requesting inadequate appropriations and reinvent how it handles critical habitat. Streamlining the bureaucracy by using agency economists, scientists, and geographers to do the required analysis saves both time and money. NMFS had its in-house economists and biologists do the analysis for the green and hawksbill sea turtle critical habitat designation, and FWS used the United States Geological Survey and its Biological Research Division (formerly the National Biological Survey) to do the mapping and economic analysis for the Mexican spotted owl critical habitat. In fact, FWS's costs from losing numerous court battles over critical habitat designation are probably

greater than the costs of going ahead and designating critical habitat when it is legally required.

Critical issues for critical habitat

It should come as no surprise that the real reason the Clinton Administration refuses to designate and enforce critical habitat is that, like most environmental issues, critical habitat is viewed through a political prism. Critical habitat designation draws a circle around an individual's property and without proper information, it might look like the walls are closing in. It is no wonder Rep. Frank Riggs (R-CA) wanted to waive designation of marbled murrelet critical habitat in the redwoods owned by the Maxxam Corporation, now known as the Headwaters forest.

We forget that Rep. Riggs' efforts in the 104th Congress to pass a critical habitat exemption for the Headwaters forest failed by a resounding 257-164 vote (LCV Scorecard 1996). We also forget that the majority of Americans (84% according to recent polls) support current or stronger endangered species laws (Czech and Krausman 1997). Yet the Clinton Administration backed an ESA reauthorization proposal to expand the exemptions for critical habitat designation (Senate bill 1180), and continues to use all possible excuses to avoid implementing this section of the law.

No matter how FWS twists the arguments, it is clear that critical habitat on public lands, private lands, and in our oceans is important. Increased threats and expenses are pretexts for an Administration frightened by political controversy. With proper funding, enforcement, and good public relations, critical habitat could provide both private and public resource managers with the clear guidance needed to recover endangered species.

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In Response

Endocrine Disrupters and Bald Eagles: A Response

Robert W. Risebrough

I should like to thank the editor of the *Endangered Species UPDATE* for the opportunity to comment on the article "Endocrine Disruption: Hidden Threats to Wildlife" by Michael Smolen and Theo Colborn of the World Wildlife Fund in the September/October 1997 issue. The conclusion of this article is that a very wide range of wildlife species is now threatened by a diverse assortment of synthetic chemicals in the environment. Their effects are initially hidden but in the longer term reproductive abnormalities and disruptions in other essential life processes result from the "stealth damage caused by interference with endogenous messengers" (Smolen and Colborn 1997:10).

Thirty years ago, this statement would have been at least partly true, with an important qualification: the effects at that time were hardly hidden. Peregrine falcons (*Falco peregrinus*) had become extinct as a breeding species over half of the country. Bald eagle (*Haliaeetus leucocephalus*) populations were rapidly declining. The state bird of Louisiana, the brown pelican (*Pelecanus occidentalis*), once numerous, was no longer breeding in the delta of the Mississippi. Everywhere, fish-eating birds were in trouble. A process of extinction, without precedent in evolutionary history, was threatening the integrity of ecosystems.

In 1968, six years after *Silent Spring* (Carson 1962), there was as yet little control over the application of vast quantities of the chlorinated hydrocarbon pesticides then still in widespread use; polychlorinated biphenyls (PCBs), not yet known to be environmental contaminants of greater significance than the biocides, could be purchased in railway-car amounts for incorporation into a diversity of industrial products.

In that year, the spraying programs to "eradicate" Dutch elm disease in Milwaukee were continuing to kill countless numbers of songbirds, prompting a group of citizens to petition the Wisconsin Department of Natural Resources. The Hearing Examiner ruled that he had no legal authority to stop the spraying program, but pointed out that a law on the Wisconsin books prohibited the use in that state of any substance that, as a consequence of its use, entered the waters of the state and caused harm to wildlife. The stage was set for a confrontation between the environmentalists, represented by the Environmental Defense Fund, and the pesticide industry. In less than a decade the uses of the major chlorinated hydrocarbon pesticides had ended in the USA and most of the other industrialized countries; PCBs were no longer manufactured in North America and a process, inevitably imperfect, to prevent future 'PCBs' (chemicals that are persistent, mobile in the environment, with unpredictable biological activity) was implemented by the Toxic Substances Control Act.

Recovery of the wildlife populations affected by these contaminants, although dramatic for peregrine falcons and most populations of the bald eagle, has not happened overnight, and is not yet complete. Environmental contamination by the persistent biocides, although declining, continues to affect populations of sensitive species. How then are the remnant 'old' effects, those caused by the chemicals whose uses ended a generation or more ago, to be distinguished from the 'new' "hidden threats" that are the subject of the article by Smolen and Colborn

The example of a 'new' threat that is discussed in greatest detail is the continuing lower productivity of bald eagles nesting on the shores of the Great Lakes, even though "Eggshell thinning and outright mortality are no longer visible" (Smolen and Colborn 1997:6). The balance of the scientific evidence, however, indicates that this is a remnant 'old' effect; in part, the evidence comes from a population of bald eagles reintroduced to Santa Catalina Island in southern California that continues to suffer from severe effects of contamination by DDE, the environmental derivative of DDT that has been responsible for all, or almost all, of the eggshell thinning documented since 1946. The argument derives from multiple sources.

1) The bald eagle was the first species for which an effect at the population level induced by an environmental contaminant was documented. A retired Canadian banker, Charles Broley from Winnipeg, began to band nestling bald eagles in Florida in 1939. By 1946, he had reached 150 young eagles a year. But in 1947 the number of young eagles dropped sharply and continued to drop in the following years (Broley 1958).

2) Beginning abruptly in 1947, the weights of eggshells and the eggshell thickness of Florida bald eagles dropped by 15-19 % (Hickey and Anderson 1968; Anderson and Hickey 1972), coinciding with the sudden depression of productivity observed by Broley.

3) The eggshell weight and the shell thicknesses of other species of raptorial birds also declined abruptly in 1947 in other areas of North America (Hickey and Anderson 1968; Anderson and Hickey 1972) and in Britain (Ratcliffe 1967).

4) Like the brown pelican and the prairie falcon (*Falco mexicanus*), the bald eagle is very sensitive to DDE. Reproduction invariably fails whenever concentrations in the eggs exceed a few parts per million, whether the relationship is expressed logarithmically with a pronounced effect even at the lowest levels of DDE (Wiemeyer et al. 1984, 1993) or by a model that assumes a minimum effect at the lowest levels with a sharp decrease above a threshold (Nisbet 1989).

5) Unlike species such as the brown pelican, whose eggs break above a critical level of thinning thereby accounting for a major portion if not all of the reproductive failures, productivity of bald eagles is, unexpectedly, not related to shell thinning, but is nevertheless strongly related to DDE concentrations (Nisbet 1989). This DDE effect on reproduction is therefore distinct from eggshell thinning.

6) Bald eagles disappeared from the southern California islands during the 1950s (Kiff 1980) when wastes from a DDT factory in Los Angeles, containing many tons of DDT, were taken in barges to sea throughout the 1950s for offshore dumping. Following recovery of the brown pelicans in the mid-1970s, they were reintroduced to Santa Catalina Island beginning in 1980 by David Garcelon of the Institute for Wildlife Studies. The first egg appeared in 1987, but it broke shortly after being laid. Shell fragments with portions of the yolk were retrieved for analysis in my laboratory. The California Bald Eagle Working Team was to meet the following week on Santa Catalina Island; there was a certain urgency to report both the contaminant levels and the degree of shell thinning. On a lipid basis DDE concentrations were five times higher than the threshold level of reproduction effects. On the day of the meeting, Sam Sumida of the Western Foundation of Vertebrate Zoology, measured shell thickness. It was almost normal. We had no explanation why the egg had broken. In 1988 a second female produced an egg which also broke in the nest almost immediately after being laid. Its shell thickness was also almost normal, and the DDE levels were high (Garcelon et al. 1989; Jenkins et al. 1994).

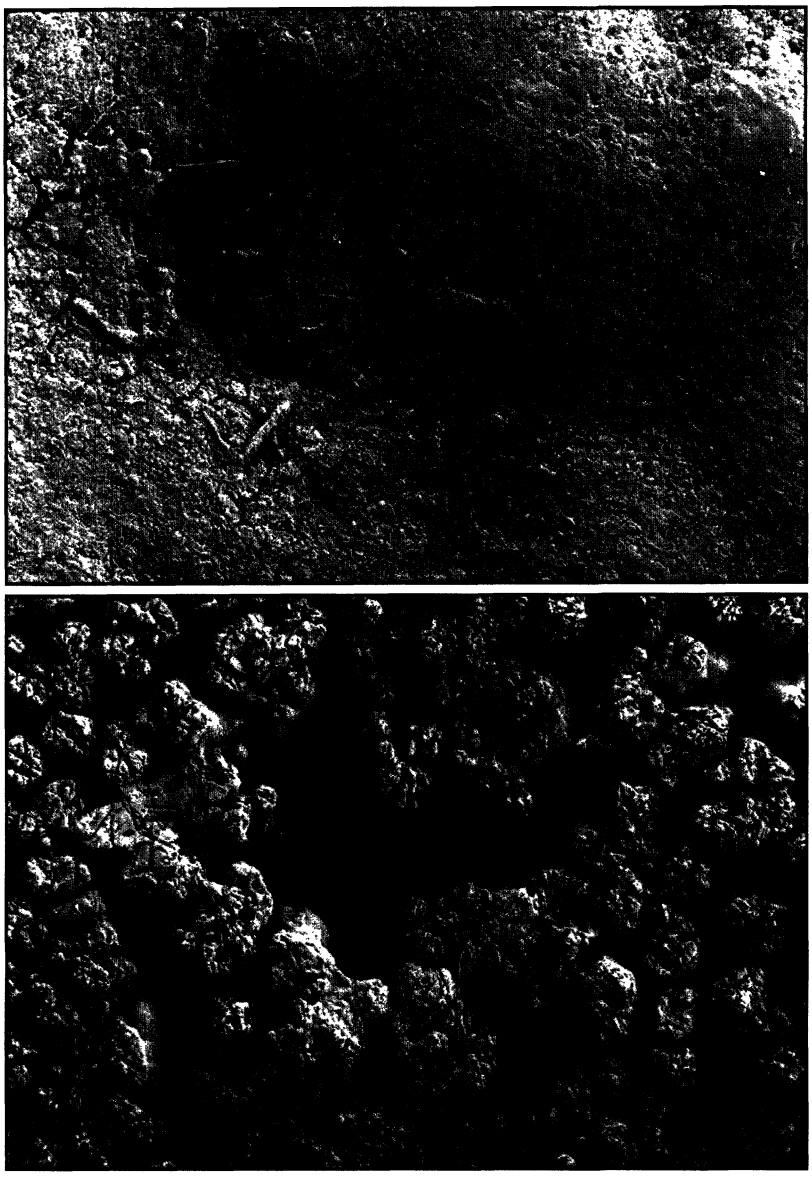
7) Thereafter eggs have been collected as soon as possible for artificial incubation, initially at the Santa Cruz Predatory Bird Group and currently at the San Francisco Zoo. Only if exhaustive measures are taken to control the rate of water loss from the egg is the embryo able to survive. David Garcelon reports that one of this year's breeding males was hatched in 1992 from a deformed egg artificially incubated by the Santa Cruz Predatory Bird Group in 1992 while his parents incubated a dummy egg on Santa Catalina Island. Like his parents before him, he and his mate incubated dummy eggs after their own deformed eggs were removed. This year's chicks, however, died at the pipping stage, despite all the efforts of the zoo personnel to nurse them through the hatching process (D.K. Garcelon, personal communication).

8) Scanning electron microscopy detected small areas of gross structural abnormalities of the eggshell (Figures 1 and 2), associated with gross changes of the organic crystallization sites on the eggshell membrane (Bland 1990; Risebrough 1993). The rapid rate of water loss and the embryonic deaths were thereby explained; these structural abnormalities could also have produced a weakening of the eggshell that resulted in breakage in the absence of any significant thinning.

9) There are no DDE effects on the structure and thickness of eggshells of many bird species. Particularly if the primary effect of DDE is on the organic crystallization matrices, a 'disruption' if any of an endocrine function could be a secondary effect. Moreover, virtually any metabolic function is related one way or another to an endocrine activity. In this context therefore, the use of the term 'endocrine disruption' in the absence of any definitive demonstration of the cause(s) of eggshell thinning and structural abnormalities would not appear to be justified.

10) The number of young bald eagles fledged per breeding pair in the Great Lakes and along rivers supporting runs of anadromous fish increased from 0.23 in 1977 to 0.87 in 1993 (Bowerman 1993). A goal of 1.0 young fledged/occupied nest has been established by the Northern States Bald Eagle Recovery Plan (Grier et al. 1983). This recovery is remarkable, particularly to those of us who were bird-watching on the shores of the Great Lakes in the 1950s and who followed the later population declines of bald eagles with dismay and alarm. Smolen and Colborn, however, look at the remaining 13% of the unfilled glass and predict catastrophe.

It is not therefore necessary to evoke a hypothesis that new, even more insidious, chemicals with "hid-



Figures 1 and 2. Scanning electron micrographs of a fragment of an eggshell from Pinnacle Rock on Santa Catalina Island, 1992. A depression on the outer surface (above), associated with sites of water loss during incubation, is paired with a reduction in calcification on the inner surface (below). From Risebrough (1993); micrographs by Dana Bland.

den" effects will threaten the future survival of the national emblem. The low production of young eagles in Florida beginning in 1947, the continuing lower production on the shores of the Great Lakes, and the absence of any natural reproduction in the marine environment of southern California can all be considered as 'old' effects. Until DDE contamination drops further in the Great Lakes, depression of bald eagle reproduction will continue. As long as the Institute for Wildlife Studies is able to continue its program in southern California, the bald eagle population will be maintained–and continue to fly free in the Channel Islands–until the DDE contamination finally clears. Meanwhile, the defective eggshells will continue to provide a living example of an unpredictable deleterious effect of an environmental contaminant.

Each of the other 'new' effects cited by Smolen and Colborn deserves a comparable, detailed comment for which there is no space in this issue of the *Endangered Species UPDATE*. Certainly, something happened to the sexuality of the alligators of Lake Apopka in Florida; was this, however, an 'early warning' of a new universal environmental threat or a unique, local event? A possibility that the effects were local only comes from a recent report (Semenza et al. 1997) that the nematicide DBCP had been manufactured at a nearby pesticide manufacturing facility. Like the dieldrin and related biocides from a factory on the Rhine that killed seabirds along the Netherlands coast, and like DDT in factory wastes in Los Angeles and Alabama that grossly contaminated local environments, DBCP from factory waste could have entered the waters of Lake Apopka. This pesticide was banned in the US when it was found to cause sterility among male workers in California (unused supplies were then sent, shamefully, to Costa Rica). Hopefully, experiments to resolve this question are currently underway.

Smolen and Colborn mention the "feminization and de-masculinization of male birds", referring to a study by Ian Nisbet and his colleagues of common terns of a colony in New Bedford Harbor that is highly contaminated by PCBs (Nisbet et al. 1996). The "feminization" refers to the appearance of female-type cells in the testes of male embryos. Not mentioned is that the degree of feminization could not be correlated with the concentrations of contaminants, and that so far at least it has been reported only in embryos; whether or not the phenomenon in this colony is related to contaminants is yet to be demonstrated. For the layman it is reasonable to believe that "reproductivity and survivorship are compromised" in this population of terns, but a scientist can hardly make such a statement in the absence of any supporting information. The production of young is high, and the colony has survived many years of high contamination.

Documentation of the existence of feminized adult male com-

mon terns, or of any other species of birds for which "feminization" has been claimed, would be the critical first step in the establishment of credibility.

The argument for simplified technologies with fewer, or no, synthetic chemicals has its own, defensible, rationale. It is not, however, the same argument that prompted the DDT hearings in Madison thirty years ago, - that persistent, mobile, bioaccumulating and biologically active chemicals such as DDT and the PCBs have no place in the longer-term technology. This technology does have room for any combination of synthetic chemicals that does not threaten either human health or wildlife. The public interest requires that all participants in the continuing debates about synthetic chemicals distinguish between these two separate and distinct arguments.

The chemical analysis of environmental samples, however, continues to detect unidentified contaminants of undetermined significance. Chromatograms frequently contain many more peaks representing unidentified organic contaminants than peaks that have been identified in previous programs. Older chemists remember the first electron capture chromatograms in the 1960s with the unidentified peaks that turned out to be the PCBs. Vigilance to protect both wildlife and human health from any unanticipated effect of chemical technologies is required now more than ever. But the most significant of the "new threats" to wildlife proposed by Smolen and Colborn are already a half-century old and should not be confused with unanticipated effects of newer chemicals.

Serious and important issues therefore remain. The argument, for example, that genetic defects alone can not account for the abnormalities in the Florida panther population, and that one or more contaminants might be involved, deserves to be expanded. Meanwhile, however, in the absence of supporting data, the central thesis of Smolen and Colborn—that many wildlife species, including populations of endangered species, are now threatened by new 'hidden' factors—lacks credibility.

Acknowledgments

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NEWS FROM ZOOS

News ABOUT Zoos

More than 122 million people visited AZA (American Zoo and Aquarium Association) member zoos and aquariums in 1997. That attendance exceeds the number of individuals who attended professional football, basketball, ice hockey, and baseball games combined.

Professional Sports Attendance 1997

National Football League (NFL 1998)	19,490,886
Major League Baseball (MLB 1998)	63,168,689
National Hockey League (NHL 1998)	17,640,529
National Basketball Association (NBA 1998)	21,656,348
TOTAL:	121, 956,452

Harpy Eagle Released in Panama Rainforest

An endangered Harpy eagle (*Harpia harpyja*), hatched at the San Diego Zoo last October, was successfully released into the Panamanian rainforests in May as part of a captive breeding and re-introduction effort. The national bird of Panama, its population began to decline after the construction of the Panama Canal in 1914. Its slow reproductive rate and large home range made it one of the first species to be virtually eliminated due to human activities (such as deforestation and poaching). Today only a few nesting pairs are known to remain in the Panamanian forests.

Since 1989, the San Diego Zoo and The Peregrine Fund have been working together to release young harpy eagles into its native habitat. A young harpy pair, hatched at The Peregrine Fund's World Center for Bird's of Prey in Boise, Idaho, was released earlier this year. A fourth chick, hatched at the San Diego Zoo this January, will be released later this summer, creating two new pairs of harpy eagles in Panama.

To avoid imprinting on humans, the eagle was fed via a harpy eagle hand puppet. Now, until the birds learn to hunt on their own, biologists place food high in the forest canopy, where the eagles live. Biologists living in the rainforests near the release site monitor the birds daily. Harpy eagle chicks are dependent on their parents for more than two years so biologists fill the released birds' parent role until they mature. Radio transmitters allow scientists to track the birds as they travel through dense forests.

Rare Bongo Antelope Embryos Implanted into Wild Elands

In a new effort to manage and repopulate species of endangered animals, a team of scientists from the Audubon Institute Center for Research of Endangered Species (CRES) are the first to implant frozen embryos from captive animals in one continent into wild animals in another.

The experiment involved freezing 20 microscopic African bongo embryos from CRES and the Baton Rouge Zoo in liquid nitrogen and transporting them to the Mount Kenya Game Ranch, a private wildlife preserve. There, female elands (*Tragelaphus eurycerus*) had two embryos implanted once it was determined that their uteruses were at the right stage to accept the embryos (*Taurotragus oryx*). (Elands occasionally bear twins, so if both develop there won't be a problem.)

Bongos and elands are similar in size but differ in behavior, environment and activity level. As a consequence, the results will be analyzed behaviorally as well as biologically. Since the animals would be reintroduced into the wild from birth, this experiment also negates the criticism of current reintroduction methods—that captive-raised animals may lack survival skills and natural immunity to diseases or suffer from the difficulties of acclimatization.

Team members will return to Kenya in February to gauge the results. CRES members hope the work will continue for the next 5-10 years, with two trips a year.

Information for News From Zoos *is provided by the American Zoo and Aquarium Association.*

Bulletin Board

IUCN Red List of Threatened Plants

More than one out of eight plant species worldwide is at risk of extinction, according to the most comprehensive scientific assessment ever assembled on the status of the world's plants. This announcement was made on April 8 at a press conference at the Smithsonian's National Museum of Natural History as the 1997 IUCN Red List of Threatened Plants was released. The IUCN Red List reveals that 12.5%, or 34,000, of the world's vascular plant species are threatened with extinction

The Red List is available for $45 (plus shipping and handling) from The New York Botanical Garden, Scientific Publications, Bronx, NY 10458-5126; Tel.:(718) 817-8721; Fax:(718) 817-8842); E-mail: scipubs@nybg.org.

U.S. ecosystem assessments

World Wildlife Fund (WWF) has published two assessments regarding threatened ecosystems in the U.S. and how global warming is causing ecological change in U.S. parks and wildlife refuges.

These reports point to the urgent need to reach an international agreement to reduce greenhouse gas emissions, and slow the effects of global warming on the earth's biological diversity. For more information on both of these reports, visit WWF's Web site at http://www.wwfus.org.

The Second Congress of the Mesoamerican Society

July 6-10. The Second Congress of the Mesoamerican Society for Biology and Conservation will be held in Managua, Nicaragua hosted by the Universidad Centroamericana Department of Agricultural Sciences. The 5-day congress will include symposia on: conservation of neotropical migratory birds, management of protected areas, management and conservation of marine turtles, data centers and biodiversity monitoring, and management and conservation of wetlands.

More information is available at http://www.uca.edu.ni/infogral/congresoma.htm or http:www-leland.stanford.edu/group/CCB/News or by contacting the congress organizers, Teresa Zuniga or Ramiro Perez, Apdo. C-211, Managua, Nicaragua; Tel.: (505) 277-2177; Fax: (505) 270-3561; E-mail: perezuniga@sdnnic.org.ni.

Society for Conservation Biology

July 13-16. The annual meeting of the Society for Conservation Biology will be held at Macquarie University, Sydney, Australia. The scientific sessions will consist of a plenary session, "Biodiversity Conservation: Myths and Realities", 22 symposia, four workshops and a number of open sessions. A complete up-to-date list of symposia can be obtained by consulting the Web site at http://www.bio.mq.edu.au/consbio or by writing: Society for Conservation Biology, c/o Key Centre for Biodiverstiy and Bioresources, School of Biological Sciences, Macquarie University, Sidney, NSW 2109, Australia.

Announcements for the Bulletin Board are welcomed. Some items from the Bulletin Board have been provided by Jane Villa-Lobos, Smithsonian Institution.

Endangered Species UPDATE

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