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**Appendix B**  
**Restore Bald Eagles to the Channel Islands**

**Restore Bald Eagles to the Channel Islands**

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Bald eagle restoration throughout the Channel Islands presents a special situation because bald eagles introduced to and currently nesting on Santa Catalina Island continue to exhibit reproductive injuries caused by ongoing exposures to DDTs and PCBs. Also, bald eagles historically inhabited most of the Channel Islands, and we do not yet know if they would have greater success reproducing on islands other than Santa Catalina Island (none of the Catalina Island bald eagles has dispersed to and established territories on any of the other Channel Islands). Thus, selecting restoration actions requires consideration of interrelated factors and depends ultimately on the outcome of the ongoing Feasibility Study for Reestablishment of Bald Eagles on the Northern Channel Islands (NCI), California (MSRP 2002). (This ongoing study is referred to as the “NCI Bald Eagle Feasibility Study” throughout this appendix.) Sections B.3 and B.4 describe and evaluate the two contrasting options for bald eagle restoration that this plan addresses.

**B.1 GOALS AND NEXUS TO INJURY**

The bald eagle is a priority resource for restoration that continues to demonstrate injury from the contaminants of the Montrose case. The overall goal for this resource is for the Natural Resource Trustees for the Montrose case (Trustees) to restore self-sustaining bald eagles to the Channel Islands. Bald eagles historically nested throughout the Channel Islands prior to releases of DDTs and PCBs, but by the early 1960s had disappeared from the area (Kiff 1980). In 1980, a multiagency program reintroduced the birds to Santa Catalina Island but their breeding continues to be impaired by these contaminants. Due to the continued presence of DDTs and PCBs in their environment, it is not yet known to what extent the bald eagle restoration goal is attainable in the near term.

**B.2 BACKGROUND**

Bald eagles were a resident breeding species on all of the California Channel Islands from before the turn of the century until at least the 1930s (Willett 1933, Kiff 1980). Ornithologists and egg collectors reported bald eagles to be common on the Northern Channel Islands between the late 1800s through the 1930s. From the 1800s to 1950, bald eagle nesting areas were reported from a minimum of 35 different locations on the islands, making the Channel Islands a stronghold for this species in Southern California (Kiff 2000). However, due to the lack of systematic surveys, this number is likely an underestimate (Kiff 2000). The last confirmed nesting of an eagle on the Channel Islands was in 1949 on Anacapa Island (Kiff 1980).

Little published information is available regarding the status of bald eagles on the Channel Islands after the 1940s, but a few adult birds continued to be observed on some of the islands into the late 1950s and 1960s. Santa Catalina Island residents remember seeing eagles up until the mid to late 1950s (Kiff 1980, Garcelon 1988). By the early 1960s, bald eagles had disappeared from all of the Channel Islands (Kiff 1980). The timing of the decline of bald eagles on the Channel Islands coincided closely with the extirpation of peregrine falcons and bald eagles from other portions of their North American range as a result of the eggshell thinning effects of DDE (Kiff 2000, Garcelon 1988). The reduction of bald eagle populations in many areas of the country has been correlated with high levels of organochlorine compounds and specifically with DDTs (Stickel et al. 1966, Krantz et al. 1970). Other factors contributing to the decline of bald eagles on the Channel Islands and Southern California included historical

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persecution by humans (egg collecting and shooting) and limited nesting opportunities on the mainland of Southern California due to development and recreation (Kiff 1980).

Raptor species, such as bald eagles and peregrine falcons, are particularly susceptible to these contaminants because they are high-trophic-level predators. Because DDTs and PCBs are slow to break down and are strongly attracted to fats, they bioaccumulate and become more concentrated in animals at higher levels in the food web. When feeding on food contaminated with DDE (a metabolite of DDT) and PCBs, animals at the top of the food web, like bald eagles and peregrine falcons, can accumulate harmful concentrations of these chemicals. DDE has been demonstrated to cause eggshell thinning and subsequent reproductive failure in many species of birds feeding in the marine ecosystem (Hickey and Anderson 1968, Risebrough et al. 1971, Gress et al. 1973). DDE in the diet of bald eagles has negatively affected the ability of the eagles to produce young (Wiemeyer et al. 1993). The continuing influence of this contaminant also accounted for the inability of bald eagles to recolonize the islands after other sources of mortality had ceased (Kiff 2000).

Bald eagles are currently listed as threatened under the Endangered Species Act, but have been proposed for delisting due to substantial recovery of the species on the mainland. In its Pacific Bald Eagle Recovery Plan, the U.S. Fish and Wildlife Service (USFWS) set recovery goals for bald eagles for specific zones in California. The Recovery Plan indicates that the most suitable habitat in Southern California is on the Channel Islands, especially Santa Cruz and Santa Catalina Islands (Jurek 2000, USFWS 1986). As outlined in the Recovery Plan, the recovery population goal is the minimum nucleus of nesting pairs that, if self-sustaining over the long term, will be capable of maintaining the genetic variability in the breeding population (USFWS 1986). This population goal is 6 nesting pairs for the Channel Islands zone and a minimum of 16 territories needed to provide secure habitat for the recovered population. Although Santa Catalina Island currently has 5 breeding pairs, they continue to suffer reproductive problems and are not considered self-sustaining (see Section B.2.3).

### **B.2.1 Historical Presence of Bald Eagles on the Channel Islands**

In a survey of historical records, Kiff (2000) showed the following maximum numbers of nesting bald eagles reported per island in a single year: Anacapa (3); San Miguel (3); Santa Cruz (5); Santa Rosa (3); Santa Barbara (1); Santa Catalina (4); San Clemente (3); and San Nicolas (1). Between 1875 and 1960, active eagle nests were reported from a minimum of 35 different sites on the Channel Islands.

Santa Cruz Island regularly supported a minimum of at least five pairs of bald eagles, which nested in niches and potholes on the sea cliffs (Kiff 1980). Known nesting areas on Santa Cruz Island included Pelican Bay, San Pedro Point, Blue Banks, Valley Anchorage, Chinese Harbor, Potato Harbor, and Middle Grounds. Anacapa Island had as many as three nesting pairs in some years. However, since collectors or ornithologists did not visit large portions of the Northern Channel Islands very often, if at all, the estimates of nesting pairs are likely an underestimate (Kiff 2000).

Grinnell (1897) visited San Clemente Island in 1897 and stated, “The Bald Eagle was seen rather commonly along the shores of the island.” The lack of ornithologist visits to the island after 1939 makes it impossible to speculate on the date of the bald eagle extirpation from the island. Few

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ornithologists visited San Nicolas Island historically, so the size of the eagle population is poorly known. However, there is no question that the species was formerly resident there (Kiff 2000). Finally, numerous ornithologists reported bald eagles to be common on Santa Catalina Island and present on Santa Barbara Island starting in the 1870s (Kiff 2000).

**B.2.2 Ecological Role of Bald Eagles on the Channel Islands**

Bald eagles historically played a role in the ecology of the Channel Islands by serving as both a top carnivore and a scavenger. Bald eagles prey primarily on fish taken live from the ocean; however, they also feed on seabirds and the carcasses of animals that wash up on shore.

No other species plays the same ecological role as the bald eagle. In the absence of bald eagles on the Northern Channel Islands, golden eagles (not native to the Northern Channel Islands) have become established. Nesting adult bald eagles defend territories and would likely have excluded golden eagles from becoming established on the Northern Channel Islands (USFWS 2004). The golden eagle, a terrestrial predator, has had tremendous negative impacts on native island foxes in the Northern Channel Islands, a species that does not have evolutionary adaptations to avoid predation (Coonan 2001, Roemer 1999).

In addition to their role in the balance of natural systems, bald eagles were revered by Native American cultures historically occupying the Channel Islands and are still admired and valued by people for whom the bald eagle is both a striking bird and our American symbol.

**B.2.3 Santa Catalina Island Bald Eagle Program**

In 1980, the USFWS and the Institute for Wildlife Studies, with the cooperation of the California Department of Fish and Game and the Catalina Island Conservancy, initiated a program to reintroduce bald eagles to Santa Catalina Island. Between 1980 and 1986, 33 eagles from wild nests were raised on three different artificial nest or hacking platforms on Santa Catalina Island (Garcelon 1988). The birds were released once they were able to fly (at around 12 weeks of age). Some of these birds matured and formed breeding pairs on the island. In 1987, the first bald eagle eggs were laid but soon broke. Subsequent contaminant analysis of egg remains revealed DDE levels sufficient to cause complete reproductive failure (Garcelon et al. 1989). From 1991 to 1993, the Institute for Wildlife Studies studied food habits of the released eagles and documented high levels of DDE in the tissues of certain prey items commonly consumed by these eagles (Garcelon 1997, Garcelon et al. 1997a, 1997b).

Since 1989, the reintroduced population has been maintained through manipulations of eggs and chicks at each nest site, and through hacking of additional birds. In the egg manipulation process, structurally deficient eggs laid by the birds affected by DDE are replaced with artificial eggs. The adult eagles continue to incubate the artificial eggs, while the real eggs are removed and artificially incubated at the Avian Conservation Center (ACC) at the San Francisco Zoo. Chicks that hatch from these removed eggs, or those produced by captive adults at the ACC or by wild birds, are then fostered back into the nests. In 2005, the Trustees funded the establishment of an incubation facility on Santa Catalina Island so that eggs and chicks would not need to be transported to and from the ACC at the San Francisco Zoo.

From 1980 to 2004, a total of 80 eggs were removed from nests on Santa Catalina Island, 14 of which hatched (Sharpe et al. 2004). A total of 47 chicks and 3 eggs (of which 2 hatched) were

fostered into nests (Sharpe et al. 2004), and adult bald eagles successfully reared 40 of these 49 chicks. During this time, an additional 21 birds were also hatched onto the island (Sharpe et al. 2004). Because of the high DDE concentrations in the eggs, this active program of manipulation and augmentation is necessary to maintain bald eagles on Santa Catalina Island at this time.

### *Bald Eagle Territories on Santa Catalina Island*

Nesting bald eagles have established five territories on Santa Catalina Island since 1984 (see Figure 3.4-3 in Section 3). A brief description of each territory is provided below.

- The West End territory was established in 1991 and is located 0.5 kilometers (km) (0.3 miles) from the northwestern end of the island on a rock pinnacle approximately 75 meters (246 feet) above the water. The territory was initially occupied by a 10-year-old male and a 5-year old female, but a second female has assisted in breeding activities since 1992 (Sharpe et al. 2004). The nest has been used since 1991.
- The Pinnacle Rock territory is located 4.3 km (2.7 miles) southwest of the city of Avalon. It was initially occupied in 1990 and the original pair, a 5-year old female and a 4-year old male, have continuously nested there since 1990 (Sharpe et al. 2004).
- The Twin Rocks territory is located 5 km (3 miles) northwest of Avalon. The territory was first occupied in 1984 and contained active nests in 1985, 1987, and 1989. A new 4-year-old male joined the female of the original pair in 1995. The first eggs of the new pair were laid in 1997, but were abandoned after the egg switch. In 1998, the original female was replaced by a 12-year old female and this pair has nested in the territory every year to the present (Sharpe et al. 2004).
- The Seal Rocks territory is located 4.5 km (2.8 miles) southeast of the city of Avalon. The original pair of this territory first nested in 1988. The female died on May 5, 1993, from DDE contaminant poisoning (Garcelon and Thomas 1997). In 1995, another adult female laid two infertile eggs. A new female and male began occupying the territory in 1997. In 1999, the pair laid one egg, but the nest was destroyed during a storm. The pair did not attempt to nest in 2000, but successfully fledged fostered chicks from 2001 to 2004 (Sharpe et al. 2004).
- The Two Harbors territory is located 2 km (1.2 miles) southwest of the town of Two Harbors. This territory was first active in 2003, and was occupied by a pair of 5-year old birds. The male of this territory is an ACC-produced eagle that was fostered into the West End territory in 1998. The female hatched from an egg laid in the West End territory in 1998 and fostered into the Pinnacle Rock nest (Sharpe 2003).

### *Summary of Contaminant Data*

Organochlorine contaminants, especially DDE, have been related to deleterious effects on bald eagle reproduction (Krantz et. al 1970, Grier 1982, Wiemeyer et al. 1984, 1993). Wiemeyer et al. (1993) reported that less than 3.6 micrograms per gram ( $\mu\text{g/g}$ ) of DDE (wet weight) was found in eagle eggs where normal reproduction was occurring (mean 5-year production  $\geq 1.0$  fledgling per nest). When DDE levels in bald eagle eggs exceed 3.6  $\mu\text{g/g}$  (wet weight), declines in productivity are expected (productivity was almost halved), with considerable reduction in

productivity expected when eggs exceed 6.3  $\mu\text{g/g}$  (wet weight) (mean 5-year production  $\leq 0.27$  fledgling per nest) (Wiemeyer et al. 1993).

In addition to DDE, other contaminants have been associated with reduced nest success (Wiemeyer et al. 1993, Nisbet 1989). Of particular concern are PCBs, which co-occur with DDTs in eagle eggs (Wiemeyer et al. 1993) and have adverse effects that translate into reduced number of fledglings produced per nest. The adverse effects associated with PCB exposure include embryo and chick mortality, edema, growth retardation, and deformities (Peakall 1994). Normal reproduction has been associated with eagle eggs containing less than 4.0  $\mu\text{g/g}$  PCBs (Wiemeyer et al. 1984). In the analysis by Wiemeyer et al. (1993) of data on eagle eggs containing both DDTs and PCBs, less than 3.0  $\mu\text{g/g}$  total PCBs (wet weight) was measured in eggs where mean 5-year productivity approached 1.0 fledgling per nest. Productivity was substantially reduced (0.61 fledgling per nest) in nests where eggs had more than 5.6  $\mu\text{g/g}$  total PCBs (wet weight) (Wiemeyer et al. 1993).

Sprunt et al. (1973) reported that a minimum of 0.7 chicks per active nest is considered necessary to prevent a bald eagle population from declining. Kubiak and Best (1991) reported that 1.0 chick per nest is expected from a healthy eagle population. Similarly, the USFWS Pacific Bald Eagle Recovery Plan identifies the goal of 1.0 fledged young per pair with an average success rate per occupied site of not less than 65 percent over a 5-year period (USFWS 1986).

### **Contaminant Levels in Bald Eagle Eggs**

Bald eagle eggs collected from Santa Catalina Island that failed to hatch have been monitored for DDE and PCB levels from 1989–2004 (Figures B-1 and B-2). Eagle eggs collected from the Pinnacle Rock and West End nests continue to show the highest DDE concentrations among the five different territories on the island. Unlike the other territories on the island, these nests have been occupied by the original female of that territory throughout the study period. Because these nests have been occupied by the same female over a period of 13 to 14 years, continuous, long-term information on DDE concentrations in the eggs can be used to measure changes in contamination over time.

The concentrations of DDE in eggs from all five territories, and PCBs in eggs from three territories exceed thresholds ( $< 3.6 \mu\text{g/g}$  and  $< 3 \mu\text{g/g}$ , respectively) associated with reduced productivity ( $< 1.0$  fledgling/nest). In addition, no significant change (e.g., no reduction) in the DDE levels has occurred in these territories over time. For example the DDE concentrations in eggs show no temporal change over the past 4 years (i.e., 2001–2004, regression analysis,  $p > 0.05$ ) with most nests showing no trend ( $p > 0.2$ ). The concentration of DDE in one nest (Seal Rocks) did show an indication of a trend that could be considered borderline ( $p = 0.054$ ). However, regressions on data from two nests monitored since 1989 (Pinnacle Rock and West End) show no significant long-term change in DDE levels as well ( $p > 0.4$ ,  $df_{residuals} > 10$ ) and do not support the inference that changes in DDE concentrations observed in eggs from the Seal Rocks territory reflect a long-term linear change that might be projected into the future.

A change in the female of a territory can affect the contaminant levels in eggs (e.g., the Seal Rocks and Twin Rocks territories, Figures B-1 and B-2). This effect may result from female prey preference, foraging style, and age. Although concentrations in recent eggs from the Seal Rocks territory are significantly lower than in eggs from 1990 and 1992 (when the same nest was occupied by a different pair of eagles), concentrations continue to exceed the adverse effect

threshold for DDE (3.6 µg/g). The presence of a new female in the Twin Rocks Territory since 1998 has resulted in egg concentrations that still exceed the effect threshold for DDE. Despite the lower DDE levels in these eggs, the detrimental effects of eggshell thinning continue today, as evidenced by a broken egg found in the Twin Rocks nest in 2003.

The Two Harbors territory was established in 2003 by two 5-year-old birds, but concentrations in the single sample from 2003 already exceeded the threshold concentration for DDE and PCBs necessary for healthy eagle reproduction (Figures B-1 and B-2), and are similar to those found in the eggs of long-term resident eagles (e.g., at West End and Pinnacle Rock).

Given that DDE and PCB levels in eggs are not declining and currently exceed thresholds associated with reduced productivity (<1.0 fledgling/nest), it is unlikely that eagles will be able to be self-sustaining on Santa Catalina Island in the foreseeable future.

### **Limited Hatching Success Despite Artificial Incubation**

The first bald eagle nesting attempts failed on Santa Catalina Island due to eggs breaking in the nest. To remove the risk of adults crushing the eggs during incubation and to reduce the effect of environmental factors such as water loss, bald eagle eggs have been collected since 1989 and placed in an artificial incubation facility. Between 1989 and 2004, 80 eggs have been collected and transported primarily to the San Francisco Zoo. Without such intervention, successful reproduction is highly unlikely, as documented by the continued breaking of eggs that are left in the nests. For example, in 2000 an egg broke in each of the three active nests (Pinnacle Rock, West End, and Twin Rocks), and in 2003 an egg broke in the Twin Rocks territory. Despite the efforts to hatch these eggs in a controlled environment, only 14 of the 80 eggs (18 percent) have hatched to date. Low hatching success may be the result of embryo mortality often attributed to PCBs and/or eggshell thinning generally associated with DDTs. The low hatching rate confirms the continued effect of DDTs and PCBs despite measures to reduce the effects of eggshell thinning by placing the eggs in an optimal, controlled environment.

### **Conclusion**

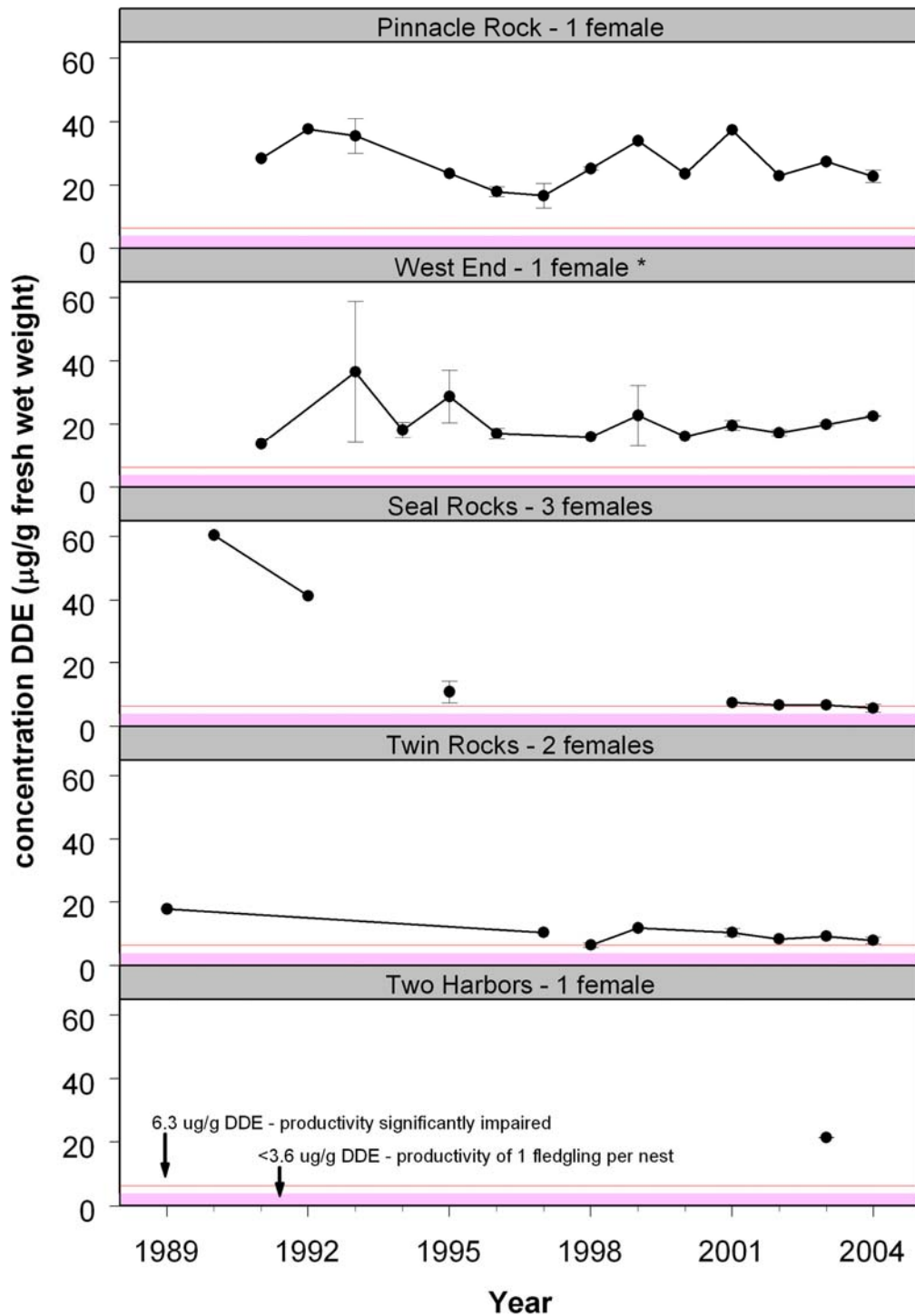
The available egg data and limited hatching success even with artificial incubation indicate that overall concentrations of DDE and total PCBs in failed-to-hatch eggs from all territories continue to exceed thresholds for adverse effects (reduced nest success). Based on the current levels of DDE and PCBs in eggs and the lack of any significant trends in reduction of DDE levels in eggs, Santa Catalina Island bald eagles are not likely to reach a state of self-sustainability in the foreseeable future.

### ***Costs of the Santa Catalina Bald Eagle Program***

From 2002–2005, the average annual cost of supporting the Santa Catalina Island Bald Eagle Program (including monitoring, retrieval of eggs from nests, artificial incubation of eggs, failed-



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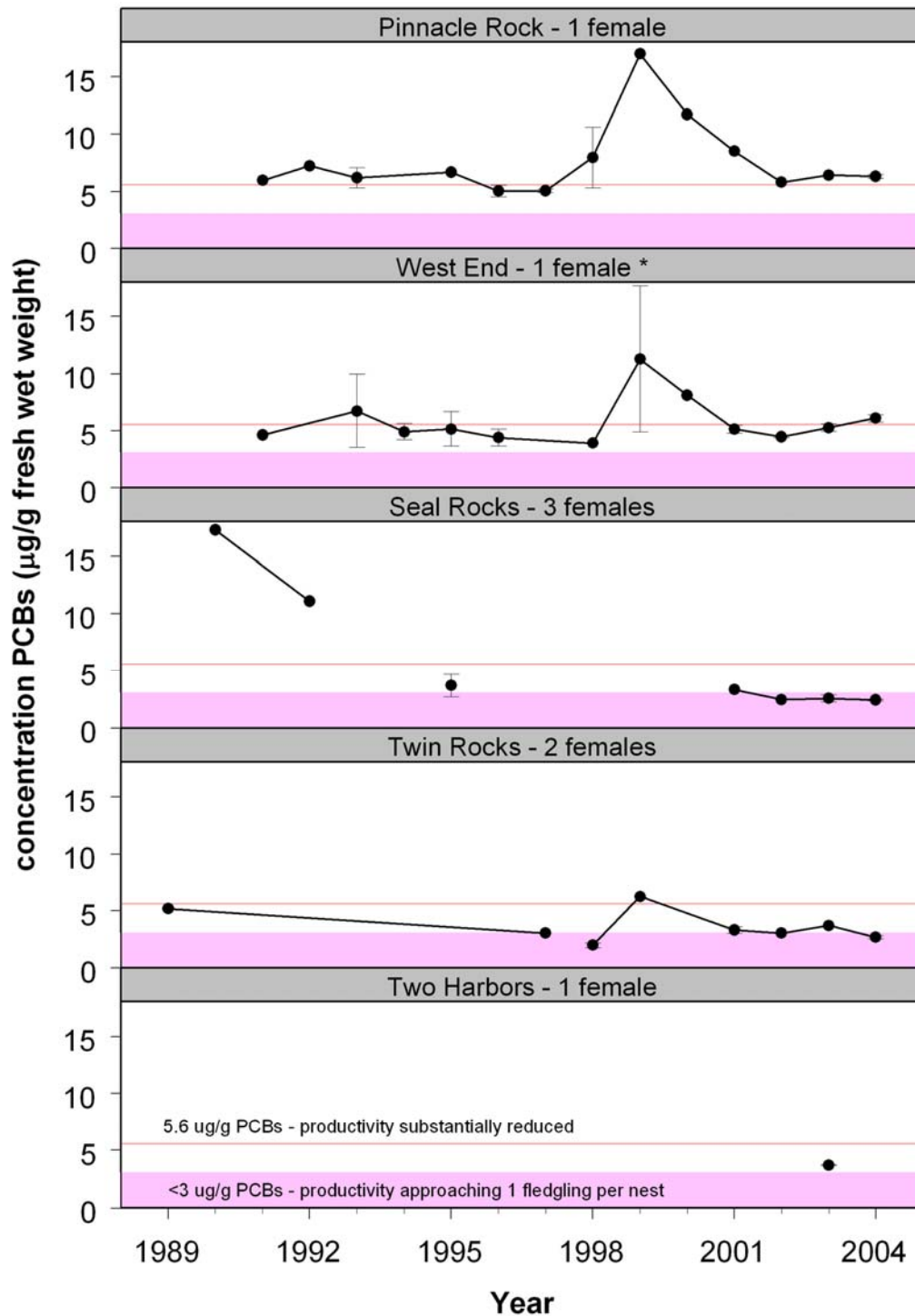


**Figure B-1. Levels of DDE in Santa Catalina bald eagle failed-to-hatch eggs from 1989–2004.**

Each panel includes data from one of the five bald eagle territories on Santa Catalina Island. Threshold DDE contamination levels are indicated for each panel as labeled in the Two Harbors panel. Line breaks within a panel indicate a change in females within a territory. For the West End Territory(\*), a second female joined the original pair in 1992 and has assisted in incubation of eggs, but has not produced any eggs used in this analysis.

**Figure B-1 [BACK]**

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**Figure B-2. Levels of PCBs in Santa Catalina bald eagle failed-to-hatch eggs from 1989–2004.**

Each panel includes data from one of the five bald eagle territories on Santa Catalina Island. Threshold PCB contamination levels are indicated for each panel as labeled in the Two Harbors panel. Line breaks within a panel indicate a change in females within a territory. For the West End Territory(\*), a second female joined the original pair in 1992 and has assisted in incubation of eggs, but has not produced any eggs used in this analysis.

**Figure B-2 [BACK]**

to-hatch egg contaminant analysis, fostering healthy chicks into nests, and agency support) was approximately \$270,000. In recent years, the Trustees have assumed full funding of the Santa Catalina Island Bald Eagle Program to ensure that the option of maintaining a population of bald eagles on Santa Catalina Island could receive consideration within this Restoration Plan.

#### **B.2.4 Northern Channel Islands Bald Eagle Feasibility Study**

Since bald eagles have not recolonized other Channel Islands, in 2002 the Trustees initiated the NCI Bald Eagle Feasibility Study to determine whether bald eagles reintroduced to the Northern Channel Islands (and thus farther from the main source of contamination) would have sufficiently low exposures that they can successfully breed and produce young.

From 2002 to 2004, 34 bald eagle juveniles were released on Santa Cruz Island (12 birds in 2002, 10 in 2003, and 12 in 2004). These birds were either hatched from eggs from the captive breeding population at the San Francisco Zoo or were juveniles collected from the wild in Alaska. Of these 34 birds, 19 birds are known to have survived to date and have been observed or recorded recently on the Northern Channel Islands (Dooley, pers. comm., 2005). These birds have been documented moving among Santa Cruz, San Miguel, Santa Rosa, and Anacapa Islands. An additional 7 birds may have survived; however, no recent satellite tracking data (due to transmitters falling off or no longer working) or recent sightings confirm this statement (Dooley, pers. comm., 2005). Of these 7 birds, 3 were last recorded on the mainland and the other 4 were last reported on Anacapa or Santa Rosa Islands. The remaining 8 of the 34 eagles that were released are known or are suspected to have died as follows: five eagles drowned trying to cross the Santa Barbara Channel to the mainland, one was hit by a car in Salt Lake City, Utah, one died after getting stuck in a tree on Santa Rosa Island, and one is assumed dead although the cause of death is unknown (Dooley, pers. comm., 2005).

Since the NCI Feasibility Study began, eagles have crossed to the mainland, ranging as far as Yellowstone National Park in Wyoming. Eagles have also been documented from Oregon, Northern California, and Utah. The presence of the bald eagles on the Northern Channel Islands has attracted bald eagles from nearby Santa Catalina Island. A minimum of two eagles from Santa Catalina Island have been documented spending time on Santa Cruz Island (Dooley, pers. comm., 2005).

In August 2004, biologists recaptured three eagles released in 2003 to collect blood and feather samples, which will be analyzed to determine current contaminant levels in the birds. When the bald eagles on the Northern Channel Islands begin to reproduce, biologists will monitor their nests to determine if the eagles are capable of hatching eggs in the wild. Because it takes as many as five to seven years for bald eagles to reach reproductive age, the Trustees anticipate having initial results of the first breeding attempts available around 2008.

Monitoring is an important component of the NCI Bald Eagle Feasibility Study. Appendix A of the Feasibility Study for Reestablishment of Bald Eagles on the Northern Channel Islands (MSRP 2002) outlined the central components of the monitoring program, including obtaining bald eagle blood samples and prey items for DDT and PCB analysis, tracking movement of the birds with satellite telemetry, and performing stable isotope analysis on prey resources (MSRP 2002). Once the birds begin breeding, biologists will monitor nests to determine reproductive

success. Nest monitoring will likely continue for several years after the first breeding attempts to obtain data from multiple pairs over several years and to account for unsuccessful breeding attempts that are typical of first-time breeders. Specific details of the nest monitoring will be developed as part of the overall ongoing monitoring program. This monitoring program is evaluated on a yearly basis in consultation with experts, and is modified as needed.

For the study period from 2002–2005, a total of approximately \$2.3 million was budgeted for the NCI Bald Eagle Feasibility Study. This cost covers all aspects, including obtaining, caring for, and releasing bald eagle juveniles, fieldwork, monitoring, contaminant analysis, and agency support. The Trustees anticipate allocating an additional \$1 million over the next several years in support of the NCI Bald Eagle Feasibility Study. Costs would likely decrease after 2006 as the released birds mature and emphasis shifts to nest monitoring and contaminant analysis (rather than the release of additional birds). Therefore, the total estimated cost of the NCI Bald Eagle Feasibility Study is \$3.3 million.

Two possible courses of action for bald eagle restoration are described and evaluated in the following sections.

### **B.3 COMPLETE THE NCI BALD EAGLE FEASIBILITY STUDY BEFORE DECIDING ON FURTHER RESTORATION ACTIONS**

#### **B.3.1 Project Description and Methods**

This action is the Trustees' selected action for bald eagle restoration. The Trustees will defer making longer-term decisions on bald eagle restoration until the results of the NCI Bald Eagle Feasibility Study are known (in or around 2008). Also, the Trustees will discontinue funding for the Santa Catalina Island Bald Eagle Program during the interim period until the results of the NCI Bald Eagle Feasibility Study are known. When these study results are known the Trustees will re-evaluate all potential options for bald eagle restoration, including measures that may be taken even if bald eagles are not able to reproduce on their own anywhere in the Channel Islands. The Trustees will release a subsequent National Environmental Policy Act (NEPA)/California Environmental Quality Act (CEQA) document for public review and input once the results of the NCI Bald Eagle Feasibility Study are known. The remaining bald eagle restoration funds could then be used on any of the Channel Islands. This action conserves limited restoration funds until sufficient information is available to evaluate the ability of the different Channel Island environments to support bald eagles.

This action is modified from the one proposed in the draft Restoration Plan and programmatic Environmental Impact Statement (EIS)/ Environmental Impact Report (EIR), which was released for public comment in April 2005. The modification is a result of the Trustees' consideration of the public comments received. In the draft Restoration Plan and programmatic EIS/EIR, the Trustees had proposed that the restoration of bald eagles proceed only if it was ultimately found that they are able to reproduce on their own in the Northern Channel Islands. If the results of the NCI Bald Eagle Feasibility Study indicated that there were no territories in the Channel Islands where bald eagles could reproduce unaided, the preferred course of action proposed in the draft Restoration Plan called for bald eagle restoration efforts to cease, and the remaining funds to be either set aside or used for seabird restoration.

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### Restore Bald Eagles to the Channel Islands

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The Trustees received diverse and opposing public comments on the advisability of bald eagle restoration given the continued observation of contaminant effects on Santa Catalina Island. Predominantly, however, public comments expressed the desire to maintain the presence of bald eagles on the Channel Islands. After considering public comments, along with the evaluation criteria for this plan (particularly the preferences that actions have long-term benefits and minimal ongoing operation and maintenance requirements), the Trustees modified the preferred action for bald eagles to provide for a re-examination of all options once the results of the NCI Bald Eagle Feasibility Study are known, rather than predetermining subsequent actions. The re-examination will be conducted with opportunity for public review and comment in a subsequent document.

The results of the NCI Bald Eagle Feasibility Study are expected to be known in or around 2008. If it is found at that time that the birds released on Santa Cruz Island are able to fledge chicks without human intervention, the Trustees may continue releasing and monitoring bald eagles on Santa Cruz Island. The Trustees anticipate that if eagles can successfully reproduce on the Northern Channel Islands, then eagles will eventually repopulate the rest of the Channel Islands, including Santa Catalina Island. The general methods for additional hacking and monitoring would be the same as those outlined in the Feasibility Study for Reestablishment of Bald Eagles on the Northern Channel Islands (MSRP 2002).

In light of the continuing high levels of contamination in bald eagles on Santa Catalina Island, continued funding of the Santa Catalina Island Bald Eagle Program over the near term is unlikely to achieve the goal of the long-term restoration of bald eagles to the Channel Islands. Thus, during the interim period until the NCI Bald Eagle Feasibility Study is completed, the Trustees have chosen to focus restoration efforts on the Northern Channel Islands, which continue to hold the potential for long-term restoration, and discontinue funding of the Santa Catalina Island Bald Eagle Program.

Even without continued Trustee funding for the current Santa Catalina Island Bald Eagle Program, it is highly likely that bald eagles will remain on Santa Catalina Island for several years despite their inability to hatch offspring naturally. Bald eagles in the wild typically live for 25 to 30 years, and Santa Catalina Island currently supports 15 to 20 birds of a wide range of ages. Currently, five active bald eagle nesting territories exist on the island, and the Institute for Wildlife Studies reports that two birds are currently establishing a new territory near Avalon. Even assuming the Santa Catalina Island bald eagles fail to hatch new chicks in the coming years, bald eagle experts do not expect that they will immediately break their pair bonds and abandon their Santa Catalina Island territories. Rather, it is likely that bald eagles will remain on Santa Catalina Island, with their numbers diminishing gradually over a period of as many as 10 years or longer as some of the birds die and are not replaced by others and as certain bald eagle pairs break their pair bonds and leave after several years of failing to produce chicks.

Thus, the Trustees anticipate that bald eagles will still inhabit several of the Channel Islands, including Santa Catalina Island, when the results of the NCI Bald Eagle Feasibility Study are known (in or around 2008). If the results of the NCI Bald Eagle Feasibility Study indicate that bald eagles throughout the Channel Islands still experience reproductive impairment due to the persistence of DDTs and PCBs in their diets, the Trustees would explore various options for further bald eagle restoration on one or more of the Channel Islands, including Santa Catalina Island. Some options may not be as costly as the current egg manipulation and chick fostering

work being conducted on Santa Catalina Island. For example, the Trustees could fund a monitoring and hacking program to maintain a non-breeding bald eagle presence on the Channel Islands (and thus maintain their human use and ecological services) for as long as funds remain available or until contaminant levels decline to a level that would support naturally reproducing eagles.

The Trustees will release a subsequent NEPA/CEQA document for public review and input once the results of the NCI Bald Eagle Feasibility Study are known. The document will be released between 2008 and 2010 and will outline the next steps for bald eagle restoration on the Channel Islands.

### **B.3.2 Environmental Benefits and Impacts**

#### *Biological*

##### **Benefits**

Bald eagles historically played an important role in the ecology of the Channel Islands, and the bald eagle fills a distinct niche there. Reintroducing bald eagles to the Channel Islands will restore this part of the ecosystem, which has been missing since their extirpation.

The presence of the bald eagle on some of the Channel Islands likely provides benefits to the endangered island fox. Predation of island foxes by golden eagles has resulted in precipitous declines in island fox populations on the Northern Channel Islands (Coonan et al. 1998, USFWS 2004). The presence of territorial bald eagles on the Northern Channel Islands would likely benefit the island fox if they deter golden eagles from inhabiting the islands.

##### **Impacts**

Individual bald eagles will be impacted by the restoration efforts. During the first 3 years of the NCI Bald Eagle Feasibility Study, 8 of the 34 released birds (approximately 24 percent) are known to have died from various causes (see Section B.2.4). The majority of these deaths (5 of 8, or 63 percent) were recently fledged eagles crossing the Santa Barbara Channel. This source of mortality was also reported by Sharpe and Garcelon (2000) when a bald eagle fledgling died while trying to fly to the mainland from Santa Catalina Island. Overall, the survival rate of eagles released on the Northern Channel Islands appears to be within the normal range of eagle survival in the wild and for a reintroduction program. The loss of several individuals is not considered significant in light of the overall recovery of the bald eagle in the United States and the efforts to restore this species to the Channel Islands.

This action suspends the Trustees' annual contribution of funds for the Santa Catalina Island Bald Eagle Program at least until the completion of the NCI Bald Eagle Feasibility Study, when subsequent decisions on restoring bald eagles to the Channel Islands will be made. Human intervention of one form or another is necessary to maintain a bald eagle presence on Santa Catalina Island, as these birds cannot reproduce on their own. If no other sources of funding are identified to support a program that maintains bald eagles on Santa Catalina Island and this



intervention ceases, eventually the bald eagles currently inhabiting the island will die or disperse to other locations, and they may not be replaced by others.

As stated previously, even without continued Trustee funding for the current Santa Catalina Island Bald Eagle Program, it is highly likely that bald eagles will remain on the island for several years despite their inability to hatch offspring naturally. Bald eagles in the wild typically live for 25 to 30 years, and Santa Catalina Island currently supports 15 to 20 birds of a wide range of ages. Currently, five active bald eagle nesting territories exist on the island, and the Institute for Wildlife Studies reports that two birds are currently establishing a new territory near Avalon. Even assuming that the Santa Catalina Island bald eagles fail to hatch new chicks in the coming years, bald eagle experts do not expect that they would immediately break their pair bonds and abandon their Santa Catalina Island territories. Rather, it is likely that the bald eagles would remain on Santa Catalina Island, with their numbers diminishing gradually over a period of as many as 10 years or longer as some of the birds die and are not replaced by others and as certain bald eagle pairs break their pair bonds and leave after failing to produce chicks for several years.

Thus, it is highly likely that bald eagles will continue to inhabit Santa Catalina Island during the limited period this action addresses (i.e., until the subsequent bald eagle restoration decision-making after the NCI Bald Eagle Feasibility Study is completed, in or around 2008). At that time the Trustees will consider all options available for continuing efforts at restoring bald eagles to the Channel Islands.

It should be noted that the Trustees do not have ultimate responsibility for the continuation of the Santa Catalina Island Bald Eagle Program. This program is permitted (and was originally planned and funded) by the endangered species offices of the California Department of Fish and Game and the U.S. Fish and Wildlife Service.

The potential impact of eagles on the avian populations, particularly seabird populations, of the Northern Channel Islands was analyzed in depth as part of the Feasibility Study for Reestablishment of Bald Eagles to the Northern Channel Islands (MSRP 2002). Because bald eagles have had a long historical presence on the Channel Islands before their extirpation and presumably coexisted with the seabird populations there, restoration of bald eagles is not expected to have a significant impact on the populations of these birds. The avian species known to be in the diet of eagles on Santa Catalina Island occur in greater numbers on the Northern Channel Islands. However, an increase in the availability of these birds would not necessarily result in a proportional increase in the eagle's diet because it is energetically expensive for eagles to pursue and capture live birds (Sharpe and Garcelon 1999a), and pursuits of birds are usually unsuccessful (Bayer 1987, Ofelt 1975, Parrish 1995). Based on these factors, it is estimated that the overall bird component of the eagle's diet would remain close to the 9 percent observed on Santa Catalina Island, though the species composition would likely differ among the islands (Sharpe and Garcelon 1999a).

Monitoring results from the NCI Bald Eagle Feasibility Study in 2002 and 2003 show that released bald eagles foraged primarily on pig carcasses provided by field biologists (Sharpe et al. 2004). Eagles were also observed feeding on marine mammal carcasses on Santa Cruz Island and on mule deer and elk carcasses or gut piles on Santa Rosa Island. In addition, a recreational fisherman reported seeing an eagle catch fish off of Santa Cruz Island (Sharpe et al. 2004).

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## Restore Bald Eagles to the Channel Islands

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Telemetry data have recorded little use of Anacapa Island by bald eagles during the seabird breeding season. Therefore, it is unlikely that released eagles have had a measurable impact on seabird populations on that island (Sharpe et al. 2004).

### *Physical*

#### **Benefits**

This action will have no known benefits to the physical environment.

#### **Impacts**

This action will have no known impacts to the physical environment.

### *Human Use*

#### **Benefits**

The presence of bald eagles provides both aesthetic and recreational benefits to visitors of Santa Catalina Island and the Northern Channel Islands. The presence of the bald eagle also provides human non-use or intrinsic value in that the bald eagle is a symbolically important species in the United States. In addition, bald eagles play an important role in the cultural history of the Channel Islands.

#### **Impacts**

This action suspends the Trustee's annual contribution of funds for the Santa Catalina Island Bald Eagle Program at least until the completion of the NCI Bald Eagle Feasibility Study, when subsequent decisions on restoring bald eagles to the Channel Islands will be made. Human intervention of one form or another is necessary to maintain a bald eagle presence on Santa Catalina Island, as these birds cannot reproduce on their own. If no other sources of funding are identified to support the program that maintains bald eagles on Santa Catalina Island and this intervention ceases, eventually the bald eagles currently inhabiting the island will die or disperse to other locations and may not be replaced by others. This absence of bald eagles would represent a loss of the human use and non-use services that bald eagles currently provide on Santa Catalina Island.

As stated previously, even without continued Trustee funding for the current Santa Catalina Island bald eagle intervention, it is highly likely that bald eagles will remain on the island for several years despite their inability to hatch offspring naturally. Bald eagles in the wild typically live for 25 to 30 years, and Santa Catalina Island currently supports 15 to 20 birds of a wide range of ages. Currently, five active bald eagle nesting territories exist on the island, and the Institute for Wildlife Studies reports that two birds are currently establishing a new territory near Avalon. Even assuming that the Santa Catalina Island bald eagles fail to hatch new chicks in the coming years, bald eagle experts do not expect that they will immediately break their pair bonds and abandon their Santa Catalina Island territories. Rather, it is likely that bald eagles will remain on Santa Catalina Island, with their numbers diminishing gradually over a period of as

many as 10 years or longer as some of the birds die and are not replaced by others and as certain bald eagle pairs break their pair bonds and leave after several years of failing to produce chicks.

Thus, it is highly likely that bald eagles will continue to inhabit Santa Catalina Island during the limited period that this action addresses (i.e., until the subsequent bald eagle restoration decision-making after the NCI Bald Eagle Feasibility Study is completed, in or around 2008). At that time the Trustees will consider all options available for continuing efforts at restoring bald eagles to the Channel Islands.

It should be noted that the Trustees do not have ultimate responsibility for the continuation of the Santa Catalina Island Bald Eagle Program. This program is permitted (and was originally planned and funded) by the endangered species offices of the California Department of Fish and Game and the U.S. Fish and Wildlife Service. Thus, the Trustees' decision to suspend funding does not constitute an action that would in and of itself either directly or indirectly cause the disappearance of bald eagles from Santa Catalina Island and the loss of the human services they provide.

### **B.3.3 Likelihood of Success/Feasibility**

This action addresses the interim period until the completion of the NCI Bald Eagle Feasibility Study. This study is being performed using proven, conventional methods to place bald eagles on Santa Cruz Island and monitor them until they attain reproductive age and are laying eggs. The purpose of the study is to determine whether they can reproduce unaided. The implementation of the study and the determination of its outcome are considered highly feasible. The outcome itself (i.e., whether or not the bald eagles nesting in the Northern Channel Islands are likely to experience the eggshell thinning injuries that impair reproduction by birds nesting on Santa Catalina Island) is uncertain.

The likelihood of success for bald eagle restoration efforts on the Channel Islands remains uncertain at present due to the continued presence of contamination and the uncertainty of the outcome of the NCI Bald Eagle Feasibility Study. However, this action only addresses the interim period until the study is completed; subsequent bald eagle restoration decision-making and documentation will address the likelihood of success and the feasibility of the various actions to be considered at that point.

### **B.3.4 Performance Criteria and Monitoring**

Monitoring for this action will include the concepts outlined in the monitoring plan developed for the NCI Bald Eagle Feasibility Study (MSRP 2002). These concepts will be adapted accordingly. The specific performance criteria for successful reproduction (e.g., productivity) of the Northern Channel Islands birds will be defined by the Trustees, in consultation with experts, prior to 2007.

### **B.3.5 Evaluation**

The Trustees have evaluated this action against the screening and evaluation criteria developed to select restoration actions and have concluded that this action is consistent with these selection factors. The initial results of the NCI Bald Eagle Feasibility Study will likely not become

**Restore Bald Eagles to the Channel Islands**

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available until 2008, when the birds reach maturity and begin breeding. If the NCI Bald Eagle Feasibility Study shows evidence of successful reproduction in bald eagles in the Northern Channel Islands, the Trustees may proceed with hacking additional eagles onto the Northern Channel Islands. If the NCI Bald Eagle Feasibility Study shows evidence of serious reproductive impairment, the Trustees may consider any number of options, including actions that maintain a bald eagle presence on one or more islands despite reproductive impairment. However, the determination of subsequent actions is beyond the scope of this analysis.

The Trustees have determined that this type and scale of interim restoration effort has the potential to provide long-term benefits to bald eagles in a way that doesn't require continuous operation and maintenance because the action places bald eagles into Channel Island territories where they may be able to reproduce unaided. This action may eventually facilitate the recovery of this species on all of the Channel Islands. For these reasons, the Trustees have chosen this action as the favored strategy for bald eagle restoration on the Channel Islands.

**B.3.6 Budget**

A total of \$6.2 million will be allocated for bald eagle restoration on the Channel Islands. This allocation will cover the costs of the Santa Catalina Island Bald Eagle Program through 2005 (approximately \$1.2 million spent since 2001) and the ongoing NCI Bald Eagle Feasibility Study (approximately \$3.3 million). These expenditures will leave a balance of approximately \$1–2 million. The Trustees will defer the decision on how to use these remaining funds until the results of the NCI Bald Eagle Feasibility Study are known. At that time, the Trustees will consider a range of restoration options and decide on the best course of action. The remaining funds could be used on any of the Channel Islands.

**B.4 COMPLETE THE NCI BALD EAGLE FEASIBILITY STUDY; REGARDLESS OF ITS OUTCOME, CONTINUE FUNDING SANTA CATALINA ISLAND BALD EAGLE PROGRAM****B.4.1 Project Description and Methods**

This action provides funding for bald eagle restoration on the Channel Islands regardless of the outcome of the NCI Bald Eagle Feasibility Study. Under this action, which is not an interim but a longer-term action, efforts to restore bald eagles to the Channel Islands focus on the continuous maintenance of the Santa Catalina Island Bald Eagle Program for as many years as funds are available, with the hope that eventually the Santa Catalina Island birds' exposures will decline to a level that allows them to reproduce on their own. Maintenance of the bald eagles on Santa Catalina Island is favored over the Northern Channel Islands due to the existing infrastructure and the ongoing program on Santa Catalina Island. Under this action, financial support of the Santa Catalina Island Bald Eagle Program would continue after 2005. The NCI Bald Eagle Feasibility Study would also continue until the results are known.

### *Summary of Program Activities on Santa Catalina Island*

Currently, the reintroduced bald eagle population on Santa Catalina Island is maintained through manipulations of eggs and chicks at each nest site. Observation of adult eagles begins in January every year to determine the location of breeding pairs and their respective nest sites. Nest sites are located by observing areas of increased use by adults and searching previously used nesting areas. When nest sites are confirmed, observation blinds are set up to observe nests. From the blinds, data are collected on the chronology of nesting, behavior during incubation, nestling and adult behavior during brood rearing, the taxa of prey delivered to the nest, and the rates of prey delivery. At the West End and Seal Rocks nests, video cameras would be set up prior to the breeding season to allow for close observations of nesting activities.

All eggs laid by nesting pairs are replaced with artificial eggs within 1 to 4 days of the date that eagles are confirmed to be incubating. The adult eagles continue to incubate the artificial eggs, while the real eggs are removed and artificially incubated. In the past, eggs have been transferred from Santa Catalina Island to the San Francisco Zoo. In 2005, the Trustees funded the transport and establishment of artificial incubation equipment at a facility on Santa Catalina Island. Chicks that hatch from the eggs removed from nests on Santa Catalina Island, or those produced by captive adults at the ACC or by wild birds, are then fostered back into the nests after the adults have incubated the artificial eggs for approximately 30 days. Failed-to-hatch eggs are saved for contaminant analysis. Project staff return to the nests when the chicks are 8 weeks of age to equip them with USFWS and colored leg bands, wing markers, and a back-pack style radio transmitter. At this time, a blood sample is also collected for contaminant analyses and morphological measurements are made to determine sex. Radiotelemetry is used to locate and visually observe the behavior of fledged eagles. Each fledged bird is located every 1 to 3 days during its first month of flight. Observers record each bird's locations, behavior, and interactions with other eagles.

In addition to egg manipulation, this action examines other potential management options to reduce contaminant exposure to bald eagles on Santa Catalina Island. These options may include experimenting with supplemental feeding of contaminant-free prey, treating the eggs in the nest to potentially allow the birds to hatch the chicks on their own, and reducing the number of nests actively manipulated to focus on those nests with less contaminated eggs.

## **B.4.2 Environmental Benefits and Impacts**

### *Biological*

#### **Benefits**

Bald eagles historically played an important role in the ecology of the Channel Islands, and the bald eagle fills a distinct niche there. The presence of the bald eagle provides benefits to the Channel Island ecosystem, as no other species fills the same ecological role.

**Impacts**

Bald eagles prey on avian species, particularly medium- to large-sized seabirds, such as gulls (*Larus* sp.) and loons. Data collected on eagle food habits on Santa Catalina Island show that they may occasionally take smaller bird species, either alive or as carrion (Garcelon 1997). Bald eagles prey primarily on fish and carrion and are, therefore, unlikely to have any major impact on other wildlife living on or around the Channel Islands. Birds have been reported to make up only 9 percent of an eagle's diet on Santa Catalina Island (Garcelon et al. 1997b). Based on this information, the Trustees do not expect a significant impact to seabirds from eagles. Seabird populations on Santa Catalina Island have not shown, to our knowledge, any measurable impact from the eagles already breeding on that island.

*Physical*

**Benefits**

This action would have no known benefits to the physical environment.

**Impacts**

This action would have no known impacts to the physical environment.

*Human Use*

**Benefits**

Santa Catalina Island is a popular tourist destination, and the presence of bald eagles provides both aesthetic and recreational benefits to both residents and visitors on the island. The presence of the bald eagle also provides human non-use or intrinsic value in that the bald eagle is a symbolically important species in the United States. Bald eagles also play an important role in the cultural history of the Channel Islands.

**Impacts**

This action would have no known impacts to cultural resources, recreation, aesthetics, or transportation.

**B.4.3 Likelihood of Success/Feasibility**

The growing number of bald eagle territories on Santa Catalina Island demonstrates that it is possible to actively maintain breeding bald eagles that successfully fledge young fostered into their nests despite ongoing exposure to contamination. However, the ultimate success of this action would be attained when eagles are able to breed on Santa Catalina Island without human assistance. The goal of the continued manipulation efforts outlined in this action is to enable the eagle pairs on the island to continue to fledge young and maintain pair bonds so that eagles would be present on the island when contamination levels are low enough to allow for successful reproduction without human intervention.

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At this time, the likelihood of the ultimate success for this action is low. Based on the current levels of DDE and PCBs in their eggs and the lack of any significant trends in DDE levels in eggs (see Section B.2.3), Santa Catalina Island bald eagles are not likely to reach a state of self-sustainability in the foreseeable future. As outlined in Section 4.2, the Trustees, for the purpose of developing this Restoration Plan, have made several assumptions regarding future DDT and PCB distribution and exposure. These assumptions include the prediction that a substantial reduction of DDT and PCB contamination in the food web will take more than a decade after any sediment remediation. However, the feasibility and extent of such remediation remain unknown; therefore, the amount of time that contamination will remain in the food web could be much longer. In addition, the Trustees assume that elevated concentrations of DDTs and PCBs in some marine mammals, bald eagles, peregrine falcons, and seabirds will persist longer than a decade due to the longer life span of these animals and their foraging preferences, and that impacts from these contaminants would continue into the foreseeable future even if the U.S. Environmental Protection Agency undertakes a sediment source control effort.

**B.4.4 Performance Criteria and Monitoring**

As described in Section B.4.1, bald eagle adults and chicks would be closely monitored throughout the breeding season. Monitoring would continue using current protocols, and failed-to-hatch eggs would continue to undergo contaminant analysis. If funding of this program were to continue for the long term, the Trustees would evaluate the different components of the monitoring program and look for ways to maximize cost-effectiveness. For example, analysis of failed-to-hatch eggs may not need to be analyzed every year but rather at a set interval.

**B.4.5 Evaluation**

The Trustees have evaluated this action against the screening and evaluation criteria developed to select restoration actions and have concluded that it is consistent with these selection factors. However, this action is not considered to rank as high as the selected bald eagle restoration action. This action would provide benefits to injured bald eagles on Santa Catalina Island for as long as the intervention program continues. However, it is uncertain whether the program could operate until such a time that bald eagles will be able to reproduce unaided. The Trustees have determined that these benefits are outweighed by the size of the investment required to obtain the benefits, which would foreclose pursuit of other restoration actions that have a greater potential for long-term benefits and low ongoing operation and maintenance requirements. The Trustees assume that elevated concentrations of DDTs and PCBs are expected to persist in the environment and that these impacts will continue to impair successful reproduction into the foreseeable future even if the U.S. Environmental Protection Agency undertakes a sediment source control effort. For these reasons, the Trustees have not chosen this course of action (i.e., maintaining bald eagles on Santa Catalina Island for the long term) as a preferred restoration action.

**B.4.6 Budget**

Under this action, the Trustees propose to allocate a total of \$10 million for bald eagle restoration on the Channel Islands. Approximately \$4 million would be utilized through the end of the NCI Bald Eagle Feasibility Study (supporting both the NCI Bald Eagle Feasibility Study

## **Appendix B**

### **Restore Bald Eagles to the Channel Islands**

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and the Santa Catalina Island Bald Eagle Program), leaving approximately \$6 million to place into a long-term endowment or other financial mechanism to support the continuation of the Santa Catalina Island Bald Eagle Program for as long as possible or until such time that the birds are able to reproduce successfully on their own. A total of \$6 million would fund approximately 22 years of restoration efforts on Santa Catalina Island if the average annual cost remains at approximately \$270,000. This amount does not include any interest that would be generated.