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# DDE/DDT Trends in Potential Bald Eagle Prey Species, A Possible Role for the Introduction of Ospreys to Northern Channel Islands, and Bald Eagle Releases to Historic Sites in Mexico

*A Science Review Panel Report: Northern Channel Islands Bald Eagle Feasibility Study*

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## Introduction

The scenarios presented in the "Ecological Risk Assessment for the Potential Reintroduction of Bald Eagles to the Northern Channel Islands" (Valoppi *et al.* 2000), although based on limited data and a number of assumptions, all indicate that a re-introduced Bald Eagle population would not be able to maintain its numbers (i.e., production would be well below the standard of 0.7 young per occupied nest). Two salient points need to be made about this risk assessment: (1) all residue data for prey species are 8 or more years old and, (2) serious adverse reproductive effects are predicted even with no marine mammals (group with the highest DDE concentrations) in the diet. The present risk assessment provides no positive feedback for successfully reintroducing Bald Eagles to the Northern Channel Islands.

With the model and the data used (old data) yielding only negative findings with respect to Bald Eagles, it is imperative to determine either if DDE residues in prey species have decreased over the last decade, or if DDE residues in prey species are considerably lower at locations surrounding the more northern islands. Lower DDE concentrations in prey species than reported in the early 1990s is mandatory if there is to be any hope for the success of Bald Eagle reintroductions. Another series of prey species need to be collected and evaluated for DDE.

**DDE in Potential Prey Species**

Three different topics seem to be of importance: (1) present DDE concentrations in prey species at Santa Cruz/Anacapa Islands, (2) long-term DDE residue trends at Santa Catalina and elsewhere that may lead to future predictions, and (3) a better understanding of the egg-carcass relationship for validation of its use in the risk assessment model. Based upon the prey species collected in the early 1990s, the same species, with some additions, need to be again collected. Since fish form the bulk of the Bald Eagle diet, an emphasis needs to be placed on fish from near the Northern Islands. The earlier fish residue data (a very limited sample) from Anacapa/Santa Cruz Islands showed a mean of 0.23 ppm DDE (wet weight). If Bald Eagles only ate fish, and with published DDE biomagnification factors (BMFs) from fish to bird eggs ranging from 31 to 34 (Blus *et al.* 1977, Braune and Norstrom 1989), the Bald Eagle DDE egg concentrations would be estimated at 7.1 to 7.8 ppm (wet weight). The best estimate of DDE concentrations in eggs that results in a calculated productivity of 0.7 young per nesting attempt is 7.5 ppm (wet weight) (Quantitative Environmental Analysis 2000). Thus, if no DDE decline occurred in fish residues from Anacapa/Santa Cruz during the last decade, fish residues alone place the Bald Eagles in a barely breakeven situation. Add a few birds and some marine mammals in the diet and the situation becomes bleak according to the modeling process.

In view of the limited number of fish collected earlier, new fish collections and analyses are needed around the Northern Islands. Consideration about what species of fish to collect should be based on fish taken by eagles on Santa Catalina. With the limited historic fish data available near the Northern Islands, emphasis should be placed on collecting a meaningful dataset now, and not attempt to evaluate fish residue trends over time.

New collections of birds and marine mammals also need to be made. As with the fish, birds (or bird eggs) will provide the needed input for new analyses. If bird eggs are collected (series to match earlier collections for trend analyses), some adults should also be collected of the same species (preferably from same colony with eggs collected) to check the modeled relationships between egg and carcass projections. The risk assessment converts egg residues (because larger numbers of eggs were already available) to carcass residues for use in the modeling process (QEA 2000). This adjustment factor is another potential place for making errors in the risk assessment and needs to be validated with data from the study area.

Although the present situation regarding DDE residues in potential prey species on Santa Cruz Island (and perhaps adjacent Anacapa) is needed, the trend over the last decade is also important and may lead to predicting future rates of change. Therefore, the seabird eggs collected in the early 1990s provide a means of evaluating the DDE trend over the last decade in the species that were initially selected. It is recommended that those seabird species with at least 10 eggs collected earlier on Santa Cruz or Anacapa be resampled. They include Ashy Storm-petrel and Pigeon Guillemot from Santa Cruz Island, and Brown Pelican and Double-crested Cormorant from Anacapa Island. Western Gull eggs may be collected at either Santa Cruz or Anacapa since DDE/DDT residues were nearly identical [geo. mean 1.16 vs. 1.13 ppm] in earlier collections. These five species represent a total of 50 eggs for the trend analyses over the last decade. Five adults from each species sampled (25 birds) should be collected from the same colony sampled for eggs (preferably the adult from the same nest with eggs collected) to evaluate the relationship between DDE concentrations in carcass and DDE concentrations in eggs, i.e., determine if model relating egg concentrations to carcass concentrations is providing realistic results. Petrels can be grabbed at the nest burrows, gulls can be easily trapped at the nest, and cormorants can be shot by setting in a blind and using 22 shorts with a scope. The pelicans and guillemots would be more difficult. The Canadian Wildlife Service has an ongoing long-term study (1991-92, 1995, and 1999), which includes eggs of the Leach's Storm Petrel and Double-crested Cormorant, which could be used for evaluating DDE trends elsewhere. Pigeon Guillemot, Western Gull, Double-crested Cormorant, and Leach's Storm Petrel eggs were also collected in Oregon in 1979 (Henny *et al.* 1982) and 1992 (NRDA data) and can provide long-term trends. Less appears to be known about marine mammal residues around the northern islands. The marine mammal sampling effort among species should be based upon the average biomass of each species (seals and sealions) present, or if adequate data exists, use the average biomass of dead carcasses of each species found ashore on Santa Cruz. New marine mammal data needs to be collected.

In summary, the three general components of the Bald Eagle diet (fish, birds, and marine mammals) need to be assessed from the DDE residue perspective at the present time; however equally important is the percent biomass (not percent incidence) of each species (or group) in the Bald Eagle diet. The percent biomass of each category (subject of other report) provides the weighting factors for each prey component in an improved and updated risk assessment.

**Possible Role of Introduced Ospreys**

The Osprey only eats fish and historically nested on the Channel Islands (Kiff 1980). It is noteworthy that Bald Eagles snatch fish from the surface, while Ospreys catch fish within about a foot of the surface. Therefore, the fish diets of the two species may be similar (i.e., have similar contaminant concentrations?). In contrast, cormorants and pelicans in the area dive and catch fish farther below the surface (perhaps different fish species and different contaminant exposure?). The Osprey reaches sexual maturity at 3 years of age (1 or 2 years before the Bald Eagle). Thus, the success or failure to produce young by released Ospreys to the islands could be determined sooner (i.e., can they produce young successfully in the system on a surface fish only diet and no modeling is needed). Direct observation in the field will provide the answer. Data on sensitivity to DDE in eggs of the two species is similar, with the Osprey perhaps being slightly less sensitive than the Bald Eagle (Wiemeyer *et al.* 1988, Wiemeyer *et al.* 1993). If the Osprey cannot produce successfully with a 100% fish diet, and while being slightly less sensitive to DDE in eggs, it will certainly provide a direct early warning that Bald Eagle efforts will be unsuccessful. As a possible bonus, if Osprey efforts are successful and a population becomes established, Bald Eagles are known to pirate fish from Ospreys. Potentially, this trait may cause the eagles to rely more upon fish which would result in lowered intake of birds and marine mammals which have higher DDE concentrations.

Ospreys have been hacked with great success into several areas where local populations were extirpated in the United States (e.g., Tennessee [Hammer and Hatcher 1983], Pennsylvania [Rymon 1987]). The most logical source of young Ospreys for hacking would seem to be San Ignacio Lagoon, Baja, Mexico. In the early 1990s, 145 active nests were present on a small island in the lagoon. The nests are on the ground and easily accessible. For several years, one young could be taken from a series of nests (perhaps 20) which contained 3 young. The timing of the nesting cycle at San Ignacio Lagoon is well understood and could be used for planning the collection of young. Ospreys from Mexico are resident (non-migratory) and coastal. Therefore, birds from Mexico should be used in the re-introduction and not migratory northern Ospreys from Oregon or elsewhere. With respect to Ospreys, the placement of nesting platforms (poles with platforms) should greatly enhance the birds potential for nesting on the desired islands. I believe that historically, the coastal and island Ospreys in the Channel Islands and Mexico were all part of the same population, and the same can be stated for the Bald Eagles.

Apparently four young Ospreys (from a northern migratory population at Eagle Lake, CA) were backed on Santa Catalina in 2000, and another four birds in 2001. These birds may provide some useful information about DDE exposure by the time they are about 2 years old (1 year before nesting). Perhaps to potentially evaluate the influence of mammals and birds in the eagle diet, blood plasma could be collected from the same aged eagles and ospreys and a direct comparison of DDE concentrations made, i.e., assume difference in DDE is due to bird and mammals in diet.

**Summary for Channel Islands**

Current concentrations of DDE in fish, marine mammals and birds need to be determined. To the extent possible, samples collected now should be paired with samples collected earlier to determine if decreases have taken place and to what extent. The new information should be subjected to the modeling process for a risk assessment. However, the fish-eating Osprey can also play a role in directly understanding what might happen to the eagles several years in advance of any observed eagle response. The Ospreys may also alter Bald Eagle food habits toward a higher percentage of fish (the least contaminated prey) in their diet, and the Ospreys may again, become part of an ecosystem from which they were long ago extirpated.

**Bald Eagle Releases in Baja California, Mexico**

Bald Eagles historically nested as scattered pairs along the peninsula of Baja California, Mexico (Henny *et al.* 1993). Two of the islands with historic Bald Eagle nesting records are immediately south of the U.S. border (Los Coronados [near the border] and Todos Santos [off Ensenada, Mexico]). Other locations further south included Cedros Island, and a small remnant Bald Eagle population (perhaps 3-4 pairs) is still present and producing young in Magdalena Bay (24-25° N latitude). These eagles are nesting in Cardon Cactus and Mangroves A review of historic and present nesting records should be considered in any eagle release plans. We know that Ospreys along the Pacific Coast of Baja have increased in numbers from 1977 to 1992 (Henny, unpublished data) and that the Magdalena Bay eagles have been producing young (Henny *et al.* 1993). If the situation remains bleak for the successful reintroduction of Bald Eagles on the Channel Islands, releases along the Pacific Coast of Baja should be seriously considered. The presence of Fish and Wildlife personnel at many towns in coastal Mexico during the last two decades has resulted in an improved acceptance of birds of prey and specifically Ospreys. I believe Bald Eagles on the Channel Islands were part of the same population that existed farther south in coastal Mexico where a remnant population still is present. Reintroduction efforts south of the Mexico border on the Pacific Ocean side of Baja between the Channel Islands and Magdalena Bay, where Osprey population increases indicate less DDE contamination, seems very logical at this time. Then, as contaminant levels decline in the Channel Islands, theoretically the Bald Eagle population from adjacent Mexico will gradually expand into its historic range in the Channel Islands. Reintroductions into coastal Mexico would also reduce the vulnerability of the remnant population that persists in Magdalena Bay. With the present eagle population on the Pacific Coast Pacific Coast restricted to a small area (Magdalena Bay), one natural disaster (hurricane, etc.) could eliminate it.

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