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LETTERS

CHRONIC REPRODUCTIVE FAILURES AT A BALD EAGLE (*Haliaeetus leucocephalus*) NESTING TERRITORY IN NORTHERN CALIFORNIA

During a long-term study of breeding bald eagles (*Haliaeetus leucocephalus*) in northern California, we observed repeated reproductive failures at a single nesting territory in our study area. Between 1970 and 1992, eagles at this consistently occupied territory did not produce a single fledgling. Here we report possible causes of these failures.

The territory where repeated failures occurred (South Shore Nesting Territory) was one of six territories where bald eagles bred at Lake Britton in Shasta County in northcentral California. Reproductive data were available for this territory 15 of the 18 yr since 1970 that the territory was known to be occupied. All reproductive attempts were unsuccessful through 1992 (no young fledged). The eagles at no other territory in our study area were as unsuccessful.

The female occupying this territory (AF03) was first captured and banded in 1983, and recaptured and color-banded in 1989. We believe she occupied this territory continually between 1983 and 1992 (J.M. Jenkins and R.E. Jackman 1993, *Condor* 95:1053–1056). Her mate (AM07) was captured and color-banded in 1988. In 1984 and 1985, after nesting failures, we collected and analyzed four whole eggs from this territory which were presumably laid by AF03. Dichloro-diphenyl-dichloroethylene (DDE) concentrations from these four eggs ranged from 4.2–8.4 ppm wet weight ($\bar{x}$ = 5.6; J.M Jenkins 1992, Ph.D. diss., Univ. Calif., Davis, CA U.S.A.). Wiemeyer et al. (1993, *Arch. Environ. Contam. Toxicol.* 24:213–227) found a marked drop in bald eagle reproduction when DDE concentrations in eggs exceeded 5 ppm (wet weight). Three of the four eggs contained dead embryos and one was infertile. Eggshell thinning of these four eggs ranged from 6.9–11.5% ($\bar{x}$ = 9.2) based on pre-DDT era standards (0.609 mm standard; L. Kiff pers. comm.).

In the mid-1980s, following the egg analyses, we speculated on causes for the chronic reproductive failures that were occurring at the South Shore territory. Certainly, DDE contamination was implicated. One possible scenario was that AF03 held this territory long before her first capture in 1983, and this might explain why the territory had so repeatedly failed since 1970. If this were so, AF03 may have been exposed to relatively greater DDE contamination in the 1960s and 1970s than in the 1980s. Eggs from other territories in our study area, perhaps laid by younger females, did not show the elevated DDE residues at levels that appeared in the South Shore territory eggs. We also considered the possibility that somehow the South Shore territory was inferior in quality, perhaps in food resources. Three of the analyzed eggs were fertile, so it seemed unlikely that the male of the territory might be the cause of the problem.

In 1992, AF03 was found dead in her territory and sent to the National Wildlife Health Research Center in Madison, Wisconsin, for necropsy. Results of the necropsy indicated AF03 had likely died because of an aggressive interaction with another eagle. The bird also suffered chronic oviduct impaction created by a stricture in the lower oviduct. In the late 1980s and early 1990s, we did not observe the presence of eggs or note incubation behavior in the South Shore territory, which coincides with the findings of the necropsy.

Following the death of AF03 in 1992, a new adult female (AF13) paired with the resident male (AM07). This pair nested successfully in the territory in 1993, fledging one young. This was the first recorded successful reproduction in the South Shore nesting territory since it was first reported and monitoring began in 1970. In 1994, AM07 and AF13 again nested successfully, fledging two young from the South Shore territory.

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