

Reproductive performance and associated developmental and endocrinological effects of polychlorinated biphenyls (Aroclor 1242) on captive American kestrels (*Falco sparverius*).

PRIMARY PROGRAM ELEMENT: Contaminants

DURATION: Start Date: 10/1/1995 End Date: 9/30/2001

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PROJECT DESCRIPTION:

The endocrine function (as both hormonal mimics and antagonists) of many environmental contaminants has been emphasized recently, leading to the speculation that exposure to these chemicals during early development could lead to functional impairment later in life. Particularly important is the possibility that contaminants interfere with sex-steroid metabolism (estrogens have been most widely studied), since when hormone levels are altered during critical stages of embryonic and post-hatching development, the results can be abnormal maturation of the reproductive tract, abnormal endocrine function and poor reproductive capability as mature organisms. Certain PCB congeners have estrogenic activity; PCBs are highly lipophilic, mobilized with fat during reproduction, and body burdens in reproductive adults are transferred to offspring in the energy provisioned to the eggs. Using the breeding American kestrels at Patuxent as a model, this study tests the hypothesis that trans-generational exposure to PCBs can impair later reproductive performance of exposed offspring, and is associated with abnormal development of the reproductive system and endocrine function in exposed offspring. It meets Patuxent objectives in the areas of natural and human impacts on biological resources and will help develop indicators of the status of biological resources that are exposed to these compounds. Cooperators include Patuxent scientists Paula Henry, Barnett Rattner and Mark Melancon, and University of Maryland professor Dr. Mary Ann Ottinger. Results will include morphological, histological and endocrinological development of kestrel chicks exposed as embryos through PCBs deposited into the egg, as well as a functional test of the reproductive ability of similarly exposed kestrels.

APPLICATION OF RESEARCH: This study adds to our scientific understanding of the human-induced processes (PCB pollution) that influences the structure and function of many species of wildlife, especially birds at high trophic levels. PCBs are widespread environmental contaminants, certain PCB congeners have estrogenic activity, PCBs are highly lipophilic, mobilized with fat during reproduction, and body burdens in reproductive females are transferred to offspring in the lipid provisioned to the eggs. An important results will be our comparison of the developmental data with the functional reproductive ability of these birds exposed as embryos, because currently most of the data on these effects in birds is from embryonic and immature individuals. It is important for managers of exposed populations to know if the abnormalities seen in immature individuals indicate reproductive impairments later in life, among mature individuals.

PROGRESS: 4/21/1999

This year we finished the breeding trials for the second generation of kestrels, that is those adult birds that had been exposed only as embryos and only through that amount of contaminant deposited into the egg by their mothers. In addition to measuring reproductive performance, we collected data on the incubation behavior of those "F2" birds, the growth rates of their offspring,

and collected blood for plasma steroid concentrations. In the lab, the incubation behavior was analyzed, and the steroid determinations were finished. We could demonstrate no difference in reproductive performance among the treatment groups and the one numerically significant difference among the groups in incubation behavior was contrary to our expectation: the birds in the high exposure group incubated more faithfully through the day and were less prone to be flushed off their clutch. In a related study, we collected (1997) and analyzed the PCB residue and steroid (3 androgens and estrogen) concentrations in the eggs of wild Common terns. Whole clutches were analyzed in which the laying order of the eggs was known, and eggs were collected from a relatively clean colony and one where the birds feed in PCB-polluted waters. Analysis of the data this year could demonstrate no relationship between the concentrations of steroid and contaminant, but there was an expected positive egg-order effect on steroid concentrations.

DESCRIPTORS:

Base Funds; biomarkers; birds; contaminants; human impacts; toxicology