Current Status of PCB Toxicity to Mink, and Effect on Their Reproduction

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Abstract. Experiments were conducted from 1968 to 1974 to investigate reproductive complications and mortality in mink fed Great Lakes coho salmon and to ascertain the effects of polychlorinated biphenyls (PCB's) on this fur bearer. The results of mink feeding trials indicated that coho salmon, as such, were not responsible for the loss of reproduction in the adult, or the kit mortality. Mink diets that contained other species of Great Lakes fish caused similar reproductive complications, but to a lesser degree.

Rancidity, mercury poisoning and chlorinated hydrocarbon pesticide contamination of the fish were all discounted as being responsible for the problem. The clinical signs and lesions noted in mink that died while receiving diets that contained Lake Michigan coho salmon were very similar to those observed in mink fed on rations that contained supplemental PCB's. These included anorexia, bloody stools, fatty liver, kidney degeneration, and hemorrhagic gastric ulcers. Analyses of tissues from mink that died when fed 30% Lake Michigan coho salmon or 30 ppm supplemental PCB diets showed similar PCB residues.

PCB toxicity experiments revealed that mink are very sensitive to these compounds and that the lethal dose varied inversely with the chlorine content of the PCB's although only Aroclor 1254 exerted a detrimental effect on reproduction when fed at a low level (2 ppm) for 8 months. The reproductive failure encountered in feeding mink Lake Michigan coho salmon and Aroclor 1254 was shown to be of a non-permanent nature.

The fisheries of the Great Lakes have for many years provided the mink ranching industries of the North Central United States and Canada with an abundant and inexpensive supply of fish for mink feeding. The utilization of Great Lakes fish as mink feed has, however, declined considerably since the early 1960's due to reports of reproductive complications and excessive kit mortality in mink fed these fish (Hartsough 1965). In the fall of 1967 an acute problem was evident as coho salmon, taken from tributaries of Lake Michigan during the spawning run, were fed to mink and caused a precipitous increase in newborn mink mortality. Breeding and whelping were reported as normal, but kit mortality reaching 80% was reported and appeared to depend upon the percentage of coho salmon fed, as

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well as the duration of feeding. The cause of the problem was not ascertained, although rancidity, pesticide contamination, and mercury poisoning were suspected (Aulerich, et al. 1971 and 1973). Because of the human health implications and the economic importance of the Great Lakes fisheries to the mink and pet food industries this study was conducted to investigate the problem.

Experimental

The study consisted of a series of mink feeding experiments conducted between 1968 and 1974 to investigate the industry's observations relative to the adverse effects of Great Lakes fish on mink reproduction, to ascertain the cause of the problem, and to investigate the effects of the causative agent on mink.

The following general procedures were employed throughout the study. Specific procedures for certain experiments are described in the text.

Composition of the basal diet was 15% fortified cereal, 20% tripe, 5% beef liver, 15% horse meat, 15% chicken, and 30% whole fish. The same basal diet, except where specified, was fed throughout the study. Routine ranch procedures were employed in the feeding, care, and breeding of the animals. The mink were vaccinated as kits against canine distemper, botulism, and virus enteritis. Whenever possible, the females were mated to males within their respective dietary groups. All matings were verified by the presence of apparently normal motile spermatozoa in the vaginal smear after copulation. The mated females were checked daily for young during the whelping period. Kits were counted on the day of birth and at 4 weeks of age.

Diets containing supplemental polychlorinated hydrocarbons were prepared by dissolving the desired quantity of the compound in acetone and blending the solution with ground commercial mink cereal. The acetone was evaporated and the cereal-compound premix mixed with the other dietary ingredients to yield a ration that contained the desired amount of the chlorinated compound.

Preliminary Studies

The first phase of the study consisted of 3 mink feeding experiments designed to ascertain the nature and extent of the problem. In these trials, 201 mink were fed diets that contained 30% of various species of Great Lakes or marine fish. As shown in Table 1, reproductive failure occurred in the females fed all diets that contained Lake Michigan coho salmon. Only 10 kits were whelped by the 53 mated females; eight were stillborn and the two that were born alive died within 24 hrs postpartum. No teratism was observed. The reproductive performance of the females fed West Coast coho salmon was not impaired. The average size of the litters whelped by females fed the rations that contained Lake Erie coho salmon, Lake Michigan bloater chub and Lake Michigan yellow perch, was not greatly reduced, although high kit mortality occurred on the diets that contained Lake Erie coho salmon, Lake Michigan bloater chub and Lake Michigan yellow perch.

The average birth weight of the kits whelped by females fed the diet that contained Lake Michigan bloater chub was significantly less (P < 0.01) than those whelped by females fed the control ration (Table 2). The average body weights of 4-week-old kits nursed by females fed diets that contained West Coast coho salmon, Lake Erie coho salmon, Lake Michigan bloater chub and Lake Michigan yellow perch were significantly less (P < 0.01) than those nursed by females fed the control diet (Table 2).

All breeder mink that received Lake Michigan coho salmon canning by-products (heads, fins, tails, viscera, and belly fat) in their diet died between the beginning of the breeding season (March 1) and the end of the whelping period (May 15). Six adult mink fed Lake Michigan coho salmon in the

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2 Kel-blend No. 1009, W. K. Kellogg Co., Battle Creek, MI.