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drastic deformities

by Kyla Dunn

Don't let the soaring numbers of double-crested cormorants in the Great Lakes fool you. Although this species survived a DDT-induced population crash, cormorants now fall victim to a host of bizarre deformities associated with other manmade chemicals.

The cormorant deformities are spectacular, and often grotesque. All are a sign of disrupted development and appear while a chick is still in the egg. In "crossed-bill syndrome," pictured here, a bird cannot close its bill because the upper and lower halves curve in opposite directions. Some birds' bills are bent downward, or form corkscrew shapes in midair. Crossed-bill birds tend to die within a few weeks, unable to catch fish with the deformed bills. A more common problem is "edema", which is swelling caused by extra fluid underneath the skin. When the swelling is severe, an embryo's head and neck can be 2-3 times the normal size. Edema often kills chicks before they hatch. Other birds have missing eyes, dwarf limbs, clubfoot (where a foot is rotated inward, or a leg appears stuck on sideways), internal organs on the outsides of their bodies, incomplete skulls, or crooked necks caused by abnormal vertebrae. Nineteen types of abnormality have been described in all.

The deformed cormorant embryos are much less likely to survive. Overall, 5% of cormorant eggs in the upper Great Lakes contain a deformed embryo. However, among live chicks, only 0.5% are deformed. This means that most chicks with deformities die before hatching. In fact, 90% of them die while still in the egg.

The deformities can be accompanied by other problems that are more characteristic of endocrine, or "hormone", disruption. Researcher Jim Ludwig sent a batch of deformed embryos to a colleague, Michael Fry, who analyzed their ovaries and testes. Some of the embryos were clearly intersex, with both male and female reproductive structures. 85% appeared to be female. What this showed was a clear relationship between deformities and the sexual development of an embryo. It also raised the possibility that some of the birds were genetic males "feminized" by contaminants.

Chemical Culprits

Jim Ludwig and his colleagues have evidence that this rash of cormorant defects is caused by manmade chemicals. Ludwig is one of the researchers most heavily involved with cormorants in the Great Lakes. From 1986 to 1991, these researchers surveyed cormorant breeding colonies throughout the area. As they roamed the colonies, they broke open some of the eggs to measure contaminant levels and examine the chicks inside. When they counted deformities in dead eggs, live eggs, and newly hatched chicks, a clear pattern soon emerged. The higher the levels of manmade chemicals in the eggs, the more deformities were seen in the chicks.

The culprit chemicals are "polychlorinated diaromatic hydrocarbons". This family includes the infamous dioxin and dioxin-like PCBs. These are fat- loving chemicals which bioaccumulate in the aquatic food chain, reaching high concentrations in the Great Lakes fish that make up a cormorant's diet. Adult birds pass the chemicals on to their eggs where they wreak havoc in the developing young. Cormorant deformities are most often reported in bird colonies near the forty-two "Areas of Concern" identified as having the highest contaminant levels in the region. In one survey, the contaminated Green Bay area of Lake Michigan had over 80 times more cross-billed cormorants than less contaminated parts of Canada. What's more, the deformities can be reproduced in the laboratory by treating domestic chickens with PCB- or dioxin-contaminated feed before they lay eggs, or by injecting the eggs with these chemicals.

Jim Ludwig sees first-hand the devastation caused by contaminants, and has brought this message "live" to legislators. In the 1980's, Ludwig toured with a crossed-bill cormorant named Cosmos. Cosmos' bill was so deformed that she had to be kept alive by hand feeding. This striking creature became a "Smokey the Bear" of the bird world. According to Ludwig, she made twenty-seven television appearances and had her picture on the cover of a Japanese schoolbook before she died at the age of 14 months. Ludwig made a point of taking her to legislative hearings where the rules governing PCB use were in debate. When she appeared at state Senate hearings in Madison, Wisconsin, lawmakers decided not to relax the rules. Ludwig credits Cosmos with the victory.

A History of Devastation

Cormorants like Cosmos have fought a long and difficult battle with manmade chemicals. In the early 1950's thousands of breeding pairs nested on islands throughout the Great Lakes. By the 1970's, however, double-crested cormorants seemed headed for extinction. Widespread exposure to DDE--a breakdown product of DDT--made it impossible for the birds to reproduce. Cormorants are extremely sensitive to DDE-induced eggshell thinning. A DDT concentration above 15 ppm in an egg will cause total reproductive failure, and by 1972 the average DDT level in cormorant eggs reached 22 ppm.

Canadian Wildlife Service biologists were alarmed. They found that adult birds were producing the normal number of eggs, but those eggs were not hatching. The eggs had chalky shells that were over 20% thinner than museum specimens collected in the pre- DDT era. By 1973, only 125 cormorant breeding pairs remained, and these pairs produced less than half the number of chicks needed to maintain the population.

Death caused by high levels of DDT masked the more subtle developmental problems linked to PCBs and dioxins. Now that cormorant chicks hatch in greater numbers, these underlying problems have come to light. The good news is that total PCB contamination in the Great Lakes has fallen during the past two decades. However, the incidence of deformities remains high. This could be due to a selective accumulation of dioxin-like PCBs in the food chain. One study found that dioxin-like PCB levels in water birds and their forage fish were four to six times higher than in parent PCB mixtures.

Just five years after the 1972 ban on DDT use cormorants began to reproduce almost normally, and have since staged an astounding recovery. Oddly enough, manmade chemicals are to thank for the population explosion as well as the deformities. Contaminants have devastated predators such as mink, Great Horned Owls, and Bald Eagles that once kept the cormorant population in check. Species like the Herring Gull, which compete with cormorants for food, are also fewer in number. Cormorants are less sensitive than other species to contaminants still present in the Great Lakes, and can detoxify them in their bodies. They also have a high fecundity rate: two to three fold greater than their competitors. The combination means that, despite their problems, double-crested cormorants are well on their way to reclaiming their former status as an abundant "pest".

KEY POINTS / SUPPLEMENTAL INFORMATION:

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