

POISONS AND TOXICANTS OF BIRDS OF PREY AND POULTRY

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SUMMARY

Birds of prey are birds that hunt for food primarily via flight, using their keen senses, especially vision. They primarily hunt vertebrates, including other birds and their talons and beaks are large, powerful and adapted for tearing flesh. They are called "raptor" due to their ability to seize or take by force. Because of their predatory lifestyle, often at the top of the food chain, the birds of prey face distinct conservation concerns. Among the major issues is exposure to poisonous xenobiotics (substances that are foreign to living systems).

Ecotoxicology is the study of the adverse effects of toxicants on organisms that compose ecosystems including such as the birds of prey. Environmental persistence, propensity to accumulate in living things and high toxicity the three insidious characteristics shared by chemicals pose major environmental hazards.

Naturally occurring toxicants are from geothermal sources and heavy metals such leached from minerals. Industrial and agricultural endeavors are associated with the extensive use of a wide array of chemicals. Pesticides and other agricultural chemicals have revolutionized farm and forest productivity and their potential adverse effects are often viewed as insignificant relative to the benefits. Environmental toxicology is divided into environmental health toxicology and ecotoxicology. Ecotoxicology focuses on the effects of environmental contaminants on ecosystems and constituents thereof including raptors, fish and other wildlife.

Effects of toxicants on population and ecosystem

A xenobiotic species is one that is foreign to living systems. Exposure of organisms to xenobiotic materials is a very important consideration in environmental and toxicological chemistry. Chemicals that have posed major environmental hazards share three insidious characteristics. This environmental persistence, the propensity to accumulate in living things, and high toxicity.

Classes of toxicants

Persistent organic pollutants

Easily degraded pollutants

Heavy metals

Non metallic inorganic chemicals

Radioactive pollutants.

Effects of toxicants on population, individuals, community, ecosystem

Mostly toxicology considers the effects of toxicants on individuals. Ecotoxicology is more concerned with toxic effects on large numbers of individuals composing populations of organisms. Exposure to toxicants lowers populations by lowering reproductive rates, causing mortality, or weakening members of the species so that they become more vulnerable to predation, disease, or parasites.

In severe cases of exposure to toxicants, a population may go to zero. Another possibility is for a population to decline, and then rise again as the population develops resistance to the effects of the toxic substance. This effect has been observed in the case of exposure to insecticides of insects whose short reproductive times enable natural selection to build

populations resistant to the insecticides. Decreased populations due to exposure to toxic substances may result from mortality to members of the population or from adverse effect on reproduction.

Increased mortality obviously decreases numbers directly, but it also results in decreased numbers because of fewer adults capable of producing young. Effects of toxicants on populations may be indirect. There have been cases reported in which herbicides destroyed weed species that served as sources of food for certain kinds of insects that, in turn, were the food source for particular species of birds. Spraying with these herbicides resulted in decreases in bird populations because of the destruction of their insect food sources.

Toxicants have been known to result in increases in some populations. This occurs when organisms that are predators to a particular species are poisoned, allowing the species to increase in numbers.

In an ecosystem intricate relationships exist among the organisms with each other and with their surroundings and these relationships may be perturbed by the effects of toxicants. Exposure to xenobiotics may alter the homeostasis of individual organisms, leading to effects on populations, specific kinds of organisms, communities of organisms, and whole ecosystems.

Ecosystems are divided generally into terrestrial ecosystems and aquatic ecosystems.

Populations of organisms in ecosystems may reflect exposures to toxicants. Observations of effects on populations of organisms or on entire ecosystems are considered to be higher order end points in toxicological studies than are observations of effects on individual organisms.

A severe decline in populations of a particular kind of organism may be the result of the direct effects of a toxic substance on the population. This was the case of drastically reduced populations of eagles exposed to insecticidal DDT, which prevented production of eggs capable of hatching. Populations may reflect indirect effects of toxicants, such as an overpopulation of rodents resulting from reduced numbers of birds of prey killed by toxicants.

Population distributions between young and older organisms and between sexes may be altered by toxic substance exposure. During times when DDT and other organochlorine insecticides were widely used, declines in some populations of female ducks were observed. These ducks died because they accumulated large amounts of fat tissue contaminated with organochlorine compounds prior to the season in which they laid eggs.

These stores of fat were rapidly used during egg production and incubation, leading to a release of high levels of toxic organics into the blood of the female ducks and causing fatal poisoning to result. Effects on population distributions may serve as evidence of kinds of toxicants. A marked decrease in numbers of juveniles may indicate the presence of reproductive poisons. A low population of older individuals can result from exposure to carcinogens, which take a relatively long time to act, so that older members develop cancer and die. Many of the factors that can affect organisms adversely are inherent stressors, including availability of nutrition, water quality, temperature and other climatic extremes, disease, and predation.

It is also important to consider sub-lethal effects of toxicants, which may cause ill effects in populations without directly killing individuals. Exposure to toxicants can lower reproductive rates of organisms and affect rates of survival of juveniles to adulthood. Biochemical tests such as examination of the induction of mixed-function oxygenase enzymes, which are produced by organisms to metabolize toxicants, are used in ecotoxicological studies. The presence of stress proteins that serve to repair proteins denatured by toxicants can be evidence of an organism attempting to cope with sub-lethal effects of toxicants. The activity of the acetylcholinesterase enzyme can be measured as evidence of the harmful effects of

organophosphate and carbamate insecticides. Genotoxicity and immune system effects can also be monitored for evidence of sub-lethal effects.

Environmental factors have long been shown to influence the toxicity of pollutants in living organisms. The factors discussed include temperature, salinity, water hardness, pH, oxygen tension, nonionizing radiation, photoperiod, and season. Furthermore, biological monitoring is very useful in determining the effectiveness of measures taken to prevent exposure.

Indiscriminate killing of birds for meat is a looming threat to the birds' survival.

Pesticides like furadan are still available and used in some rice growing areas. Tragic effects of pesticide poisoning on predators and vultures in Kenya wildlife have been documented.

The problem is occurring across Africa where vultures in particular are at risk across the continent. In Kenya, Tanzania, Namibia, South Africa and Botswana, pesticides containing carbofuran are being used to wipe out vultures. In Botswana vultures are targeted by poachers who want to get rid of them because they attract the authorities to their kills. Farmers also lace meat to target hyenas and this often results in vulture kills as well. Researchers have warned that some birds of prey like the vulture are endangered species and may be extinct unless efforts are made to save them.

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