

Patuxent Wildlife Research Center

Hazard, Risk and Physiologically-based Pharmacokinetic Model for Anticoagulant Rodenticides in Kestrels and Owls



The Challenge: Anticoagulant rodenticides have been identified as being hazardous to predatory and scavenging birds on a global scale. Restrictions on the sale, distribution and packaging of some second-generation anticoagulant rodenticides (e.g., brodifacoum, difethialone, bromadiolone and difenacoum) have been instituted by the US EPA, and will likely result in expanded use of first-generation anticoagulant rodenticides (e.g., chlorophacinone, diphacinone). The risk posed by anticoagulant rodenticides to wildlife is inadequately characterized, and toxicological data are needed to better evaluate the threat of these compounds non-target organisms.



The Science: Data on the toxicity of chlorophacinone, diphacinone and brodifacoum are being collected in American kestrels and Eastern screech-owls. Measurement endpoints include blood clotting time, hematocrit, histopathological lesions, overt signs of distress, and survival. The half-life of anticoagulant rodenticide residue in tissues is also being determined. These data are employed in both deterministic and probabilistic risk assessments, and in the generation of dietary- and tissue residue-based toxicity reference values associated with prolonged clotting time. A pharmacokinetic model for diphacinone in various species of wild birds is under development in predatory birds and will assist in further evaluating the hazard of this rodenticide.



The Future: The acute oral toxicity of diphacinone was found to be over 20 times greater in American kestrels than in Northern bobwhite and mallards. More importantly, at environmentally realistic dietary concentrations, chlorophacinone and diphacinone have been shown to prolong clotting time and cause other toxicological effects in kestrels and owls. Their hazards to predatory birds are greater than predicted by studies in mallard ducks and bobwhite quail. Studies are being initiated to examine latent and protracted effects of combinations of anticoagulant rodenticides encountered by free-ranging raptors residing at the urban-agricultural interface.