

Patuxent Wildlife Research Center

Avian Egg Injection Studies for Assessing Adverse Outcomes Associated with Exposure to Flame Retardants



The Challenge: The use of flame retardants (FRs) as additives in a variety of consumer use products, including plastics, textiles, and electronics, is projected to continue and increase for the foreseeable future. Because of unforeseen environmental problems, some FRs have either been banned, restricted, or are being phased-out, while other new and presumably safer FRs are seeing wider usage. Regrettably, many of these alternative FRs are still found to bioaccumulate in wildlife tissues, including within bird eggs, suggesting exposure through maternal deposition. However, few data are available on the potential adverse effects in the exposed animals.



The Science: In collaboration with Environment Canada, USGS biologists from Patuxent Wildlife Research Center (PWRC) are investigating the effects of embryonic exposure to alternative flame retardants in birds. These studies employ avian egg injection methods developed at PWRC to simulate maternal deposition of pollutants. Initial studies focused on the effects of the brominated FR tetrabromobisphenol A bis[2,3-dibromopropyl ether] (TBBPA-BDBPE), an additive flame retardant used in plastic products, resins, textiles, paints, and household electronics as a replacement for the phased-out FR decabromodiphenyl ether (decaBDE). Using American kestrel (*Falco sparverius*), a semi-altricial raptorial model, and Japanese quail (*Coturnix japonica*), a precocial gamebird model, we examined the potential toxicity of TBBPA-BDBPE on survival, growth, molecular, biochemical, and endocrine endpoints. Transcriptome sequencing (RNAseq) is being used to identify additional affected pathways in the birds.



The Future: These data will help determine the potential hazards posed by this chemical class to free-ranging birds and will provide information for the development of an avian adverse outcome pathway (AOP). An AOP is a conceptual construct that links a series of events that occur in response to a contaminant, which span multiple levels of biological organization, from the molecular to whole animal or higher level. Egg injection studies will continue in 2015 to screen additional flame retardants of emerging concern.