

Patuxent Wildlife Research Center

MERCURY AND SELENIUM POISONING: WHEN 1+1 ≠ 2

One of the most difficult problems in studying how harmful chemicals poison wildlife is to learn what happens when an animal is exposed to more than one chemical at the same time. An example in nature is with mercury and selenium. Each chemical is known to cause mortality and reproductive failure in animals. However, when an animal is exposed to both of them at the same time, some unexpected things can happen.

IN WHAT WAYS CAN HARMFUL CHEMICALS INTERACT?

Normally, they do *not* interact at all with each other. However, in those unusual instances when they do interact, two opposite things can happen.

- The two contaminants can nullify each other's toxicity - a phenomenon called **antagonism**
- The two can magnify each other's toxicity - called **synergism**

MERCURY AND SELENIUM INTERACT BOTH WAYS!

Until recently, mercury and selenium were believed to act only antagonistically. However, when mallards were fed the most harmful form of mercury (methylmercury) in combination with the most harmful form of selenium (selenomethionine), **both** antagonism and synergism were observed.

- Ten parts per million (ppm) of mercury in the diet killed adult male ducks, but when 10 ppm selenium was also in the diet with the mercury, the ducks did not die - a classic case of antagonism
- However, eggs laid by female mallards that had eaten the same combination of mercury plus selenium experienced greater mortality and deformities of embryos than eggs of females fed only mercury or selenium - a case of synergism that has not been reported before



WHERE DOES RESEARCH NEED TO GO FROM HERE?

- Research is needed to more fully understand how mercury and selenium can harm various species of wildlife that encounter these chemicals separately
- Different levels of mercury and selenium must be fed in the same diet to wildlife to learn what combinations cause harm
- Field studies are needed to discover how prevalent these mercury-selenium interactions are in nature
- The underlying biochemical mechanisms of mercury-selenium interactions must be discovered
- Resource managers need to be alerted to this unusual contaminant problem

Additional scientific information is needed to understand the extent to which synergistic interactions between methylmercury and selenomethionine can harm wildlife, and to advise resource managers on ways to avoid or correct such harm. As the Nation's leading wildlife contaminant research facility, Patuxent is poised to address this problem.