

Publication Brief for Resource Managers

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Mercury Toxicological Risk is Highest at Hatching and Fledging for Terns, Stilts and Avocets

Laboratory studies have shown that methylmercury exposure can impair bird chick behavior, health, growth and survival. A study by USGS researchers published in *Environmental Science & Technology* reports that for three North American waterbird species, mercury toxicological risk is highest at hatching and fledging.

Researchers examined total mercury and methylmercury concentrations in blood, liver, kidney, muscle, and feathers of 111 Forster's tern (*Sterna forsteri*), 69 black-necked stilt (*Himantopus mexicanus*) and 43 American avocet (*Recurvirostra americana*) chicks as they aged from hatching through postfledging at wetlands that had either low or high mercury contamination in San Francisco Bay. The study sites were at the Don Edwards San Francisco Bay National Wildlife Refuge and Eden Landing Ecological Reserve; both are part of the South Bay Salt Pond Restoration Project.

Mercury concentrations in chick feathers were highly variable and declined linearly with age. In contrast, mercury concentrations in internal tissues were highest immediately after hatching, due to maternally deposited mercury in eggs. Concentrations then rapidly declined as chicks aged and diluted their mercury concentrations through growth in size and as mercury is transferred into growing feathers. Mercury concentrations then increased during fledging when tissue growth and feather growth slowed, while chicks continued to acquire mercury through their diet.

This "U-shaped" pattern of mercury concentrations from hatching to fledging indicates that juvenile birds may be at highest risk to methylmercury toxicity shortly after hatching and again after fledging.

Management Implications

- Hatching and postfledging stages are especially sensitive time periods for the survival of juvenile birds, in terms of mercury toxicological risk.
- Mercury concentrations declined more in chicks that gained more mass between sampling events, indicating the importance of mass dilution for reducing mercury concentrations in chicks, even though they still acquire mercury in their diets as they age.
- Fully grown feathers are relatively poor indicators of internal tissue mercury concentrations in free-living chicks, and down feathers may have more utility for estimating internal tissue concentration, especially in recently-hatched chicks.

THIS BRIEF REFERS TO:

Ackerman, J.T., C.A. Eagles-Smith, M.P. Herzog. 2011. Bird Mercury Concentration Change Rapidly as Chicks Age: Toxicological Risk is Highest at Hatching and Fledging. *Environmental Science & Technology* 45: 5418-5425. doi: 10.1021/es200647g

<http://www.werc.usgs.gov/davis>
<http://www.werc.usgs.gov/ProductDetails.aspx?ID=4307>
<http://www.southbayrestoration.org>



Mercury toxicological risk is highest during hatching and fledging for Forster's tern chicks. Photo: Josh Ackerman/USGS