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Publication Brief for Resource Managers

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Integrating Toxicity Risk in Bird Eggs and Chicks

The concentration of mercury in eggs that causes reduced hatching success is regarded as a critical endpoint for mercury toxicity in birds. However, incorporating effects of *in ovo* mercury exposure on chick health and survival could improve risk assessment. In a recent issue of *Environmental Science and Technology*, USGS scientists Drs. Josh Ackerman and Collin Eagles-Smith provided a means of extrapolating the toxic effects of mercury in eggs to the health and survival of chicks.

Black-necked stilt nest with a chick hatching out of its egg in San Francisco Bay, California. Photo: R. Wilming, USGS.

Management Implications:

- Commonly used endpoints, such as egg hatchability, likely underestimate the risk of mercury contamination to avian reproduction.
- However, this study's results provide the ability to develop exposure thresholds for eggs that incorporate *in ovo* mercury's effects on both egg hatchability and subsequent chick mortality.

The authors developed equations to predict mercury in eggs using mercury in chick down feathers, and vice versa, by assessing the relationship between mercury in feathers (0.5-32.4 µg g^{-1} fw) and eggs (0.04-2.79 µg g^{-1} fww) for three waterbird species in San Francisco Bay, California. Feather mercury sampled from embryos of pipping eggs was highly correlated with fresh whole-egg mercury (n=94, r^2=0.96). Additionally, using a novel egg micro-sampling technique they developed with partners at USGS Patuxent Wildlife Research Center (Stebbins et al. 2009), albumen mercury was correlated with feather mercury sampled from chicks in the same nest (n=28, r^2=0.79). Down feather mercury in recaptured chicks (≤10 days old) was correlated with down feather mercury at hatching (≤3 days old; n=88, r^2=0.74). Our results demonstrate the utility of using down feathers of chicks ≤10 days of age to non-lethally predict mercury in eggs.

Ackerman, J.T., and C.A. Eagles-Smith. 2009. Integrating toxicity risk in bird eggs and chicks: using chick down feathers to estimate mercury concentrations in eggs. Environmental Science and Technology 43:2166-2172.

Stebbins, K.R., J.D. Klimstra, C.A. Eagles-Smith, J.T. Ackerman, and G.H. Heinz. 2009. A non-lethal micro-sampling technique to monitor the effects of mercury on wild bird eggs. Environmental Toxicology and Chemistry 28:465-470.