

Western Ecological Research Center

Publication Brief for Resource Managers

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Mercury Bioaccumulation and Risk to Three Waterbird Foraging Guilds

Methylmercury exposure and bioaccumulation in wildlife is widespread and can have deleterious effects on reproduction. Waterbirds are at particularly elevated risk to mercury impairment because they commonly feed at high trophic levels and in wetland habitats where microbial production of methylmercury can be high. A recent USGS study authored by Dr. Collin Eagles-Smith, Dr. Josh Ackerman, Susan De La Cruz, and Dr. John Takekawa investigated mercury bioaccumulation and risk to five waterbird species representing three foraging guilds in San Francisco Bay, California. They reported their results in a recent issue of *Environmental Pollution*.

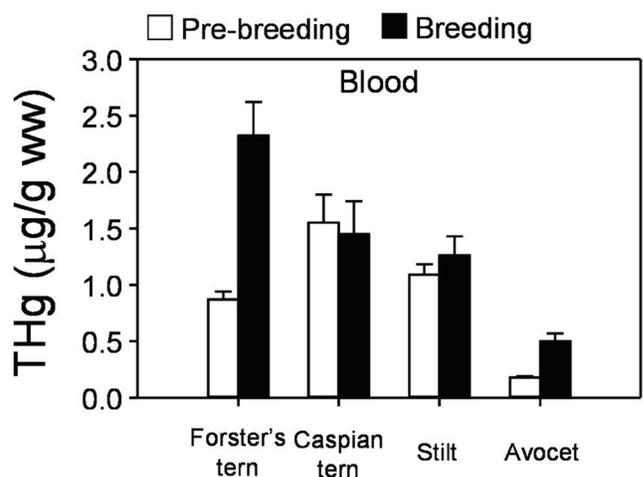
During both the pre-breeding and breeding seasons the authors analyzed mercury in tissues of two fish-eating

Management Implications:

- Waterbirds that forage in wetlands and marshes of San Francisco Bay have higher mercury exposure than waterbirds that forage more in mudflats and the open bay.
- Mercury concentrations increased dramatically in Forster's terns during the breeding season, a sensitive exposure period.
- Mercury concentrations in 48% of breeding Forster's terns exceeded levels associated with high risk in other waterbird species, suggesting that Forster's tern productivity and mercury exposure in San Francisco Bay should be monitored as restoration efforts increase marsh habitats within the region.



Forster's tern, a fish-eating species, was determined in this study to be the species most at risk to mercury exposure. Photo © Ken Phenicie, used with permission.



Mercury concentrations in blood of pre-breeding (open bars) and breeding (solid bars) waterbirds in San Francisco Bay.

bird species (Forster's tern and Caspian tern) and two invertebrate-foraging shorebird species (American avocet and black-necked stilt). Additionally, they evaluated mercury in a wintering diving duck, surf scoter. They found that fish-eating birds generally had the highest mercury concentrations in their tissues, but concentrations in an invertebrate-foraging shorebird (black-necked stilt) were also elevated. Foraging habitat was important for mercury exposure as illustrated by within-guild differences, where species more associated with marshes and salt ponds had higher concentrations than those more associated with open-bay and tidal mudflats. Importantly, mercury concentrations increased with time spent in the estuary. Surf scoter concentrations tripled over six months, whereas For-

ster's terns showed an up to five-fold increase between arrival at the estuary and breeding. Breeding waterbirds were at elevated risk of mercury-induced reproductive impairment, particularly Forster's terns, in which 48% of breeding birds were at high risk due to their mercury levels. These results highlight the importance of habitat and exposure timing, in addition to trophic position, on waterbird mercury bioaccumulation and risk.

Eagles-Smith, C. A., J. T. Ackerman, S. E. W. De La Cruz, and J. Y. Takekawa. 2009. Mercury bioaccumulation and risk to three waterbird foraging guilds is influenced by foraging ecology and breeding stage. Environmental Pollution 157:1993–2002.