

Data Gaps and Ecotoxicological Information for Terrestrial Vertebrates in Chesapeake Bay

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The Chesapeake Bay Program is attempting to assess the status of aquatic-dependent living resources in the Bay to toxics. The BEST Program of the USGS has evaluated data on contaminant effects in wildlife to compliment this program and to meet Department of the Interior partner data needs related to understanding the factors affecting health of wildlife in the Bay watershed. The Contaminant Exposure and Effects—Terrestrial Vertebrates (CEE-TV) database summarizes ecotoxicological data for terrestrial vertebrates inhabiting estuarine and coastal habitat along the Atlantic, Gulf, and Pacific coasts, Alaska, Hawaii, and the Great Lakes. Data is compiled from published literature and unpublished sources, including reports from conservation agencies, private groups, and universities. Summary information includes contaminant exposure, biomarker responses, and adverse effects on reproduction and survival that can be queried by taxonomic, spatial, and temporal fields. Several conclusions can be drawn from an analysis of CEETV data for Chesapeake Bay. Despite its ban for hunting in wetlands, the effect of the lead shot ban has not yet been assessed in the Chesapeake. Mercury does not currently appear to be posing a threat to terrestrial vertebrates in Chesapeake Bay, however, mercury methylation may be occurring at significant rates in smaller bodies of water within the bay, necessitating its continued monitoring. DDE and PCBs have steadily declined since restrictions on their use; high levels of these compounds and related effects can still be found in highly contaminated regions. Exposure to dioxins and dibenzofurans, cholinesterase-inhibiting pesticides, and rodenticides has not been adequately assessed for terrestrial vertebrates in the Chesapeake. In addition, several national parks and refuges within the Bay watershed lack terrestrial vertebrate ecotoxicological data. Compared to other estuaries in the United States, contaminant exposure and effects in Chesapeake Bay terrestrial vertebrate range from moderate to potentially significant.

METALS AND TRACE ELEMENTS

Lead

- Of 108 records that document lead exposure in waterfowl from 1972-1995, 27 reached levels indicative of subclinical or clinical poisoning
- However, since the ban on the use of lead shot for hunting waterfowl, only 13 records contain data on lead in waterfowl, 5 of which are indicative of lead poisoning (Figure 1)
- No information on diving ducks for this period, despite the high susceptibility of these birds to poisoning from lead shot
- No data examining rates of lead shot ingestion following its ban

Mercury

- Of 37 records (1973-2001) in eggs of fish-eating birds, none were above the 1 ug/g threshold for adverse effects
- Of 48 records (1971-1994) in liver and kidney of reptiles, birds, and mammals, the highest values were 8.8 and 1.3 ug/g, well below the 20-30 ug/g threshold for adverse effects (Figure 2)

Selenium

- Of 45 records (1973-1998), 11 contained selenium values above the threshold in which toxicity may occur, however all of these records were for waterfowl wintering, and not breeding, in Chesapeake Bay

Cadmium

- Of 168 records (1972-1995) of reptiles, birds, and mammals, none approached levels associated with toxicity

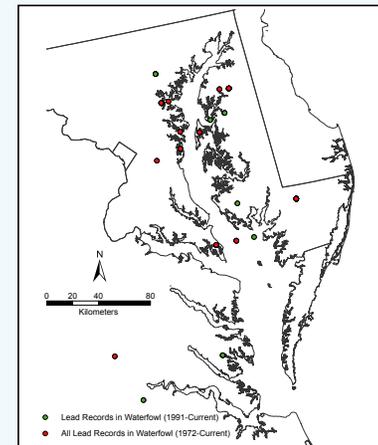


Figure 1. Chesapeake Bay CEE-TV records of lead in waterfowl compared to records of lead in waterfowl after the lead shot ban in 1991.

PESTICIDES AND ORGANIC CONTAMINANTS

DDE

- DDE concentrations in eggs of fish-eating birds have decreased steadily since the ban of DDT (Figure 3)
- Eggshell thinning, which reached mean levels of 26% in the 1970's, has not been evidenced overall in the 1990's to present, though individual values in osprey eggs in 2000 were thinned by up to 10%

PCBs

- PCB concentrations have decreased in eggs of fish-eating birds, though at a slower rate than DDE.
- Limited data exist on PCB congener exposure (only for black-crowned night-heron and osprey eggs).

Dioxins and Dibenzofurans

- No information exists for these highly toxic compounds in terrestrial vertebrates.

Cholinesterase-Inhibiting Pesticides

- Though several die-offs had previously been reported, only one record contains information on organophosphorus insecticide or carbamate exposure in terrestrial vertebrates since 1993.

Rodenticides

- Little data (1 record only) on exposure to these compounds.

Emerging Contaminants

- Detectable quantities of brominated diphenyl ethers, nonylphenol, and perfluorinated compounds were found in osprey eggs collected in 2000 and 2001. There are many sources of these contaminants (e.g., sewage outfalls), but concentrations in biota appear to be below adverse effect levels.

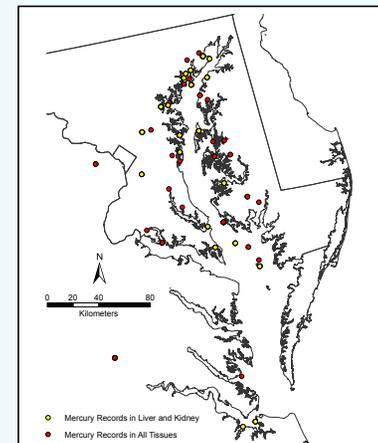
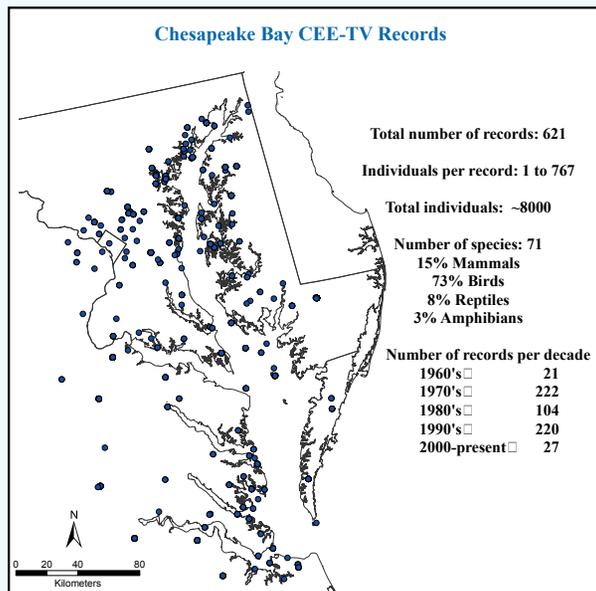
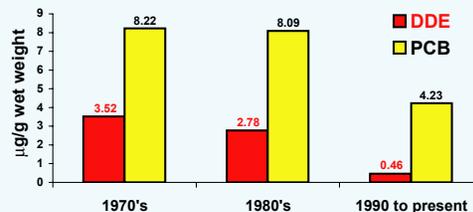


Figure 2. Chesapeake Bay CEE-TV records of mercury in all tissues compared to records of mercury in liver and kidney of reptiles, birds, and mammals.



DDE and PCB in Eggs of Fish-Eating Birds in the Chesapeake Bay



DATA GAPS AND MANAGEMENT IMPLICATIONS

- Despite its ban for hunting in wetlands, lead shot continues to appear in the gizzard of waterfowl in other regions. The effect of the lead shot ban has not yet been assessed for the Chesapeake Bay.
- Based on CEETV exposure data, mercury does not currently appear to be posing a threat to terrestrial vertebrates in Chesapeake Bay. However, mercury methylation may be occurring at significant rates in smaller bodies of water within the bay, necessitating its continued monitoring.
- DDE and PCBs have steadily declined since restrictions on their use. However, high levels of these compounds and related effects can still be found in highly contaminated regions.
- Exposure to dioxins and dibenzofurans, cholinesterase-inhibiting pesticides, and rodenticides has not been adequately assessed for terrestrial vertebrates in Chesapeake Bay.
- Limited data exist for reptiles and amphibians inhabiting coastal areas of the United States, including Chesapeake Bay.
- Several national parks and refuges within the Chesapeake Bay watershed lack terrestrial vertebrate ecotoxicological data.
- Compared to other estuaries in the United States, contaminant exposure and effects in Chesapeake Bay terrestrial vertebrate range from moderate to potentially significant.

CONTAMINANTS OCCURENCE:

- Data exist for 76 different contaminants in terrestrial vertebrates in the Chesapeake Bay, which is <0.1% of total chemicals in U.S. commerce.
- The percentage of records that contain information on the following contaminants is as follows:

<input type="checkbox"/> DDE, DDD and DDT	<input type="checkbox"/>	42%
<input type="checkbox"/> Ah-receptor active PCB Congeners	<input type="checkbox"/>	1%
<input type="checkbox"/> Mercury	<input type="checkbox"/>	25%
<input type="checkbox"/> Lead	<input type="checkbox"/>	44%
<input type="checkbox"/> Biomarker/bioindicator Responses	<input type="checkbox"/>	15%

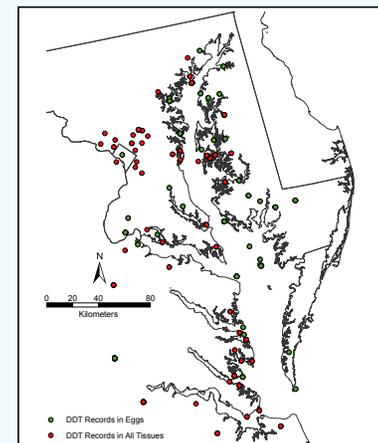


Figure 3. Chesapeake Bay CEE-TV records of DDT and its metabolites in all tissues compared to records of DDT and its metabolites in eggs.