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TERRESTRIAL VERTEBRATE CONTAMINANT EXPOSURE AND EFFECTS DATA FOR MID-ATLANTIC NATIONAL PARK SERVICE LANDS

B.K. Ackerson, B.A. Rattner, M.A. McKernan

USGS-Patuxent Wildlife Research Center, Laurel, MD

ABSTRACT

The Contaminants Exposure and Effects-Terrestrial Vertebrates (CEE-TV) database was developed to provide access to ecotoxicological information, examine exposure trends, and identify data gaps. It contains 17,450 data records on amphibians, reptiles, birds, and mammals residing in the Atlantic, Gulf, and Pacific coasts, Alaska, Hawaii, and the Great Lakes. Information in the database was derived from over 1800 source documents, representing 483 species (~ 252,000 individuals), with dates spanning from 1884 to 2004. Contaminant exposure data is available for 209 chlorinated and brominated compounds, cholinesterase-inhibiting pesticides, metals, and petroleum hydrocarbons, while only 9.3% of the records contain biomarker or bioindicator effect data in terrestrial vertebrates. Temporal evaluation of exposure data indicates declining concentrations of certain organochlorine pesticides. However, concurrent data provides evidence of an increase in the detection and possibly the incidence of die-offs related to cholinesterase-inhibiting pesticides. When 192 database records with specific locations were combined with the boundaries of NP units in the National Capital Region and Mid-Atlantic Networks, data gaps were evident. There were no records for four NP units and recent (1990-2004) data were available for only nine of the 22 NP units in the study area. Characterization of real and potential pollution hazards of these areas lacking recent data revealed seven NP units have significant pollution concerns. These areas of concern should receive priority for terrestrial vertebrate contaminant monitoring.

INTRODUCTION

The Biomonitoring of Environmental Status and Trends (BEST) Program of the U.S. Geological Survey (USGS) (1) assesses the exposure and effects of environmental contaminants on select species and habitats throughout the United States, (2) conducts research and synthesis activities that provide biomonitoring methods for field application, and (3) supports the development of methods and tools to assist the U.S. Department of the Interior (DOI) in assessing chemical threats to species and lands under its stewardship. Even with the achievements of this and other programs, pollutants continue to pose hazards to terrestrial vertebrates at many geographic scales. To address this hazard, the BEST Program seeks to identify critical data gaps through the retrospective compilation and analysis of ecotoxicological data, followed by active monitoring of terrestrial vertebrates at high priority sites and regions.

In 1996, efforts were initiated to develop and compile the CEE-TV database. It has been used to conduct exposure and effect data searches for a given species or location, identify temporal contaminant exposure trends, analyze NWR and NP unit data gaps, and rank terrestrial vertebrate ecotoxicological information needs based on data density and water quality problems.

Ecotoxicological data for terrestrial vertebrates were examined and contaminant threats to NP units in the National Capital Region and Mid-Atlantic Networks were identified. Our intent was to provide natural resource managers information on real or potential pollution hazards and identify and prioritize contaminant biomonitoring in 22 Inventorying and Monitoring (I&M) Program units in these regions.

METHODS

- Boundaries of 22 I&M NP units and 10 km buffers were mapped in ArcGIS
- NP buffer maps were overlaid with Toxic Release Inventory (TRI) sites, 303(d) Impaired Waters, Superfund National Priorities List (NPL) Sites, and Land Cover/Land Use Classes (LCLU) in ArcGIS
- Fish consumption advisories, pesticide use, solid waste and wastewater treatment facilities information were summarized
- A list of persistent and bioaccumulative pollutants was compiled
- Occurrence of persistent pollutants within each NP buffer were noted
- Compiled and plotted exposure and effects data for terrestrial vertebrates within units.
- NP units in critical need of ecotoxicological data were identified and prioritized using a qualitative and semi-quantitative classification scheme (EPA 1997, Cohen et al. 2003, Rattner et al. 2005)
- These data will be used to help focus management and remediation activities

RESULTS

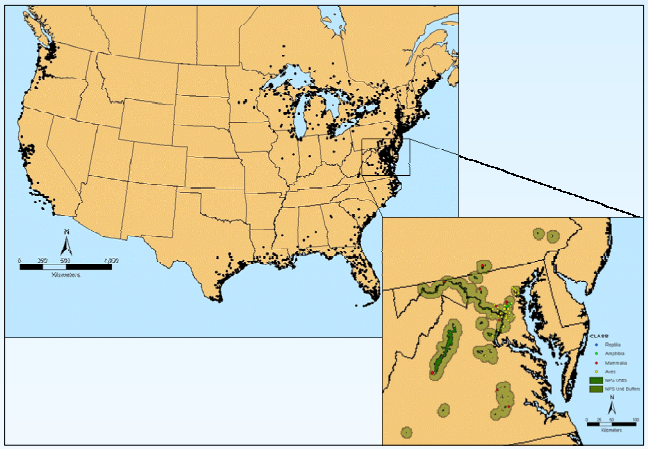

Figure 1. Geographical distribution of CEE-TV database records for the United States and the 22 NP units

Table 1. Classification[a] of real or potential pollution hazards for 22 Mid-Atlantic and National Capital Region Network Parks.

Park Name	No. and Toxicity of Pesticides Used[b]	No. of Toxic Release Inventory Sites: Total Sites	No. of Toxic Release Inventory Sites: Sites Releasing Priority Contaminant[c]	No. NPL Sites	No. Fish Consumption Advisories: Restricted Consumption	No. Fish Consumption Advisories: No Consumption	Impaired Waters (%)
Antietam NB	4	1	0	0	1	0	24.8
Appomattox Court House NHP	3	1	1	0	0	0	0
Booker T Washington NM	1	0	0	0	2	2	18.1
Catoctin Mountain NP	1	2	0	0	3	0	3.5
Chesapeake & Ohio Canal NHP	1	39	11	2	6	5	14.7
Fort McHenry NM & HS	2	62	18	2	3	0	89.3
Fredericksburg & Spotsylvania NM	2	5	1	0	0	0	2.6
George Washington MP	0	9	3	1	3	2	19
Gettysburg NMP & Eishenhower NHS	8	2	0	0	3	0	0.8
Harper's Ferry NHP	5	3	2	0	1	1	20.4
Hopewell Furnace NHS	4	8	3	0	2	1	26.7
Manassas NBP	0	8	3	0	0	0	3.7
Monocacy NB	5	11	3	0	1	0	5.9
National Capital Parks-East	0	36	10	4	4	3	26.3
National Mall & Memorial Parks	0	9	3	1	3	2	31.2
Petersburg NB	1	28	9	0	2	1	28.4
Prince William Forest Park	1	5	2	1	2	0	9.7
Richmond NBP	2	58	15	1	2	1	14.8
Rock Creek Park	2	6	2	1	3	2	33.3
Shenandoah NP	5	11	1	2	2	3	25.3
Valley Forge NHP	1	32	2	2	2	1	44.3
Wolf Trap NP for the Performing Arts	0	2	0	0	1	0	8.7

[a] Classifications were based on previous developed criteria by EPA (1997), Cohen (2003), and Rattner (2005).

[b] Toxicity of pesticides used in NP units was categorized using existing acute exposure data.

[c] Priority contaminants were defined as Priority Persistent Bio-accumulative Toxic Chemicals listed by the EPA and Persistent Organic Pollutants listed by the United Nations.

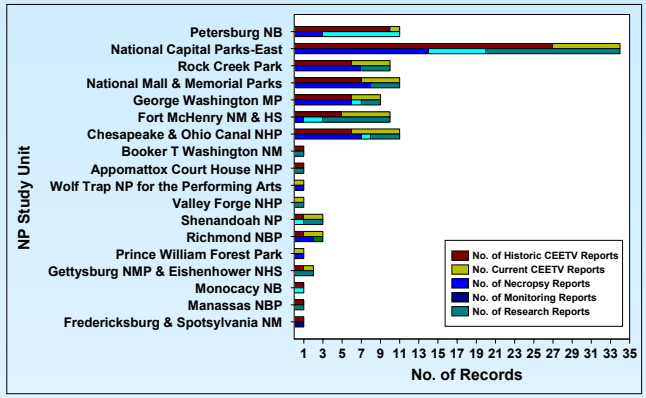

Figure 3. Number of extant CEE-TV database records in Mid-Atlantic and National Capital Region Network NP Units.

Table 2. Prioritization of Mid-Atlantic and National Capital Region Network NP Units for terrestrial vertebrate ecotoxicological research.

Park Name	Area (Km2)	Data Richness Score	Overall Contaminant Threat
Shenandoah NP	4042.3	1	14
Richmond NBP	1311.3	1	14
Valley Forge NHP	482.6	1	12
Hopewell Furnace NHS	403.5	0	10
Harper's Ferry NHP	560.4	0	9
Monocacy NB	438.8	1	10
Antietam NB	503.5	0	7
Chesapeake & Ohio Canal NHP	5088.4	3	13
Fort McHenry NM & HS	331.0	4	18
National Capital Parks-East	1826.0	4	14
Rock Creek Park	542.8	3	11
Fredericksburg & Spotsylvania NM	1467.9	1	7
Gettysburg NMP/Eishenhower NHS	666.5	1	7
Catoctin Mountain NP	563.3	0	4
Petersburg NB	1190.2	3	11
Prince William FP	673.9	1	7
Appomattox Court House NHP	491.7	1	5
Manassas NBP	544.7	1	5
National Mall & Memorial Parks	524.8	3	7
George Washington MP	1013.1	3	6
Booker T Washington NM	359.5	1	4
Wolf Trap NP for the Performing Arts	341.0	1	2

CONCLUSIONS

- About half of the 22 NP units were located in areas with multiple pollution threats, while the contaminant threat at six NP units (Appomattox Court House NHP, Manassas NBP, National Mall & Memorial Parks, George Washington MP, Booker T Washington NM, and Wolf Trap NP) was apparently minimal
- Based upon pollutant hazards, contaminant monitoring studies should be undertaken at Shenandoah NP, Richmond NB, Chesapeake & Ohio Canal NHP, Valley Forge NHP, Hopewell Furnace NHS, Monocacy NB, and Harpers Ferry NHP
- These studies should include relevant endpoints and taxa, and examine agrichemical and emerging contaminant hazards
- Management recommendations include incorporation ecotoxicological monitoring into the Vital Signs program, training and familiarization of NPS staff on current ecotoxicological issues, and restricting the use of lead ammunition and fishing sinkers, and certain pesticides and herbicides on NPS lands
- There is also a need to develop protocols for collection, submission, and analysis of samples from mortality events involving terrestrial vertebrates