

Contaminant Exposure And Effects-Terrestrial Vertebrates Database: Pacific Coast Patterns

Rebecca Kershner¹, Roger Hothem¹, Barnett Rattner², and Nancy Golden²

¹USGS Davis Field Station, 1 Shields Av, UC Davis, Kerr Hall #278, Davis, CA 95616; ²Patuxent Wildlife Research Center, 12011 Beech Forest Road, Laurel, MD, 20708

INTRODUCTION AND METHODS

- The Contaminant Exposure and Effects-Terrestrial Vertebrates database (CEE-TV) is sponsored by the Biomonitoring of Environmental Status and Trends program (BEST) as part of BEST's commitment to evaluate the threat of contaminants to terrestrial vertebrates residing in or near coasts and estuaries.
- Upon completion, CEE-TV will summarize contaminant exposure and effects information for free-ranging amphibians, reptiles, birds, and mammals residing within 30 km of Atlantic, Pacific and Gulf coasts and estuarine ecosystems, including Alaska, Hawaii, and the Great Lakes.
- Data are obtained from computerized searches of published literature, review of existing databases, and by solicitation of unpublished reports from conservation agencies, resource managers, and scientists.
- The database can be queried easily using taxonomic, temporal, geographic, and contaminant search categories.
- Data are geo-referenced and thus suitable for importation into Geographic Information Systems to examine spatial and temporal patterns.
- The CEE-TV database for Atlantic, Gulf, and Pacific Coasts is presently available on the Internet (<http://www.pwrc.usgs.gov/ceetv/>). To date, this database contains approximately 10,000 records with ecotoxicological exposure and effects information on over 200,000 individuals representing more than 400 species.
- CEE-TV data for the Pacific Coast were added to the Atlantic and Gulf Coast CEE-TV database in July of 2001. A summary of the Pacific Coast CEE-TV data for California, Oregon, and Washington is presented.

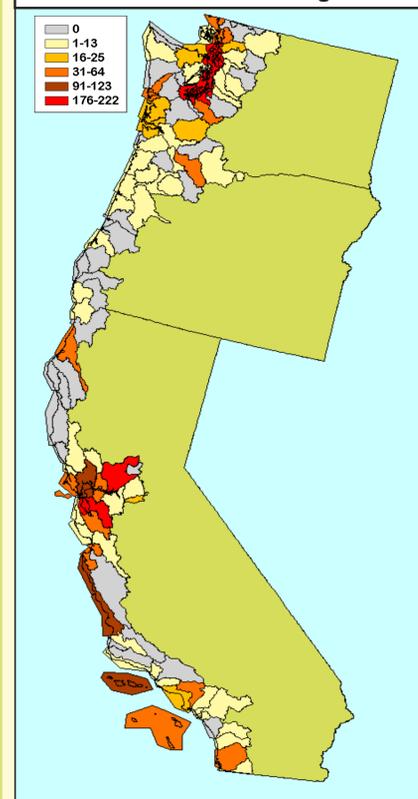
OVERVIEW OF PACIFIC CEE-TV RECORDS

Spatial Distribution

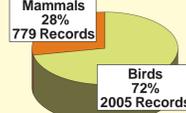
STATE	# CEE-TV RECORDS	% CEE-TV RECORDS	RECORDS PER UNIT AREA
CA	1833	66%	3
OR	258	9%	1
WA	693	25%	4

- When normalized by area, there are 3-4 times more CEE-TV data available for California and Washington than for Oregon
- CEE-TV data are concentrated in particular locations such as Puget Sound, San Francisco Bay, Monterey, the Channel Islands, San Diego Bay, and the Columbia River
- Little or no CEE-TV data are available for:
 - California coast between Humboldt and San Francisco Bay
 - Washington Coast between Gray's Harbor and Puget Sound
 - Entire Oregon coast

Number of CEE-TV records for estuaries in range

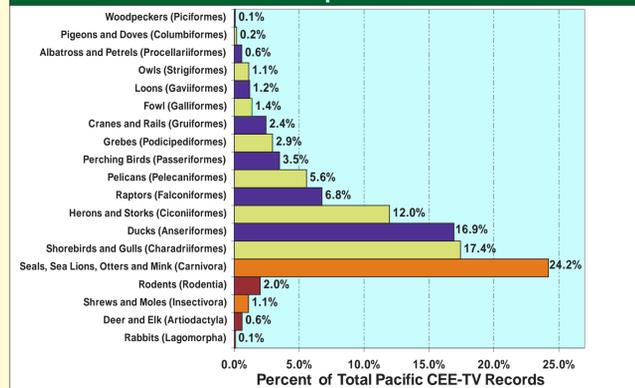


Phylogenetic Diversity



- Approximately 2/3 of Pacific Coast CEE-TV records are for birds, 1/3 are for mammals
- Carnivora (Sea lions, Seals, Otters, and Mink) is the Order with the greatest number of Pacific CEE-TV records, comprising 87% of mammal records and 24% of total Pacific CEE-TV records
- 64% of bird records (46% of total Pacific CEE-TV records) consist of 3 Orders: Herons and Storks (Ciconiiformes), Ducks (Anseriformes), and Shorebirds and Gulls (Charadriiformes)
- There are no Pacific CEE-TV data for reptiles or amphibians

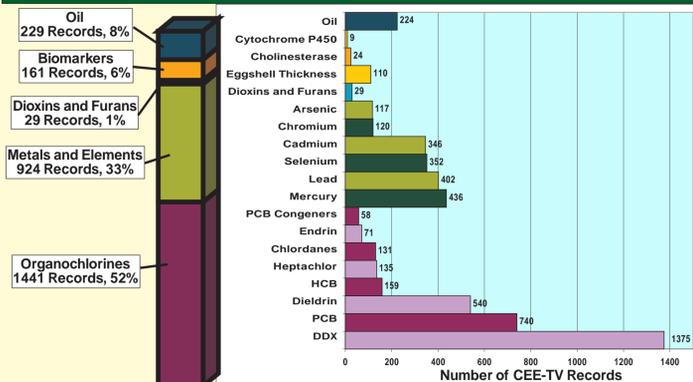
Mammal and Bird Orders Represented in Pacific CEE-TV



Contaminants & Biomarkers

- The majority of contaminant data focus on organochlorines, DDT and PCBs in particular
- Little data are available for Dioxins, Furans, or Biomarkers other than eggshell thickness

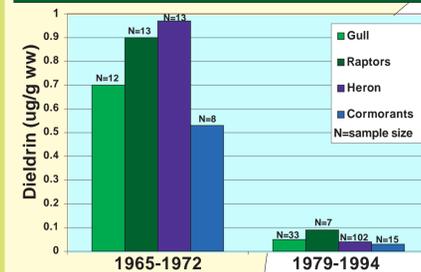
Contaminants and Biomarkers in Pacific CEE-TV



PACIFIC CEE-TV: APPLICATIONS

Focus on Matrix: Organochlorines in Bird Eggs

Dieldrin in Bird Eggs on the Pacific Coast

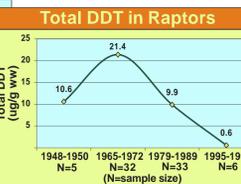
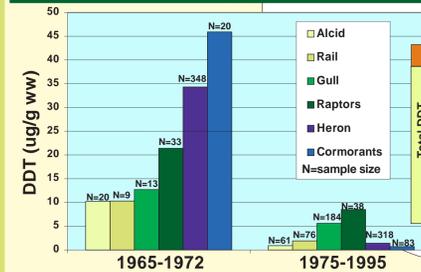


Mean DDT and Dieldrin levels in bird eggs on the West Coast reflect known trends and the history of the use of these pesticides in the United States.

All species exhibit a large drop in both DDT and Dieldrin levels after 1972, the year in which the EPA announced a ban of DDT, Dieldrin, and 11 other organochlorines.

The line graph depicted below of DDT levels in Raptor eggs spans 50 years and parallels the spread of DDT after World War II, the height of DDT use in the 1960s, and the subsequent decrease in DDT use as it became increasingly regulated in the late 1960s and early 1970s.

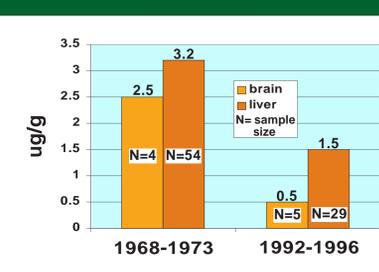
Total DDT in Bird Eggs on the Pacific Coast



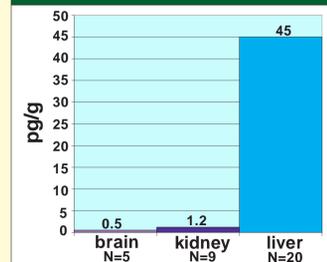
Focus on Species: Organochlorines in Sea Otters (*Enhydra lutris*)

- Brain and liver samples from 1992-1996 show an approximate 2 ug/g decrease in DDT content when compared to samples collected in 1968-1973.
- Polychlorinated biphenyls (PCBs) show no decrease with time. PCBs are observed at about 1 ug/g in liver samples from 1968-1973 and 1992-1996.
- Hexachlorobenzene accumulates mostly in the liver and was observed at low levels in 1995-1996.

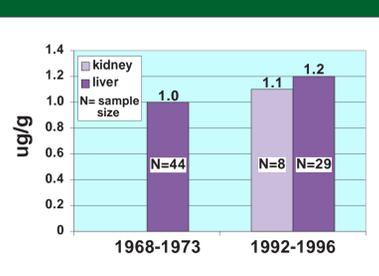
Total DDT



Hexachlorobenzene 1992-1996

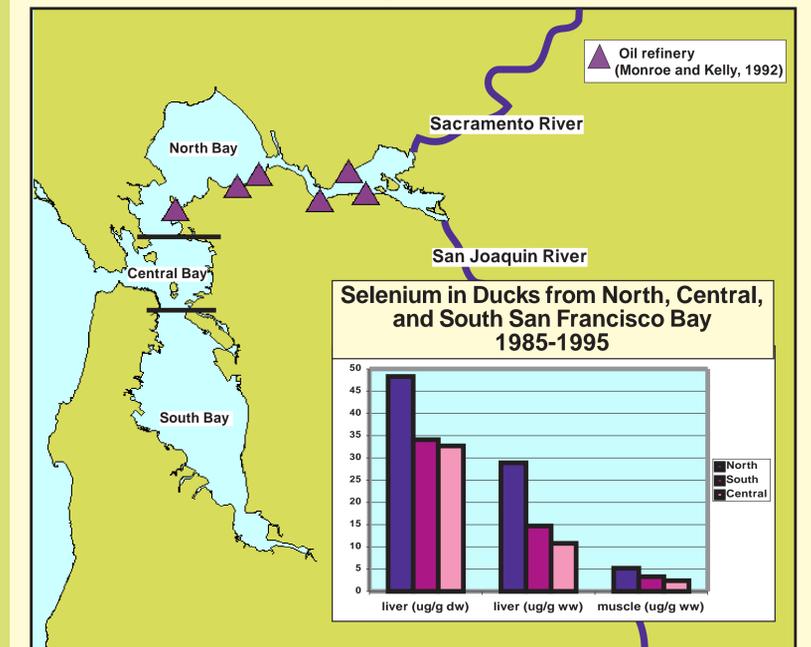


Total PCBs in Sea Otters



Focus on Location: Selenium in Ducks in San Francisco Bay

- Selenium levels in ducks in San Francisco Bay vary by location in a manner consistent with patterns observed for selenium levels in water samples (Cutter and San Diego-McGlone, 1990). In liver and muscle samples, ducks from North Bay exhibit the highest selenium levels and ducks from Central Bay exhibit the lowest. This pattern is believed to be influenced by several factors including:
 - Bay structure-Tidal flow flushes out the Central Bay, effectively reducing concentrations of selenium and other contaminants.
 - Location of oil refineries-In the North Bay, oil refineries typically account for between 74-96% of the internal selenium input depending on seasonal river flow (Cutter and San Diego-McGlone, 1990)
 - Input from the Sacramento and San Joaquin Rivers. The rivers carry inputs from Central Valley agriculture. The Central Valley contains high levels of naturally occurring selenium which is released into rivers when fields are tilled and irrigated.



CONCLUSION

- A total of 2,784 CEE-TV records for California, Oregon, and Washington were added to the Atlantic and Gulf Coast CEE-TV database in July of 2001. Similar trends are observed for Pacific CEE-TV data when compared to CEE-TV data for the Atlantic coast (Rattner et al., 2000).
- Phylogenetic diversity: The Pacific CEE-TV consists largely of birds (72%). There are no data for reptiles or amphibians. The initial Atlantic CEE-TV also consists largely of birds (84%) and mammals (11%). The greater representation of mammals in the Pacific CEE-TV is due to data gathered on seals, sea otters, and sea lions.
- Contaminant diversity: Similar to the initial Atlantic CEE-TV, organochlorines, mainly DDT and PCBs, are the largest class of contaminants featured in the Pacific CEE-TV. Only a small number of records for either coast report biomarker data. On the Pacific coast, 68% of biomarker data consists of eggshell thickness. On the Atlantic coast, a greater diversity of biomarkers is reported.
- On both coasts, a decrease in DDT in bird eggs is observed from the 1960s to the present.
- Potential applications of CEE-TV include:
 - Providing background information for research focused on a particular location, species, matrix, or contaminant
 - Identifying data gaps and focusing directions for future research. Examples include:
 - Spatial gaps demonstrated by the lack of data for the Oregon coastline
 - Phylogenetic gaps exemplified by the absence of CEE-TV data for reptiles and amphibians
 - Contaminant gaps demonstrated by the lack of data on dioxins, furans, and biomarkers other than eggshell thinning

References:

Contaminants Exposure and Effects-Terrestrial Vertebrates Database. <http://www.pwrc.nbs.gov/ceetv/>.
 Cutter, G.A., and M.L.C. San Diego-McGlone. 1990. Temporal Variability of Selenium Fluxes in San Francisco Bay. The Science of the Total Environment. 97/98: 235-250.
 Monroe, M.W., and J. Kelly. 1992. State of the Estuary. Publication of the San Francisco Estuary Project. p.166.
 Rattner, Pearson, Golden, Cohen, Erwin, and Ottinger. 2000. Contaminant Exposure and Effects-Terrestrial Vertebrates Database: Trends and Data Gaps for Atlantic Coast Estuaries. Environmental Monitoring and Assessment. 63: 131-142.

We need your help! Please send us contaminant exposure and effects data for inclusion in the database!