Columbia River Contaminants and Habitat Characterization (CR ConHab): Tracking the Occurrence and Foodweb Effects of Polybrominated Flame Retardants and Endocrine Disrupting Compounds (FY08–FY11)

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Through an interdisciplinary approach, we will assess emerging contaminants in aquatic environmental media and biological organisms, and concurrently assess the biological effects of these contaminants using fish biomarkers and bird-blood assays. By comparing these results, we will relate contaminant concentrations to biological effects. We will also model the transport of fine-grained sediments and associated contaminants to provide information about contaminant distributions in the system and contribute to understanding how emerging contaminants are affecting the ecosystem and the foodweb in the lower Columbia River.

Our approach is based on the following tasks:
Task A: Assessment of PBDE exposure and effects on ospreys
Task B: Assessment of waterborne PBDE and EDC concentrations using passive samplers
Task C: Compound-specific analysis of PBDE and EDC concentrations in invertebrates and resident fish
Task D: Biomarker assessment of PBDE and EDC exposure and effects in resident fish
Task E: Assessment of cDNA microarray technology for understanding effects of PBDE and EDC exposure on fish
Task F: Sediment characterization to support sediment modeling and assess the role of benthic communities in the transport of contaminants
Task G: Modeling sediment transport and contaminant dispersal in the lower Columbia River and estuary
Task H: Integration of Tasks A–G

The work is planned as follows:
FY08. Deploy passive samplers at 10 sites to assess the presence of emerging contaminants in the river. Collect osprey eggs and blood samples from young at a subset of the study locations and analyze eggs for PBDE concentrations.

FY09. Screen passive-sampler extracts for PBDE concentration and endocrine disruption potential. Use these data to identify areas of elevated contaminant concentrations and select site(s) for more detailed foodweb investigations, including compound-specific analyses of environmental media, invertebrates and fish. Continue to monitor nesting osprey and collect eggs and blood. Collect sediment samples to aid the expansion of the sediment transport model to Bonneville Dam, build a pilot sediment-transport model of the lower river, and carry out initial model simulations.

FY10. Conduct sediment, invertebrate, and fish sampling. Characterize sediments and invertebrates. Conduct biomarker analyses, cDNA microarray analyses, and compound-specific analyses of macroinvertebrate, fish-tissue samples, and sediments. Refine sediment-transport pilot model, collect additional field data for model calibration and validation, and carry out initial model simulations. Complete model calibration and validation and carry out model simulations to assess the sensitivity of the model and characterize changes in river habitat under various future scenarios.

FY11. Complete analyses from Year 3 samples and collect additional data as time and funding permit based on needs identified during previous years. Continue to analyze and interpret data, and communicate results to other principal investigators. Prepare individual products and contribute to a synthesis report.

Core Participants:
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Columbia River ConHab

*Letters A-H refer to Task Descriptions

Emerging Contaminant Concentrations

osprey-A*
water (passive samplers)-B
salmonids/resident fish-C
invertebrates-C
sediment-C

Relate effects and concentrations

Relate compound occurrence to point sources, bioaccumulation, organs/tissues/blood, and invertebrate assemblages

Biological Effects

well-bird panels-A
vitellogenin induction-D
gonad/thyroid histology-D
sex steroid hormones-D
sperm quality-D
cDNA microarrays-E

Relate site characterization to contamination and use to inform subsequent sampling

Relate site character and sediment distributions to biological effects

Characterize Sampling Locations/Sediment Distributions

ecosystem classification-F
sediment characterization-F
hydrodynamics and sediment transport model-G

Integrate modeling, classification, and sampling results to conceptualize contaminant distributions and effects on organisms-H

Assess Transport, Fate, and Effects of Contaminants

hydrodynamics and sediment transport model,
ecosystem classification system,
sampling results

Output: Contribute to assessing emerging contaminant distributions and impacts on the foodweb in the lower Columbia River, develop a conceptual example of an integrated monitoring project