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Effects of Water Development on Arid Land Freshwater Ecosystems

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Effects of water development on arid land freshwater ecosystems

Blue Lake

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Aquatic habitat connectivity

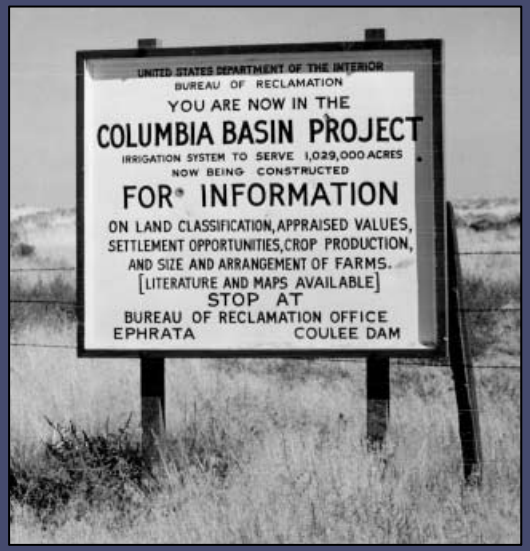
- much attention focused on fragmentation, but increased connectivity may also have ecological consequences
  - taxonomic, functional, and genetic homogenization of previously distinct communities
  - may result in loss of species with adaptations for different environmental conditions

Columbia Basin Project

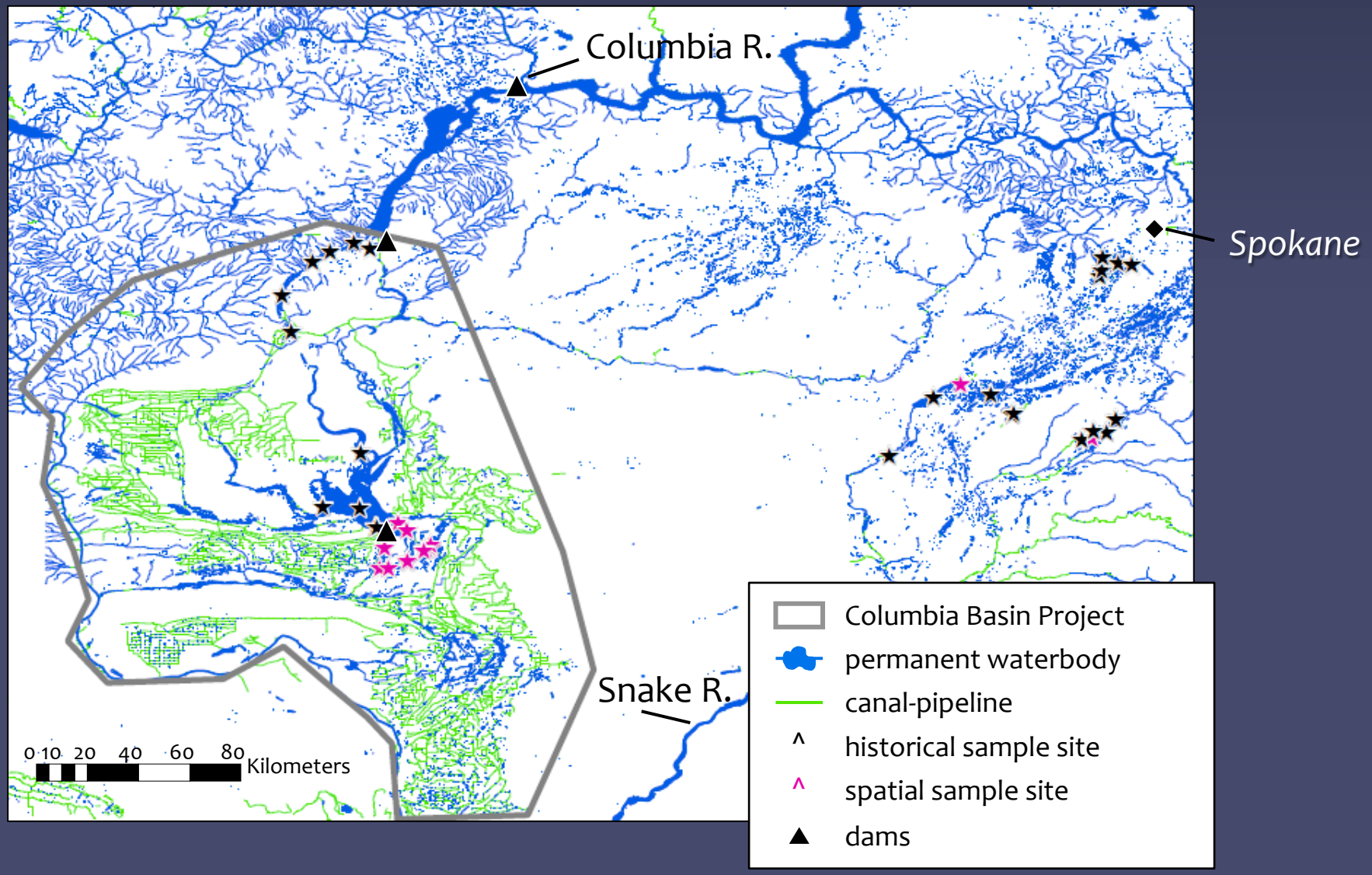
- Columbia Basin Project built six dams and >300 miles of canals for irrigation, flood protection, and power production in eastern Washington
  - irreversibly changed the region and lakes within it

- changed groundwater levels, created reservoirs, altered connectivity between previously disconnected systems


Grand Coulee Dam



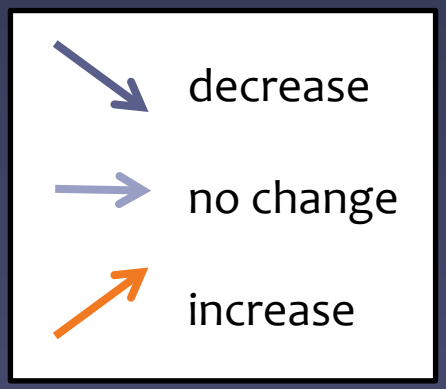
Columbia Basin Project



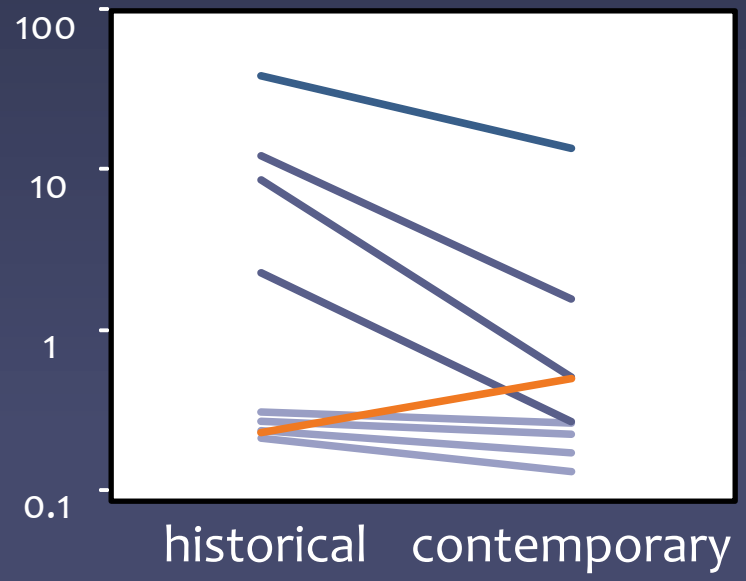
Objectives

- to compare chemical and biological characteristics of waterbodies sampled in the 1940s to contemporary samples
  - assess effects of hydrologic manipulations
- to examine effects of changing connectivity on plankton communities

Results: Salinity



salinity (ppt)

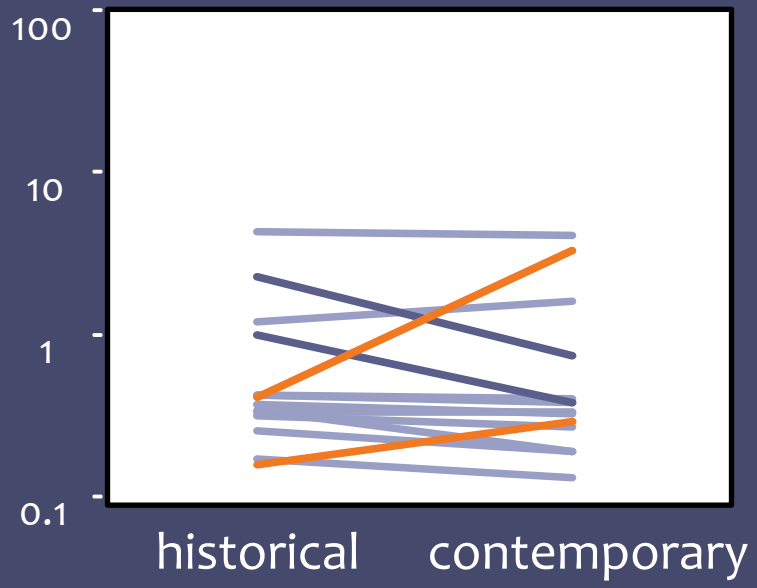


hydrologic manipulations

Paired t-test

$t_8 = 2.41$

$p = 0.021$



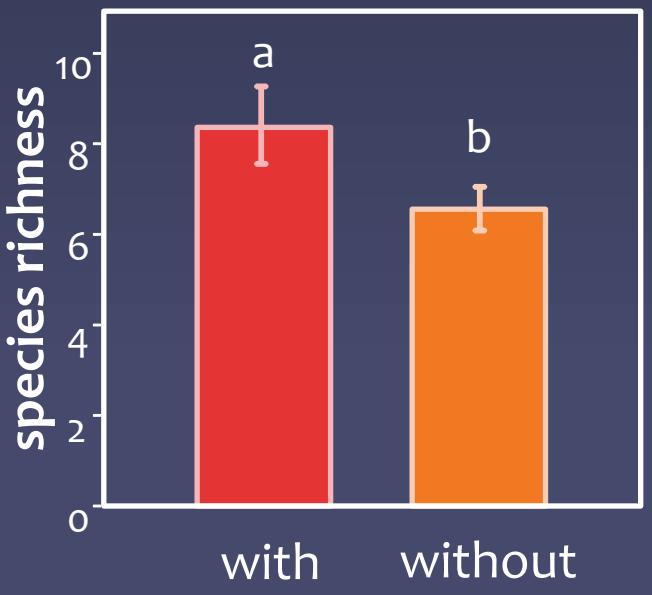
no hydrologic manipulations

Paired t-test

$t_{13} = 0.249$

$p = 0.40$

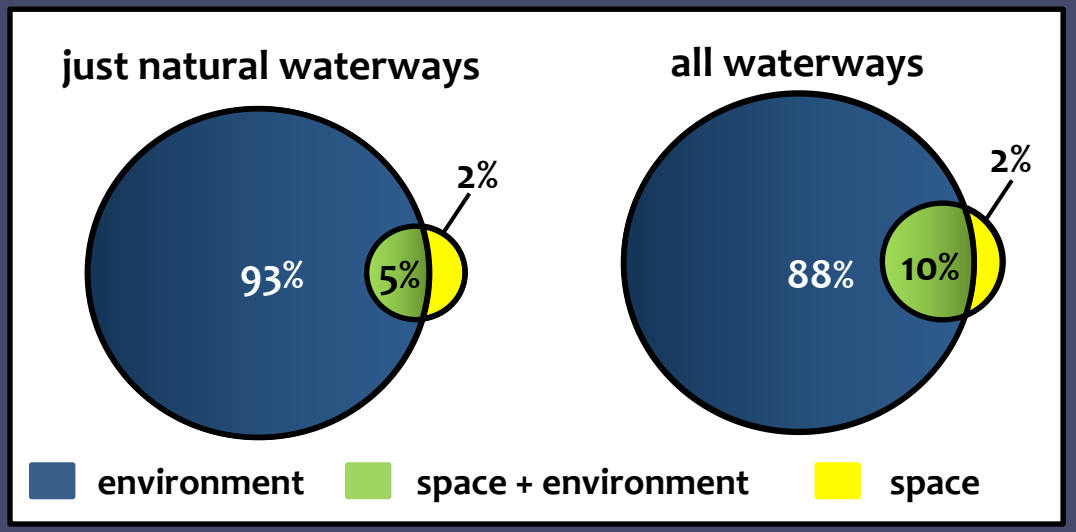
Results: Connectivity



t-test

$t_{36} = 1.704$, $p = 0.048$

- unexpectedly, highest richness found in canals and reservoirs
- hydrologic connectivity via canals explained more variation in zooplankton communities than natural connectivity
  - though environment seems to be more important



Conclusions and next steps

- future work will explore why canals/reservoirs appear to be biodiversity hotspots for zooplankton

- arid lakes are useful systems to understand and predict responses to hydrological and environmental change
  - unique case study over 70+ years
  - what are consequences for ecosystem functions and services given these changing biotic and abiotic conditions?

Acknowledgements

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