Effects of Water Development on Arid Land Freshwater Ecosystems

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Effects of water development on arid land freshwater ecosystems

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Blue Lake
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
Columbia Basin Project

- Columbia R.
- Snake R.
- Spokane

Legend:
- Columbia Basin Project
- Permanent waterbody
- Canal-pipeline
- Historical sample site
- Spatial sample site
- Dams
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)

- Decrease
- No change
- Increase

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

- 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

**t-test**

\[ t_{36} = 1.704, p = 0.048 \]
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?

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