Community-level migration patterns of fish throughout the Mitchell River, Queensland, Australia

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Migration
Found in all major branches of the animal kingdom: flying, swimming, walking, drifting (via water and air)

Often think of “heroic” long-distance mass migrations

Australasian Flyway
Migration
Most short distance migrations: freshwater-marine, within stream reach or river
Migration

I. Spatial extent – local, regional, global
II. Temporal extent – annual, seasonal, life history stage
III. Triggers – food, reproduction, habitat quality, range expansion, density-dependent/independent
IV. Limiting factors – weather, obstacles (mountains, dams), fragmentation via habitat loss

Why is this important?

i. define a population, subpopulation, or patch
ii. factors that drive population demographics: survival, recruitment, source-sink dynamics
iii. where, when, and how many resources should be allocated for conservation
Migration

Methods
• Mark-recapture – banding, radio/GPS/PIT tags
• Genetic – mitochondrial, microsatellites, nuclear markers
• Biogeochemical – Carbon, Hydrogen, Nitrogen, Sulfur, Strontium, metals, organic pollutants

Limits
• Spatial variability
• Temporal variability
• Uptake kinetics – tissue and tracer specific

How does animal integrate chemicals into different tissues at different life stages
Mitchell River, QLD
River during wet season, series of waterholes during dry season

Floodplains critical to fish productivity

Are fish migrating to floodplains from other areas of the catchment?
  • Migration patterns unknown for most fish

Multiple potential dam sites

Migration data will allow us to understand to what degree dams will potentially influence fish productivity

Sampled sites throughout the catchment
Mitchell River, QLD

Strontium (87:86 ratio)
- Spatial variability controlled by geology
Mitchell River, QLD

Strontium (87:86 ratio)
- Spatial variability controlled by geology
- Uptake kinetics
  - Strontium acts like calcium in the body
  - The axis of growth thus has a record of the strontium ratio of the water
- Variable flow regime can influence strontium ratio
Mitchell River, QLD

Strontium (87:86 ratio)

- Spatial variability controlled by geology
Mitchell River, QLD
Spangled Perch

Distance to mouth (km)
Mitchell River, QLD
- ~950 fish, 26 species (~1 to 90 cm)
- Analyzed ~341 otoliths and 10 shells; have ~600 otoliths and ~20 shells left to analyze

Questions we can potentially answer:
- Which species migrate? Yes
- Source-sink dynamics? Yes
- What are source populations? Maybe: up- vs down-stream or sub-catchments
- Do migratory patterns vary spatially? Yes
- Dispersal kernels per species? Yes

Migration plus community structure:
- How much biomass is moving through the catchment? Yes
- Where is most of fish biomass being built? Yes
Multiple tracer isoscape - similar to ecological niche models
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