Eyes on the Eel: Surveys of food webs assembled under different hydrologic regimes

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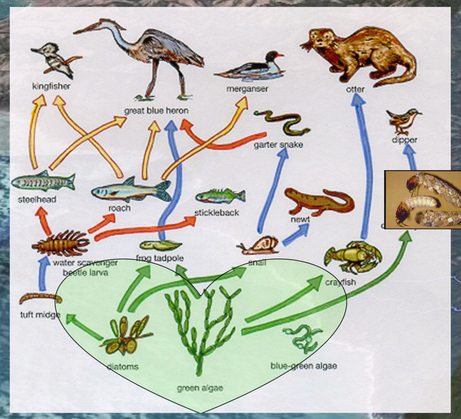
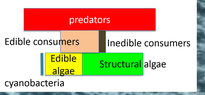
WHAT ARE THE CONSEQUENCES FOR DROUGHT, FLOODS, AND CRITICAL ZONES FOR RIVER (AND COASTAL) ALGAL BASED FOOD WEBS?

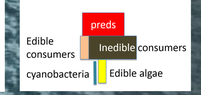
"Eyes on the Eel" is a multi-year survey of low-flow states of river and tributary food webs along Eel mainstems and tributaries. A Berkeley-Angelo Reserve-Eel River Critical Zone Observatory crew has been documenting physical conditions, cyanobacterial and algal abundances, invertebrates, and vertebrates along 48 transects and 16 pool-riffle units in four tributaries and four mainstem sites down the South Fork and mainstem Eel River. We are testing the hypothesis that summer food webs are shaped by winter hydrology (whether bed-scouring floods have occurred or not), and summer hydrology (whether flows in sunlit mainstems drop to levels at which edible algae die and are overgrown by potentially toxic cyanobacteria). During the summer low flow season, the algal-based food web of the Eel River may assemble into one of three alternative states:



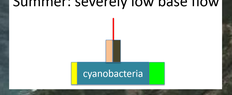
Winter: Flood
Summer: high base flow

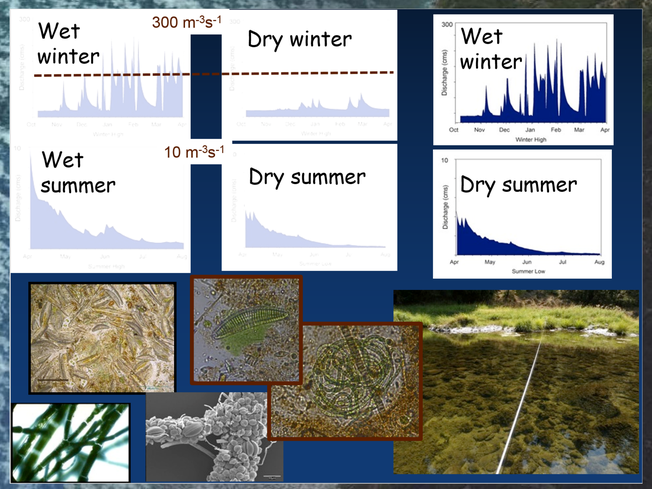


Winter: no flood,
Summer: high base flow



Either winter, worse with flood
Summer: severely low base flow



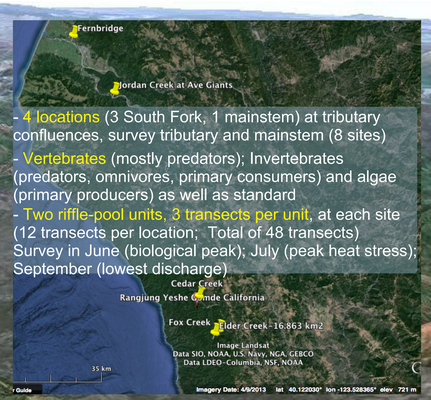


In **'Salmonid' state**, rock substrates and early summer blooms of macroalgal (Cladophora glomerata) become covered with highly edible, fat-rich diatoms, which in turn support invertebrates and tadpoles that are prey for juvenile salmonids and other aquatic predators. **Salmonid state** generally occurs after winters with one or more scouring floods, which reduce defended, slower-growing grazers (Dicosmoecus gilvipes).

Dicosmoecus state occurs if scouring floods have not occurred during the previous winter so that large, predator-resistant larvae are abundant, and suppress algae from the start of the low flow season. All web members persist, but less energy flows up the food web to sustain fish and other predators.

Cyanobacteria state emerges following either dry or wet winters if summer flows are severely low. Cyanobacteria (some potentially neurotoxic, e.g. Anabaena, Phormidium) flourish, and overgrow and smother edible algae stressed by warm stagnant conditions. Eyes on the Eel surveys are comparing food web states in years of contrasting hydrologic regimes to study how environmental conditions, including summer and winter diversions, may tip the river food web toward one state or another.

Angelo Coast Range Reserve



- 4 locations (3 South Fork, 1 mainstem) at tributary confluences, survey tributary and mainstem (8 sites)
- Vertebrates (mostly predators); Invertebrates (predators, omnivores, primary consumers) and algae (primary producers) as well as standard
- Two riffle-pool units, 3 transects per unit, at each site (12 transects per location; Total of 48 transects)

Survey in June (biological peak); July (peak heat stress); September (lowest discharge)

Vertebrates, etc.

2 swimmers snorkel both pool-riffle units at each tributary and mainstem site, counting and estimating lengths of fish and turtles.

2 bankside observers count small fish, amphibians and large invertebrates at RHS and LSH transect edges.

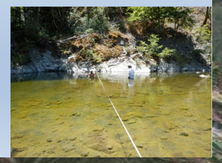
Invertebrates

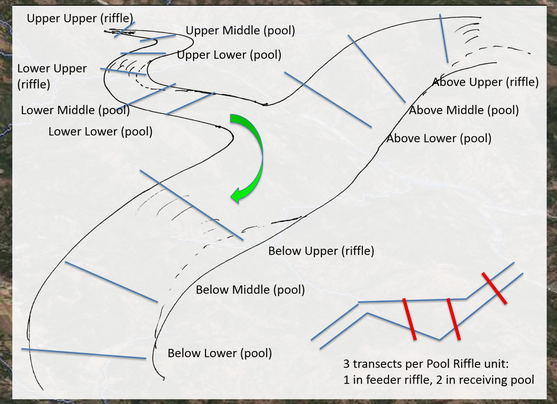
5 ~D_{50} cobbles collected along transect, rinsed into white trays and invertebrates recorded and measured. Maximum and median cobble axes and shape measured for area estimate.

Algae and physical conditions

surveyed along cross-stream transects (depth, substrate category, surface flow, algal taxa, density, and height, condition and inverts or other interesting stuff noted).

Field Methods





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