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### Long-term population and community patterns of benthic macroinvertebrates and fishes in northern California Mediterranean-climate streams

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#### ABSTRACT

Long-term studies can document temporal patterns in freshwater ecosystems, and this is particularly important in mediterranean climate (med-climate) regions because of strong interannual variation in precipitation amounts and consequently stream flow. We review long-term studies of populations and communities of benthic macroinvertebrate and fishes from sites throughout the med-climate region of California and develop generalities that may apply broadly to med-climate streams worldwide. Severe drought may result in community shifts, and alter age structure in both macroinvertebrates and fishes. Within-year seasonal patterns in macroinvertebrate communities can be influenced by annual variability in flow regimes. Macroinvertebrate biological-monitoring metrics with consistently low intra-annual variability may be especially applicable in med-climate streams, as is the use of different temporal windows to describe reference periods to reduce influence of interannual variability on impact detection. Long-term data can be used to develop macroinvertebrate-based metrics that can either show or be independent of climatechange effects. Most macroinvertebrate species are temporally rare in their annual occurrence. Multiple components of natural flow regimes can favor native over invasive fishes. Long-term, quantitative information from med-climate streams is generally lacking, which is a hindrance to both management practices and development of appropriate ecological constructs.

#### Full Text

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