Developing a Screening Causal Assessment Framework for California's Waters

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Sites in poor ecological condition often require causal assessment to determine appropriate follow-up actions. A key component of the causal assessment is to identify a series of ecologically similar (comparator) sites that are used to compare and contrast biological condition and stressor exposure at the site of interest. A good set of comparator sites should: 1. Be capable of supporting similar biota to the impaired site in the absence of disturbance; 2. Comprise a gradient of biotic condition; and 3. Contain enough sites to assess variability. We propose a quantitative approach to select good sets of comparator sites from a large pool of potential sites using expected biological similarity. Expected biological similarity was measured as Bray-Curtis dissimilarity values (BC) calculated from the expected taxa lists produced by a predictive biotic index of stream health based upon benthic macroinvertebrates for California. Sets of comparator sites were created for 15 demonstration sites across Southern California in poor condition. We examined the stressor and biological data collected at the 15 sites and their comparators to assess the likelihood of four example stressors – total nitrogen, ammonia, specific conductivity, and bifenthrin – as potential causes for the poor biotic conditions that were observed. We were able to select more than 100 comparator sites for all but 1 of the 15 demonstration sites at a BC <0.1. These sets of comparator sites were then used to evaluate the four example stressors using two commonly used causal assessment lines of evidence. Elevated conductivity was the most frequently supported likely cause among the demonstration sites, though total nitrogen and bifenthrin were also indicated at some sites. Though our specific approach was tailored for application in California's stream bioassessment framework, the concepts could be adapted for any bioassessment program with a large amount of sample data and an associated predictive index of biotic condition. Furthermore, this approach lays the groundwork for developing a novel approach to causal assessment that begins with a rapid, screening-level evaluation of stressors common to a region using these data-rich groups of comparator sites, which then informs and streamlines follow-up actions.