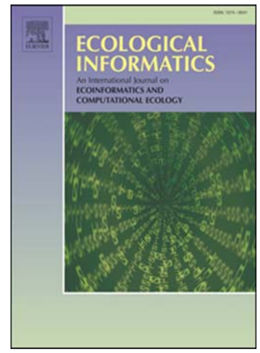

The max bin regression method to identify maximum bioindicator responses to ecological drivers

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The Max Bin regression method to identify maximum bioindicator responses to ecological drivers

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ABSTRACT

A need in environmental science is to determine the response range of a bioindicator to environmental drivers. A common problem with regression based approaches is the indicator response may be obfuscated by many zero or low-value observations when the organisms are not present because of life history characteristics. A method is described for determining the maximum response of an ecological variable to environmental drivers using a median approach. A regression is performed on the relationship histogram after taking the maximum ecological response value from a set of evenly spaced bins. This technique is an alternative to quantile regression at the 95% level and is analyzed on general examples and specific applications in coastal ecology using benthic macroinfauna as bioindicators. This new technique is useful for ecosystem management purposes where the maximum response of a biological indicator to an environmental driver is desired and is analogous to determining the 'area under the curve' of a regression.

ACCEPTED MANUSCRIPT

1. Introduction

A common goal in ecosystem-level field studies is to relate the response of a bioindicator to environmental drivers such as salinity, nutrients, and pollution. For example, as ecological indicators, benthic macroinfauna communities have been used to create broad whole estuary and lake health indices (Nyman and Korhola, 2005; Robertson et al., 2015, Rosenburg and Resh 1993; Wang et al. 2005). In freshwater environments Chironomid communities have historically been used as indicators of water quality health (Saether, 1979). Recently chironomid communities have been linked to multiple climate change drivers such as water depth, temperature, and air pollution (Luoto et al. 2016; Nyman and Korhola, 2005; Odume et al., 2016). Likewise in estuarine environments macroinfauna are used to assess the impact of freshwater inflow changes (Montagna and Kalke, 1992; Montagna et al., 2002a, Montagna et al.