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## **Water Column Turbidity Not Sediment Nutrient Enrichment Moderates Microphytobenthic Primary Production**

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### **Abstract:**

Soft sediment intertidal habitats are under intense anthropogenic pressure resulting from increased land derived sediment and nutrient delivery. Long term, this can cause high water column turbidity and nutrient enrichment of sediment porewaters, which has cascading effects on coastal ecosystem functionality. However, how these stressors may interact and influence benthic productivity over alternating periods of submergence and emergence is largely unknown. This study investigates the effects of sediment nutrient enrichment (at three levels for 20 months) on benthic primary production at six sites in four New Zealand estuaries that spanned a gradient in water column turbidity. While nutrient enrichment had no detectable effect on microphytobenthic primary production, water column turbidity had a significant influence, explaining up to 40 % variability during tidal submergence, followed by temperature and sediment characteristics. In addition, negative net primary production (NPP) estimates and therefore net heterotrophy for the most turbid estuaries during tidal submergence resulted in an increased reliance on production during emerged periods, where NPP was positive across all sites. This study highlights the prominent role of water column turbidity over nutrient enrichment in moderating microphytobenthic production, and the increasing importance of emerged periods to maintain the health and functioning of coastal habitats.

Keywords: microphytobenthos, light, nutrients, eutrophication, estuary, marine, New Zealand