

Understanding the risks of co-exposures in a changing world: a case study of dual monitoring of the biotoxin domoic acid and *Vibrio* spp. in Pacific oyster

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ABSTRACT

Assessing the co-occurrence of multiple health risk factors in coastal ecosystems is challenging due to the complexity of multi-factor interactions and limited availability of simultaneously collected data. Understanding co-occurrence is particularly important for risk factors that may be associated with, or occur in similar environmental conditions. In marine ecosystems, the co-occurrence of harmful algal bloom toxins and bacterial pathogens within the genus *Vibrio* may impact both ecosystem and human health. This study examined the co-occurrence of *Vibrio* spp. and domoic acid (DA) produced by the harmful algae *Pseudo-nitzschia* by (1) analyzing existing California Department of Public Health monitoring data for *V. parahaemolyticus* and DA in oysters; and (2) conducting a 1-year seasonal monitoring of these risk factors across two Southern California embayments. Existing public health monitoring efforts in the state were robust for individual risk factors; however, it was difficult to evaluate the co-occurrence of these risk factors in oysters due to low number of co-monitoring instances between 2015 and 2020. Seasonal co-monitoring of DA and *Vibrio* spp. (*V. vulnificus* or *V. parahaemolyticus*) at two embayments revealed the co-occurrence of these health risk factors in 35% of sampled oysters in most seasons. Interestingly, both the overall detection frequency and co-occurrence of these risk factors were considerably less frequent in water samples. These findings may in part suggest the slow depuration of *Vibrio* spp. and DA in oysters as residual levels may be retained. This study expanded our understanding of the simultaneous presence of DA and *Vibrio* spp. in bivalves and demonstrates the feasibility of co-monitoring different risk factors from the same sample. Individual programs monitoring for different risk factors from the same sample matrix may consider combining efforts to reduce cost, streamline the process, and better understand the prevalence of co-occurring health risk factors.

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