Sick mussels: toxic algae pave the way for pathogenic bacteria

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Aquaculture has become the fastest growing source of animal-derived protein in the world (FAO, 2014). However, since the early beginnings, this industry has been plagued by episodical mass mortality caused by pathogens. Currently, over 40% of the world's seafood supply (±60m tonnes) is produced by aquaculture activities of which nearly a quarter is oyster, clam, mussel and scallop farming. Unfortunately, most of these bivalves are still reared from "spat" (juveniles) collected in the natural environment. Fluctuating natural availability of these larvae limits the production capacity of European shellfish industries. However, these limitations can be overcome by improved knowledge on the environmental conditions (and threats) that affect larval development (Lucas and Southgate, 2012).

Among other environmental stressors, larval bivalves are exposed to harmful algae. In the last decade, the global occurrence of harmful algal blooms has increased due to overfishing, habitat modification, natural dispersal and the involuntary introduction of invasive species. During harmful algal blooms (HABs), hypoxia, marine toxins, physical damage and food-web starvation can lead to mass mortalities at all trophic levels. As the occurrences of both HABs (Anderson *et al.*, 2012) and marine pathogens (Burge *et al.*, 2014) are expected to increase with climate change, their detrimental effects on aquaculture will become more common. Despite of this threat, there is virtually no knowledge on the effects of HABs on host-microbial interactions. In order to better link our changing oceans with human health (seafood safety and security), this study presents some of the first evidence that harmful algae can increase the prevalence of diseases in marine organisms.

Here, we exposed larvae of the blue mussel *Mytilus edulis* to several concentrations of the common (HAB) dinoflagellate *Karenia mikimotoi.* Despite the cytotoxicity, this common dinoflagellate was not found to significantly reduce mussel larvae viability. However, it's presence did significantly increase the pathogenicity of opportunistic heterotrophic bacteria. Similarly, the tissues of adult blue mussels were observed to be susceptible to inflammation only when both algae and bacteria were present. These results suggest that the contribution of marine pathogens to the observed mass mortality during toxic HABs is currently underestimated

References

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