Dynamics of *Vibrio* spp. in relation to phytoplankton community composition and environmental conditions

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Introduction

Vibrio spp. are common marine bacteria which have a broad metabolic range and can produce a variety of enzymes that enable them to use different available nutrient resources (THOMPSON & POLZ 2006). Elevated abundances of vibrios are frequently linked to temperatures above 17 °C, low salinity and eutrophication. Vibrios has also repeatedly been shown to colonize live and decaying zooplankton (HUQ et al. 1983), diatoms (ASPLUND et al. 2011, REHNSTAM-HOLM et al. 2010), corals (CERVINO et al. 2004), shellfish and fish (DEPAOLA et al. 2003, SARKAR et al. 1985), and to form biofilms (YILDIZ & VISICK, 2008).

Vibrio species with the capacity to infect humans, like *V. cholerae* and *V. parahaemolyticus,* are well adapted and can respond fast to elevated nutrient levels and water temperatures and have a strong chemotaxis towards ecologically relevant compounds. However, studies are largely lacking that focus on more complex environmental factors that can regulate *Vibrio* species abundances in tropical and temperate areas. Further, the characteristic virulence determinants of *Vibrio* spp., isolated from wound infections in humans, have not yet been identified.

We here briefly report some studies regarding phytoplankton-bacterial interactions, in the environment as well as in experimental systems with less complexity. We have detected and used non-O1/O139 *V. cholera* and *V. parahaemolyticus* as model organisms.

Measuring principals

Three diatom species (*Skeletonema tropicum*, *Ditylium brightwelli*, *Thalassiosira pseudonana*) and one dinoflagellate (*Prorocentrum micans*), and a non-pathogenic environmental *Vibrio parahaemolyticus* isolate were used in microcosm experiments. We conducted two different experiments; in experiment one we investigated the effect of temperature (15 °C and 21 °C), algal phyla (represented by two different phytoplankton species), and algal densities on the growth of *V. parahaemolyticus* (Figure 1), and in experiment two we studied the effect of diatom species richness on the abundance of *V. parahaemolyticus* estimated by a real-time PCR based 16SrDNA detection assay (Figure 2., ASPLUND et al. 2011). The second experimental setup consisted of single algal species, or combinations of two and three species in

triplicates. The total algal biovolume per mL was equivalent in all treatments. When the algal culture had reached early exponential phase, the experiment started by adding *V. parahaemolyticus*. *Vibrio* abundance was followed as CFU on TCBS agar plates.

In an environmental study we estimated the abundances of *V. parahaemolyticus* by real-time PCR in relation to total *Vibrio* spp., plankton community composition, and a range of environmental variables in the costal water of SW India (Figure 3). Our survey was conducted during two distinct periods when the water column was stable in terms of temperature and salinity.

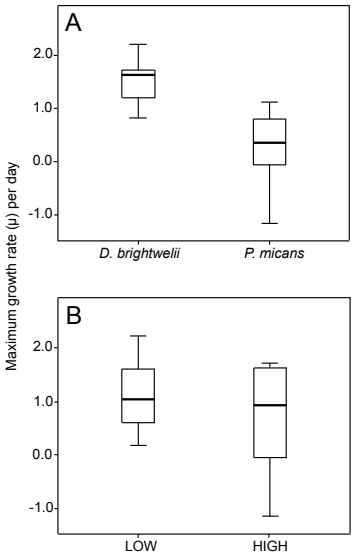

Figure 1:
Maximum *V.parahaemolyticus* growth rate in differen algal cultures with high and low.

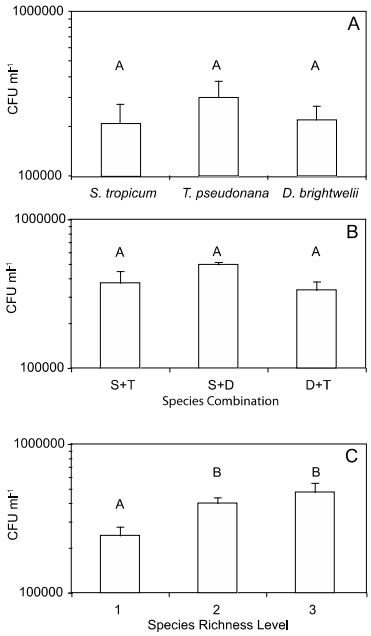

Figure 2:
V. parahaemolyticus abundance in single algal cultures, two combined algal cultures or all three algae in the cultures.

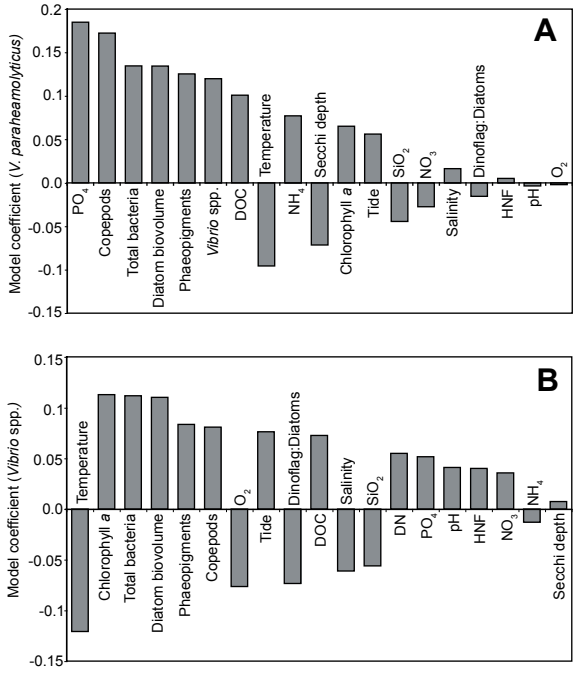

Figure 3:
Coefficients plot of PLS regression models. A. *Vibrio parahaemolyticus* abundances as response variable B. *Vibrio* spp. abundances as response variable over two sampling periods (December 2007 and February-March 2008). Physical, chemical, and biological predictor variables in the model are ranked from left (most important) to the right (least important).

Summary

Algal species and biomass concentration significantly affected the maximum growth rate of *V. parahaemolyticus*, while temperature did not. Bacterial maximum growth rate was significantly higher when incubated with a diatom compared to a dinoflagellate.

Significant differences in the abundance of *V. parahaemolyticus* could only be found between the three levels of species richness.

The environmental study demonstrates temporal variation in the abundances of pelagic *V. parahaemolyticus* in an oligotrophic tropical coastal marine area (Mangalore, India, Arabian Sea), despite stable water temperatures and salinities. The number of *V. parahaemolyticus* was higher during the first sampling period in December compared to February. The most important environmental parameter coinciding with high *V.parahaemolyticus* abundances was phosphate and copepods.

Literature

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