Diatom Bloom Dynamics in a Human-Impacted Coastal Environment: Insights from Metagenomics and Metatranscriptomics

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The proposed project focuses on diatom dynamics within the changing oceanic environment, using metagenomic and metatranscriptomic data from the Naples Ecological REsearch Augmented observatory (NEREA) spanning several years. NEREA integrates traditional and cutting-edge technologies to study planktonic communities in the Gulf of Naples, a highly humanly-impacted coastal area.

Scientific questions regarding diatom abundance and diversity, along with gene expression patterns across seasons and environmental conditions, will be explored. This investigation seeks to better understand the ecological roles of diatoms and their potential for toxin production. Additionally, the project will investigate diatom life cycle dynamics, including sexual reproduction events and bloom formation, as well as growth control mechanisms, and their relationship with the surrounding environment.

Building upon a collection of Metagenome-Assembled Genomes (MAGs) from the first year of sampling, this project aims to extend the analysis. It will leverage metagenomics and metatranscriptomic eukaryotic data over multiple years, providing novel insights into diatom dynamics, environmental triggers, and gene expression patterns. Furthermore, the project will collaborate with two PRIN projects to explore algal growth control mechanisms using genome editing approaches in model diatoms. The PhD candidate will integrate findings from genome editing experiments with computational analyses of metagenomic and metatranscriptomic data to elucidate gene networks underlying diatom dynamics and growth control in natural communities.

With a specific focus on *Pseudo-nitzschia* species, the project will also examine the occurrence and expression of genes responsible for the biosynthesis of domoic acid, a neurotoxin linked to harmful algal blooms (HABs). The societal impact of the research is significant, potentially leading to the development of *in-situ* sensors. Additionally, the outcomes of this research will be crucial for informing the design of metabolic models of diatoms that will be further developed and tested in the lab in the context of collaborations with the PRIN projects, ultimately contributing to a deeper understanding of diatom ecology and physiology.

Overall, this project promises intellectual merit through its innovative approach to studying diatom dynamics in a changing oceanic environment and broader impacts by both addressing societal concerns regarding harmful algal blooms and contributing to the development of monitoring technologies and metabolic models.