
PlanDyO: A Long-Term Meta-Epigenomic Platform to Elucidate Marine Plankton Dynamics in Onagawa Bay and Beyond

Takeshi Obayashi^{*†1,2}, Toyonobu Fujii^{‡2,3}, Akane Kitamura², Gaku Kumano^{2,4}, and Minoru Ikeda^{2,3}

¹Graduate School of Information Sciences, Tohoku University – Japan

²Advanced Institute for Marine Ecosystem Change (WPI-AIMEC), Tohoku University – Japan

³Onagawa Field Centre, Graduate School of Agricultural Science, Tohoku University – Japan

⁴Asamushi Research Center for Marine Biology, Graduate School of Life Sciences, Tohoku University – Japan

Abstract

The Sanriku Coast of northeastern Japan, where the Kuroshio and Oyashio currents converge, is renowned for its high biological productivity and dynamic ecosystem transitions. At its southern edge, Onagawa Bay offers an ideal site for long-term observation of coastal plankton communities influenced by open-ocean conditions. To uncover the genomic and epigenomic basis of these dynamics, we have launched PlanDyO (Plankton Dynamics in Onagawa), a long-term monitoring platform that integrates monthly sampling, image-based analysis, and Nanopore-based metagenomics and epigenomics.

In addition to Onagawa Bay, the PlanDyO platform has been expanded to include two additional sites: Ishinomaki Bay and Mutsu Bay. These locations were selected for their contrasting exposure to major oceanic currents, including the Kuroshio, Oyashio, and Tsugaru Warm Currents, all of which shape the physical and ecological conditions along the Sanriku coastline. The dominant aquaculture species at each site also differ substantially, offering further opportunities for comparative analysis. The prototype PlanDyO database, based on metagenomic data, features occurrence profiles for approximately 500 genera along with DNA methylation information. We are currently expanding this database to integrate additional data such as CTD profiles, plankton imaging, and seasonal methylation dynamics. We will present early findings, including seasonal patterns of phytoplankton and aquaculture species, and discuss how epigenomic data can provide insights into physiological states such as bloom formation and reproduction. PlanDyO aims to advance coastal ecosystem modeling and improve our understanding of how epigenomic variation contributes to plankton community responses under changing ocean conditions.

Keywords: metagenomics, epigenomics, microalgae

*Speaker

†Corresponding author: takeshi.obayashi.a6@tohoku.ac.jp

‡Corresponding author: toyonobu.fujii.a8@tohoku.ac.jp