

Biological Hotspots in the Galápagos Islands: Exploring Seasonal Trends of Ocean Climate Drivers to Monitor Algal Blooms

Authors : Emily Kislik, Gabriel Mantilla Saltos, Gladys Torres, Mercy Borbor-Córdova

Abstract : The Galápagos Marine Reserve (GMR) is an internationally-recognized region of consistent upwelling events, high productivity, and rich biodiversity. Despite its high-nutrient, low-chlorophyll condition, the archipelago has experienced phytoplankton blooms, especially in the western section between Isabela and Fernandina Islands. However, little is known about how climate variability will affect future phytoplankton standing stock in the Galápagos, and no consistent protocols currently exist to quantify phytoplankton biomass, identify species, or monitor for potential harmful algal blooms (HABs) within the archipelago. This analysis investigates physical, chemical, and biological oceanic variables that contribute to algal blooms within the GMR, using 4 km Aqua MODIS satellite imagery and 0.125-degree wind stress data from January 2003 to December 2016. Furthermore, this study analyzes chlorophyll-a concentrations at varying spatial scales—within the greater archipelago, as well as within five smaller bioregions based on species biodiversity in the GMR. Seasonal and interannual trend analyses, correlations, and hotspot identification were performed. Results demonstrate that chlorophyll-a is expressed in two seasons throughout the year in the GMR, most frequently in September and March, with a notable hotspot in the Elizabeth Bay bioregion. Interannual chlorophyll-a trend analyses revealed highest peaks in 2003, 2007, 2013, and 2016, and variables that correlate highly with chlorophyll-a include surface temperature and particulate organic carbon. This study recommends future in situ sampling locations for phytoplankton monitoring, including the Elizabeth Bay bioregion. Conclusions from this study contribute to the knowledge of oceanic drivers that catalyze primary productivity and consequently affect species biodiversity within the GMR. Additionally, this research can inform policy and decision-making strategies for species conservation and management within bioregions of the Galápagos.

Keywords : bioregions, ecological monitoring, phytoplankton, remote sensing

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