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Title:

Food Quality and Phytoplankton Community Composition in San Francisco Bay using Imaging Spectroscopy Data from the California HypsIRI Airborne Campaign

Abstract

The San Francisco Bay (SFB) is the largest estuary on the west coast of the United States. It is an important transition zone between marine, freshwater, and inland terrestrial watersheds. The SFB is an important region for the cycling of nutrients and pollutants and it supports nurseries of ecologically and commercially important fisheries, including some threatened species. Phytoplankton community structure influences food web dynamics, and the taxonomy of the phytoplankton may be more important in determining primary “food quality” than environmental factors. As such, estimating food quality from phytoplankton community composition can be a robust tool to understand trophic transfer of energy. Recent work explores phytoplankton “food quality” in SFB through the use of microscopy and phytoplankton chemotaxonomy to evaluate how changes in phytoplankton composition may have influenced the recent trophic collapse of pelagic fishes in the northern part of the SFB. The objective of this study is to determine if the approach can also be applied to imaging spectroscopy data in order to quantify phytoplankton “food quality” from space. Imaging spectroscopy data of SFB from the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) was collected during the Hyperspectral Infrared (HypsIRI) Airborne Campaign in California (2013 – 2015) and used in this study. Estimates of ocean chlorophyll and phytoplankton community structure were determined using standard ocean chlorophyll algorithms and the PHYtoplankton Detection with Optics (PHYDOTax) algorithms. These were validated using in situ observations of phytoplankton composition using microscopic cell counts and phytoplankton chemotaxonomy from the US Geological Survey’s ship surveys of the SFB. The findings from this study may inform the use of future high spectral resolution satellite sensors with the spatial resolution appropriate for coastal systems (e.g., HypsIRI) to assess “food quality” from space.

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