# Analyzing NASA Earth Observations Data to Evaluate Grunion Response to Ecosystem Changes Forced by Recent Environmental Conditions in California's Oceans

## Abstract

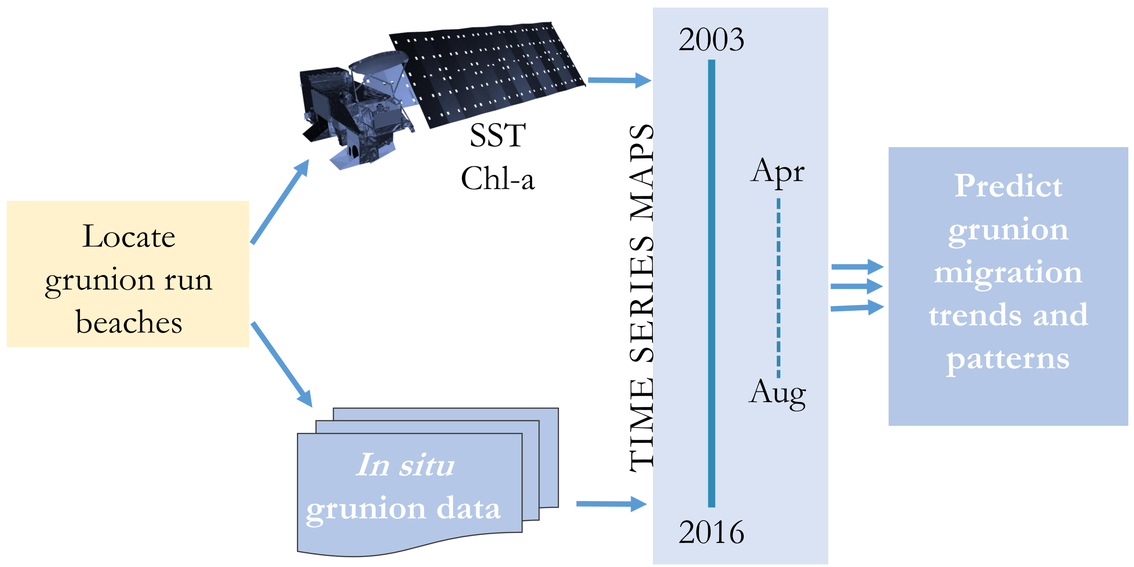
The California grunion is an endemic fish species vital to the California coast, acting as a versatile food source for many species such as seabirds, large mammals, and other fish in the food web. This species, known primarily for the unique way in which they spawn, have two specialized regions. Historically, they only occur in Southern California and northern Baja California and are vulnerable to air and ocean temperature changes. In the last 16 years, scientists recorded grunion spawning further north to the San Francisco Bay area. In response to air and ocean temperature increases, the fish migrate to cooler waters to which they are more adapted. This is an issue due to the fact that the grunion found here are much smaller in size, indicating the north coast may not be as suitable for the species. Increased beach activity, beach cleaning practices, and coastal erosion significantly contribute to the decrease in population and the significant shift of spawning areas. This project, in collaboration with the Grunion Greeters Project, used Aqua MODIS satellite data for sea surface temperature (SST) and chlorophyll-a concentration to create a time series of the California coast from 2002 to 2017. Analyzing this product will help predict grunion spawning areas and can be used to develop beneficial management practices as well as establish new protective areas to keep the species thriving and safe.

## Objectives

- **Determine** potential grunion spawning beaches and factors that affect grunion run presence and magnitude
- **Analyze** sea surface temperature and chlorophyll-a time series to identify potential future grunion spawning sites along the California coast
- **Aid** future decision making to manage seasonal spawning locations and to protect the grunion

## Study Area


## Methodology




## Results

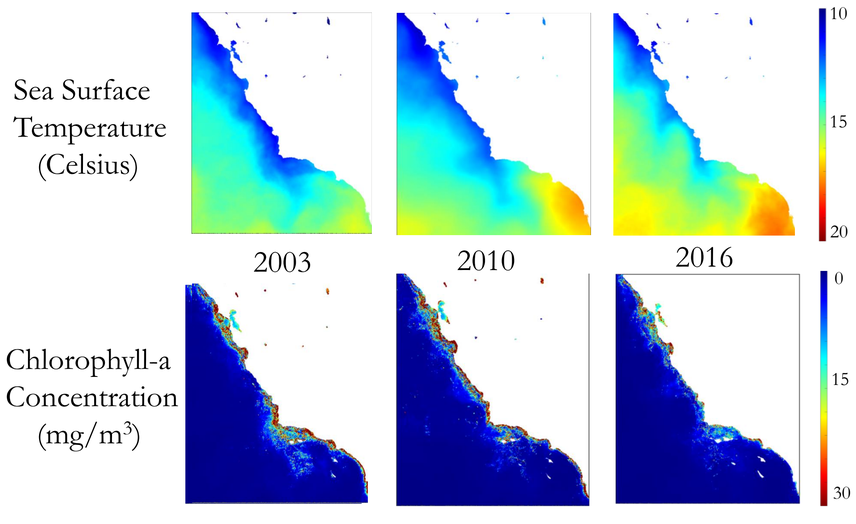



**Figure 1:** April monthly anomalies for sea surface temperature and chlorophyll-a concentrations were plotted for the years 2003, 2010, and 2016 to look at trends during the month where grunion spawning is the greatest.

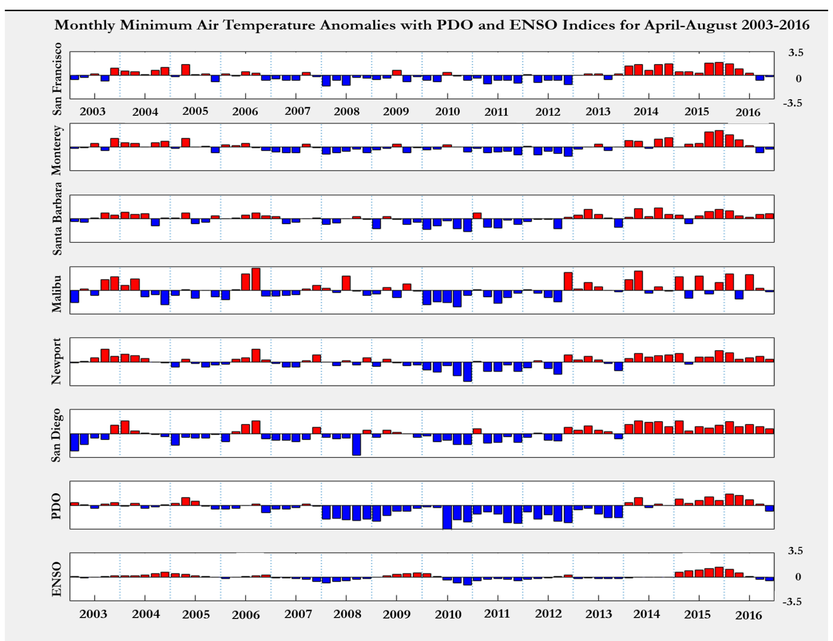
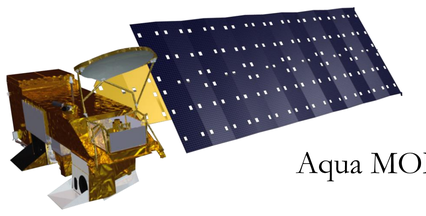



**Figure 2:** Monthly anomalies for April-August, each bar represents a month, were taken for stations in major grunion run areas. The figure is ordered so that the stations descend from north to south. The Pacific Decadal Oscillation (PDO) and the El Niño Southern Oscillation (ENSO) were added for comparison.

## Conclusions

- Grunion data were plotted against air and water temperature anomalies calculated from *in situ* and remote sensing sources.
- Chlorophyll-a and SST time series maps were generated to create another comparison map.
- Temperature anomalies were compared to the Pacific Decadal Oscillation and El Nino Southern Oscillation indices to look for broader-scale patterns of the grunion migrations.

## Earth Observations



Aqua MODIS

## Project Partners

Grunion Greeters Project

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