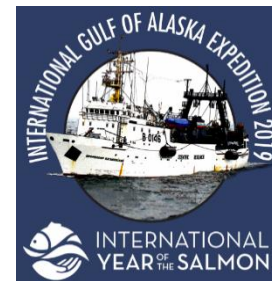
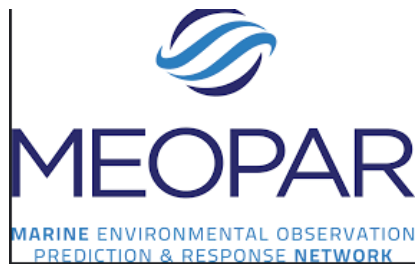


# Winter dynamics of phytoplankton biomass in the Gulf of Alaska derived from Sentinel 3 Imagery.

Vishnu Perumthuruthil Suseelan  
Maycira Costa  
Fernanda Colo Giannini



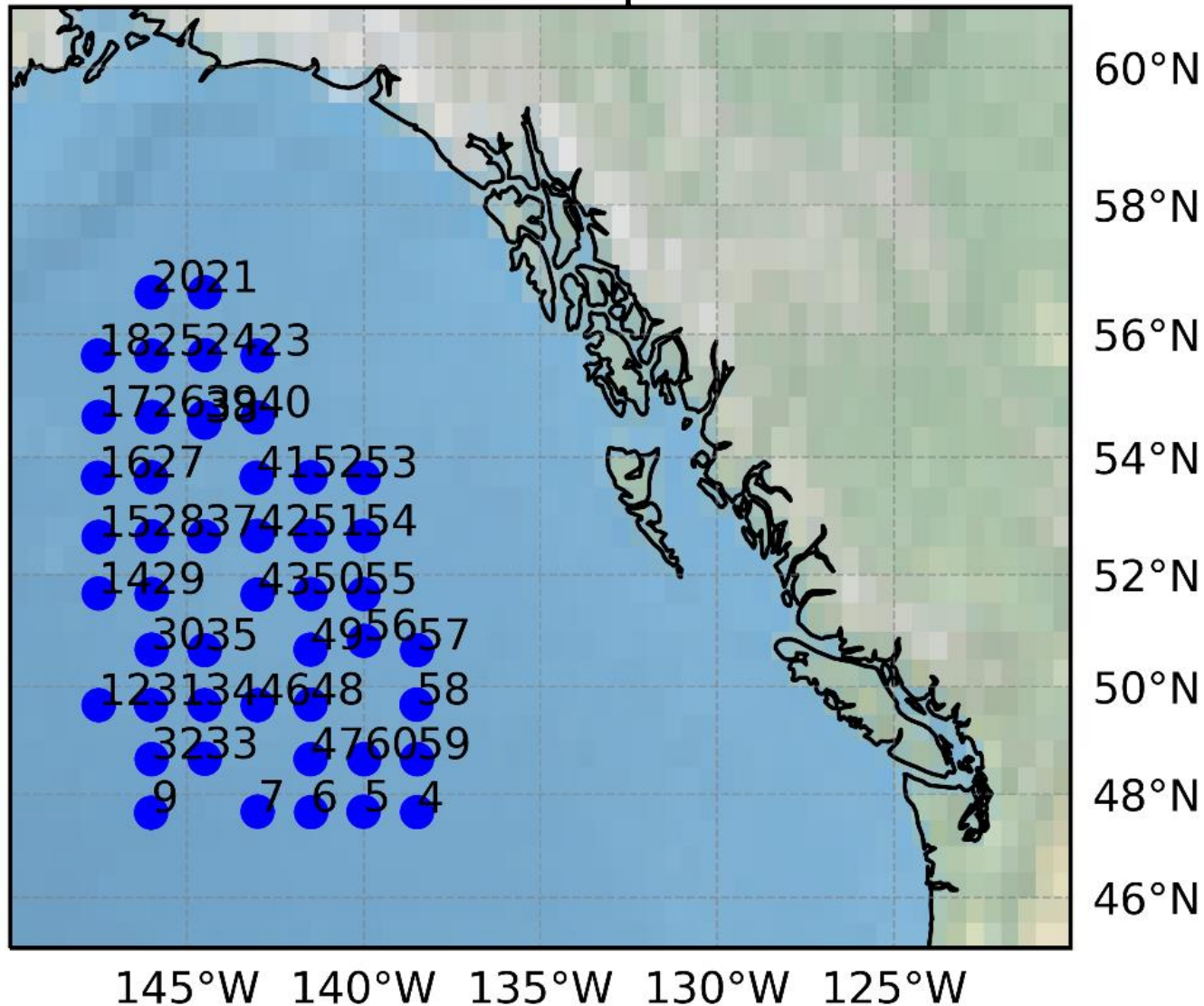
University  
of Victoria



PICES, October 2019

The international expedition to the Gulf of Alaska was the first large-scale, integrated winter pelagic ecosystem research survey (18-2-2019 to 15-03-2019).

Area Map



### Ocean Color Satellites

- Ocean color satellite provides a synoptic scale information about chlorophyll a concentration, a proxy for phytoplankton biomass.
- Possible to derive phytoplankton group (PFT) information from ocean color reflectance.
- Phytoplankton group level information helps to understand the habitat condition in the Ocean.

## Samples collected

- Remote sensing reflectance (Rrs) for validation of atmospheric correction of Sentinel 3
- Rrs for Phytoplankton Functional Type Studies.
- HPLC Chla (40 samples)
- Microscopy (40 samples)
- TSM (40 sample)
- Sentinel 3 : 300 m spatial resolution new ESA satellite

Processing with Polymer v4.10

8-Days binning

Median for a 5 x 5 pixel

Number of match ups (25 samples at +/-5hrs of solar noon)

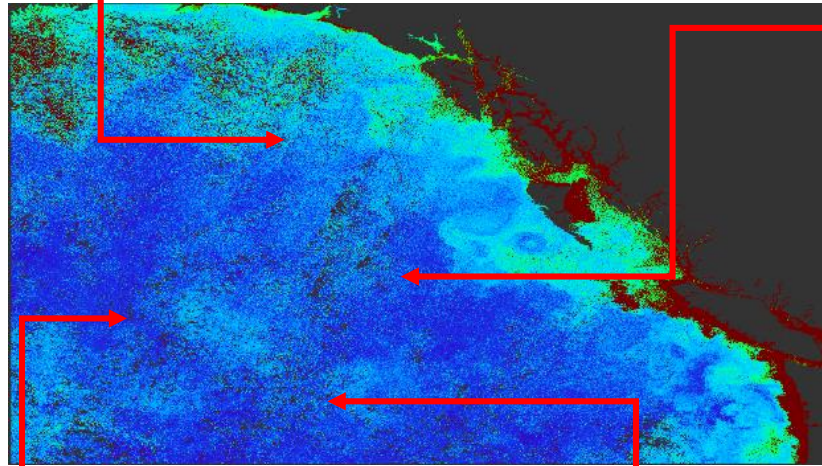
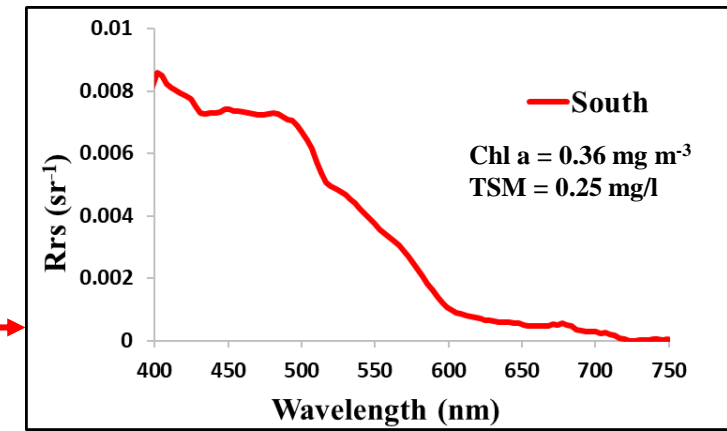
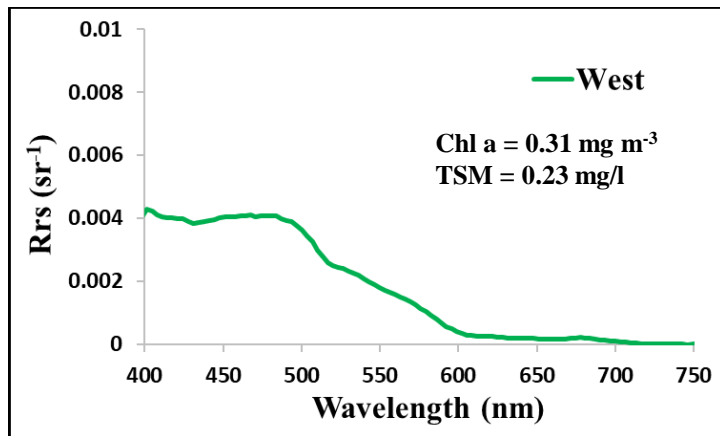
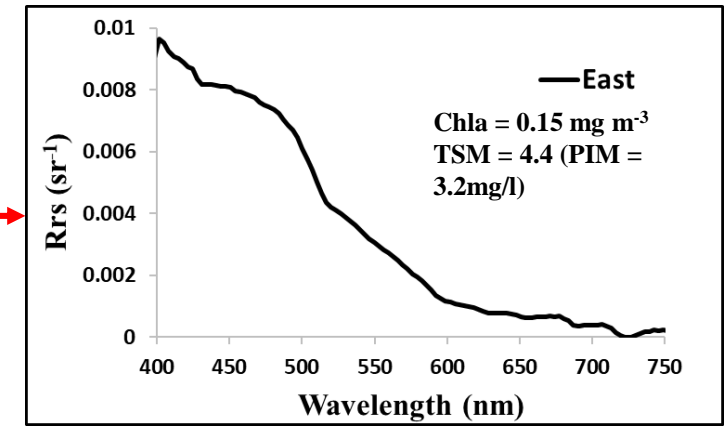
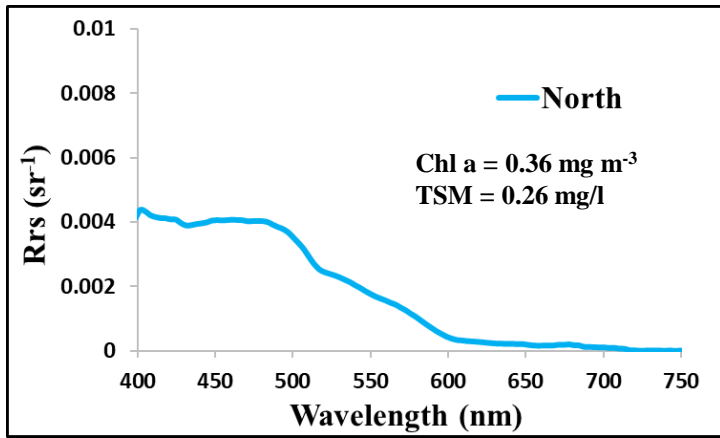


# Results

- Remote Sensing Reflectance ( $R_{rs}$ ).
- Spatial and temporal Chlorophyll a from OLCI Sentinel 3A Satellite.
- HPLC pigments data.
- Microscopy.

# Satellite Validation

# Remote Sensing Reflectance Spectra ( $\text{sr}^{-1}$ )

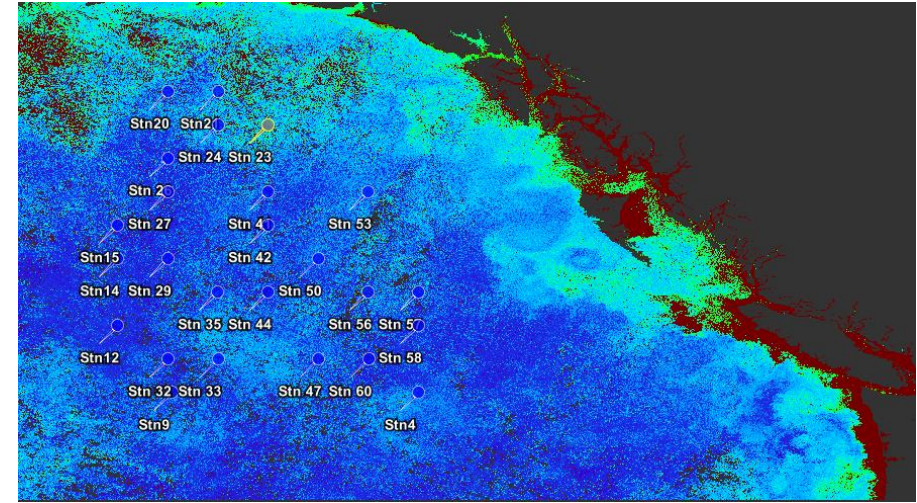
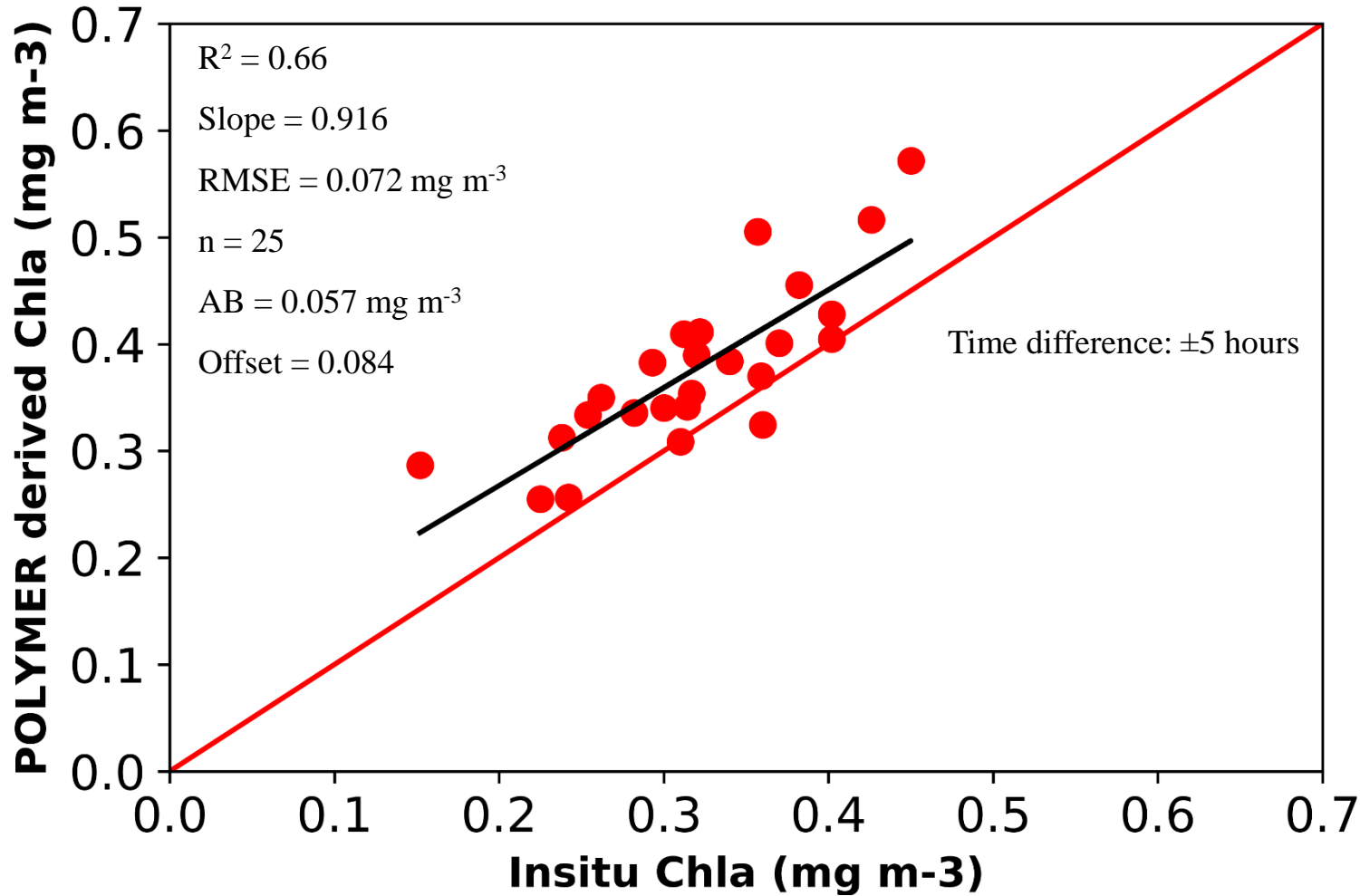


## Main points:

- Case 1 waters with low reflectance
- Signal shows waters that have low dissolved organic matter and inorganic suspended particles
- Signal shows typical signal of low Chl a concentrations, including the fluorescence signal at  $\sim 680\text{nm}$ .



# Validation of Sentinel Chl a products: In-situ vs Satellite matchup



## Main points:

- Excellent agreement between in-situ and satellite derived Chl a.
- In-situ and Satellite Chl a are in the same dynamic range.

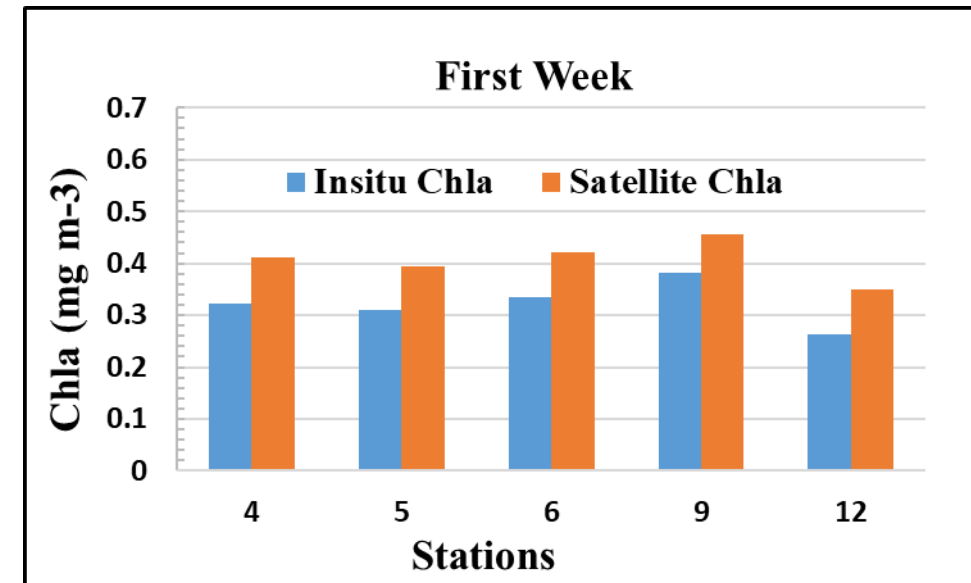
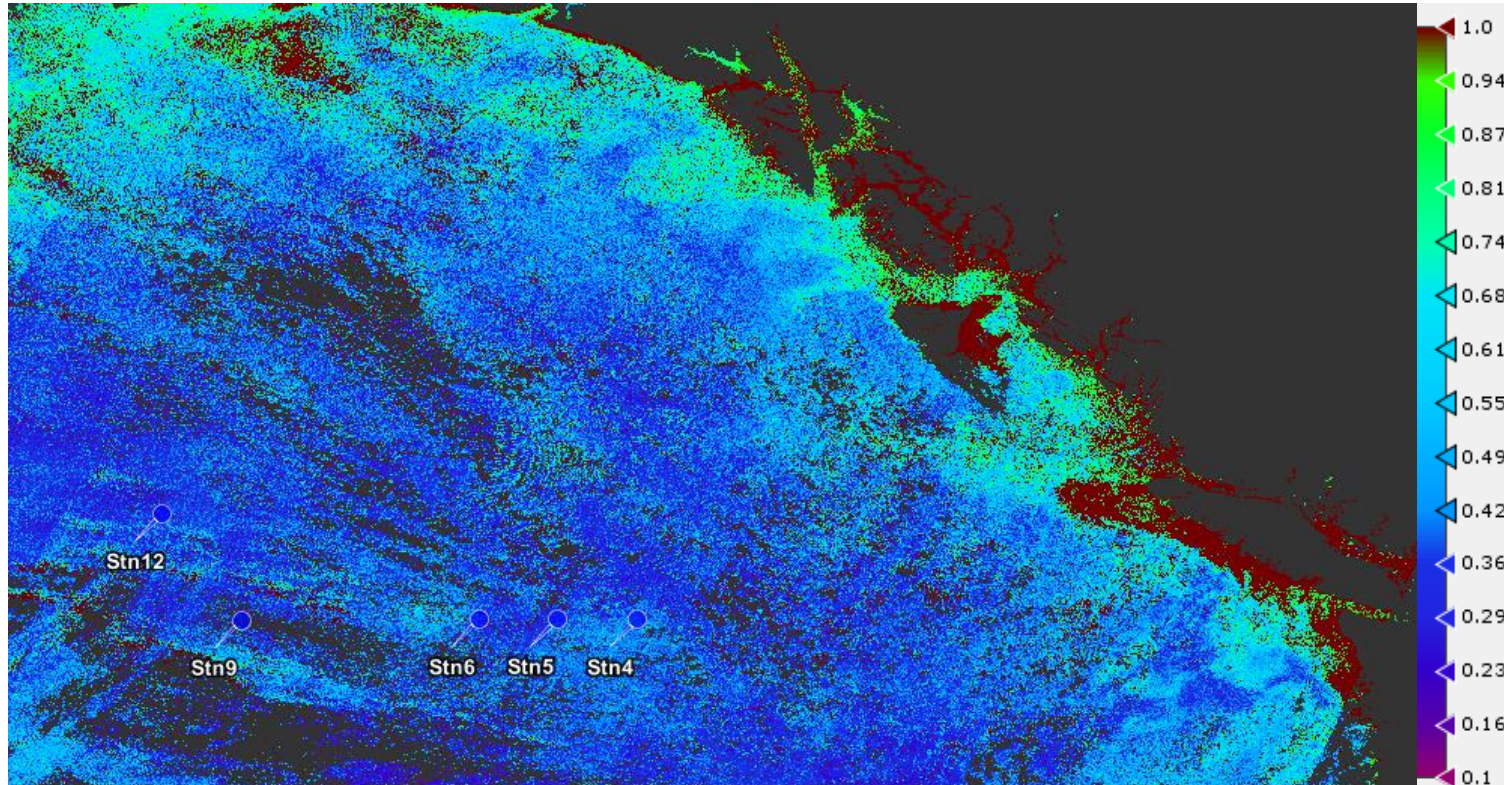
# Phytoplankton Dynamics

πυλκοβίαια δυναμική



# Sentinel 3 chlorophyll concentration: 8 days average

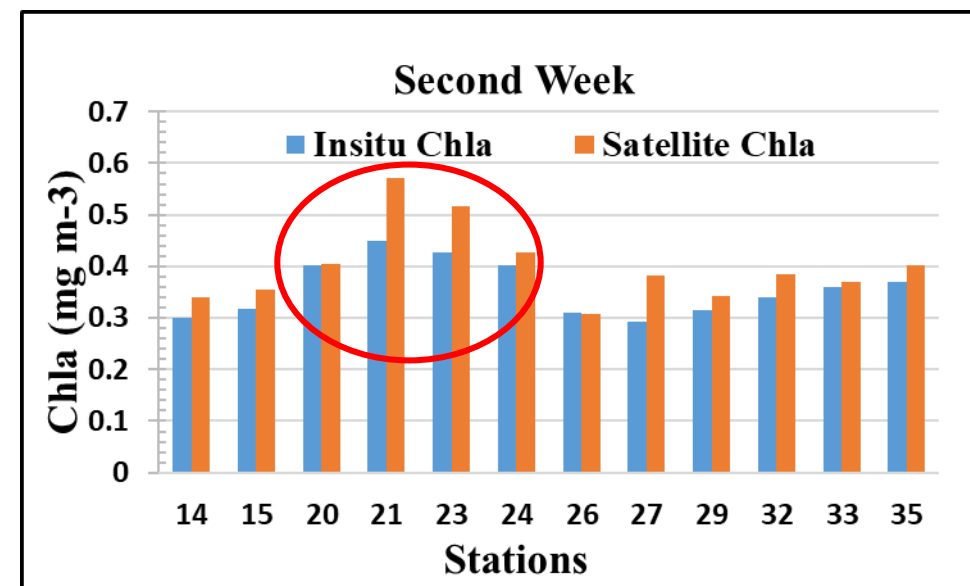
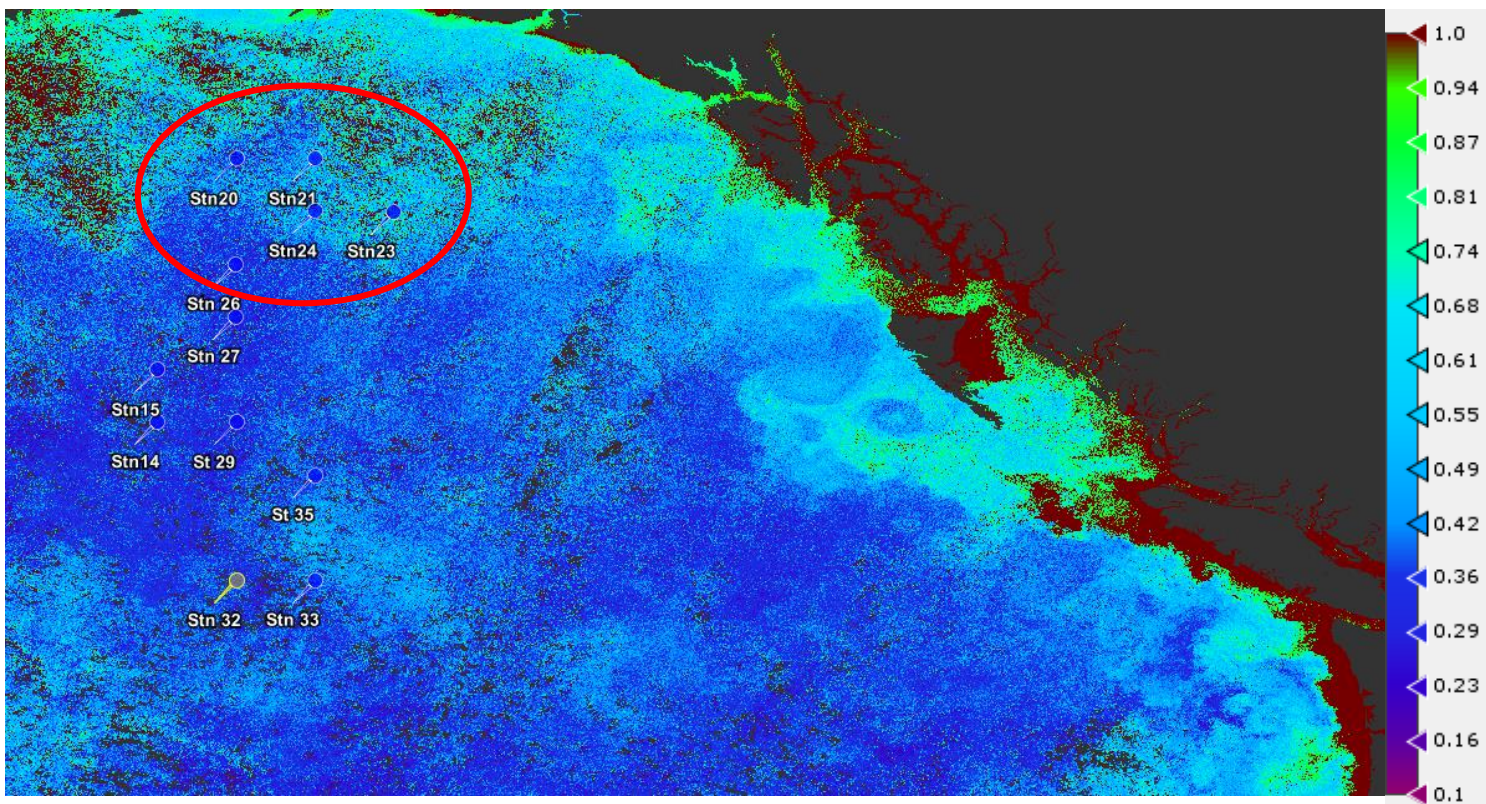
Week 1: 18-02-2019 to 25-02-2019





# Sentinel 3 chlorophyll concentration: 8 days average

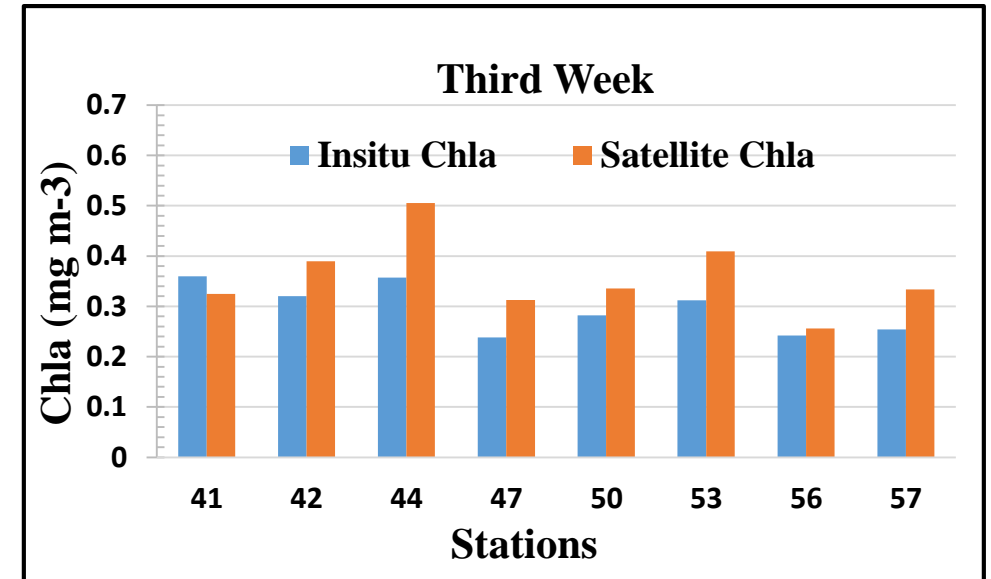
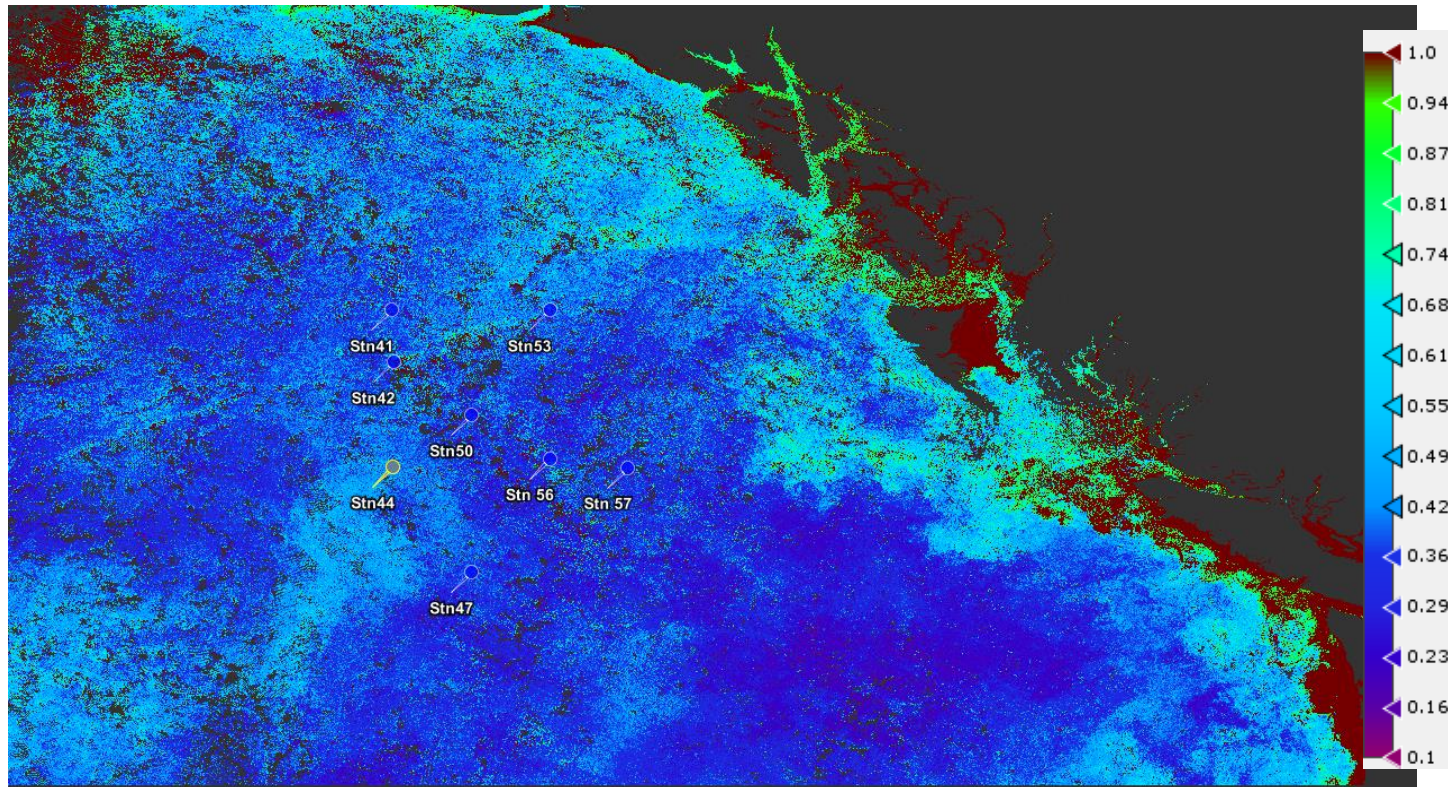
Week 2: 26-02-2019 to 05-03-2019





# Sentinel 3 chlorophyll concentration: 8 days average

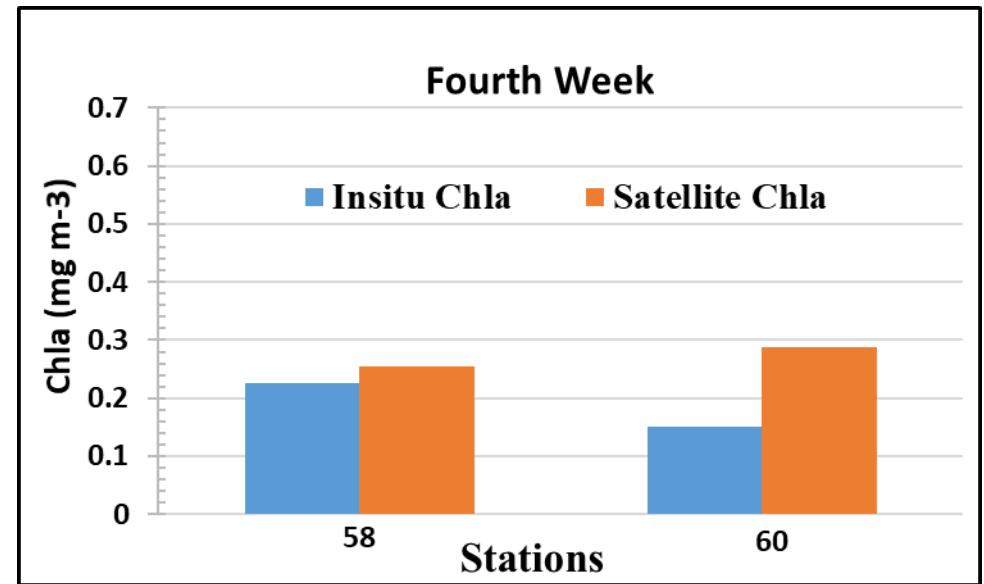
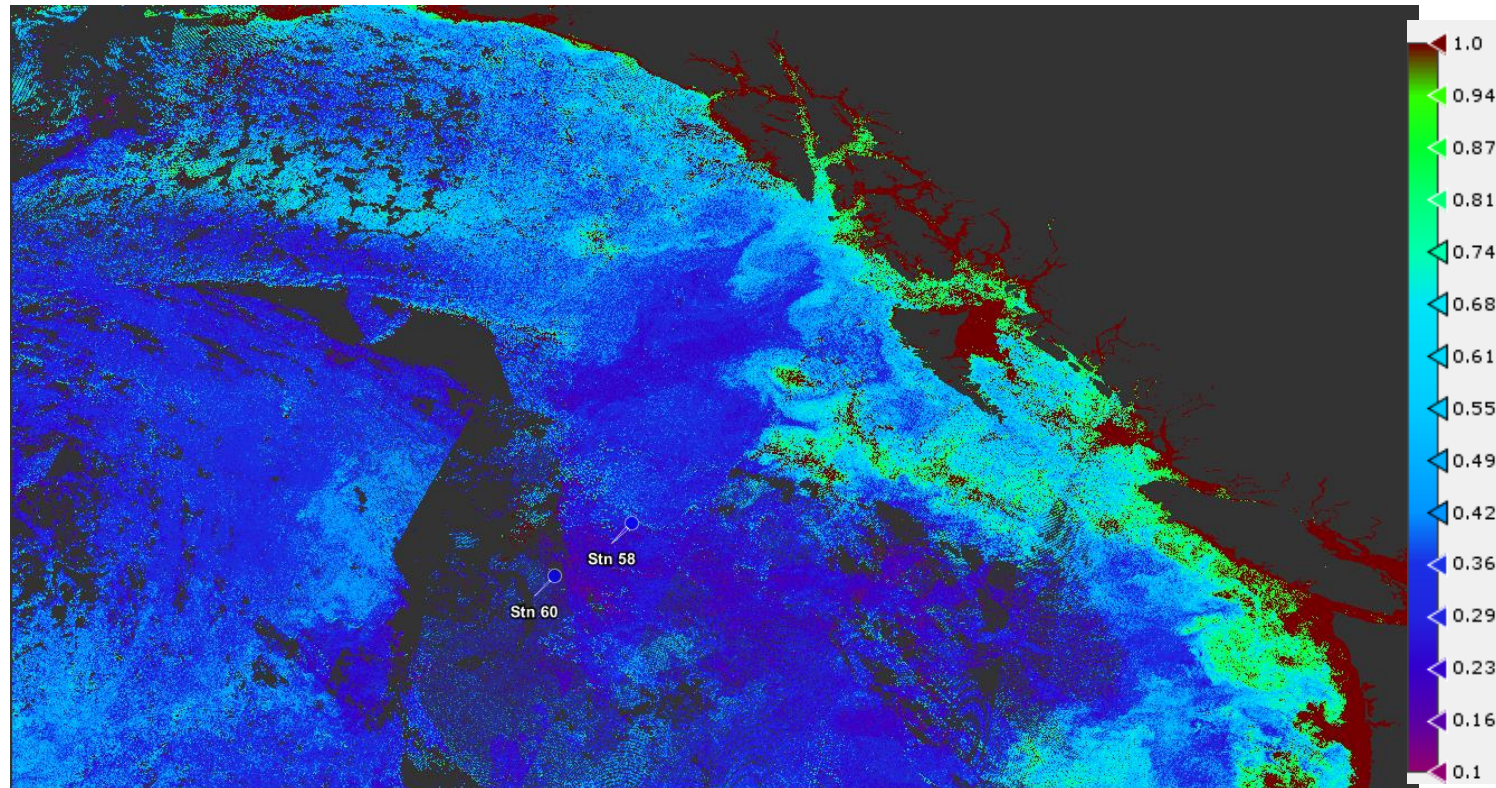
Week 3: 06-03-2019 to 13-03-2019





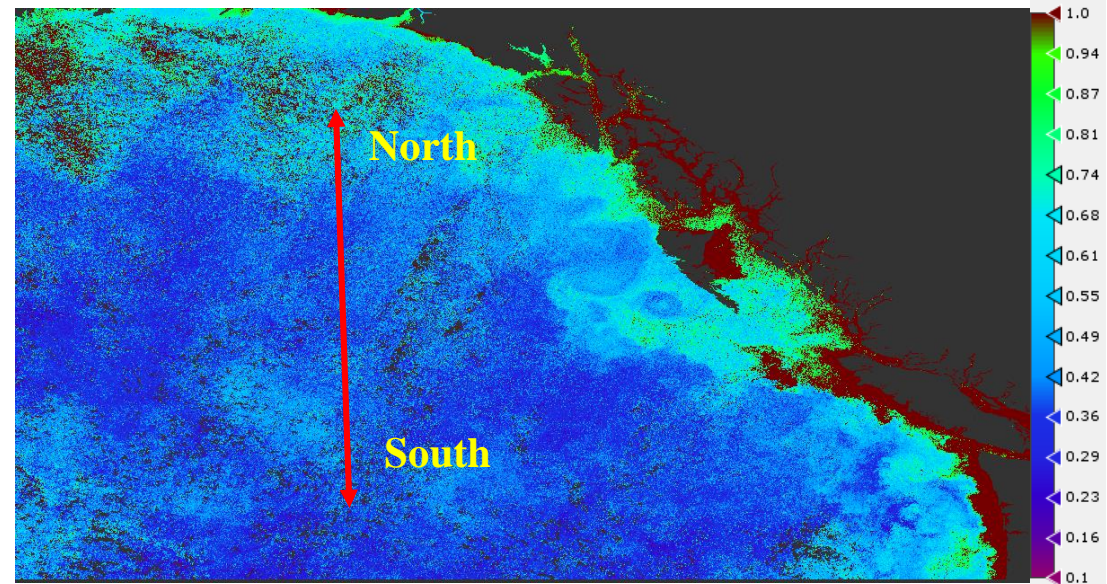
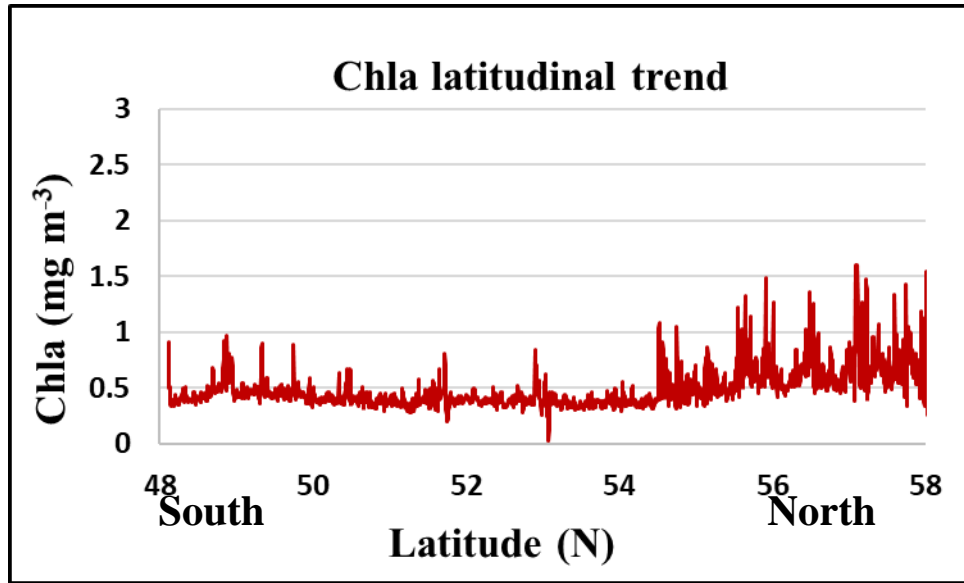
# Sentinel 3 chlorophyll concentration: 8 days average

Week 4: 14-03-2019 to 21-03-2019



# Latitudinal Trend of Chlorophyll a

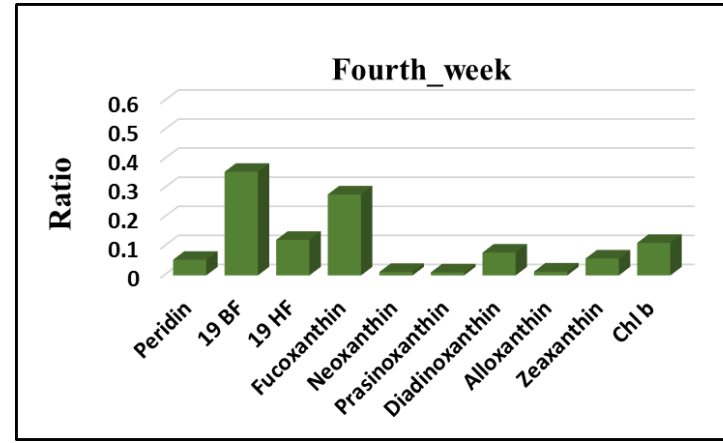
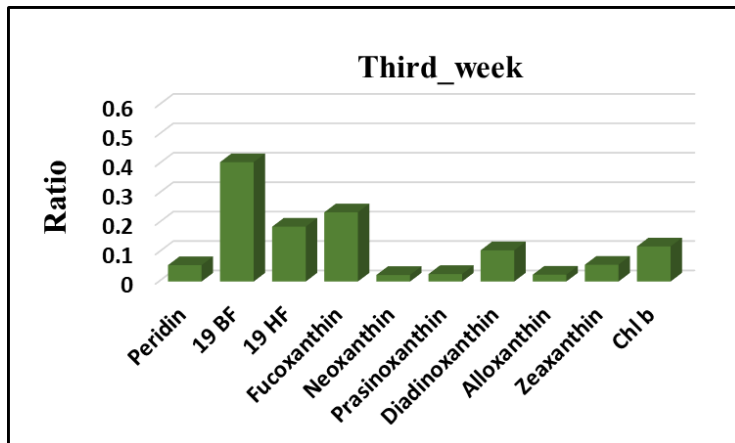
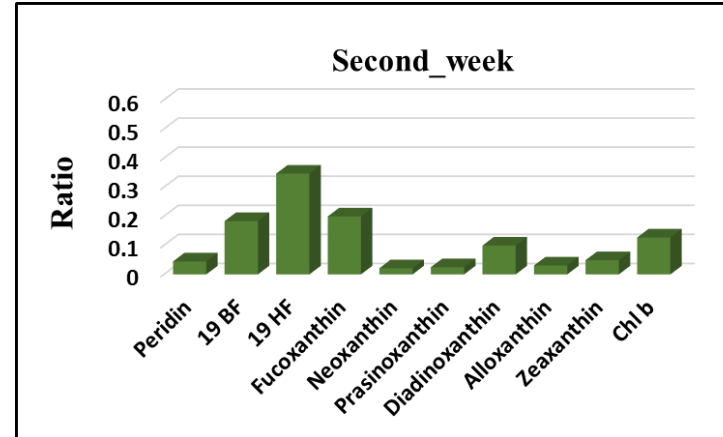
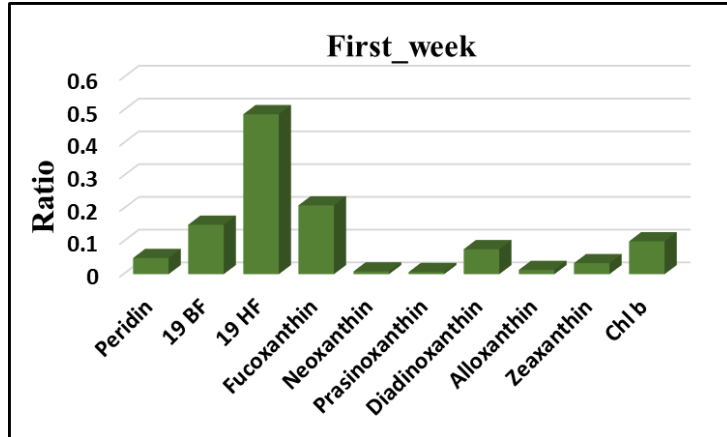
Week 2: 26-02-2019 to 05-03-2019



Main points:

- Latitudinal trend showing low chlorophyll concentration in the South and Central regions.
- As it is progressing toward the North Chlorophyll a concentration started to increase.

## HPLC pigment distribution (chla/pig ratio)



Main points:

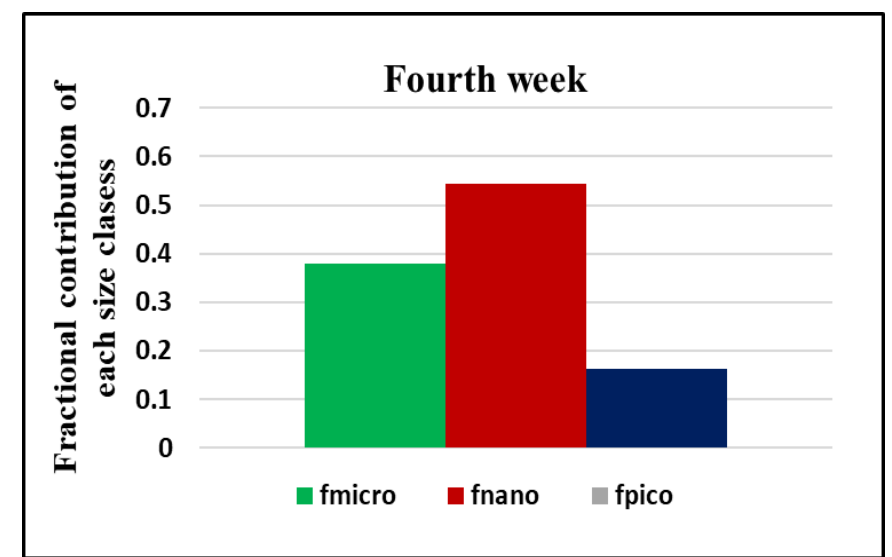
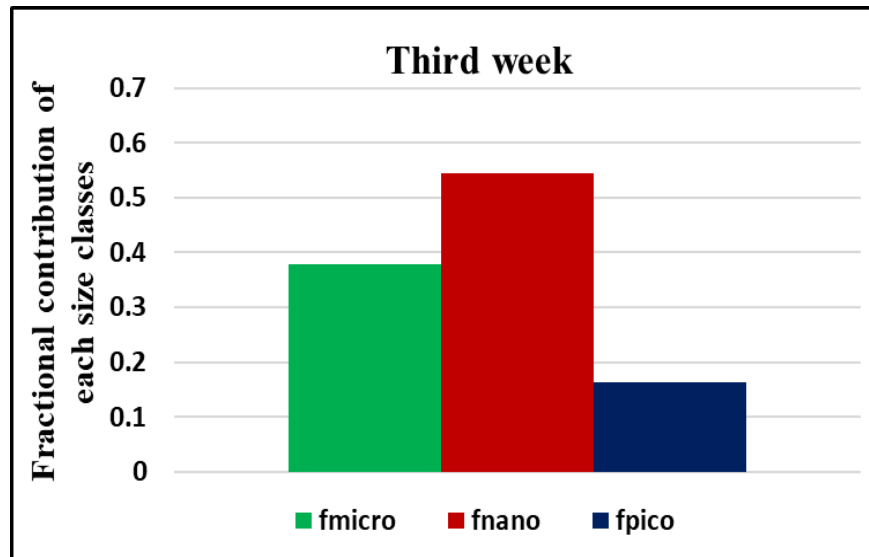
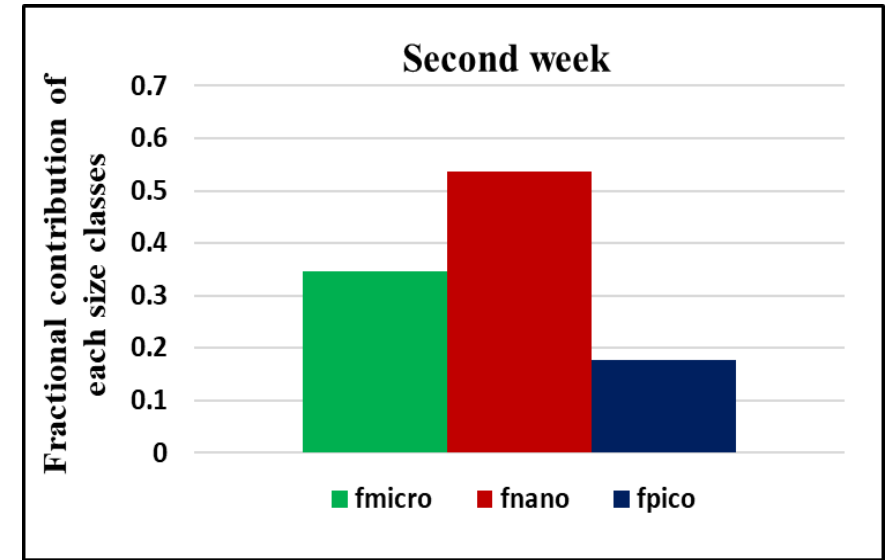
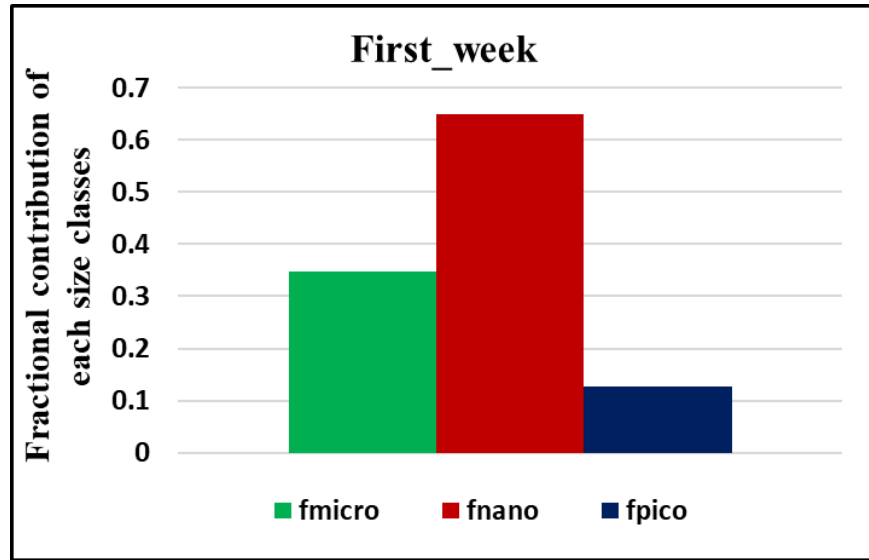
- It showing 19' HF, 19' BF, Fucoxanthin are the dominant pigments in these waters during the winter.
- Diagnostic pigment suggesting the presence of

- Prymnesiophytes
- Diatoms
- Pelagophytes
- Dinoflagellates

- This results were supported from microscopic analysis: Dinoflagallates and Diatoms are dominant at the time of the survey.



# Phytoplankton Size Classes from HPL Uitz et al., (2006)



# Take Home Message

## 1. In-situ reflectance shows:

- Case 1 clear waters indicating low concentration of dissolved organic materials and total inorganic materials.
- Phytoplankton shows absorption peak and fluorescence peak in the red wavelength.
- Reflectance data will be further used for the analysis for Phytoplankton group studies.

## 2. Satellite product validation:

- Excellent agreement with in situ HPLC Chl a -  $R^2 = 0.7$ , slope close to 1, and low RMSE =  $0.072 \text{ mg m}^{-3}$ .

## 3. Chl a satellite-derived spatial dynamic:

- Central region showed low chlorophyll concentration with range from  $0.25$  to  $0.35 \text{ mg m}^{-3}$ .

## 3. Chl a satellite-derived spatial dynamic:

- Northern and Eastern regions showed slightly higher concentration reaching  $0.5$  to  $0.8 \text{ mg m}^{-3}$ .

## 4. Phytoplankton groups based on HPLC and microscopy

- HPLC pigment indicates the likelihood of Prymnesiophytes, Diatoms, Pelagophytes, and Dinoflagellates.
- Microscopy indicates Diatoms and Dinoflagellates

## 5. Satellite data will be analyzed to derive PFT.



# THANK YOU

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