An Unconventional Investigation into the Seasonal Dynamics of Phytoplankton in the Nearshore

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McClusky et al. (In Revision) On the seasonal dynamics of phytoplankton chlorophyll-a concentration in nearshore and offshore waters of Plymouth, England: Enlisting the help of a surfer. Submitted to Oceans

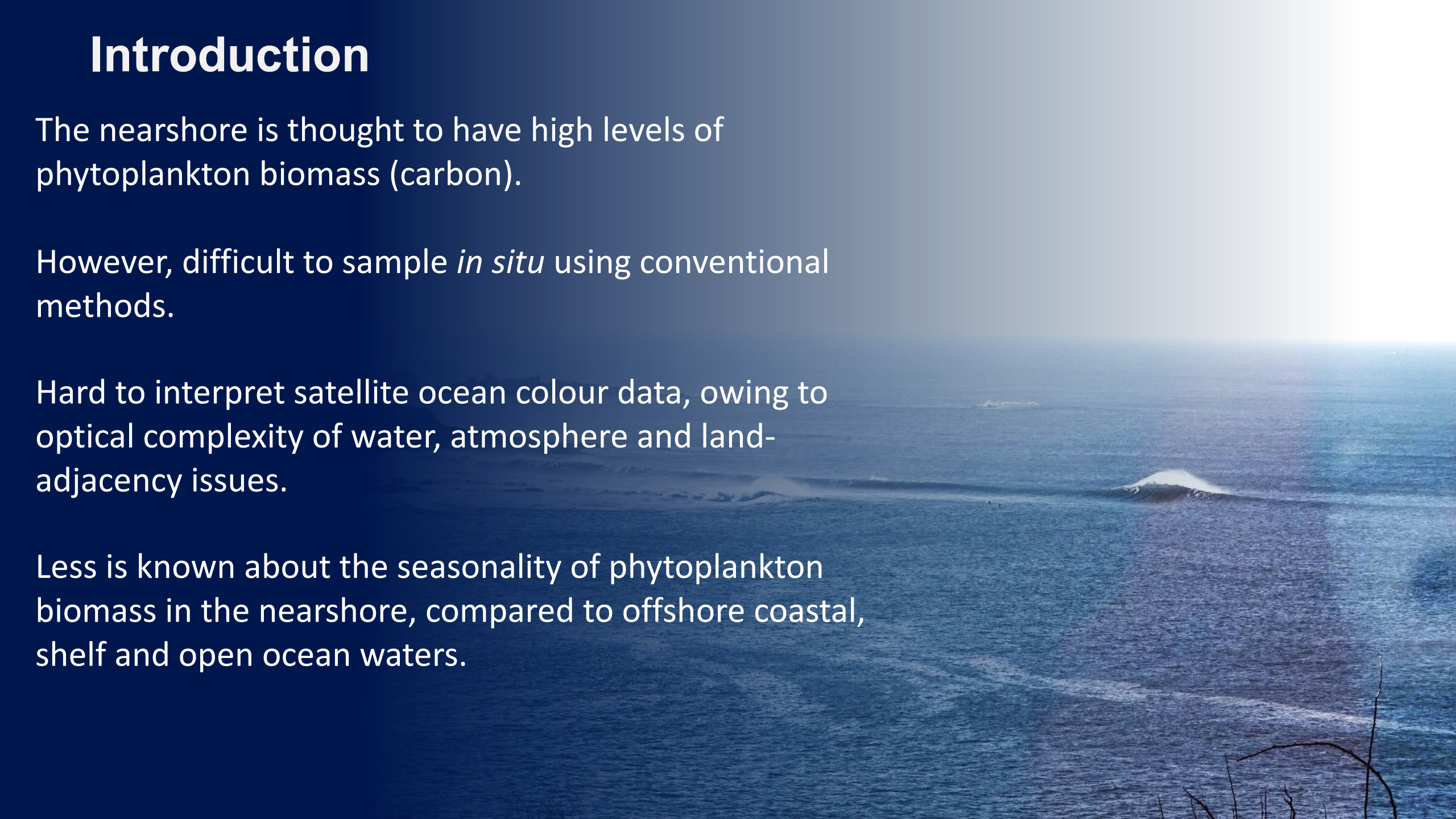
Introduction

The nearshore is thought to have high levels of phytoplankton biomass (carbon).

However, difficult to sample *in situ* using conventional methods.

Hard to interpret satellite ocean colour data, owing to optical complexity of water, atmosphere and land-adjacency issues.

Less is known about the seasonality of phytoplankton biomass in the nearshore, compared to offshore coastal, shelf and open ocean waters.



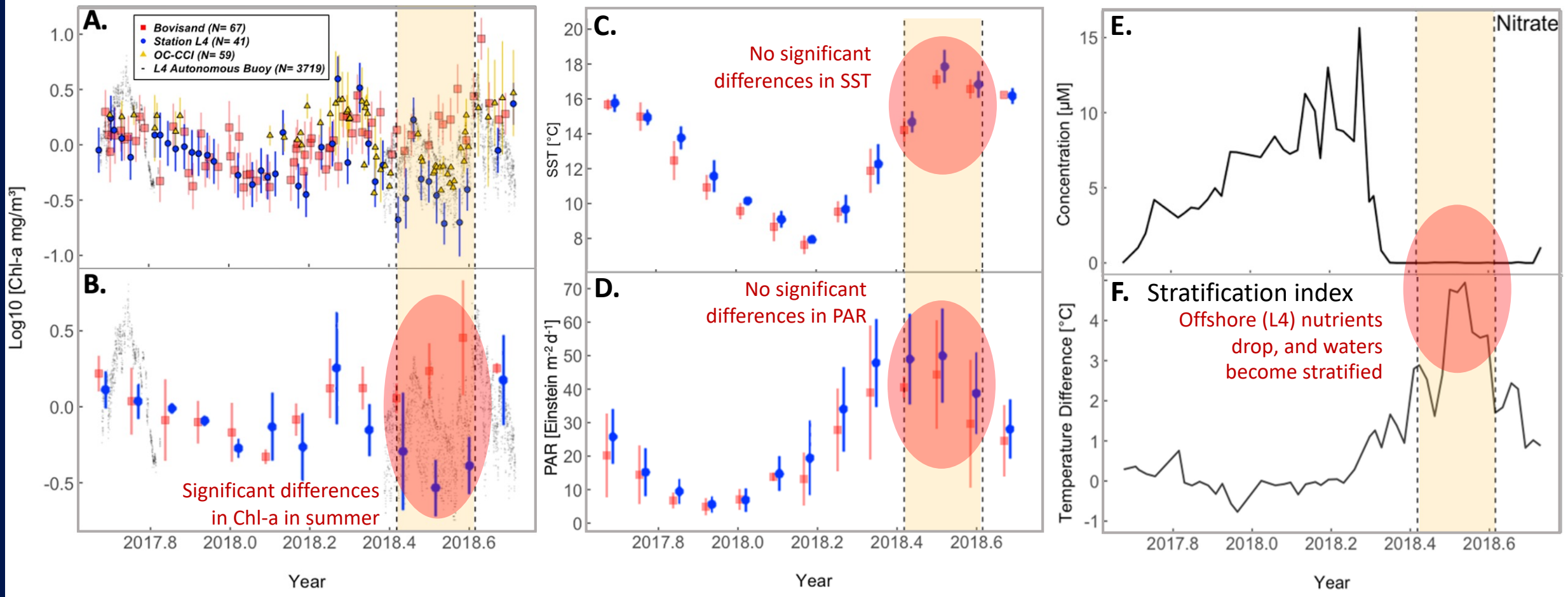
Method

Annual datasets of chlorophyll-a concentration (Chl-a) and sea surface temperature (SST) were collected by a surfer at Bovisand Beach, Plymouth, UK.

We compare this dataset with a complementary *in-situ* dataset collected 7 km offshore from the coastline (11 km from Bovisand Beach) at Station L4.

We investigated differences in phytoplankton seasonal cycles between nearshore and offshore coastal waters.

Results



(A) Time-series of Chl-a data nearshore (Bovisand, red) and offshore (L4 = blue, OC-CCI L4 = yellow). (B) Monthly averages of Chl-a data nearshore and offshore. (C) Monthly averages of SST nearshore and offshore. (D) Monthly averages of Photosynthetically Available Radiation (PAR) nearshore and offshore. (E) Nitrate concentrations offshore (L4). (F) Stratification index (temperature difference between surface (5m) and bottom (50m)) at L4.

Conclusions

Significant differences in Chl-a in summer between nearshore (remained high) and offshore (dropped low).

High stratification and low nutrient concentrations in summer offshore, suggest phytoplankton limited by nutrients.

High Chl-a in the nearshore suggests phytoplankton were not limited by nutrients in summer, likely due to proximity to land.

Considering potential for enhanced ocean stratification with climate change, such differences may become more prominent.

Recreational watersports could help monitor phytoplankton dynamics in the nearshore. Data could be useful for satellite validation (see Vanhellemont et al. 2022 https://doi.org/10.1016/j.ecss.2021.107650).

Knowledge gaps

Poor understanding of phytoplankton carbon dynamics in the nearshore.

Poor understanding of phytoplankton primary production in the nearshore.

Poor understanding of phytoplankton community structure in the nearshore.

NEARSHORE

↑ Marine biodiversity
Tittensor et al. 2010 Nature

↑ Economic value
Costanza et al. (1999,2010) Nature, Global Environ. Chang.

↑ Vulnerability
Jickells (1998) Science

↑ Variability (time and space)

Challenging to sample!

Priorities

1 year	Build a community of scientists and stakeholders interested in nearshore phytoplankton.
5 – 10 years	Investment into new tools and platforms suitable for monitoring *in situ* this highly dynamic region and for validating and improving satellite products.