# Impact of ENSO oceanographic variability in the nano- and microphytoplankton dynamics off central coast of Peru – 12° S (2013-2017)
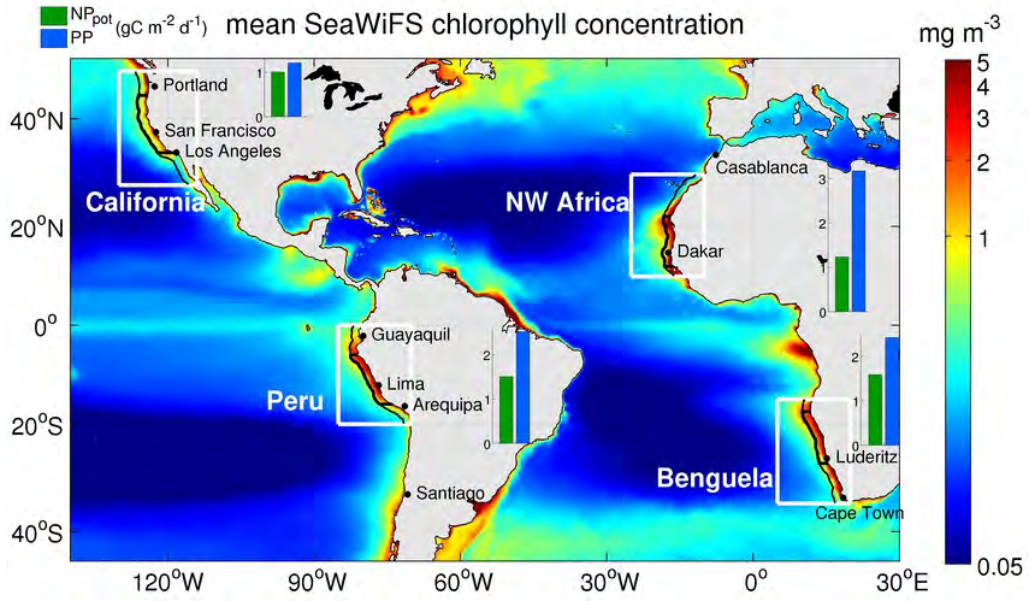
Avy N. **Bernales**, Sonia Sánchez, Michelle Graco, Elcira Delgado, Jesús Ledesma, Flor Chang, Nelly Jacobo, Diana Alvites, Luc Beaufort and David Correa.
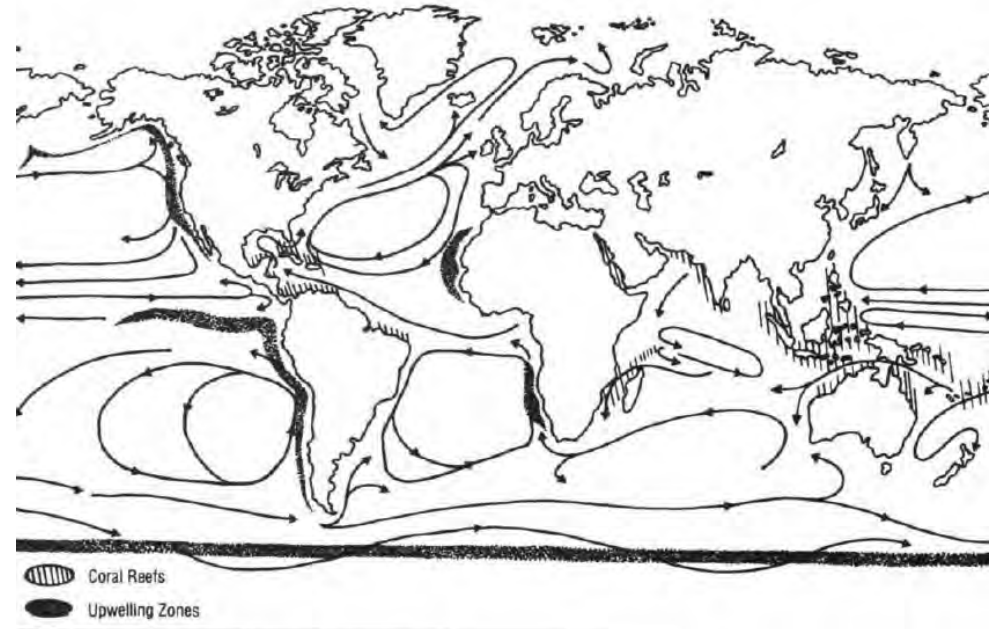
April 24-26, 2018

Project: "Integrated study of coastal upwelling off central Peru"

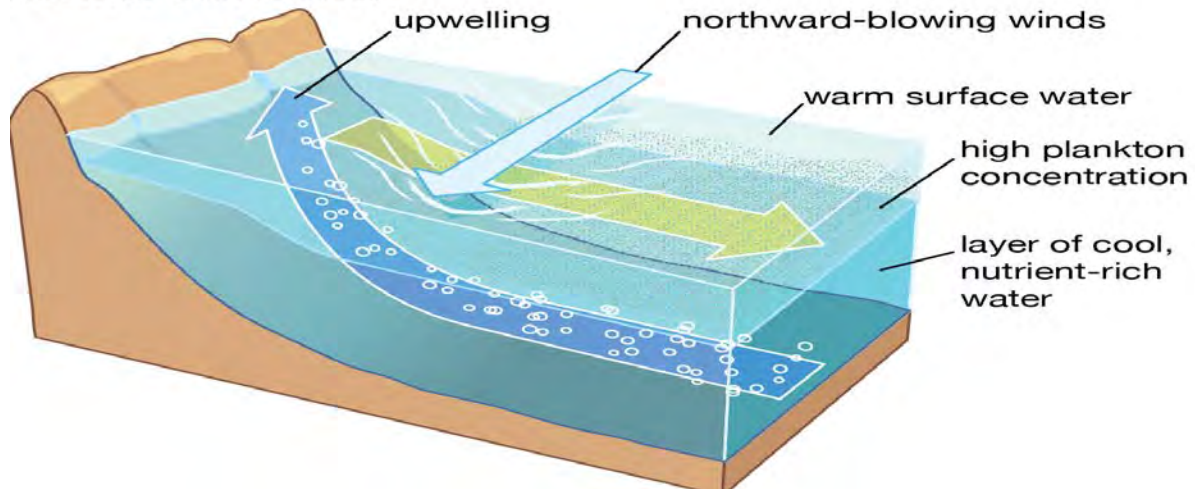*Messié and Chavez, 2015*



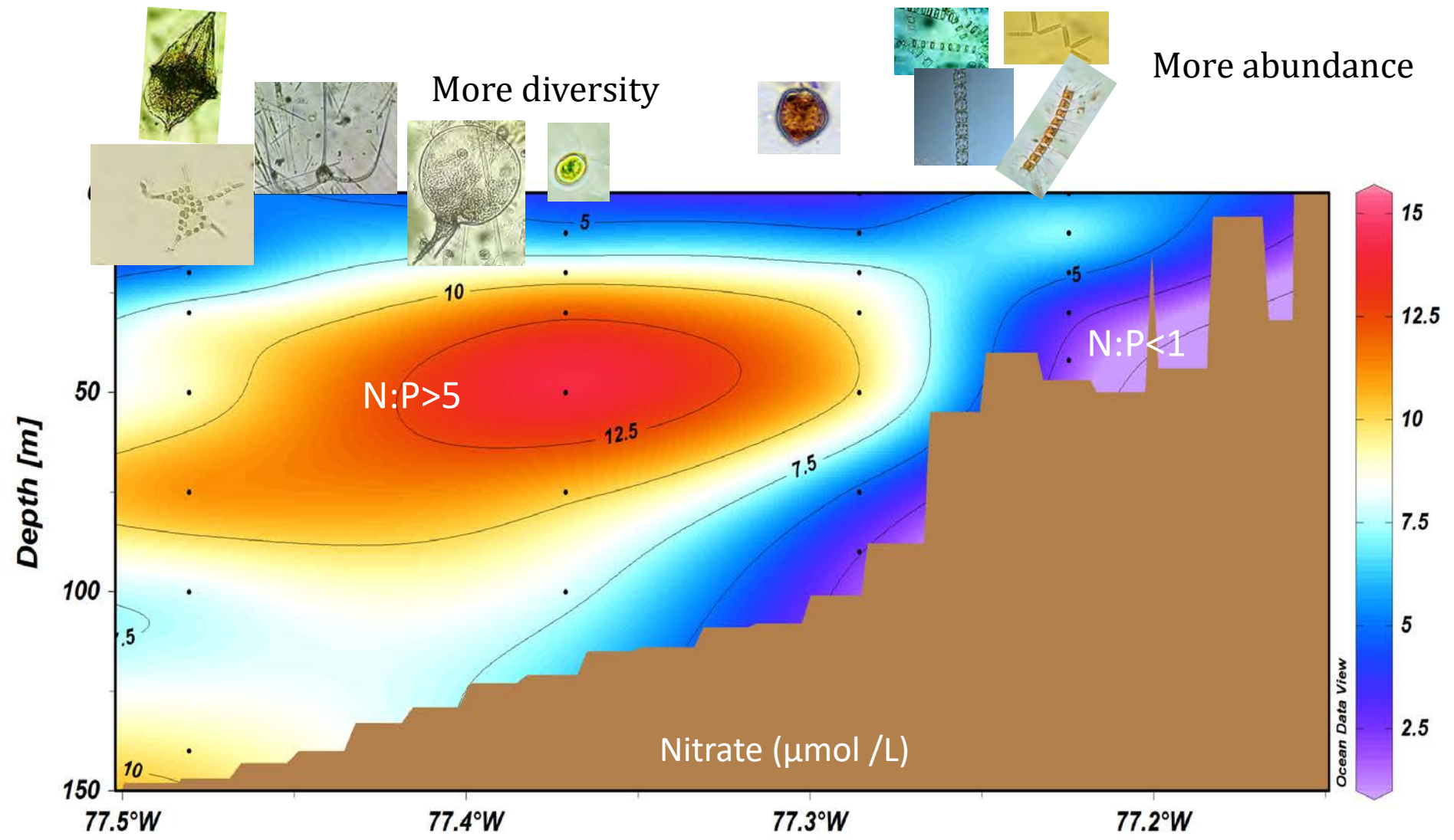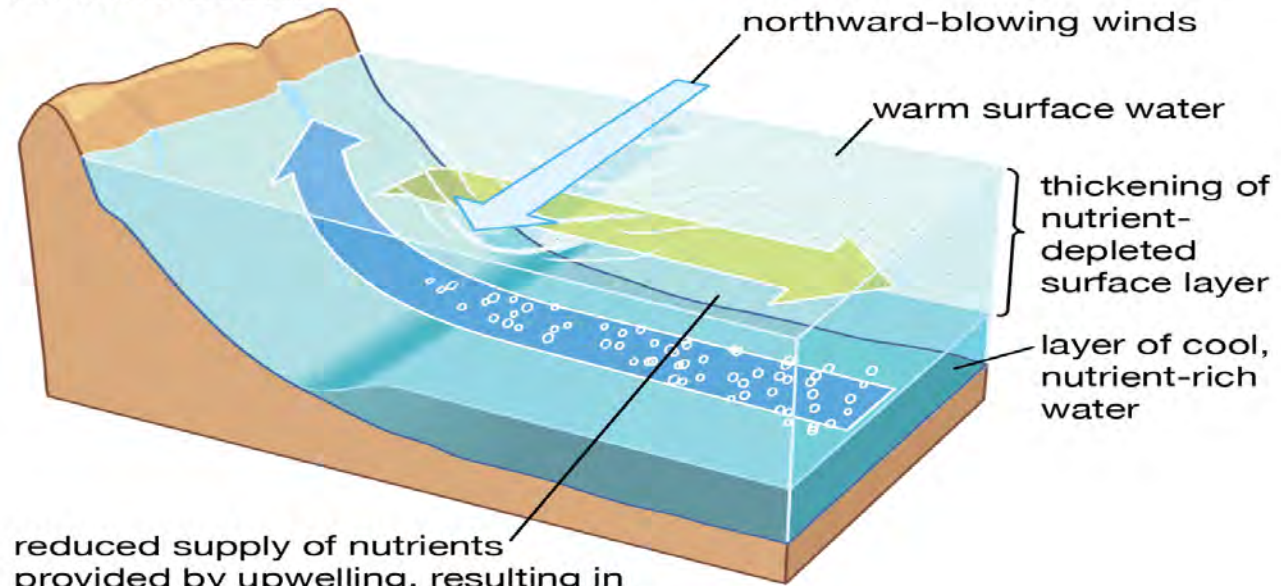*Mann & Lazier, 2006*

Microphytoplankton (20 - 300 µm)
Nanophytoplankton (2 – 20 µm)

More diversity

More abundance



N:P>5

N:P<1

Depth [m]

Nitrate (µmol /L)

Ocean Data View

El Niño event

northward-blowing winds

warm surface water

thickening of nutrient-depleted surface layer

layer of cool, nutrient-rich water
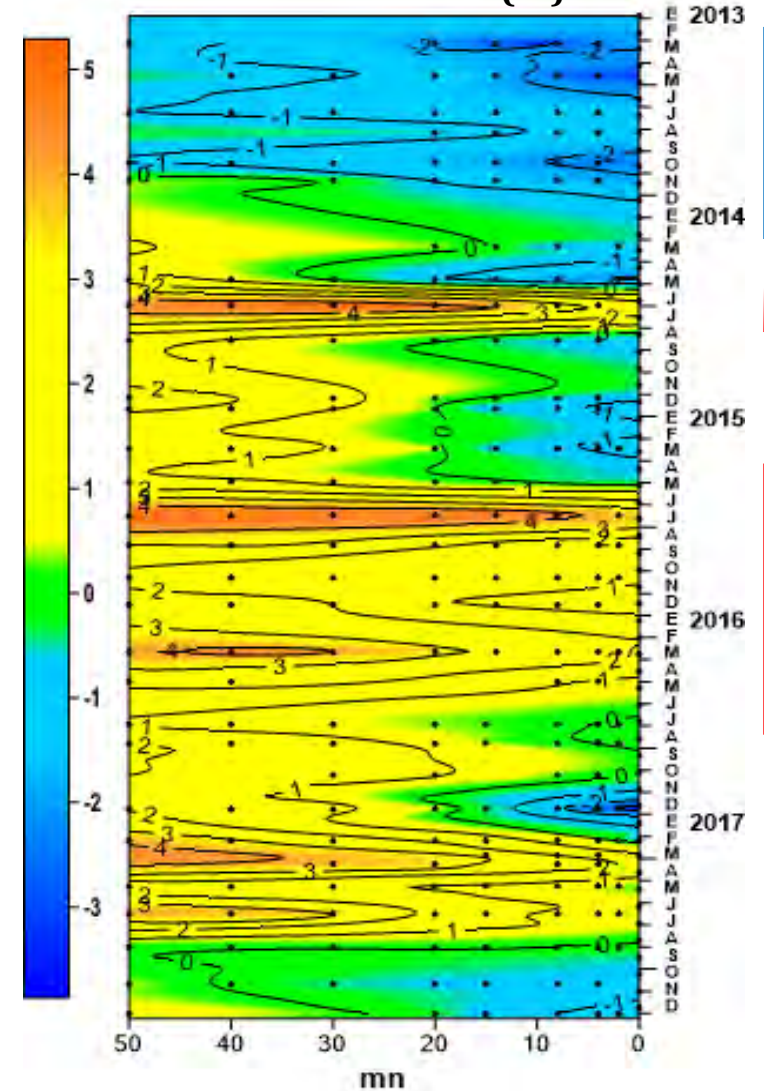
reduced supply of nutrients provided by upwelling, resulting in a decrease in plankton concentration

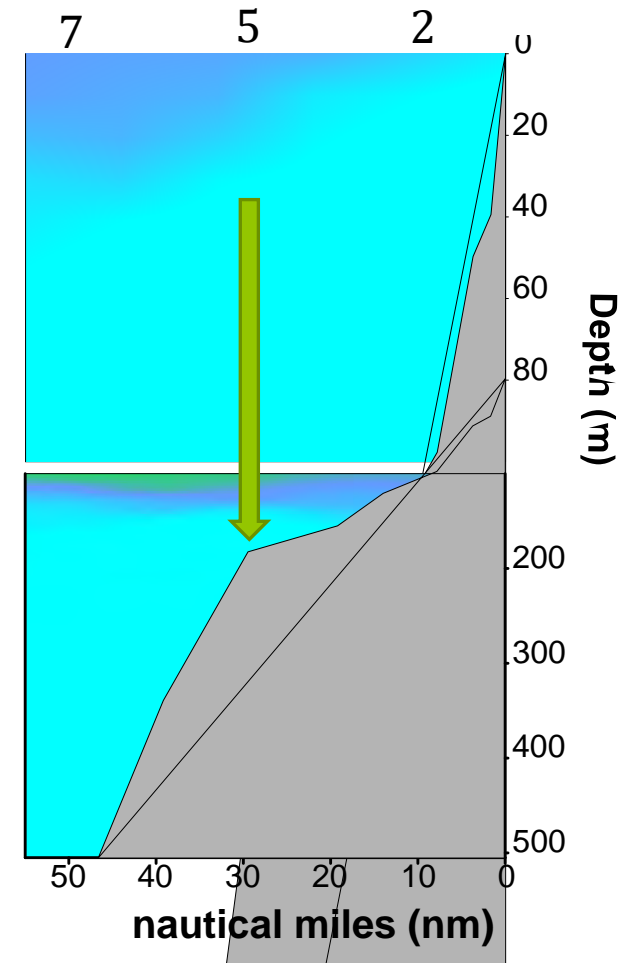© 2014 Encyclopædia Britannica, Inc.

SST ANOMALIES (°C)

**Trade winds weaken, supressing the upwelling**

## STUDY AREA



Crucero CRIO/Línea Callao
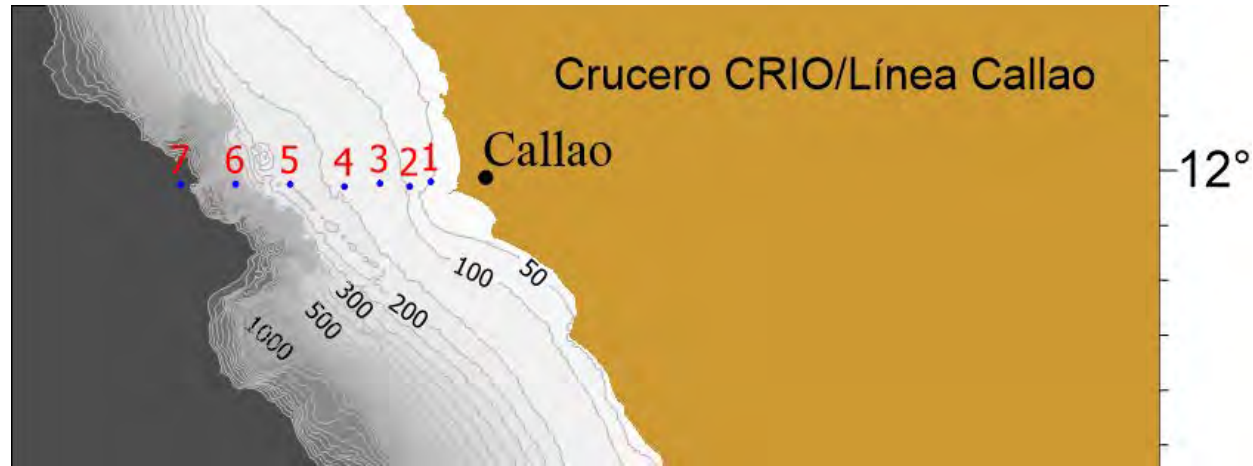
### Sampling stations



- ✓ **Sampling period:** 2013-2017
- ✓ **Sampling frequency:** bimonthly
- ✓ **Coverage:** Up to 50 nm from the coast

➤ Characterize the nano and microphytoplankton community structure in a gradient in shore – off shore in front of Callao (12° S) in space and time.

➤ Evaluate the influence of environmental parameters in the composition and distribution of phytoplankton, identifying posible habitat preferences by key species.

➤ Identify possible phytoplankton assemblages or key species of a transition zone.

✓ **Sampling with oceanographic rosette at 10 m depth and/or in water column up to 75 m.**

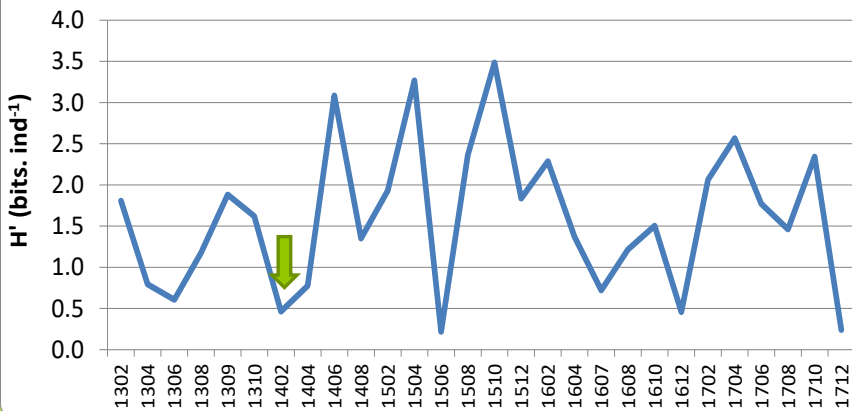✓ **Quantitative analysis (Utermöhl)**
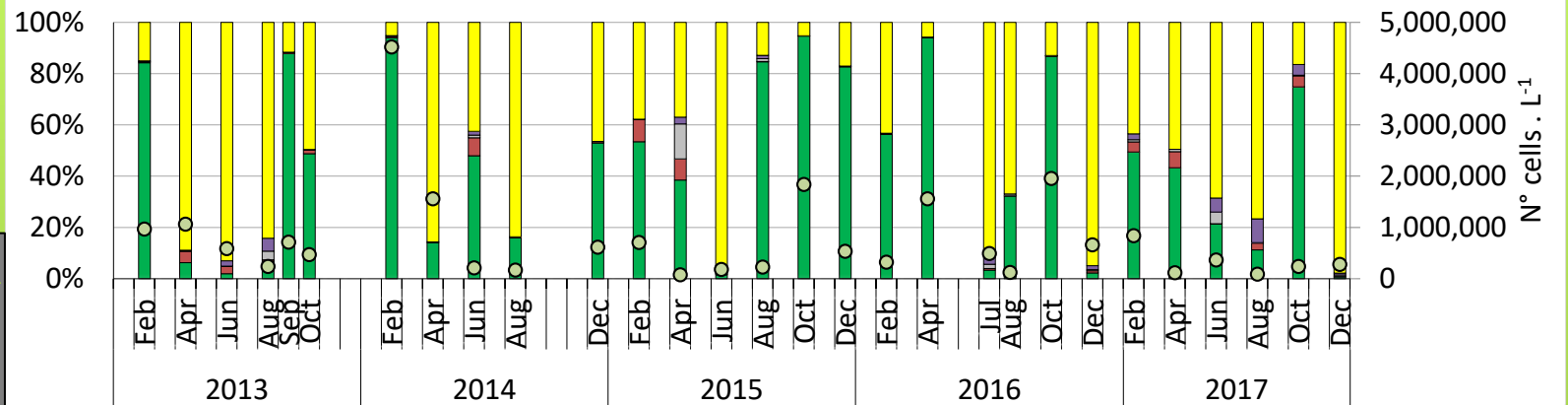✓ **Shannon index diversity**

✓ **Statistical analysis** -Olmstead and Tukey diagram

- Spatial and temporal classification and ordination

**(PRIMER 6 and R)**
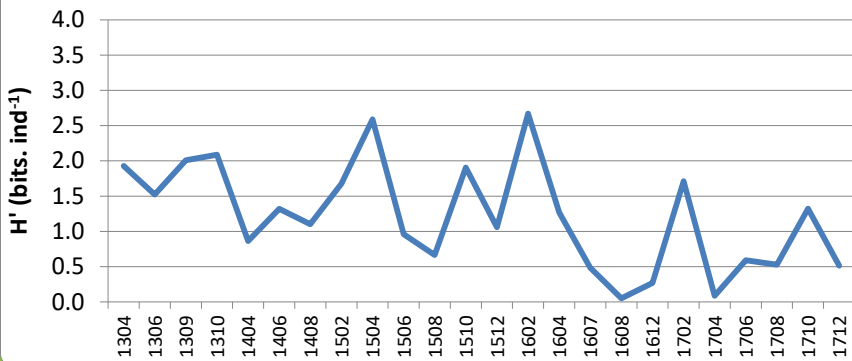
**Station 2 (8 nm)** — H' (bits . ind⁻¹) diversity index over sampling periods 1302–1712

**Station 5 (30 nm)** — H' (bits . ind⁻¹) diversity index over sampling periods 1304–1712

**Station 7 (50 nm)** — H' (bits . ind⁻¹) diversity index over sampling periods 1302–1712

RESULTS

**Station 2 ( 8 nm)** — N° cells . L⁻¹ by group (2013–2017)

**Station 5 (30 nm)** — N° cells. L⁻¹ by group (2013–2017)

**Station 7 (50 nm)** — N° cells. L⁻¹ by group (2013–2017)
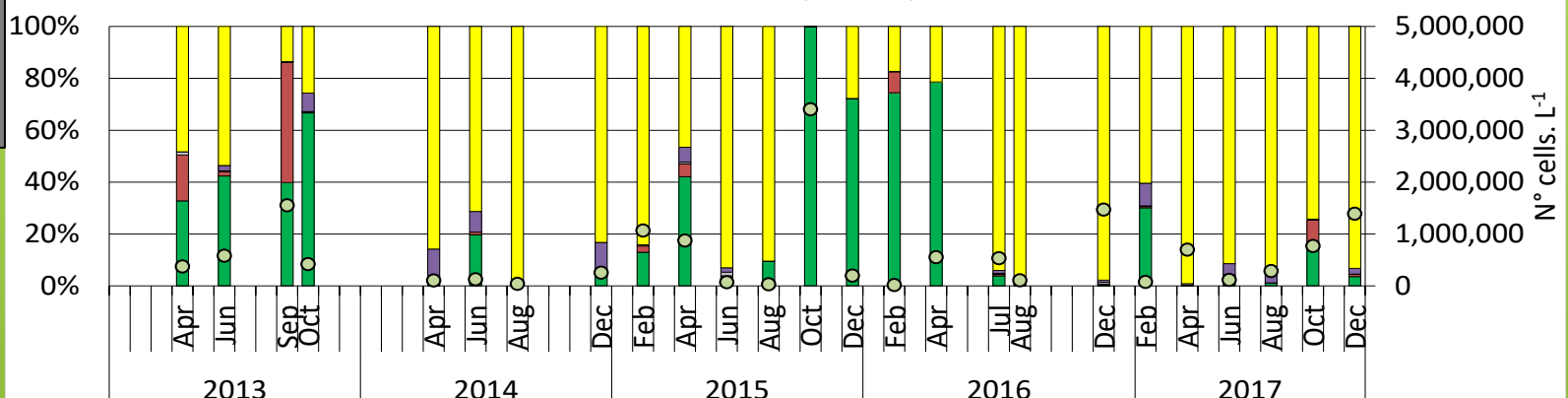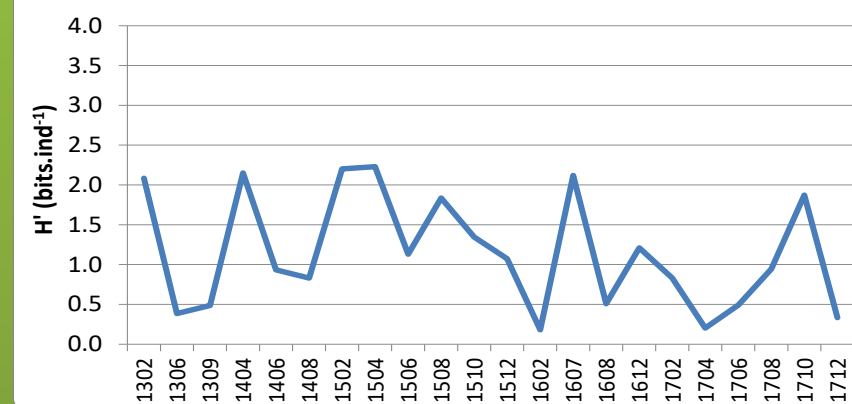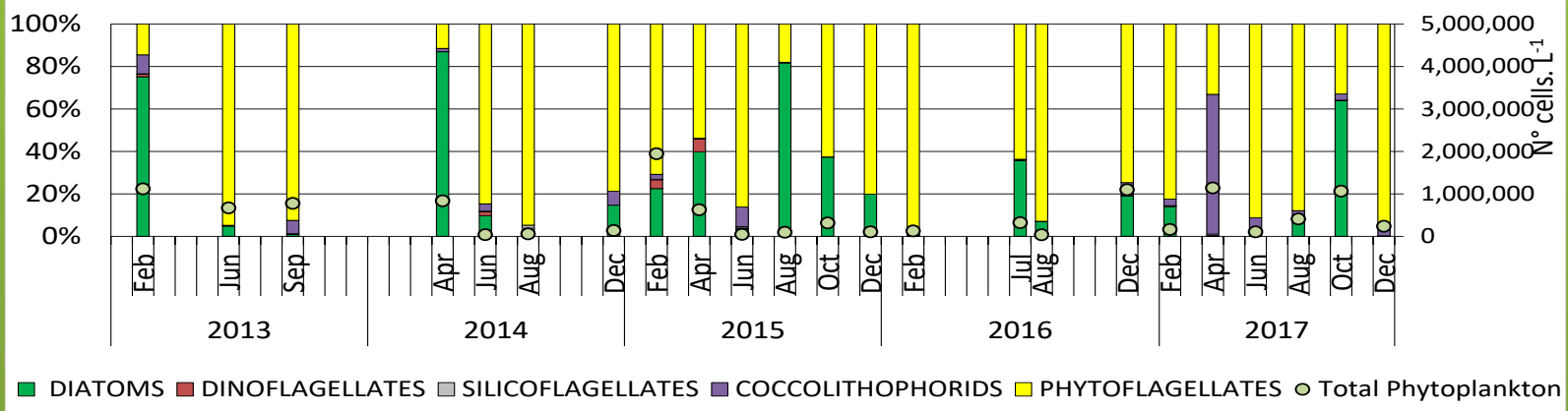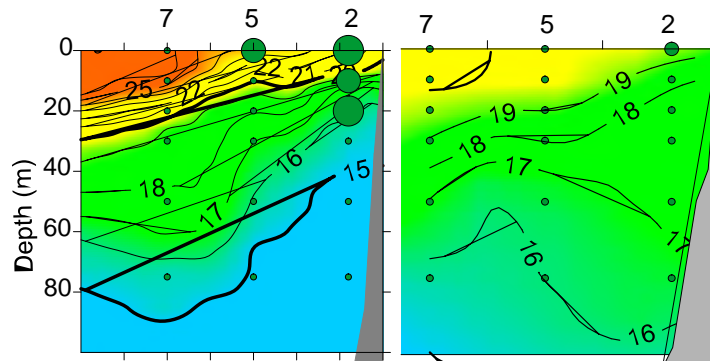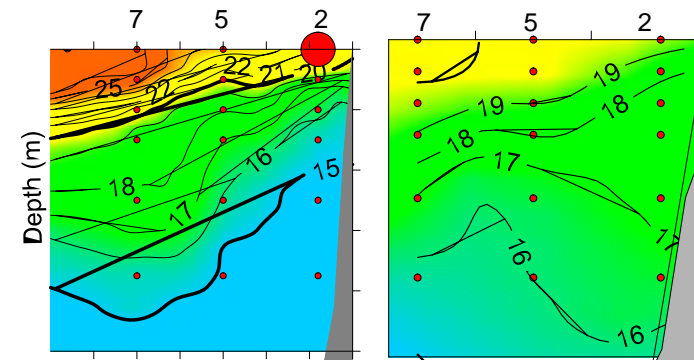
■ DIATOMS  ■ DINOFLAGELLATES  ▨ SILICOFLAGELLATES  ■ COCCOLITHOPHORIDS  ■ PHYTOFLAGELLATES  ◯ Total Phytoplankton
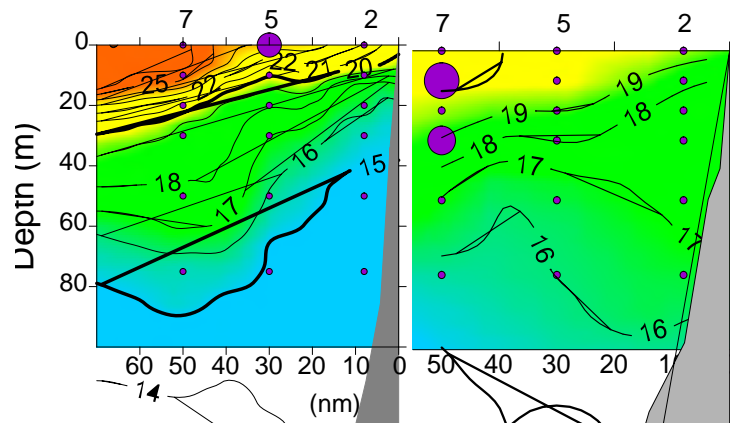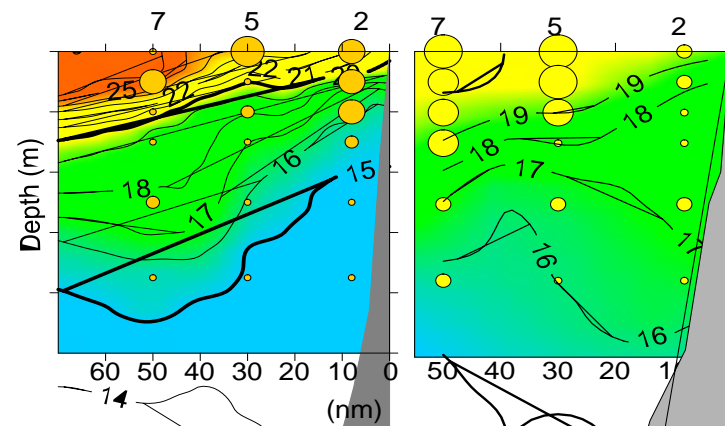
Vertical distribution

# Obtaining phytoplankton species hierarchy

Olmstead y Tukey diagram of micro and nanophytoplankton species off Callao (2013-2017)

- 189 species were obtained by **Utermöhl method.**

- They were classified in diagram to perform multivariate analysis then.

- 61 dominant species were determined

C: Coastal (8 nm)
I: Intermediate (30 nm)
O: Oceanic (50 nm)

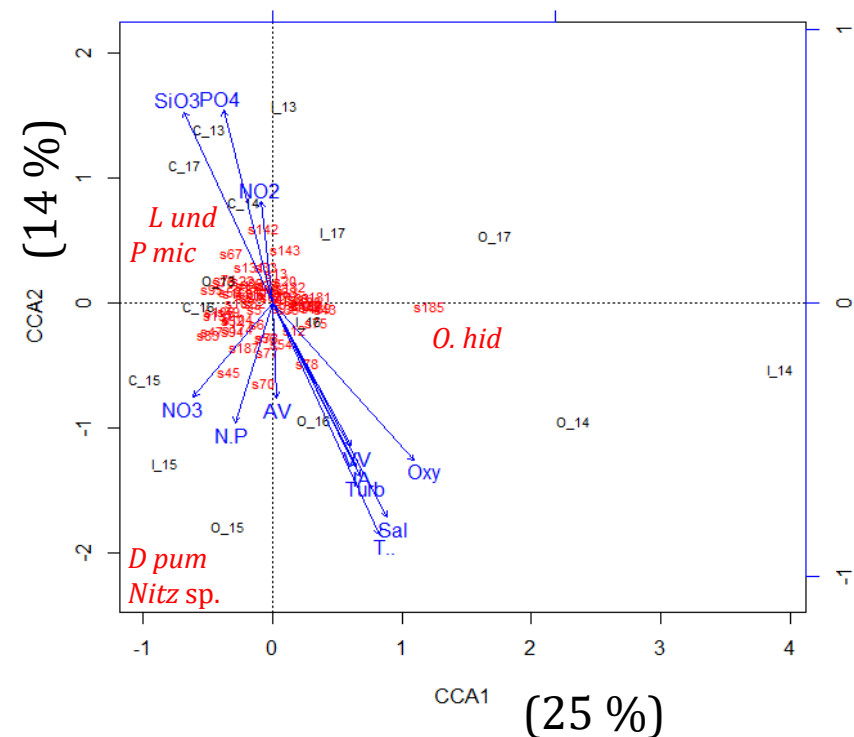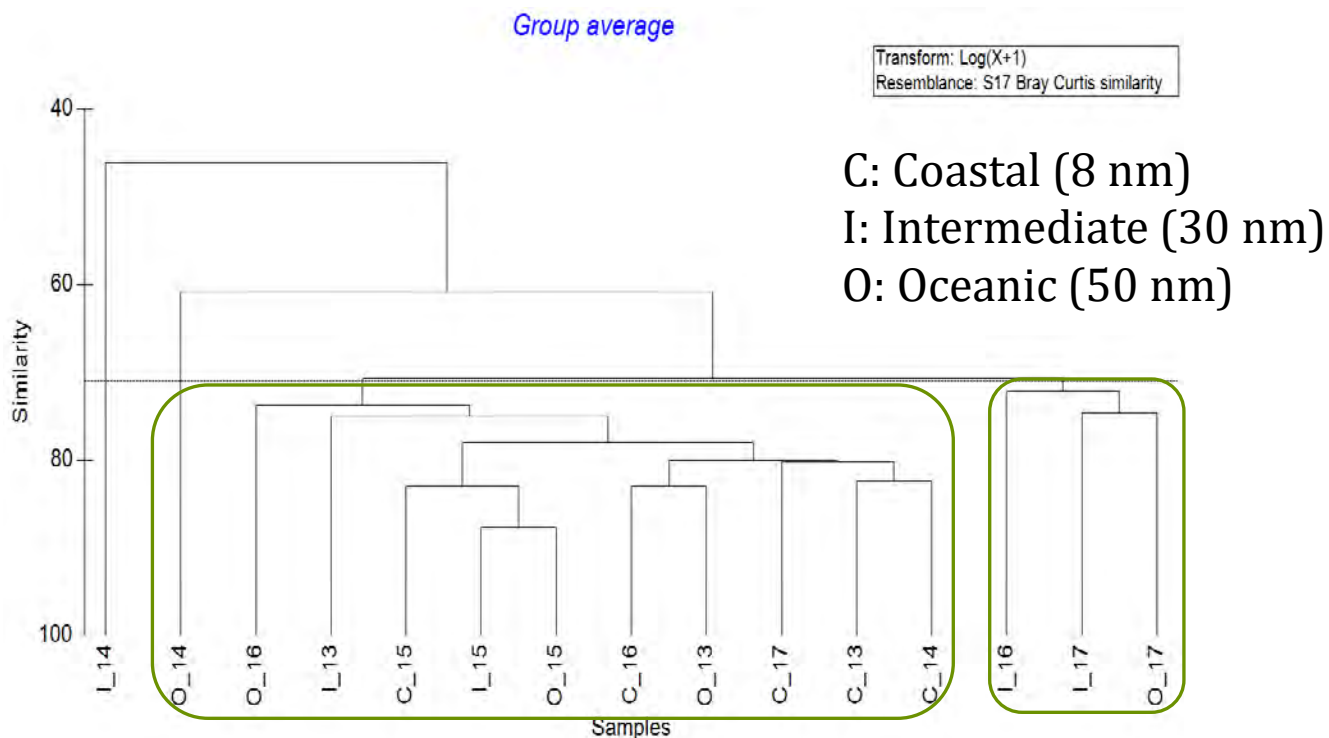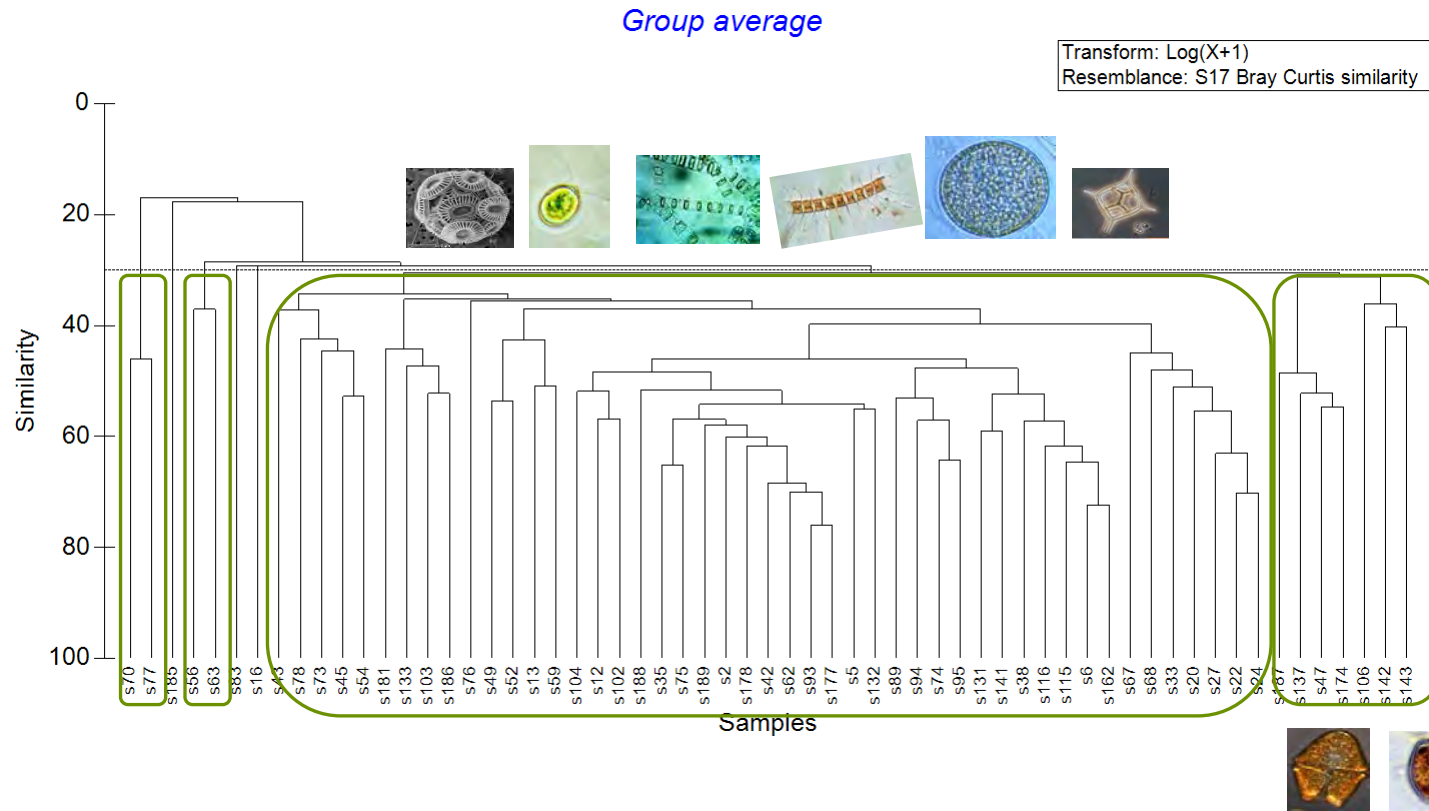**Spatial Clustering and Canonical correspondence analysis (CCA) showing the distribution of dominant phytoplankton species in relation to environmental variables**

**Temporal Clustering and Canonical correspondence analysis (CCA) showing the ocurrence of dominant phytoplankton species in relation to environmental variables**

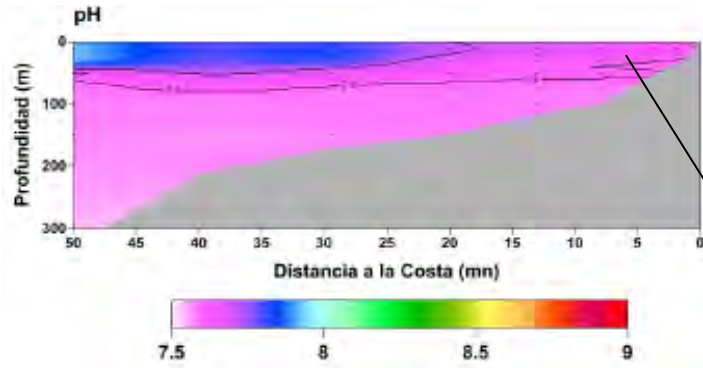➤ 4 main phytoplankton assemblages were obtained

filtration on board

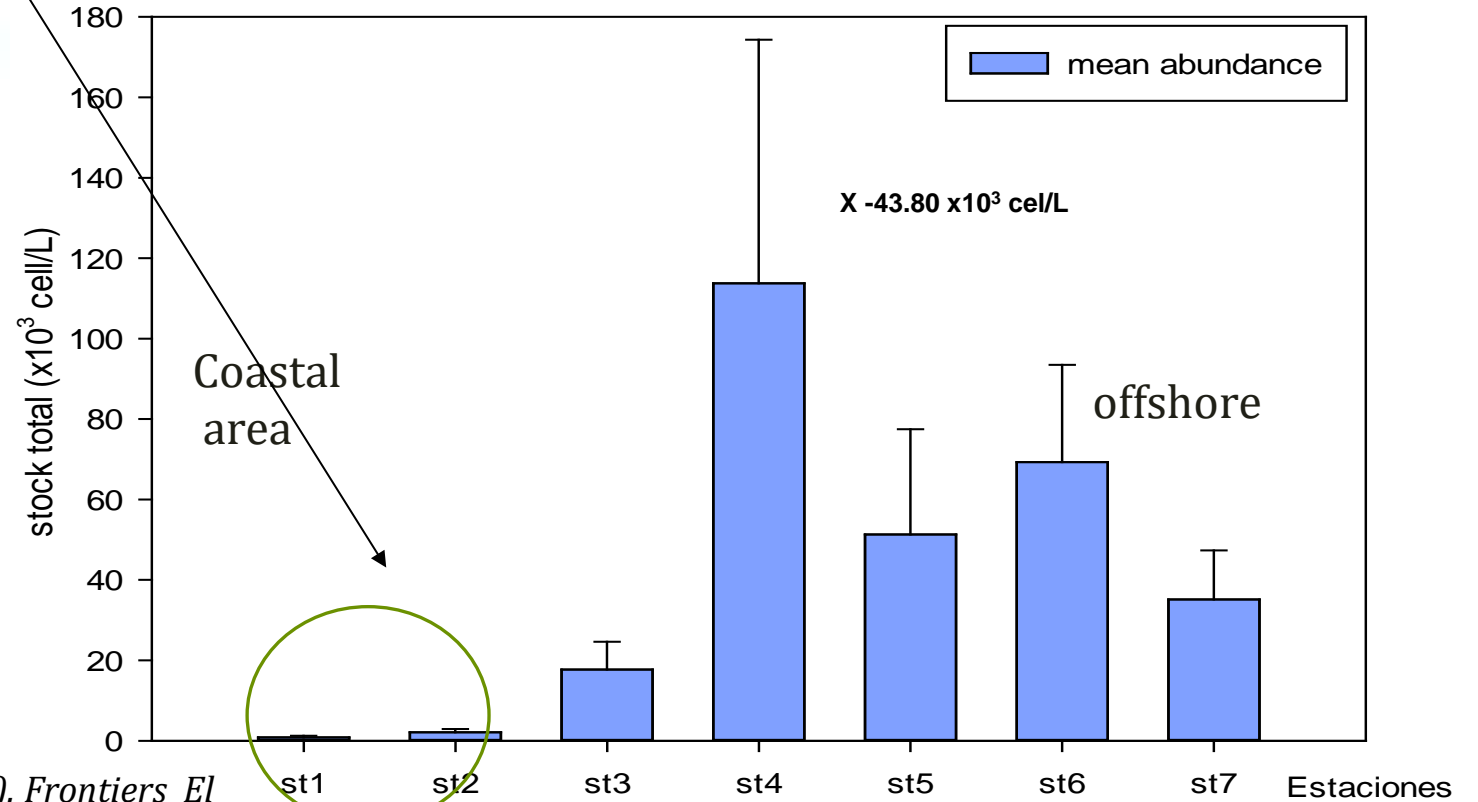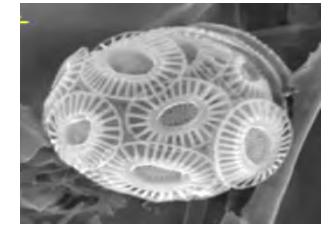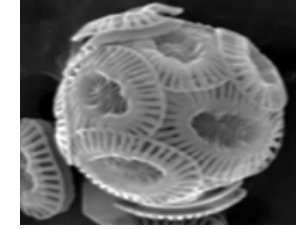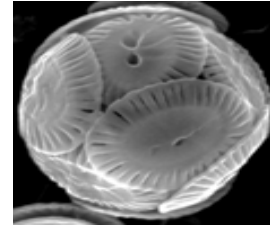stove for filter drying

polarized light set for compound microscope

## Upwelling

### Low pH/high CO2

pH



## Coccolithophorids



Coastal area

offshore

X -43.80 x$10^3$ cel/L

mean abundance

stock total (x$10^3$ cell/L)

st1  st2  st3  st4  st5  st6  st7  Estaciones

*Alvites D. 2016. MsC Thesis (Graco M. L. Beaufort). Frontiers El Niño 2018*
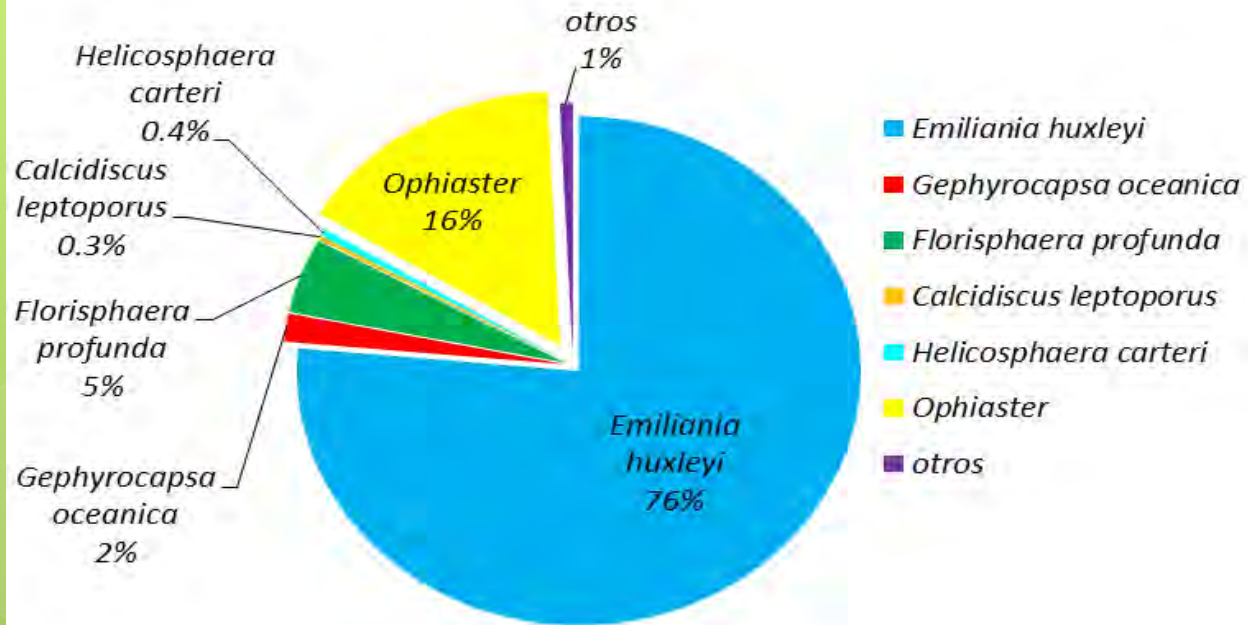
Otros:
- ✓ Acanthoica quatrospina
- ✓ Anoplosolenia brasiliensis
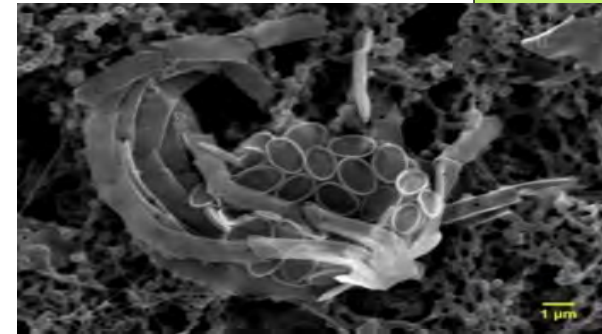- ✓ Calciosolenia sp.
- ✓ Calciopappus rigidus
- ✓ Gaardelia corolla
- ✓ Michaelsarsia adriaticus
- ✓ Pappomonas sp. Type 3
- ✓ Polycrater sp.
- ✓ Reticulofenestra parvula
- ✓ Syracosphaera anthos
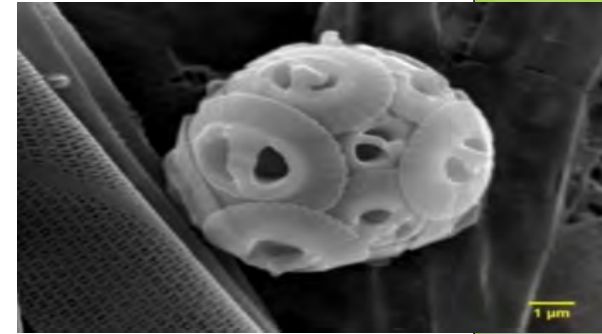- ✓ Syracosphaera prolongata
- ✓ Syracosphaera molischii
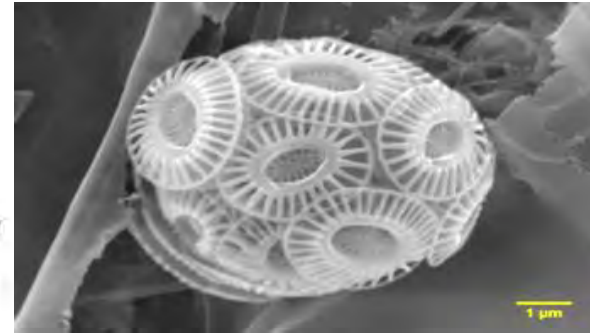
Emiliania huxleyi

Ophiaster spp.

Florisphaera profunda

Gephyrocapsa oceanica

Helicosphaera carteri

Calcidiscus leptoporus

- There was a gradient in shore- off shore in all years, except in 2015 due warmer EN event conditions.

- There is a variable transition zone at 30 nm that is favourable for dinoflagellates and coccolithophorids development.

- Seasonal and interannual oceanographic influence (annual cycle of phytoplankton and ENSO signal) is reflected in the high variability of abundances and contributions of nano and microphytoplankton.

- Ecological preferences were determined for *D. pumila, Nitzschia sp, O. hidroideus, L. undulatum* and *P.micans*.

# Thank you for the financial support to :