Dirección de Investigaciones en Oceanografía y Cambio Climático

Laboratorio de Zooplancton y Producción Secundaria

Answer of zooplankton indicator species to oceanographic variability in the transition zone off the central coast of Peru (2013-2017)

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INTRODUCTION

The so-called sea butterflies (pteropods) of calcareous origin are widely distributed, in tropical and subtropical latitudes; another at high latitudes, temperate and cold zones. (Boltovskoy, 1999; Orr *et al.*, 2005).

Of the 70000 existing species of molluscs, only 160 species are pteropods of which 86 species inhabit warm waters of the tropical and subtropical regions of the world (Boltovskoy *et al.*; 1999).

In front of the peruvian sea it has been reported 41 species: 17 order Heteropoda, 21 order Pteropoda and 3 order Nudibranchia (Quesquén, 2017)
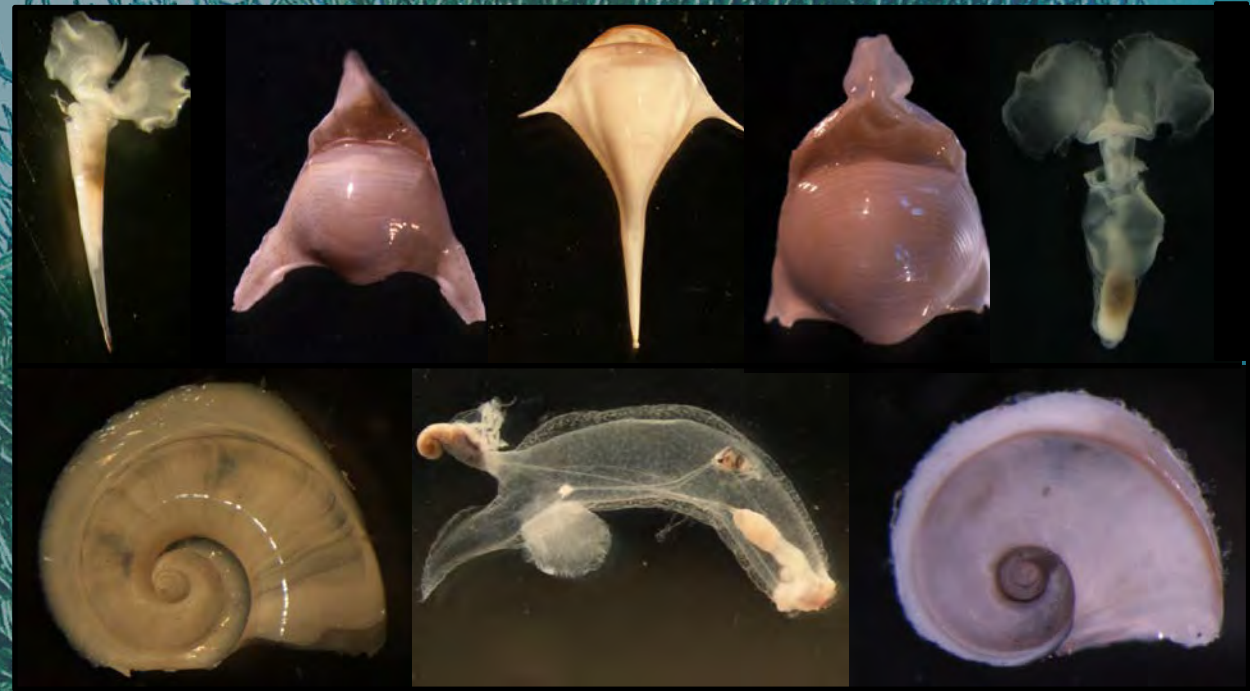
Quesquén, 2017

OBJECTIVE

The general objective of the project is to investigate the physical-chemical processes and the planktonic communities associated with the coastal upwelling compared to Peru, with emphasis at in shore- off shore gradient and its variability at different time scales.

MATERIAL AND METHODS

We analyzed 200 samples of zooplankton from the programs implemented by the IMARPE.

The Oceanographic Callao and Intensive Oceanographic Cruise (CRIO)

The sampling stations were located along a transect perpendicular to the coast for a distance of 50 nautical miles from the coast.
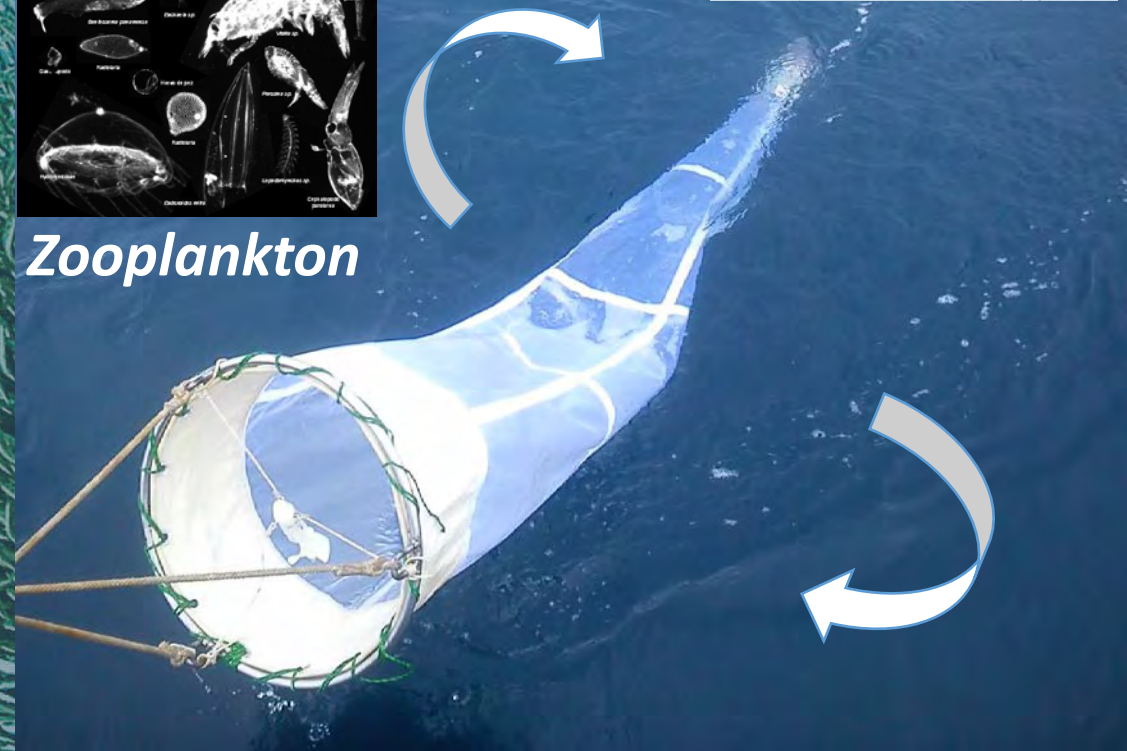

-12 °S

MATERIAL AND METHODS

The samples were collected with a standard net of 300 micron in horizontal tows at a speed of 3 knots for 5 minutes, fixed in 2% formaldehyde, to record the volume of filtered wáter, a flowmeter Hydro Bios was used with a run stop system.
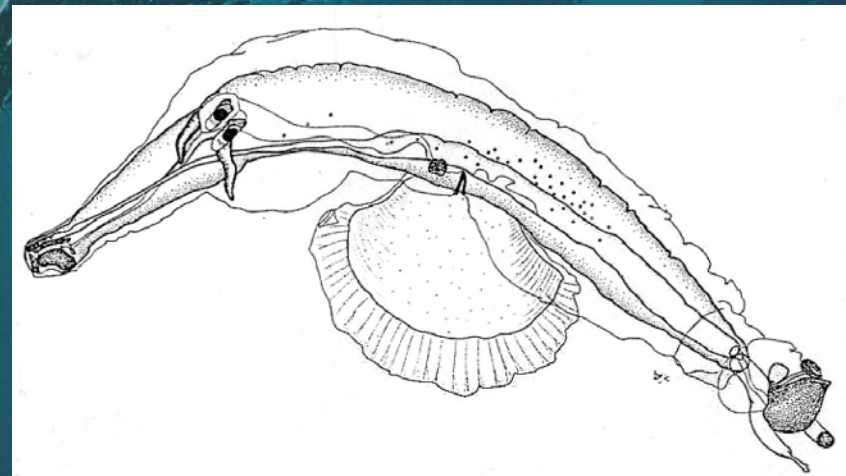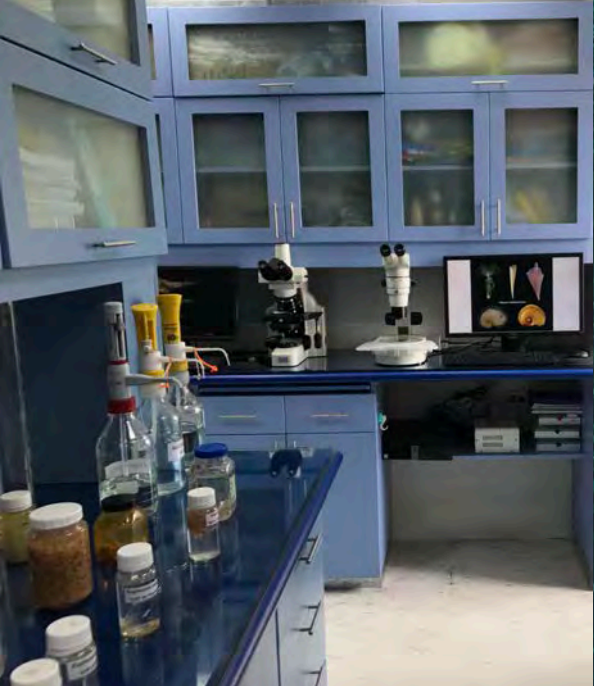

Zooplankton
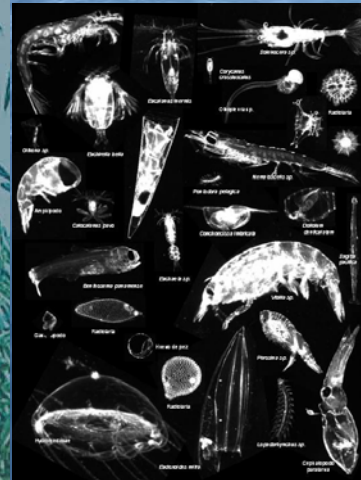
LABORATORIO DE ZOOPLANCTON E ICTIOPLANCTON

IMARPE
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The analyses were performed in the

RESULTS

According to T/S diagram and distribution of water masses, it was observed the formation of three groups:

The first group consists of the species *A. leuseuri, A. helicinoides, A. peroni, A. turricuilata, F. desmaresti, C. inflexa, C. sibogae L. inflata, P. bucephala* and *Glaucus sp.*, which are Subtropical Surface Water (SSW) species

The second group consists of *C. virgula* and *C. placenta*, species associated with Subtropical Surface Water (SSW) and mixing water (MW)

The third group consists of species *A. gaudichaudi, C. pyramidata, D. papilio, D. quadridentata, H. striata* and *L. trochiformis*, which were associated with Subtropical Surface Water (SSW), cold coastal waters (CCW) and mixing water (SSW and CCW)

Diagram T / S. Mollusks holoplanktonic off Callao during 2013 to 2017, groups according to the distribution of water masses.
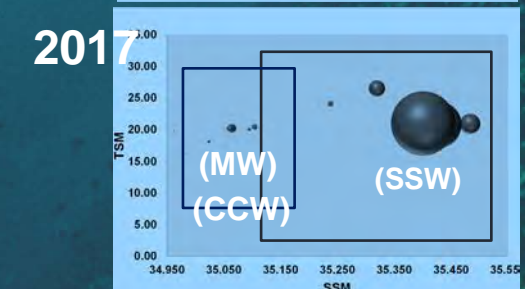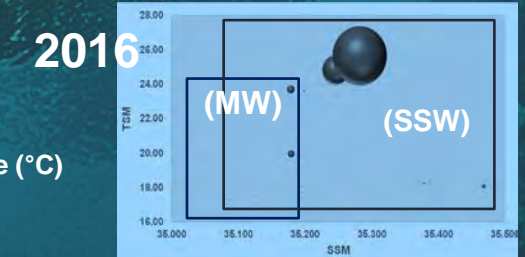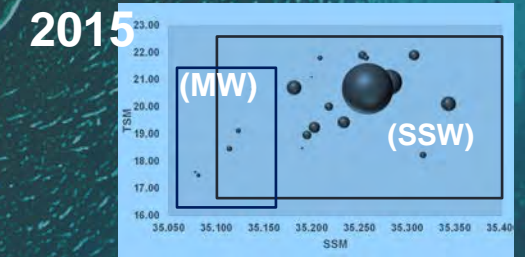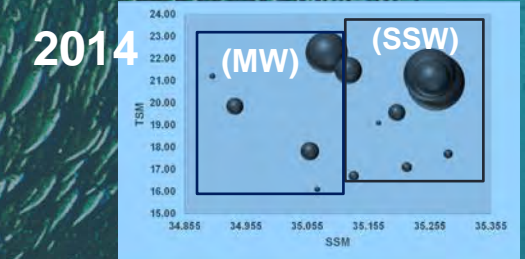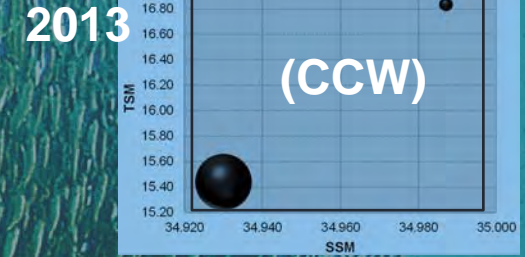
Water masses found in surface waters off Peru.

Water masses	Salinity	Temperature (°C)
Tropical Surface Water (TSW)	<33.8 a	>25 b
Equatorial Surface Water (ESW)	33.8–34.8 b	>20 b
Subtropical Surface Water (SSW)	35.1–35.7 a	18–27 b
Cold Coastal Water (CCW)	34.8–35.1 a	14–18 c

a Zuta and Guillén (1970)
b Gutiérrez et al. (2005).
c Morón (2000).

2013
(CCW)

2014
(MW) (SSW)

2015
(MW) (SSW)

2016
(MW) (SSW)

2017
(MW) (CCW) (SSW)

The máximum values located in the oceanic zone

Transition zone off the central coast of Peru (2013-2018)

a) Temperatura (°C)
b) Salinidad (ups)
c) Oxígeno (mL/L)
d) Potencial de Hidronio (pH)

Ind./100m³
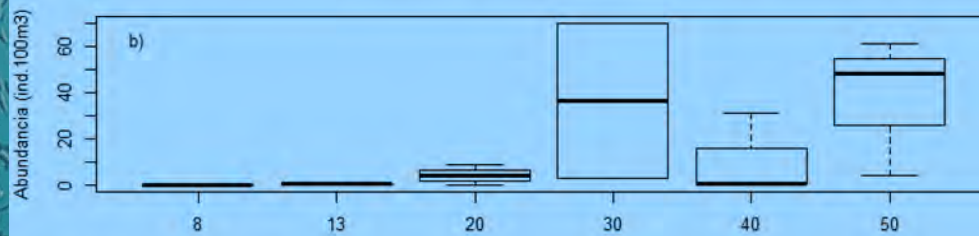○ 1 - 50   ● 51 - 500   ● 501 - 1000   ● > 1000
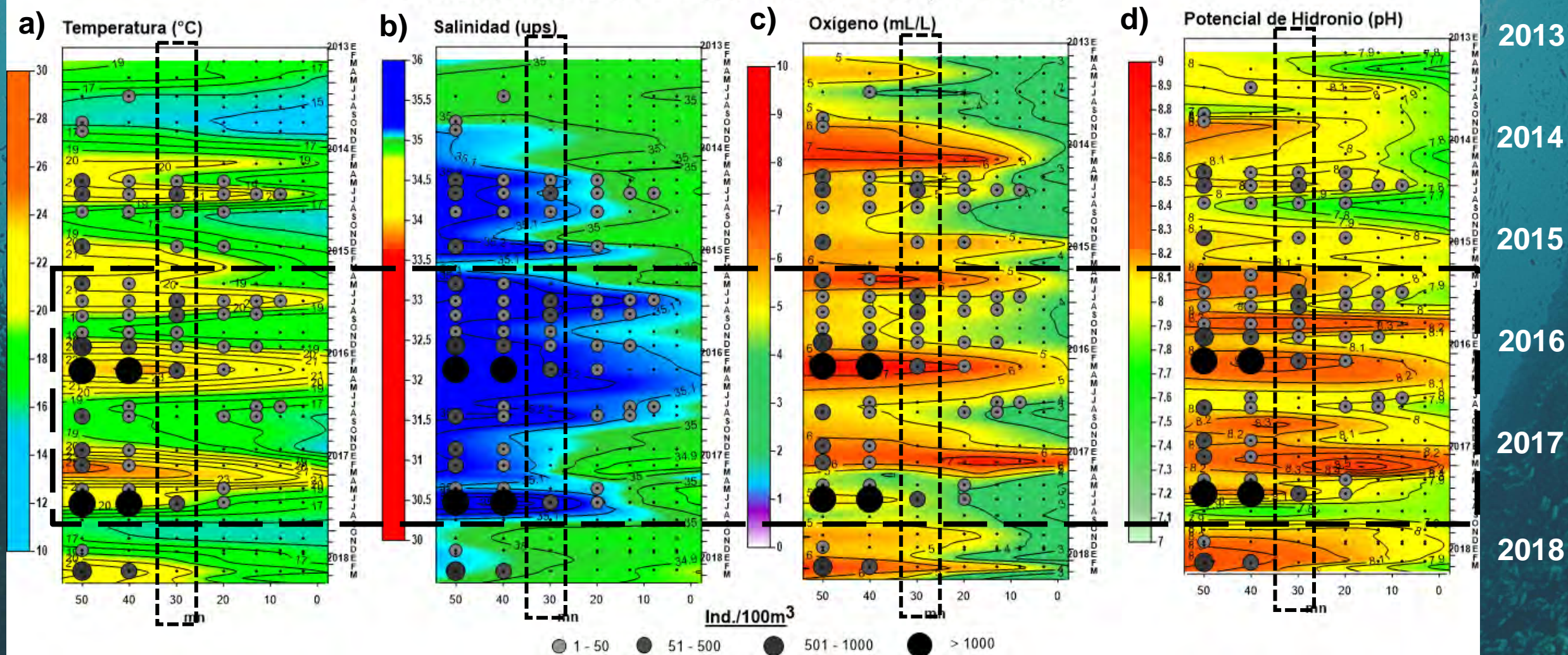
Temporal series of environmental parameters, a) Sea Surface Temperature, b) Sea Surface Salinity
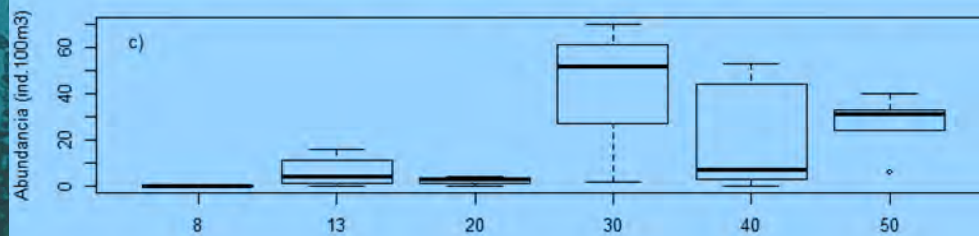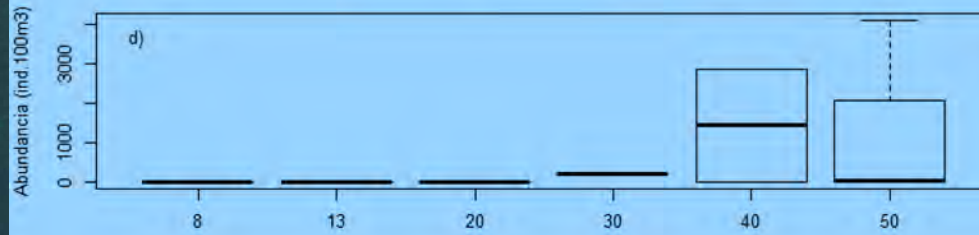c) Sea Superface Oxigeno and d) Sea Supeface pH off Callao (2013 - 2018)
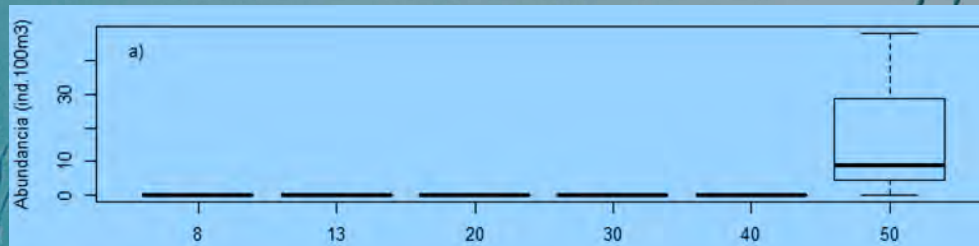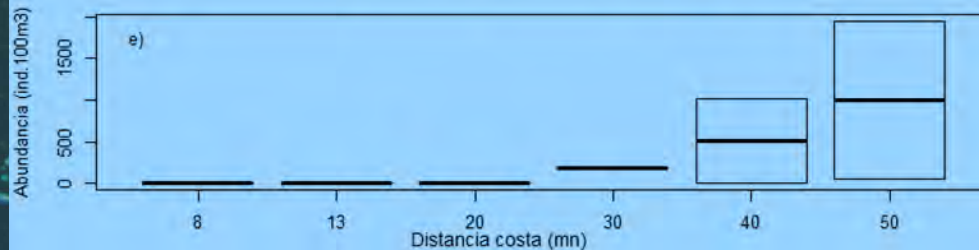
The attached figure shows a clear example that compared to Callao, the distribution of the main holoplankton mollusk species was outside the 40 mn of the coast in 2013, considered a cold year with a predominant presence of cold coastal waters (CCW).

From during 2014 to 2017 these organisms registered an increase in their frequencies and abundances towards the oceanic area outside the 13 and 8 mn of the coast, respectively, associated with the increase on sea surface temperature and salinity, related to El Niño event, El Niño costero and presence of Subtropical Surface Water (SSW) and mixing waters

VV - Callao — Distancia de la Costa [mn]
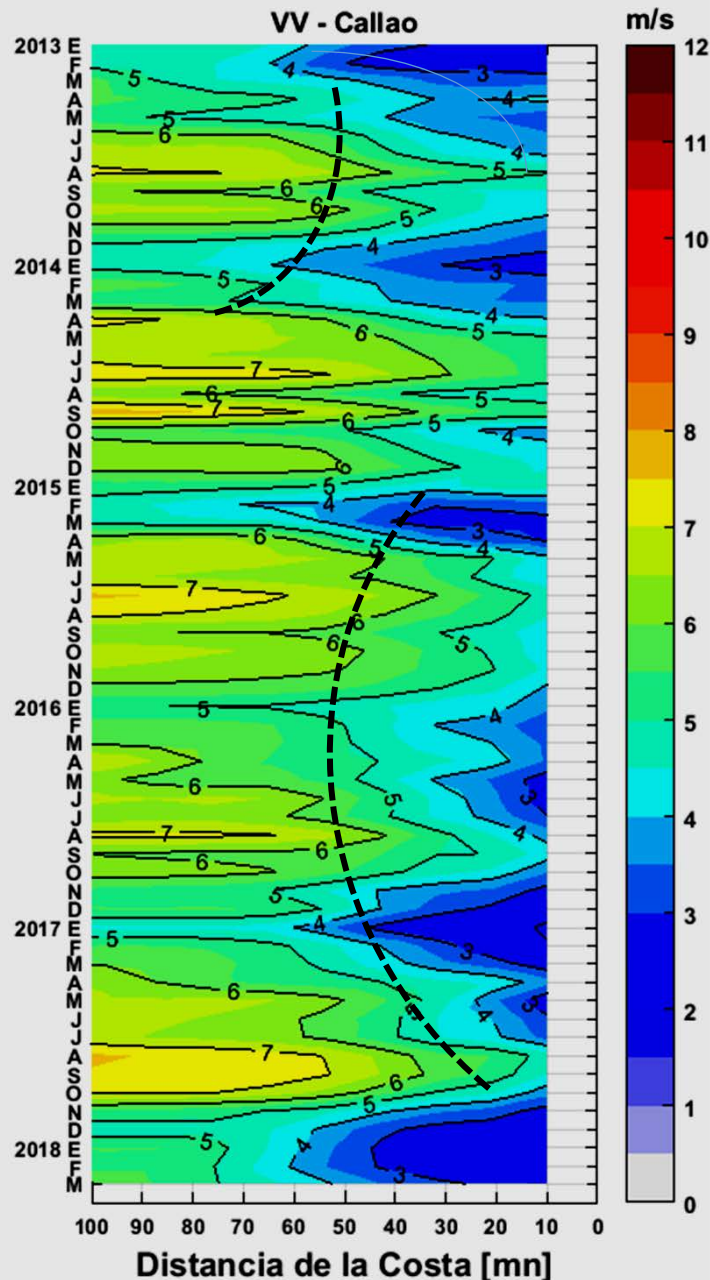
Year	Month	Month	Num. Month	Durac.
2013	Abr.	Oct.	8	La Niña Fuerte
2014	May.	Oct.	6	El Niño Moderado
2015	Abr.	Jun. 2016	14	El Niño Fuerte
2016	Dic.	May. 2017	6	El Niño Moderado
2017	Jun.	Dic.	6	Neutro

The most important factors that controlled the interannual dynamics of the marine butterflies would be the temperature, salinity and pH, and these in turn would be related to the coastal wind and the water masses.

Moderate to strong winds greater 5,0 m/s would favor the coastal upwelling and a greater presence of waters of low salinity and temperature and low pH.

While that, weak winds minors 5,0 m/s, would be associate with the approach of Subtropical Surface Water (SSW) to the coast and with it the increase of pH.

CONCLUSION

The main indicator to determinate species of certain oceanographic conditions such as "El Niño" event and El Niño Costero were: *A. gaudichaudi, A. leuseuri, A. helicinoides, A. peroni, A. turricuilata, F. desmaresti, C. virgula, C. inflexa, C. sibogae, L. trochiformis, L. inflata, P. bucephala y Glaucus sp.,* all associated with Subtropical Surface Water (SSW).

During the study period, the greatest diversity of holoplanktonic shellfish was associated with the Subtropical Surface Water (SSW) and the lowest values were found in mixed water or coastal waters, indicating that variability in these species resubject to changes of water masses.

Acknowledgements

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PICES

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