



# Spatio-temporal variability of the early life stages of anchovy (*Engraulis ringens*) and Lightfish (*Vinciguerria lucetia*) in the Northern Humboldt Current System

Patricia Ayón

Katia Aronés



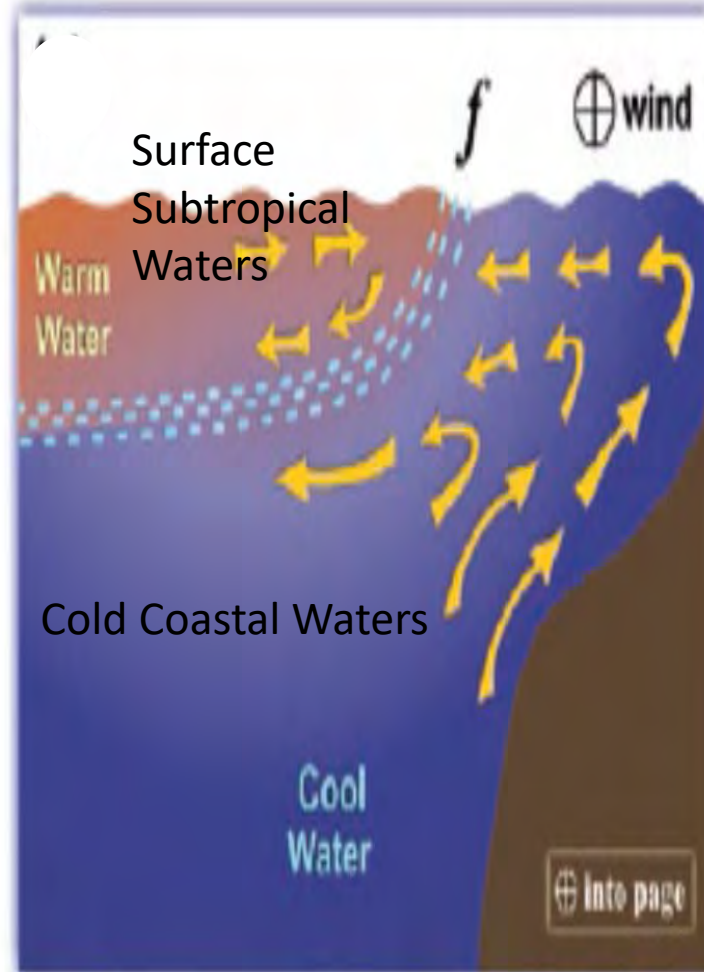
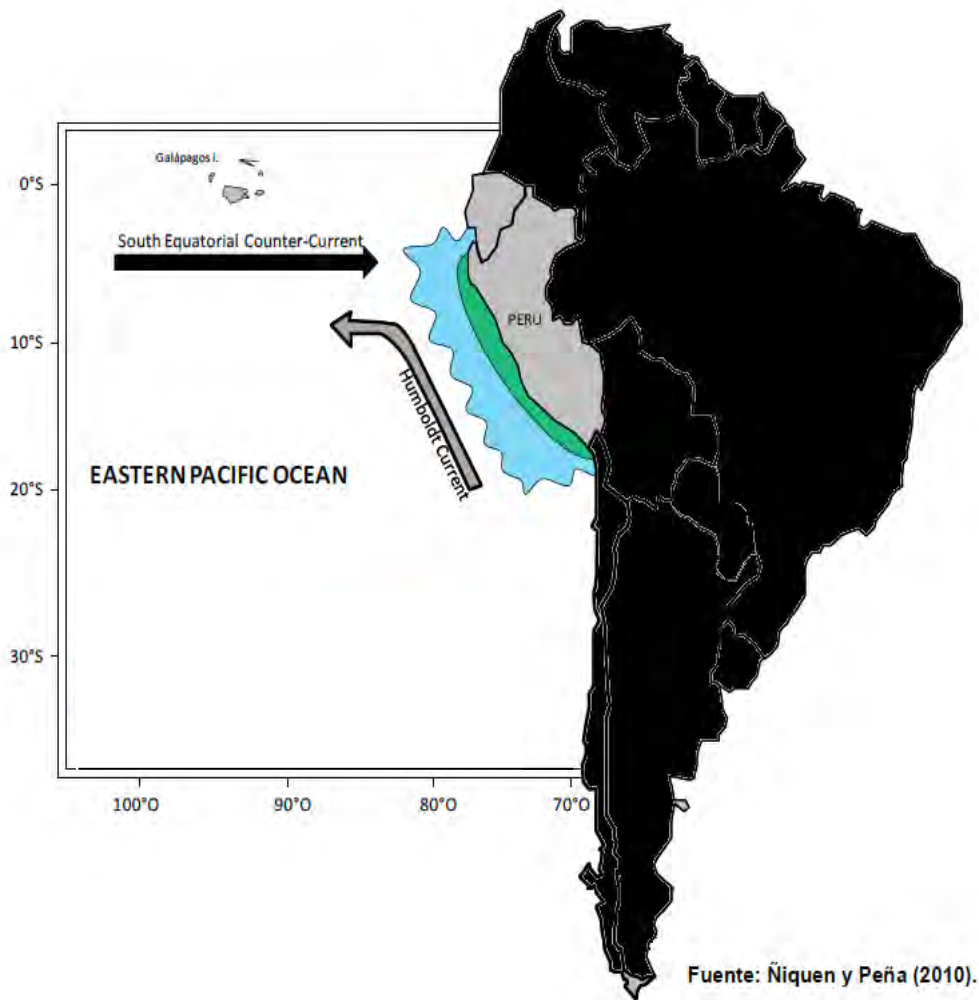
Symposium on  
"International Changes in Transitional Areas of the Pacific"  
(24-26 April 2018)



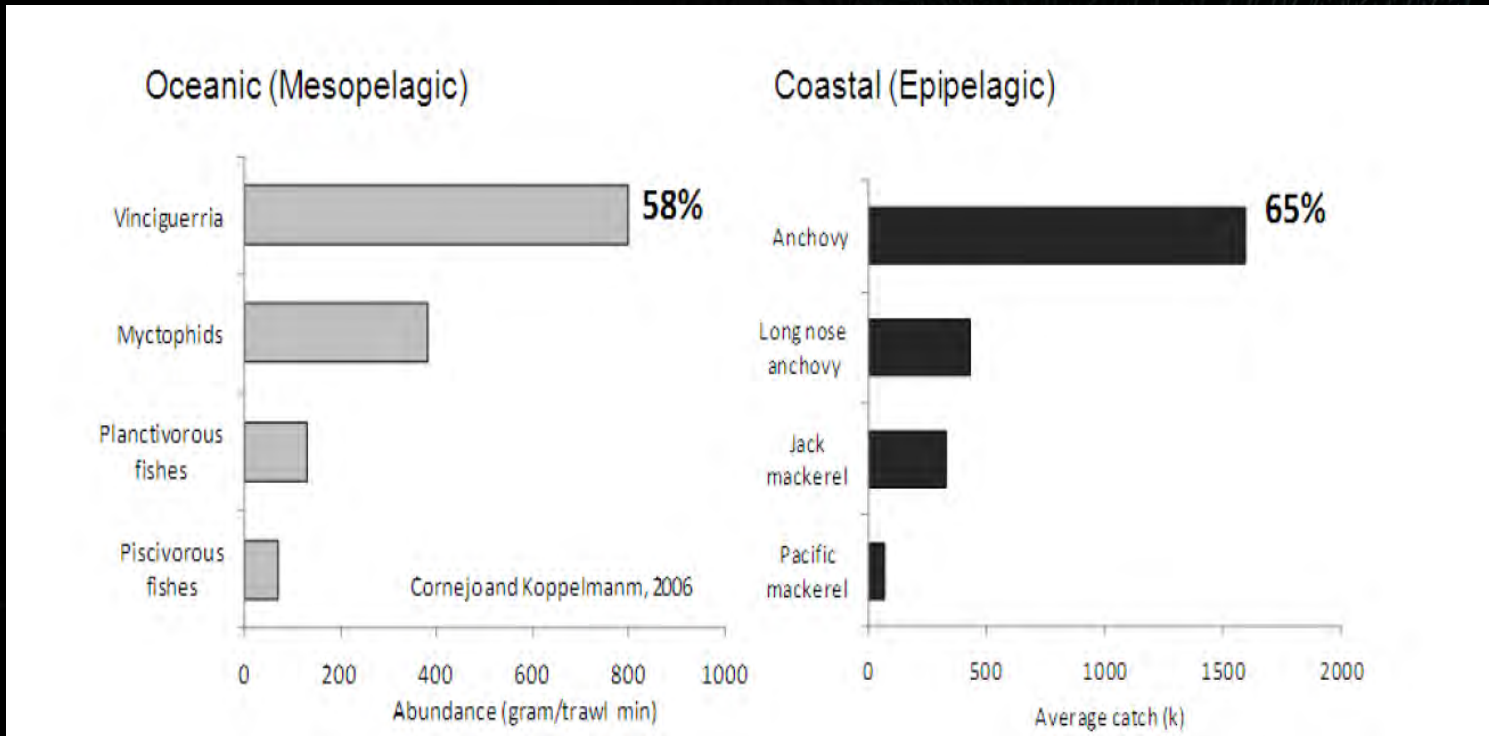
# OUTLINE

1. Introduction
2. Objectives
3. Methodology
4. Results and discussion
5. Conclusions
6. Acknowledgment

# INTRODUCTION



# INTRODUCTION



**Mesopelagic, diel migrations**



Size: 2,7 – 8,0 cm

**Neritic (20-65m)**



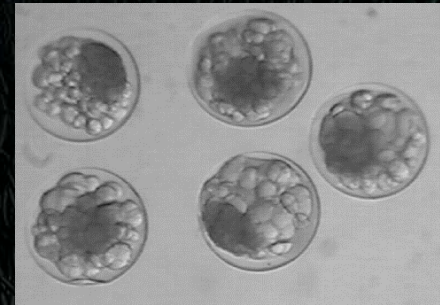
Size: 11,0 – 17,0 cm

# MAIN CHARACTERISTICS

Planktonic



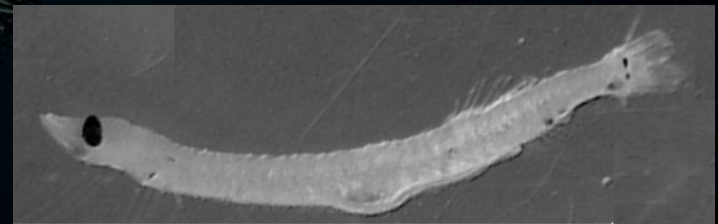
Anchovy egg: Major axis- 1.2 -1.5mm  
Minor axis 0.55-0.8mm



Lightfish egg: 0.6- 0.7 mm



Anchovy larvae: from 1.5- 30 mm



Lightfish larvae: from 2.0 - 30 mm

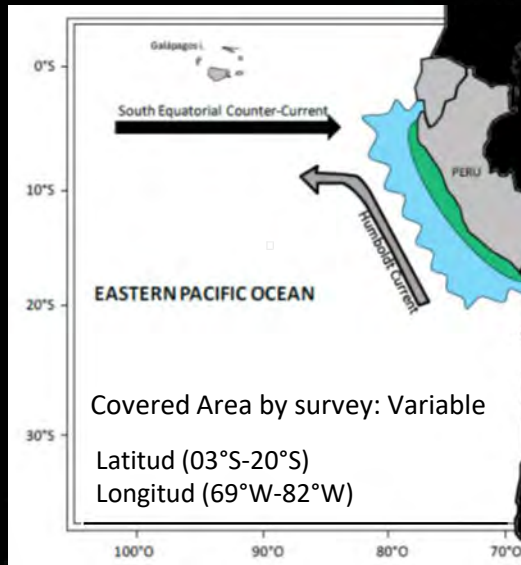


# OBJECTIVES

Compare the time series of spatio-temporal changes of early life stages of two species from NHCS: *Anchoveta* and *Lightfish*.

# METHODOLOGY

## Study Area



## Period

1964 – 2016

## Variables

Transition Areas  
SST (Satelite)

\*1981-2011  
(Pathfinder)

2012-2016  
(Aqua Modis)

## Data Analysis

Correlation – Abundance SST  
SSM  
Abundance (number/m<sup>2</sup>)

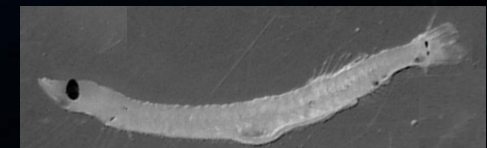
## Maps

R Program

## Sampling

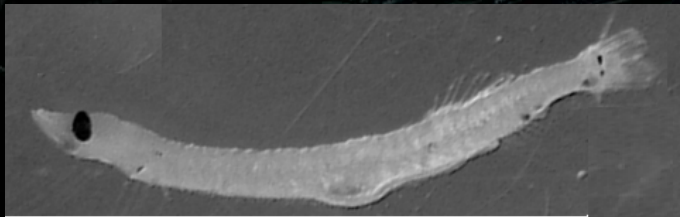


Hensen net  
Vertical  
50 meters



# ABUNDANCE

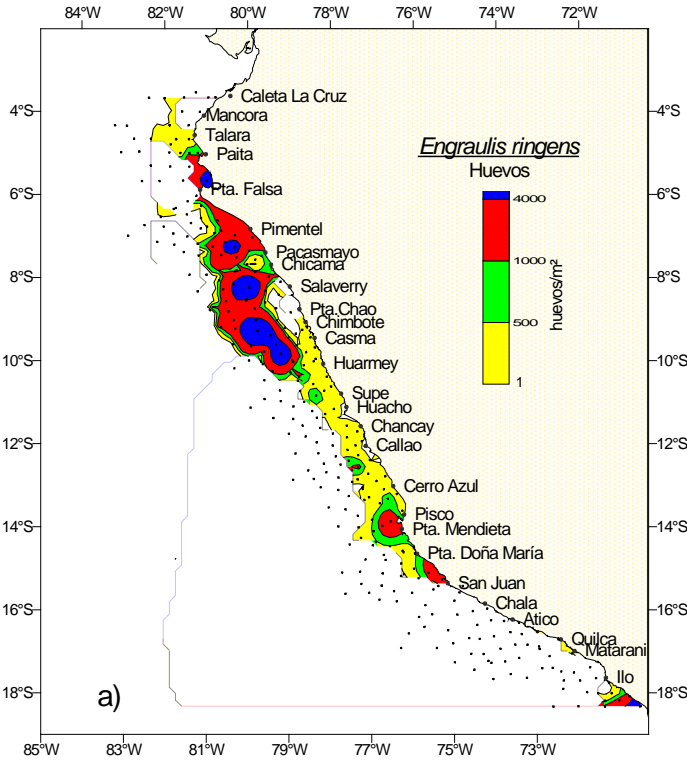
(Abundance.m <sup>2</sup> )	Anchovy		Lightfish	
	Egg	Larvae	Egg	Larvae
Min abundance	1	1	1	1
Max abundance	47552	28313	15813	3632
Mean	515	115	32	10



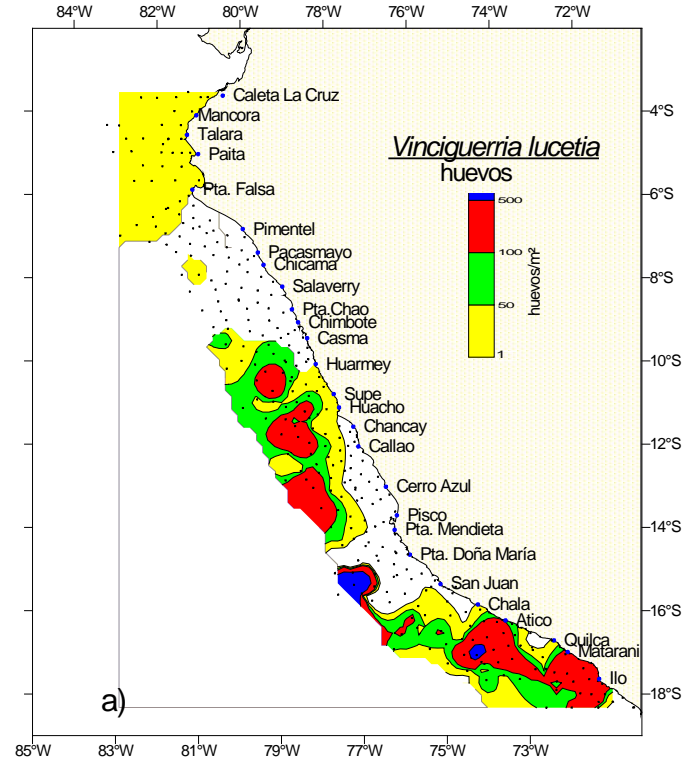


# RESULTS & DISCUSSION

## Anchovy eggs

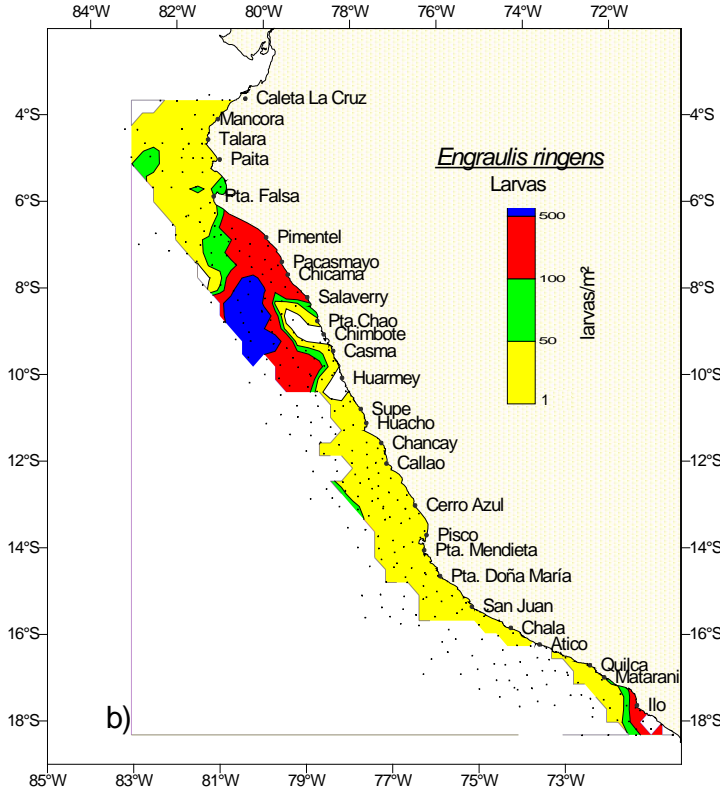


## Lightfish eggs

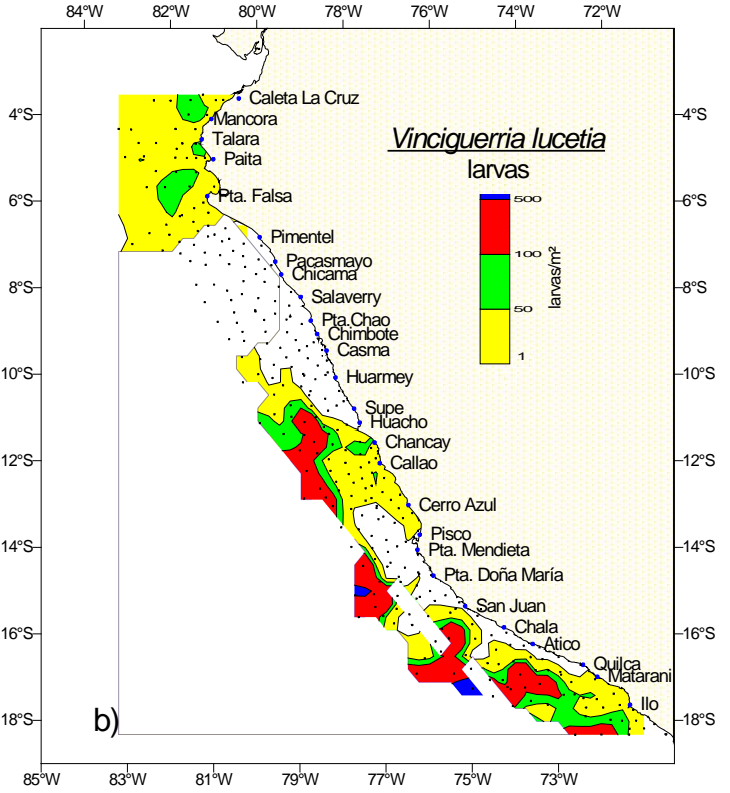


# RESULTS & DISCUSSION

## Anchovy larvae

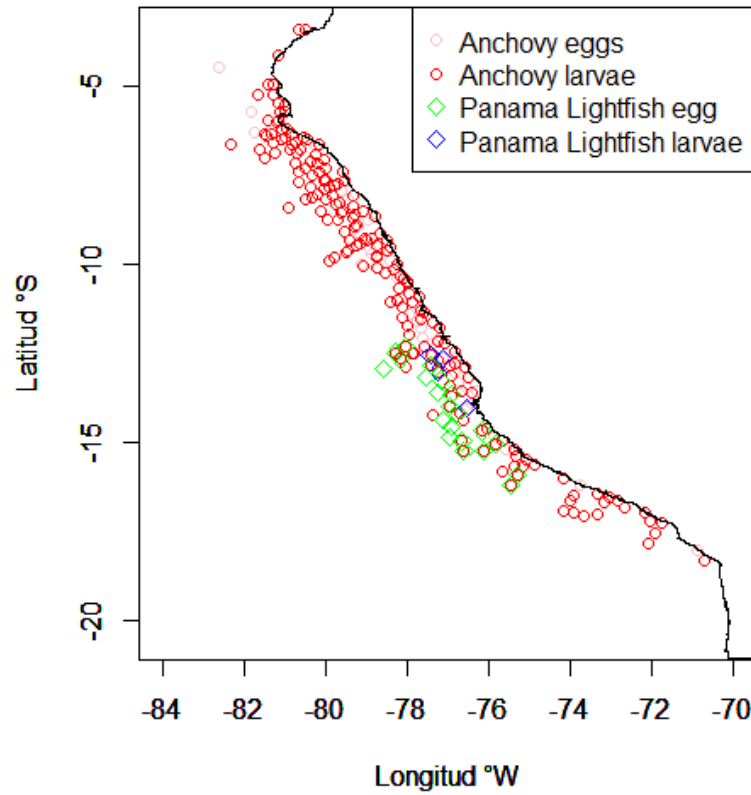


## Lightfish larvae

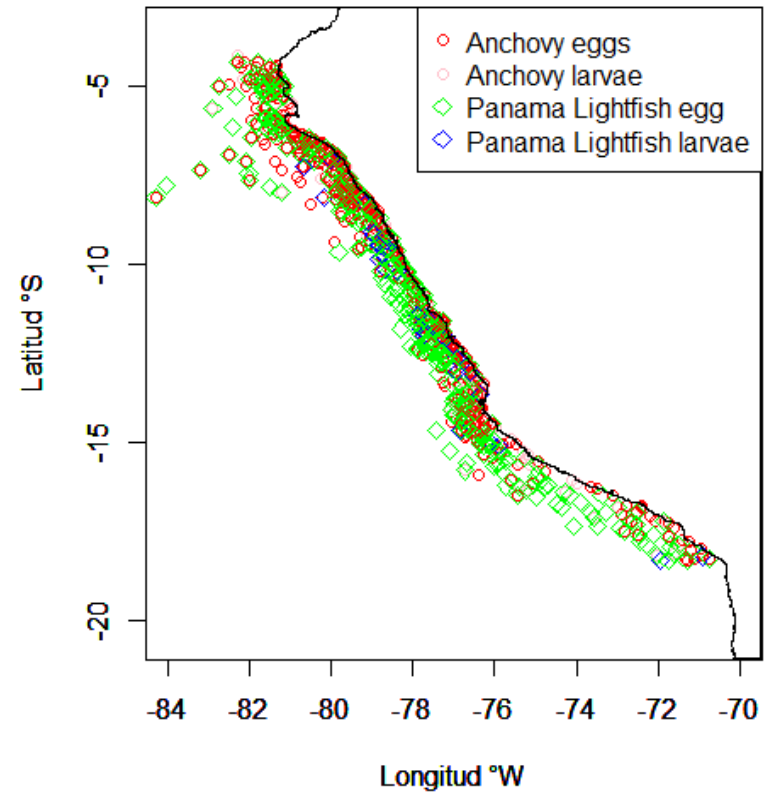


## GENERAL DISTRIBUTION

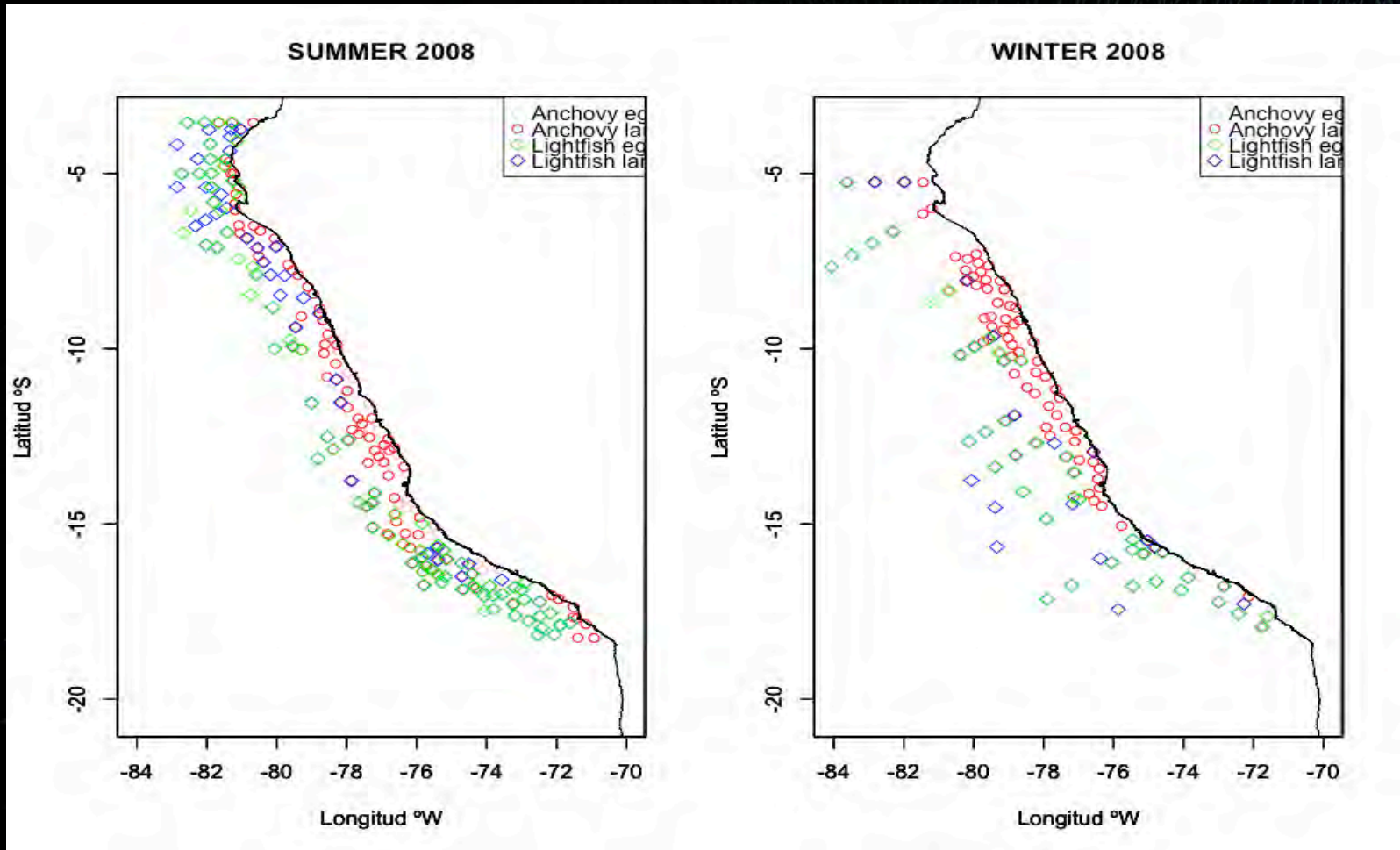
Year 2015



Year 2016



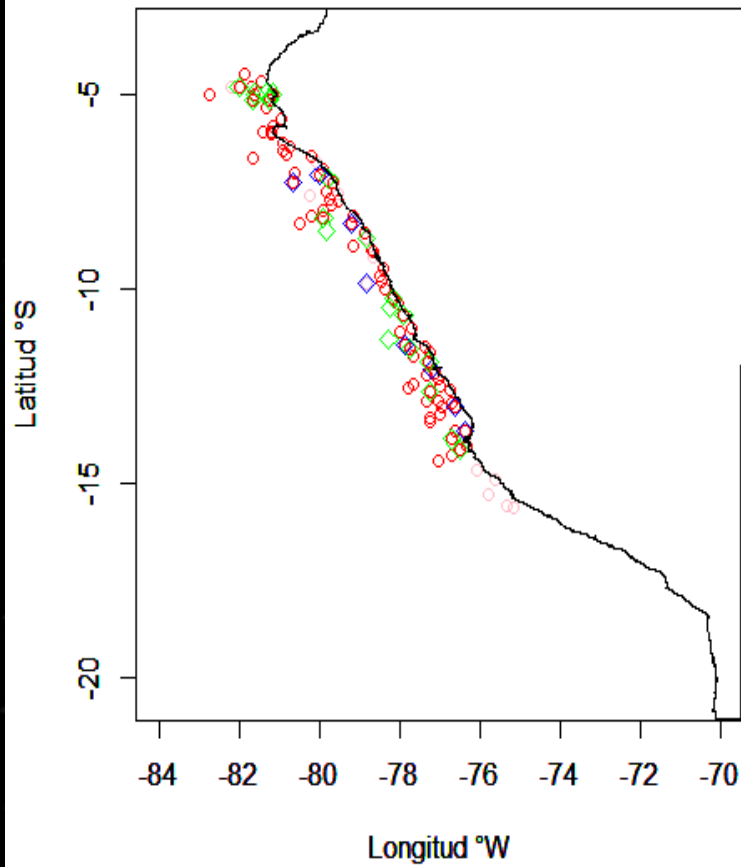
## PATTERN DISTRIBUTION (NORMAL CONDITION)



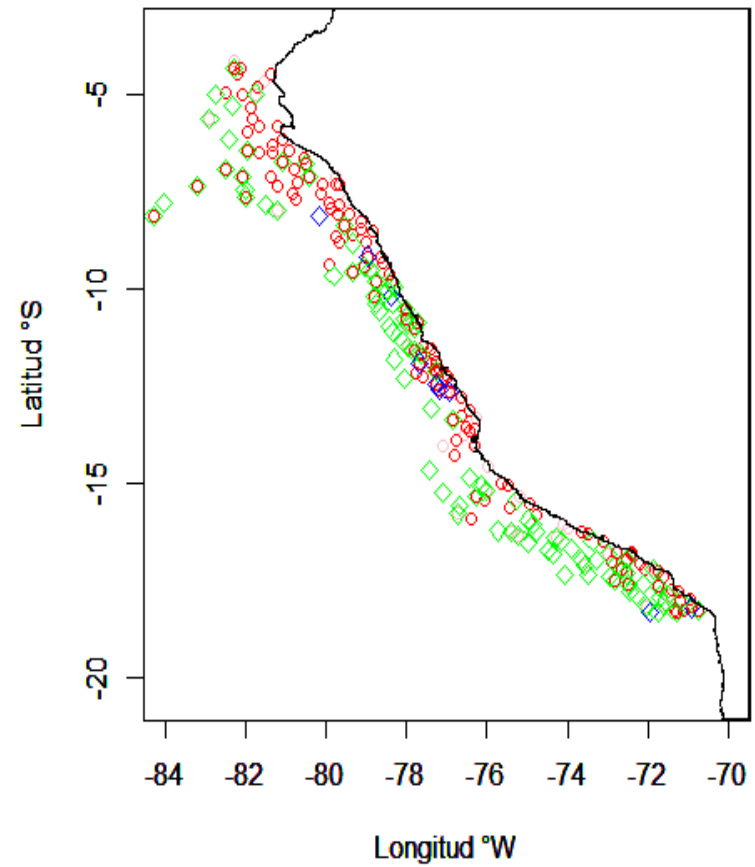
## PATTERN DISTRIBUTION (EL NIÑO CONDITION)



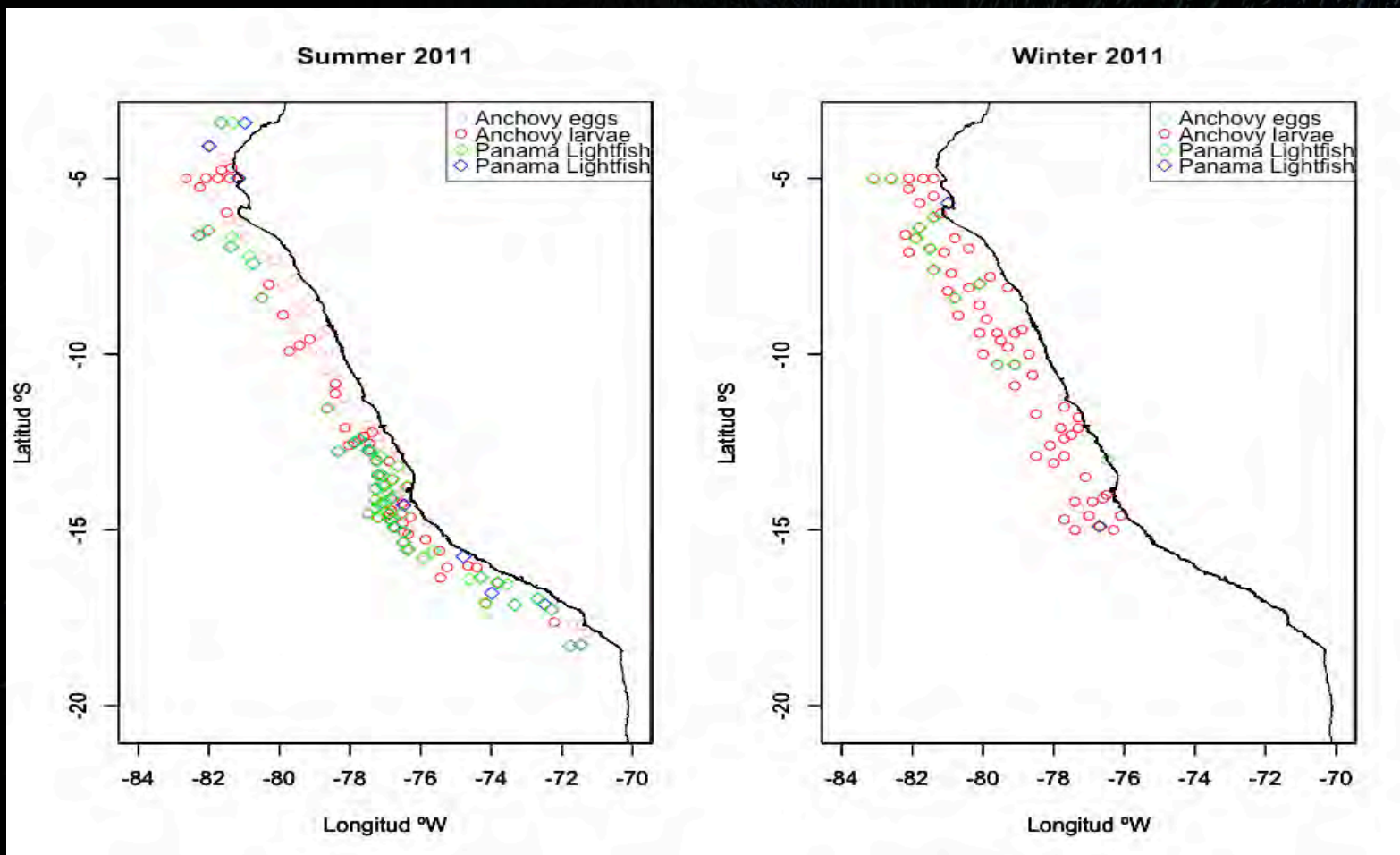
Summer 2016



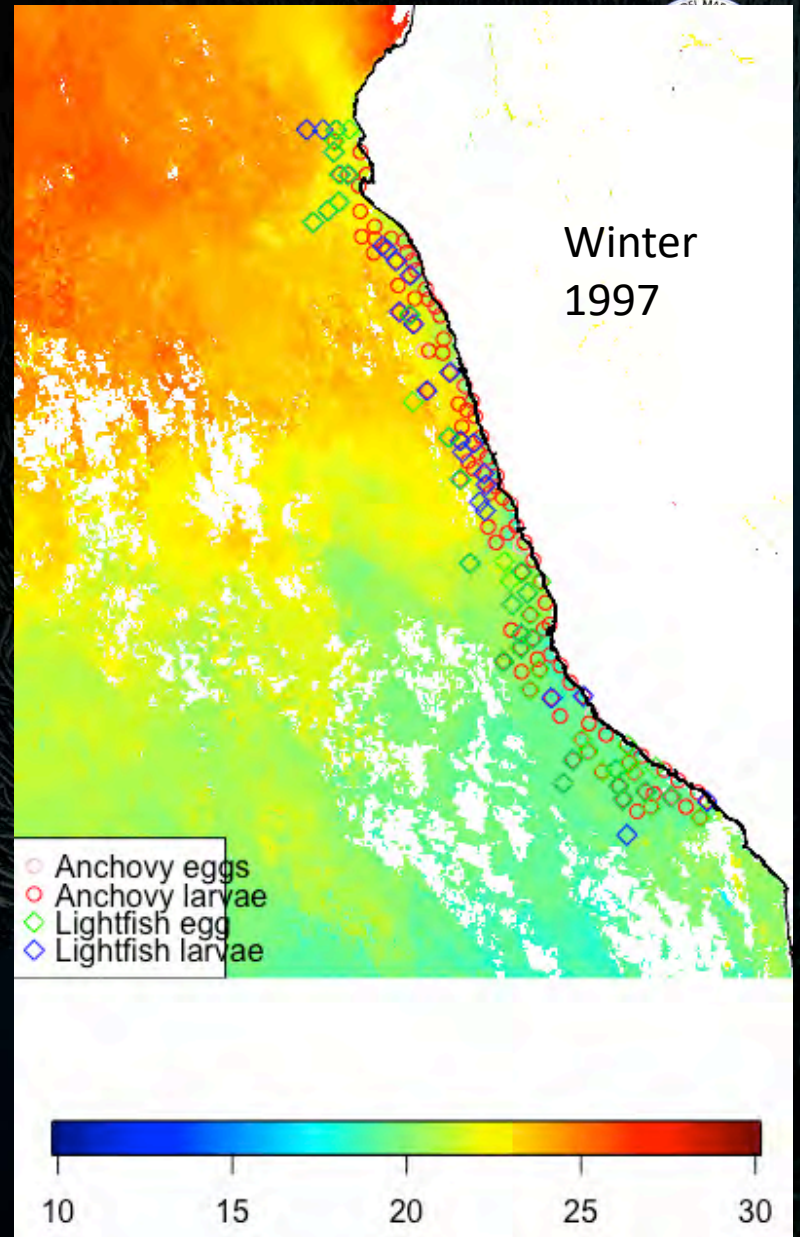
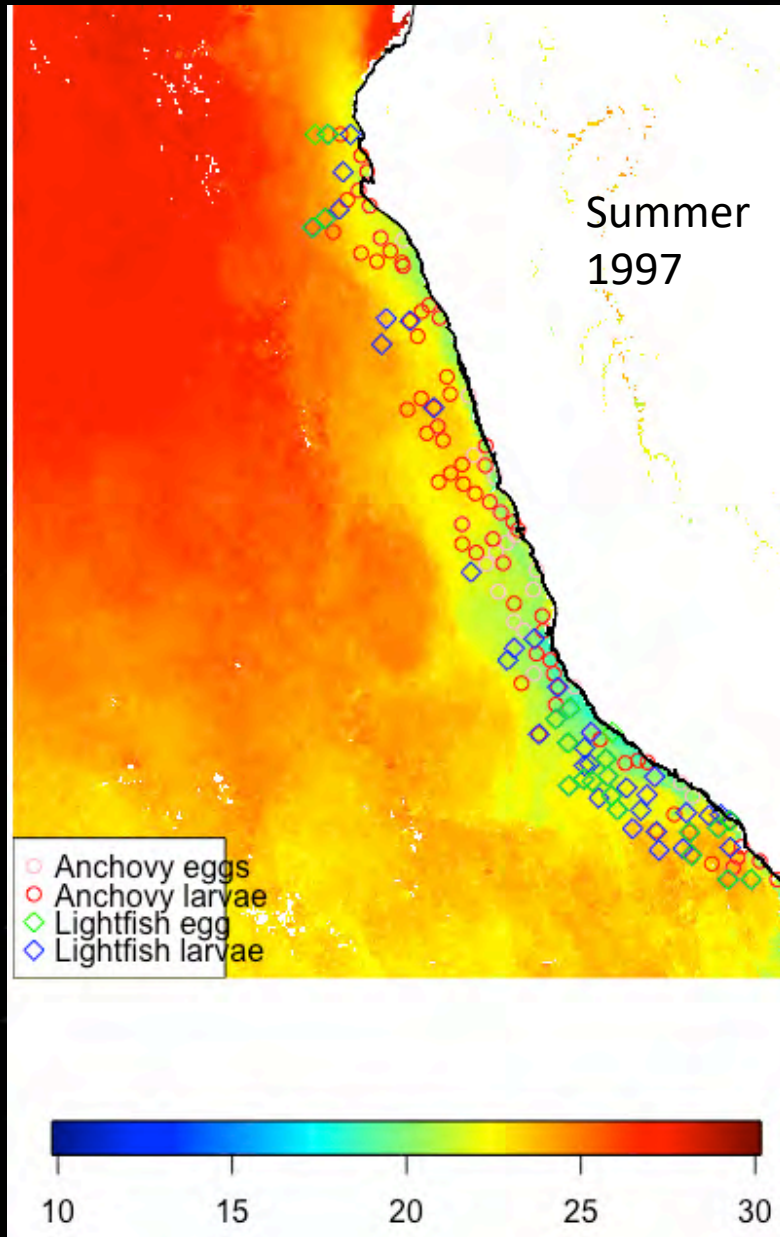
Winter 2016



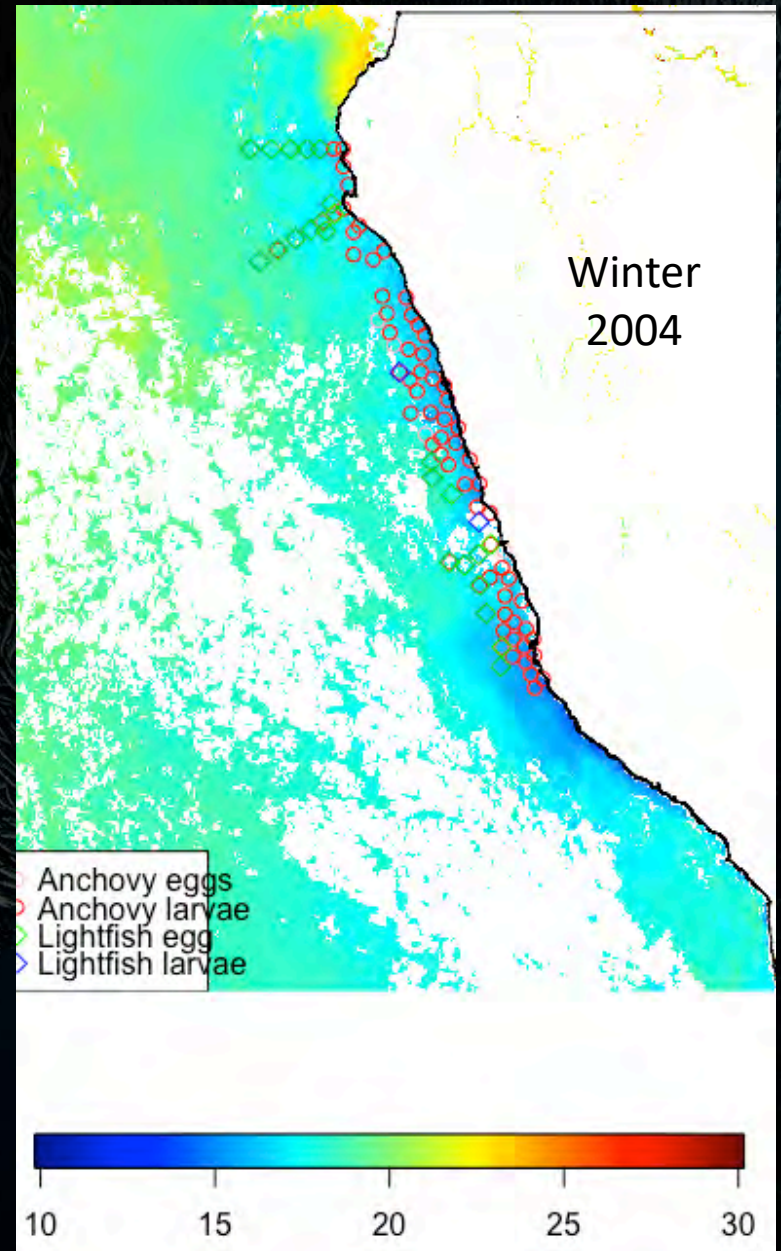
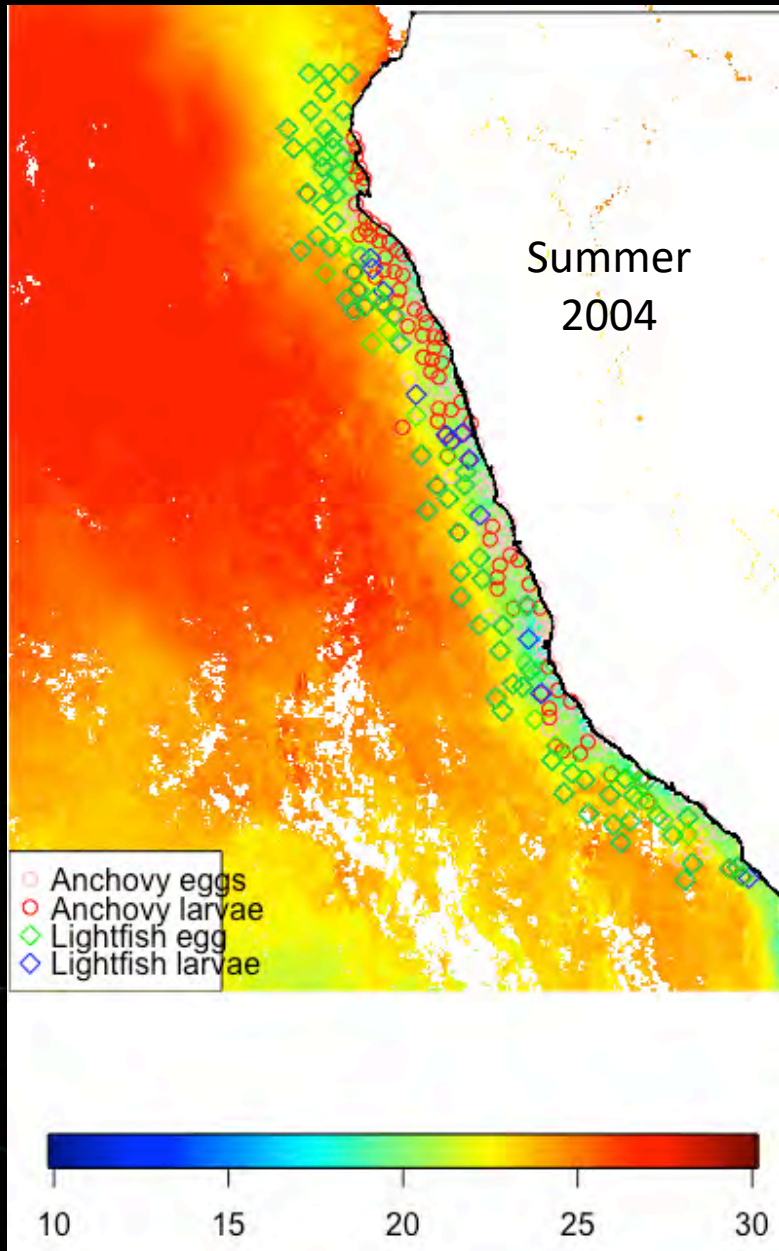
## PATTERN DISTRIBUTION (LA NIÑA CONDITION)



# RESULTS & DISCUSSION

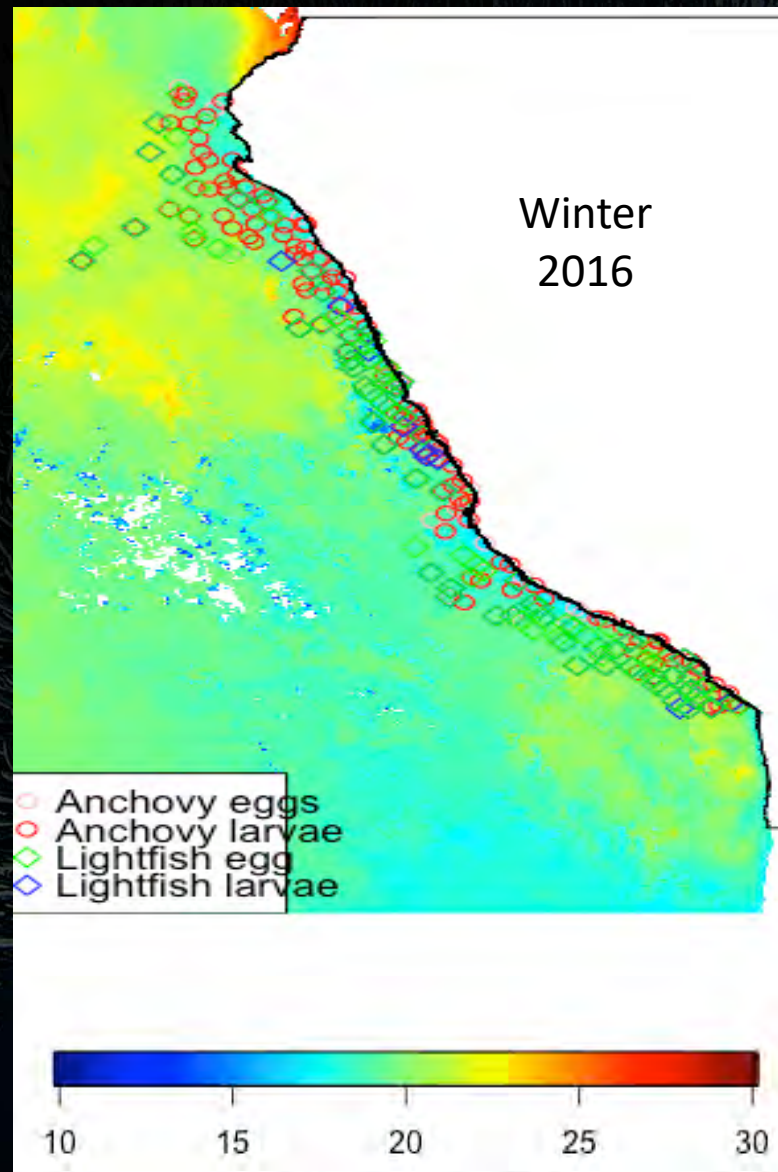
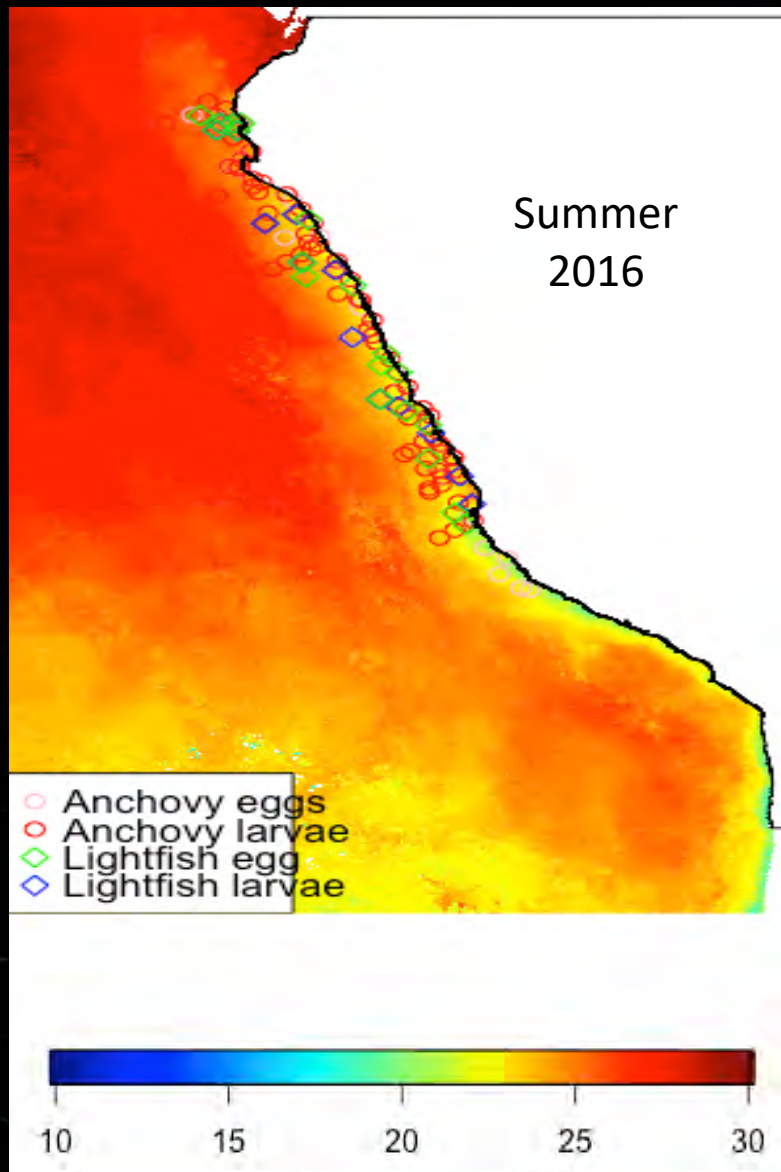


# RESULTS & DISCUSSION

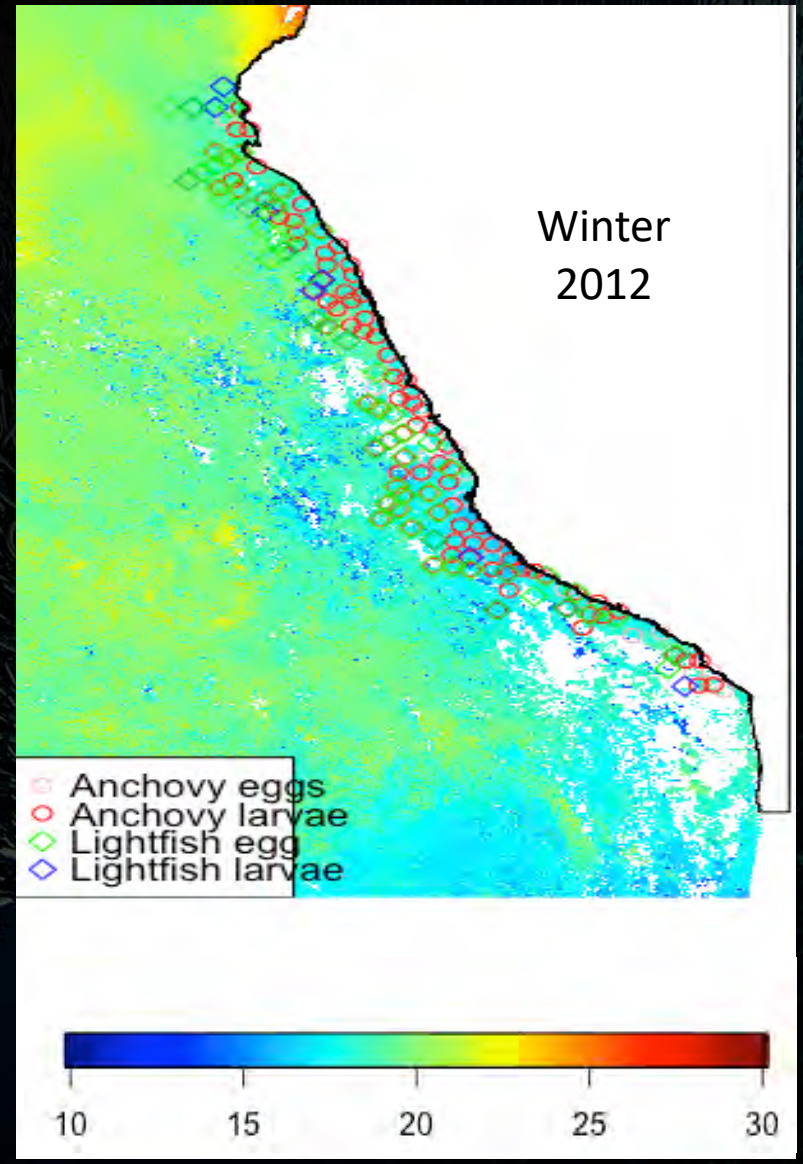
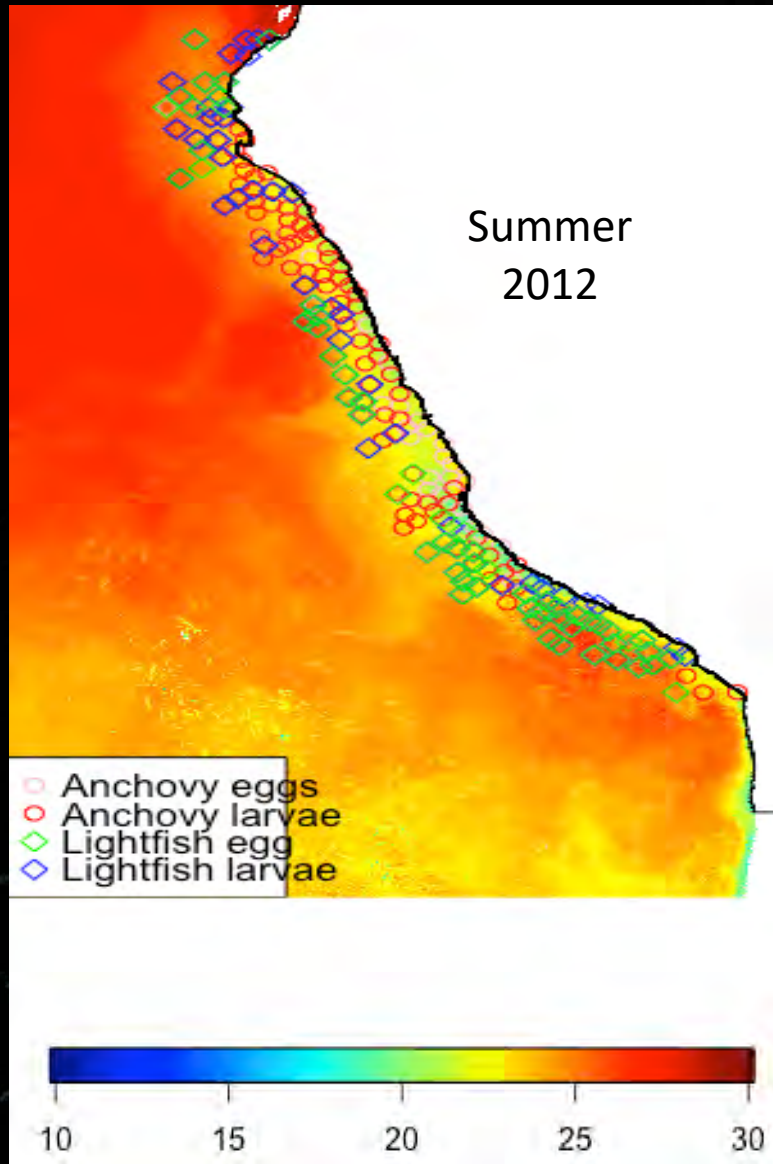




# RESULTS & DISCUSSION



# RESULTS & DISCUSSION





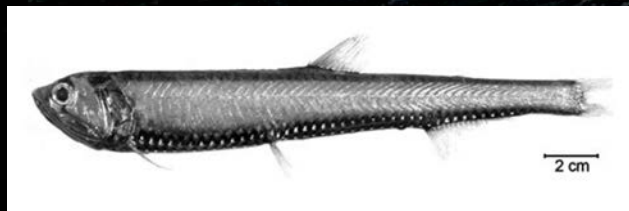
## CORRELATION ANALYSIS (Spearman)

		Anchovy Egg	Anchovy larvae	Lightfish Egg	Lightfish larvae	SST
Anchovy Egg	Corr Coef		0.678**	-0.727**	-0.6301**	-0.65*
	N		33505	33505	33505	32590
Anchovy larvae	Corr Coef			-0.702**	-0.6344**	-.6076 *
	N			33505	33505	32590
Lightfish Egg	Corr Coef				0.8344**	-.6105**
	N				33505	32590
Lightfish Larvae	Corr Coef					.6308**
	N					32590

\*\* Correlation is significant at the 0.01 level (2-tailed)  
\* Correlation is significant at the 0.05 level (2-tailed)

# CONCLUSIONS

1. In Peruvian upwelling system the main transitional area is determined by oceanic front, along the coast.
2. The interaction among the early life stages of the main planktivorous species of the coastal and oceanic system are strongly related with the oceanic front.
3. During summers and El Niño period the oceanic front became near the coast determining a nearness to the coast of the early life of lightfish.
4. During winter season and La Niña period occur the opposite, with anchovy covering all the area of cold coastal waters offshore.



# ACKNOWLEDGMENT

## ORGANIZERS



- Local Sponsors
- Co-Sponsoring Organizations
- Supporting Organizations



Zooplankton team