Biomass Zooplankton in the Northern Humboldt Current System and its variability associated with areas of transition

Aronés Katia, D. Grados, G. Vargas, Luis Vasquez
P. Ayón y A. Bertrand
Introduction
Background
Transitional Area
Objectives
Study area
Methodology
Results and Discussion
Introduction

Engraulis ringens

Betrand et al 2008
Introduction

Source: Espinoza and Bertrand 2008, 2014
Background

Carrasco-Lozano 1989

Is there enough zooplankton to feed forage fish populations off Peru? An acoustic (positive) answer

Michael Ballón, Arnaud Bertrand, Anne Lebourges-Dhaussy, Mariano Gutiérrez, Patricia Ayón, Daniel Grados, François Gerlotto
¿Transitional area in front of Peru influence on zooplankton distribution?
To know temporal-spatio dynamics of zooplankton biomass distribution associated with transitional areas
Pelagic surveys 2002-2012
08°30’-14°00’S – 100 nm
Shelf (0 – 200 m),
Slope (200 – 1000 m)
Offshore (> 1000 m).
Methodology

Conventional Method

Volumetric Methods
Biovolumes

Gravimetric Method
Wet weight

Regression: 145 samples

Mesozooplankton (0.2-20mm)

Y = aX?

\[ \log_{10}(Y) = \log_{10}(a) + \gamma \log_{10}(X) \]

\[ \log_{10}(\text{Volume}) = \log_{10}(a) + \gamma \log_{10}(\text{Wet weight}) \]

Macrozooplankton (2-20cm)

Total biomass

Acoustic Method

Density
Sampling area

Variogram
Range

Covariables: Oxycline, Coast Distance,
Echoview software

Echosounder Simrad
FK50 (2002-2007)
FK60 (2008-2012)

38 kHz (+MVBS_{120+38})
\Delta MVBS 120-38

Fish

Variogram

‘Fluid-like’
‘Blue noise’

Autocorrelation

Sampling hour: Night
Hensen Net: 50m

Gutierrez, 2013

Ballón, 2010 (+MVBS_{120+38})
Methodology

Water Masses

Oxycline depth

Statistical Analysis of Variance
Anova
Results and Discussion

Total Biomass (gr.m$^2$)

Biomass (gr.m$^{-2}$)

Mesozooplankton

Macrozooplankton
Results and Discussion

Biomass estimated series of zooplankton (g.m²) within the defined area for different habitats:

- **Shelf**
- **Slope**
- **Offshore**
- **Meso**

Yearly data from 2002 to 2012 is shown in the graphs.
Results and Discussion

Mesozooplankton distribution
Results and Discussion

Biomass (gr.m²)

- **Spring**
- **Summer**
- **Winter**
- **Autumn**

### Analysis Table

<table>
<thead>
<tr>
<th>as.factor (dataStas1on)</th>
<th>Df</th>
<th>Sum Sq</th>
<th>Mean Sq</th>
<th>F value</th>
<th>Pr(&gt;F)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>394888</td>
<td>197444</td>
<td>47.79</td>
<td>&lt;2e-16 ***</td>
</tr>
<tr>
<td>Residuals</td>
<td>7534</td>
<td>40611772</td>
<td>5418</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

### Maps

- **SUMMER**
- **SPRING**
- **2002**
- **2010**

- **8° S**
- **10° S**
- **12° S**
- **14° S**

- **82° W**
- **80° W**
- **78° W**
- **76° W**
Results and Discussion

Highest Biomass: Offshore

Calanus chilensis

2010 et al
Results and Discussion

Copepoda

Euphausiacea

Gelatinous

2000

2003

Pinedo et al 2014

Summer

2000

2003

P. parvus

Sagitta pacifica

Euphausia mucronata

Pinedo et al 2014
Results and Discussion

Summer: 2002-2012

High correlation between water masses and mesozooplankton

Tropical Surface Waters
Subtropical Surface Waters
Equatorial Surface Waters
Cold Coastal Waters
Results y Discussion

Macrozooplankton biomasses: 2002-2012

Biomass Higest: Offshore

2003

Spring

Summer

Results and Discussion

Low correlation between water masses and macrozooplankton
Results and Discussion

Macrozooplankton Biomass

![Image of Macrozooplankton Biomass map from 2002 to 2010]
Results y Discussion

Grados et al 2012
Conclusions

• Mesozooplankton and Macrozooplankton presents similar tendency.

• Mesozooplankton is associated with water masses displacement.

• Macrozooplankton can respond to water masses displacement, but is more associated with oxycline depth.
Acknowledgements

Thanks!