Characterization of plankton communities and *Acartia* reproductive traits related to environmental conditions in the Guadiana river estuary and adjacent coastal zone

Joana Cruz[1,2,3], M. Alexandra Chícharo[2], Radhouane Ben-Hamadou[2], Luís Chícharo[2], Pedro Ré[1] and A. Miguel P. Santos[3]

1- University of Lisbon, Faculty of Science, 2- University of Algarve, CCMAR, 3- INRB-IPIMAR

FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR

FACULDADE · DE · CIÊNCIAS UNIVERSIDADE · DE · LISBOA

Centro de Ciências do Mar do Algarve

ipimar Instituto de Investigação das Pescas e do Mar

Introduction

• The river inflow regime plays an important role in estuarine and coastal ecosystems since it is the provider of nutrients and sediments in these areas

• The construction of the Alqueva dam in 2002 has stimulated research on the effects of changes in freshwater flow on the downstream ecosystem dynamics

• The decrease in freshwater discharge and nutrient loading affects the primary productivity downstream influencing the trophic structure

• Plankton research in this area is scarce and mainly focusing in phytoplankton or ichthyoplankton

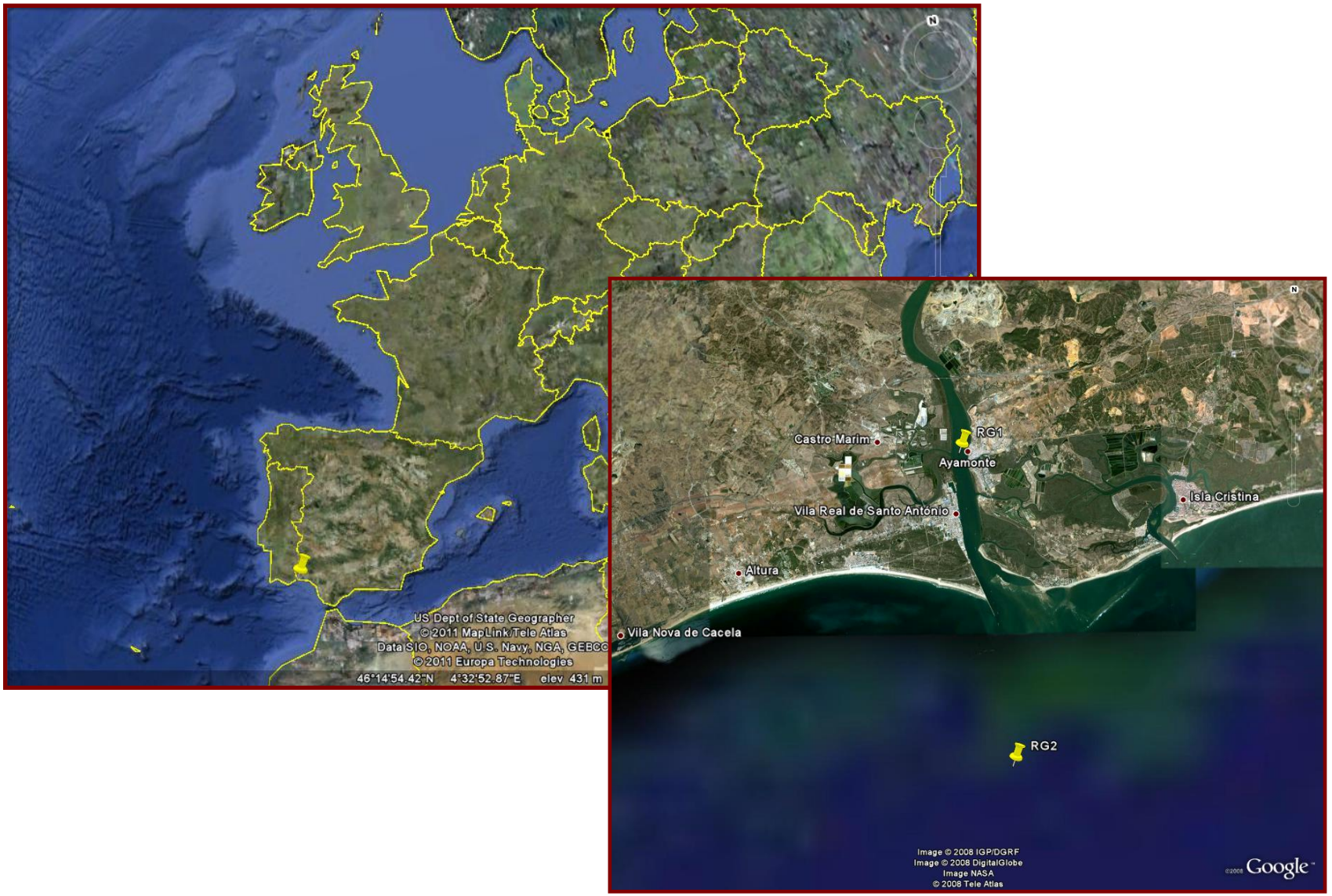
Objectives

- Characterize the zooplankton communities in the lower part of the Guadiana estuary in relation to environmental conditions

- Determine seasonal and spatial variability of *Acartia* reproductive traits and possible environmental factors that may influence reproduction

- Measure RNA:DNA ratios in order to determine if it could be considered a good proxy for secondary production

Study area


US Dept of State Geographer
© 2011 MapLink/Tele Atlas
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2011 Europa Technologies
46°14'54.42"N 4°32'52.87"E elev 431 m
Castro Marim
RG1
Ayamonte
Vila Real de Santo Antonio
Isla Cristina
Altura
Vila Nova de Cacela
RG2
Image © 2008 IGP/DGRF
Image © 2008 DigitalGlobe
Image NASA
© 2008 Tele Atlas
Google

Methods

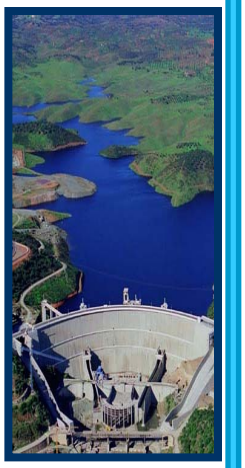
Sampling

- Sampling was carried out from December 2008 to June 2010

- Two horizontal hauls with a WP-2 net (200 µm) for zooplankton composition analysis and *Acartia* egg production experiments

- Temperature and Salinity were measured with a hand-held meter (YSI85)

- Water samples from the surface were collected with a Niskin bottle for phytoplankton composition and chlorophyll analysis



Egg production experiments

• *Acartia* females were incubated for 24 hours at sea temperature; 6 bottles (500 ml) with 4 to 5 females in each

• Egg production rate is determined after 24 hours
•and eggs are incubated for additional 48 hours for
•hatching

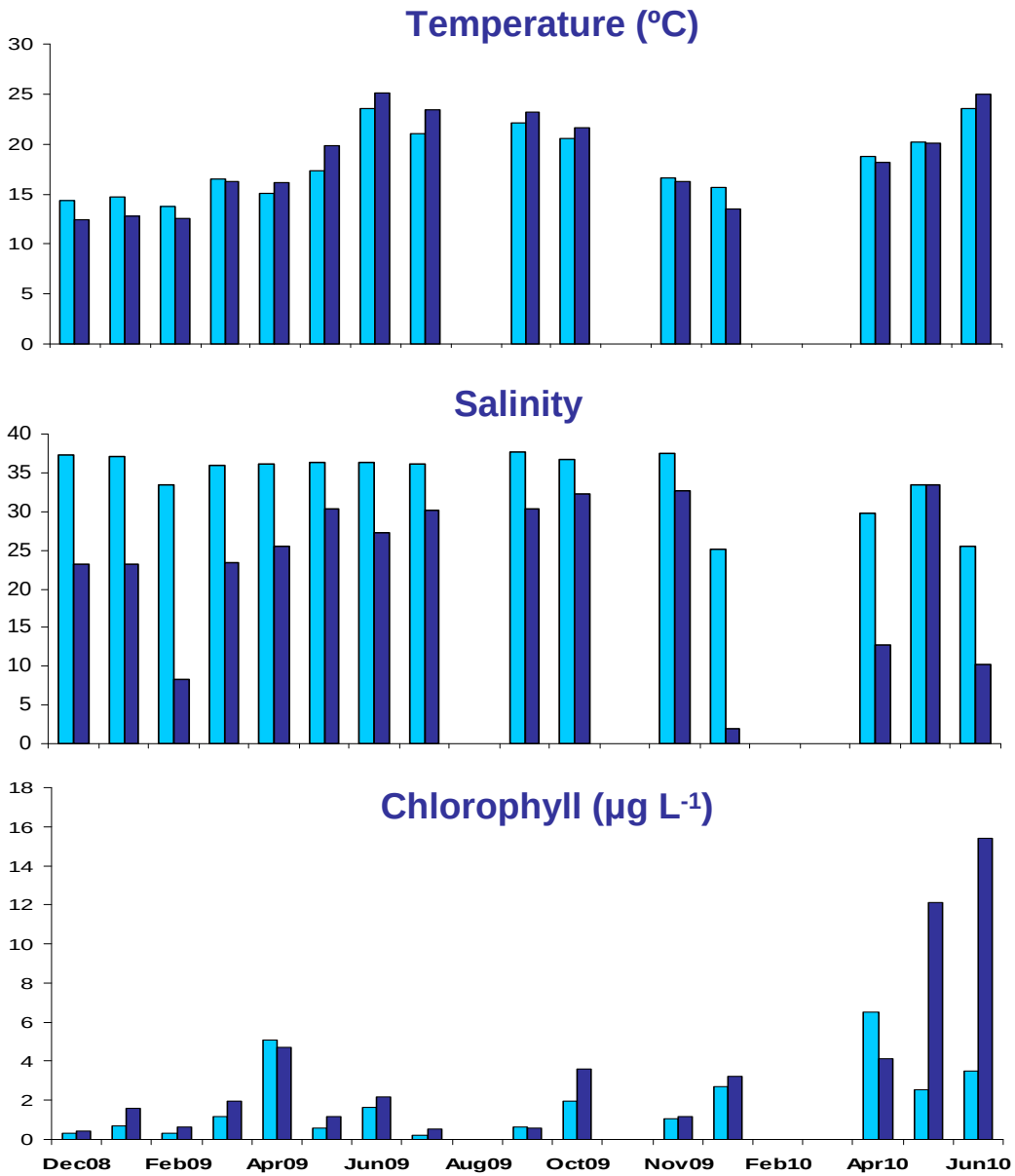
RNA:DNA ratio (based on Calderone et al 2001)

• To determine the RNA:DNA ratio *Acartia* females were homogenized with sarcosyl extraction buffer and shaken for 30 minutes at room temperature on a vortex mixer

• Samples were then centrifuged (12000 r.p.m) for 15 minutes and diluted with Tris buffer

• RNA and DNA fluorescences were measured using a microplate reader (Biotek Synergy HT)

Results



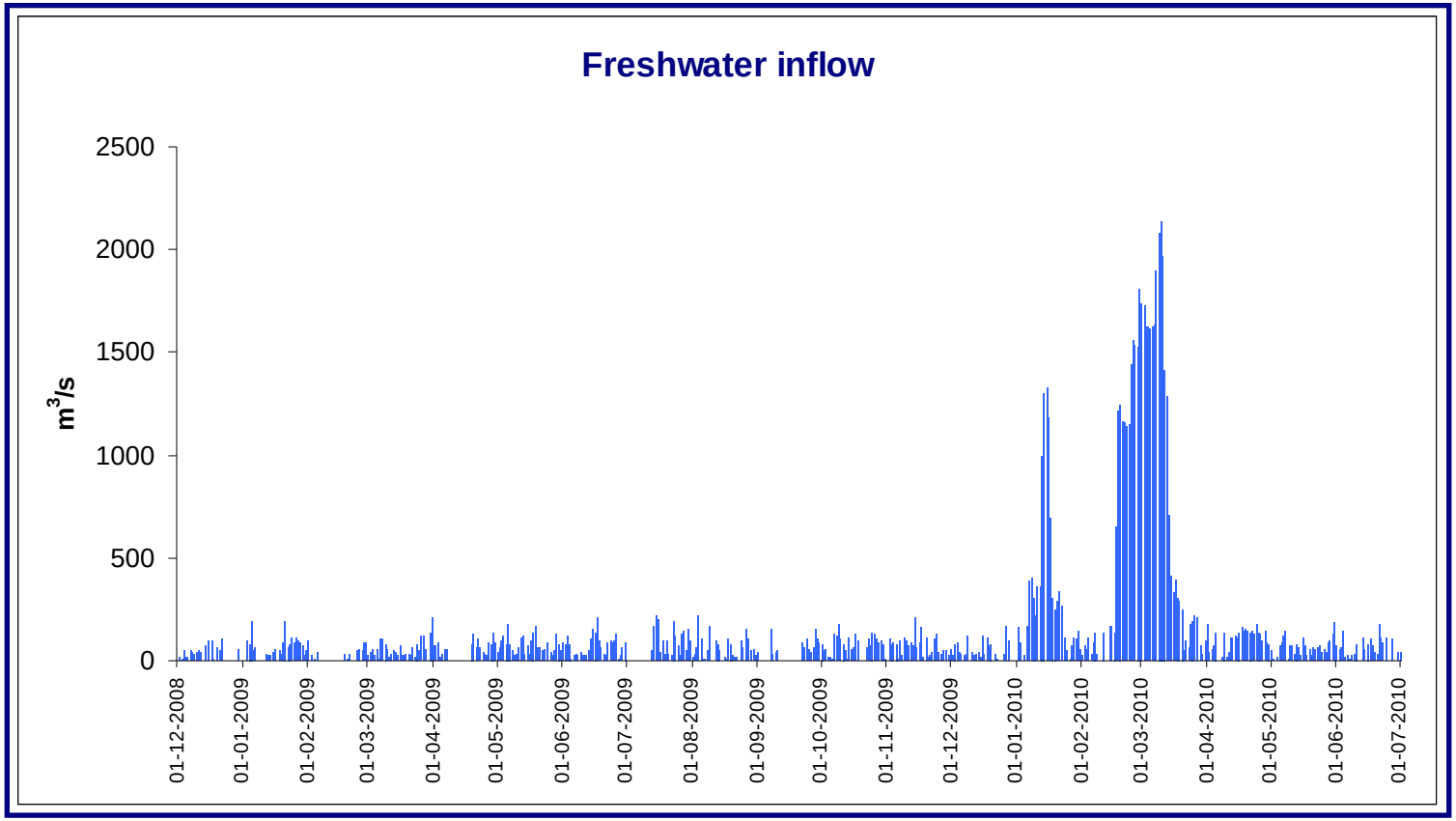
Inside estuary

Coastal zone

- Water temperature with a typical seasonal cycle in both stations

- Salinity was lower inside the estuary, reaching minimum values in February 2009 and January 2010

- Chlorophyll reached higher values inside the estuary; peak concentration during May and June 2010

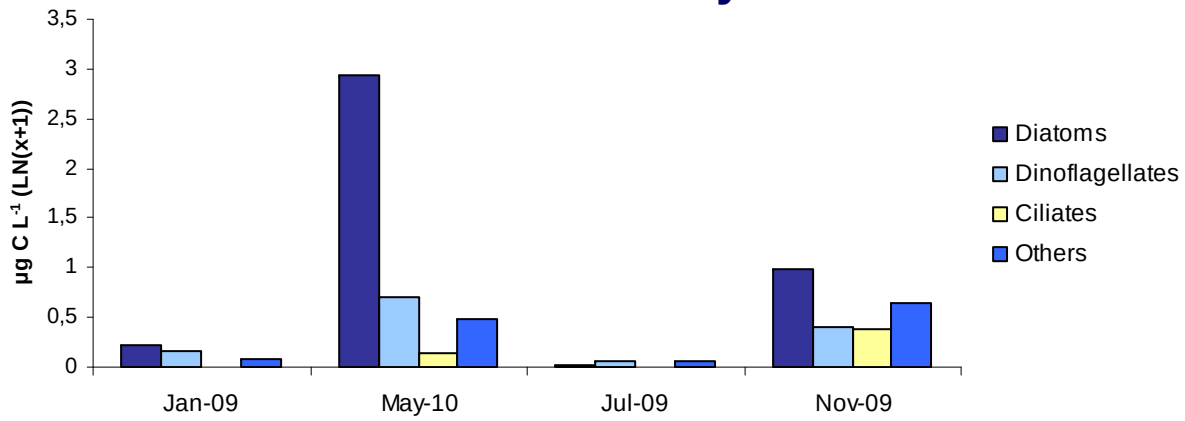


- Freshwater discharges varied between the two sampling years

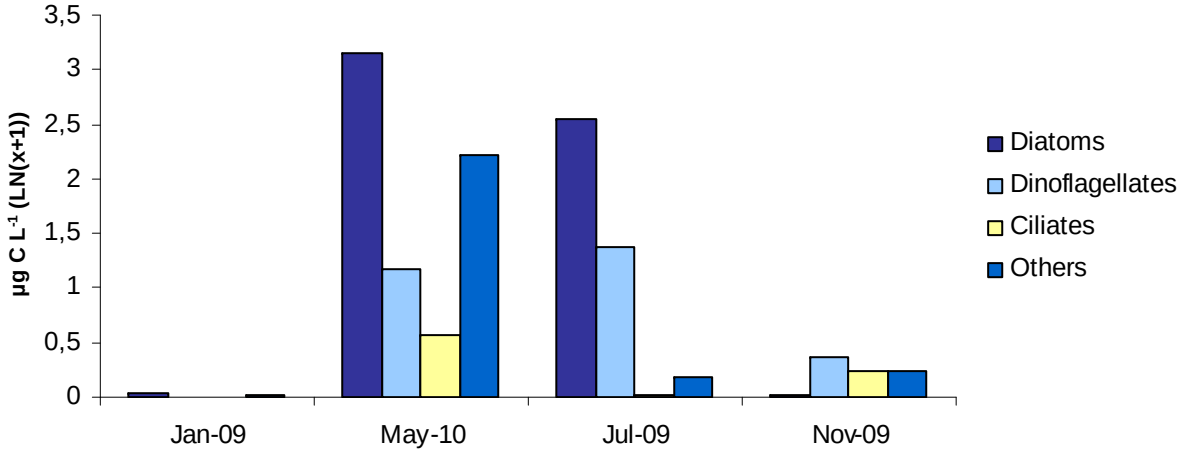
- Maximum values early 2010 were due to the discharge of Alqueva dam caused by the occurrence of high precipitation

Phytoplankton

Inside estuary



Coastal area



May
Guinardia delicatula
Thalassiosira spp.
Detonula pumila
Phytoflagellates

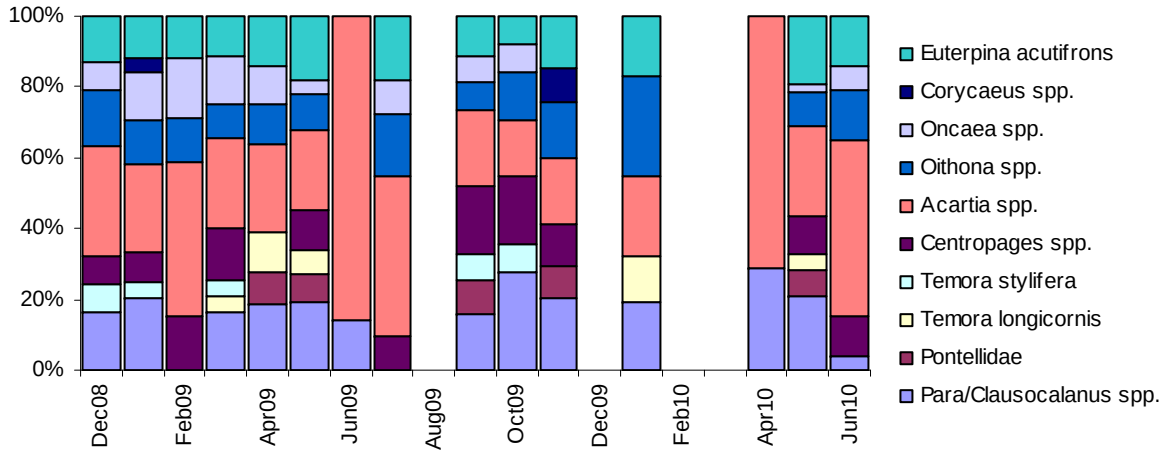
July
Leptocylindrus spp.
Guinardia delicatula
Pennate diatoms
Protoperidinium spp.

November
Lithodesmium spp.
Odontella spp.
Gymnodinium spp.
Ciliates

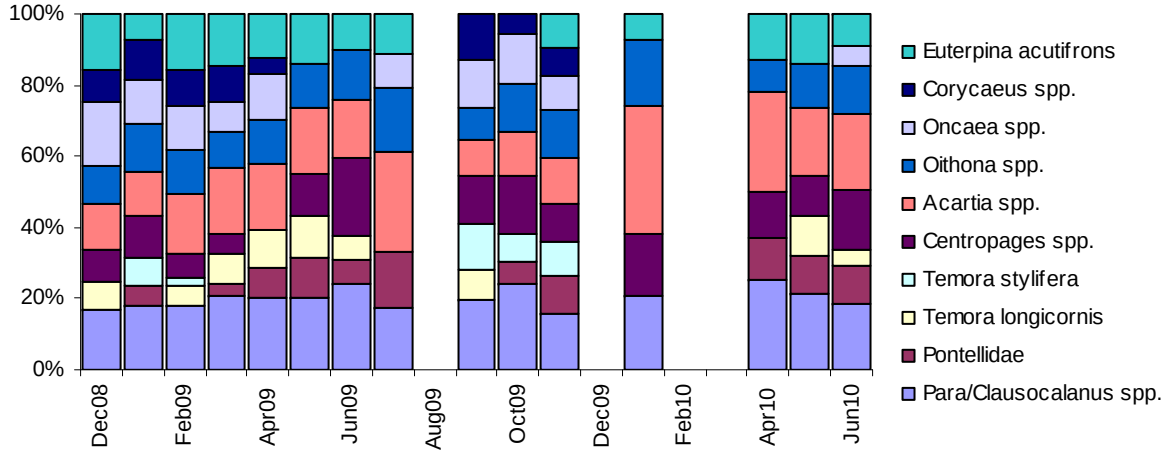
January
Chaetoceros spp.
Pennate diatoms
Fragilidium spp.

Zooplankton community

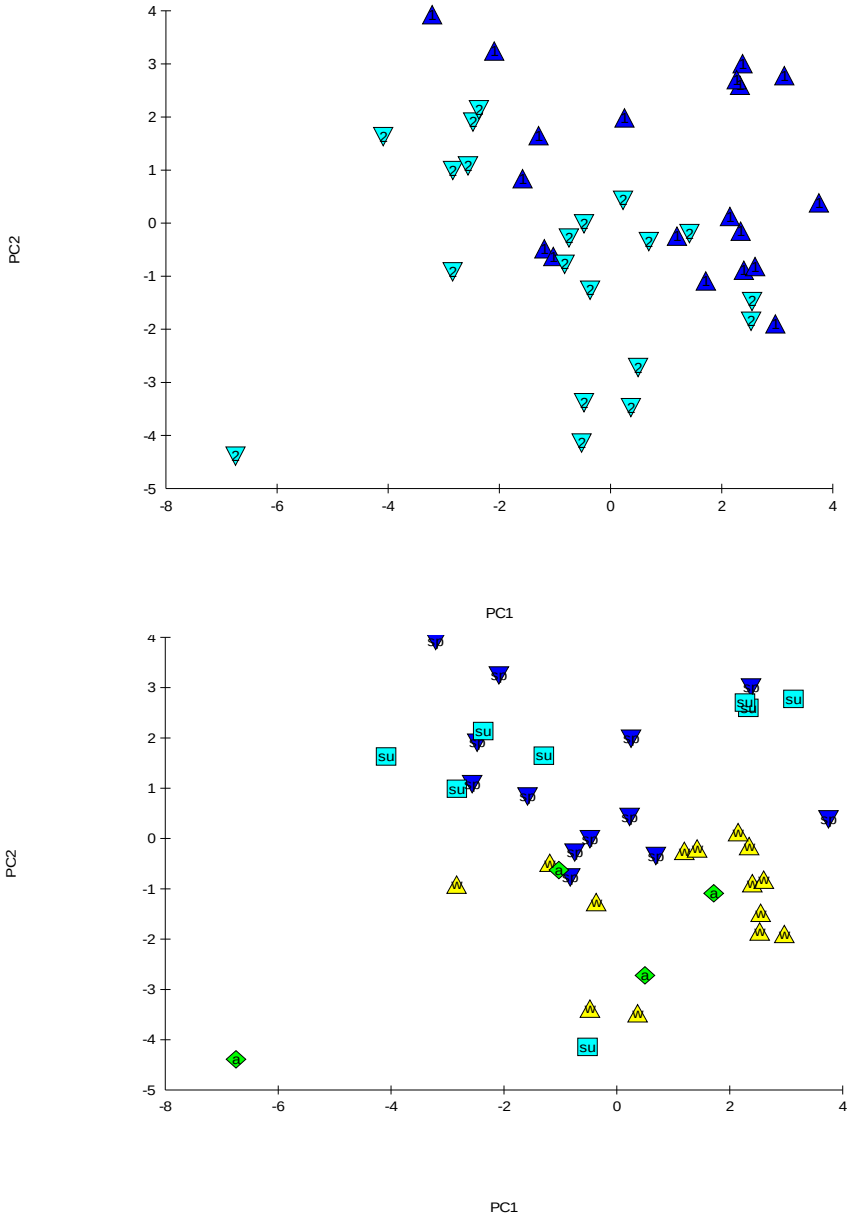
Inside estuary



Coastal area



Zooplankton community



Inside estuary

Coastal area

- The sampling site appears to influence the zooplankton composition

Winter

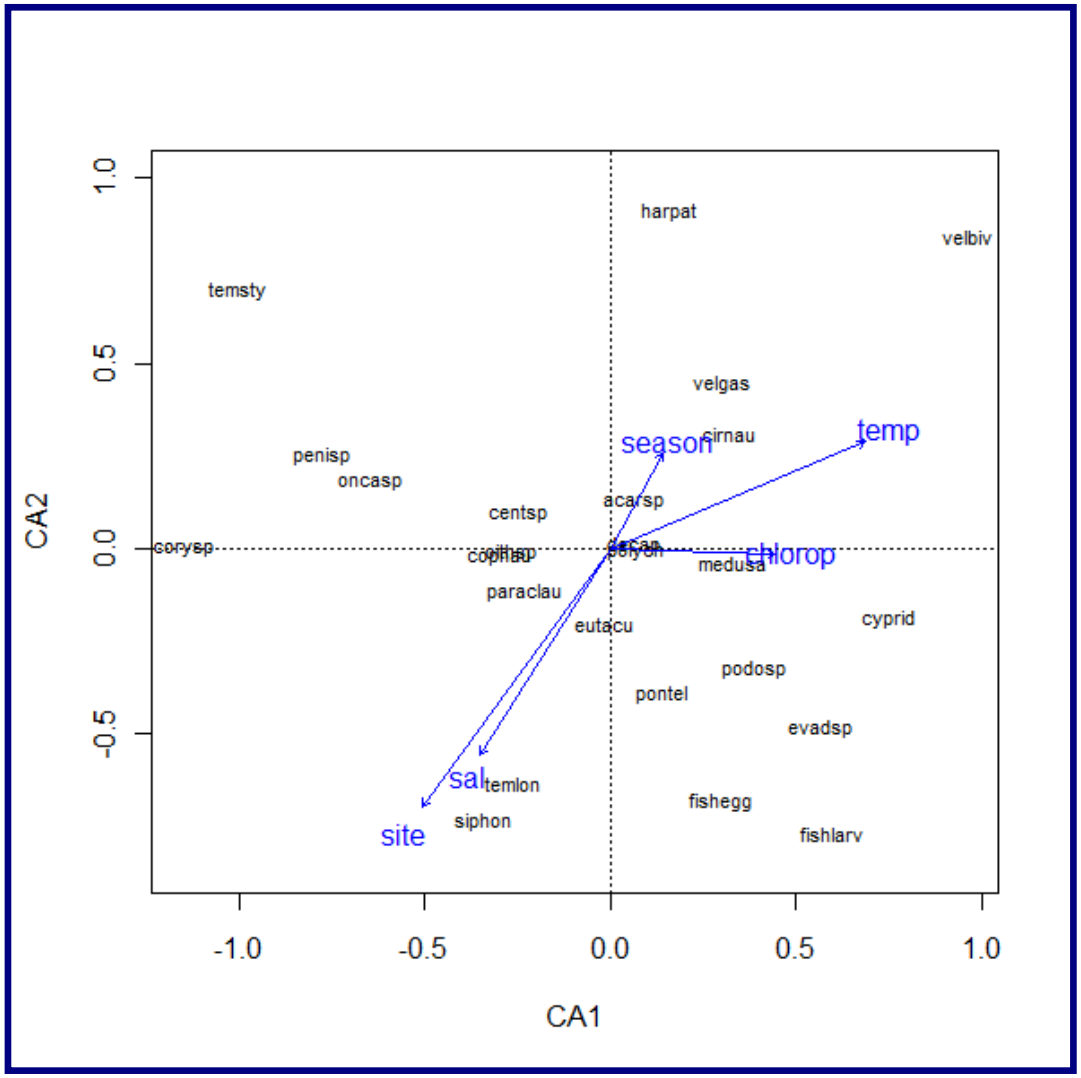
Spring

Summer

Autumn

- Autumn/winter and spring/summer stations seem to be related

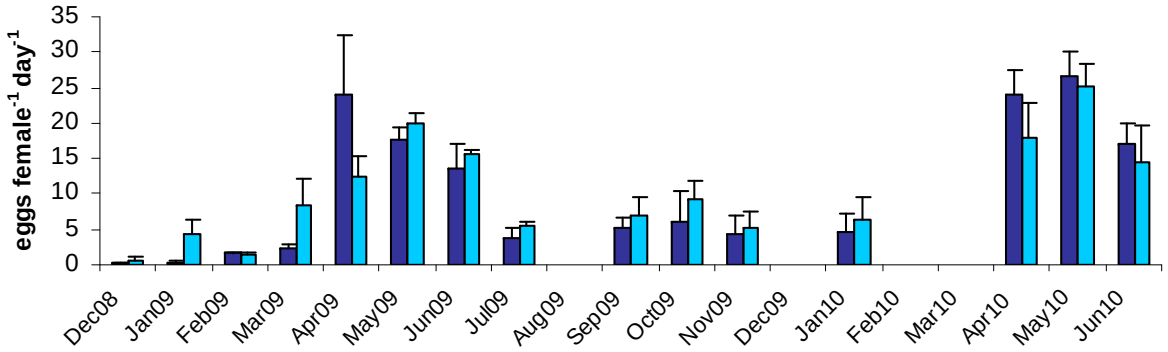
Zooplankton community



- The significant variables explaining the variability are the sampling site, salinity (related variables) and temperature

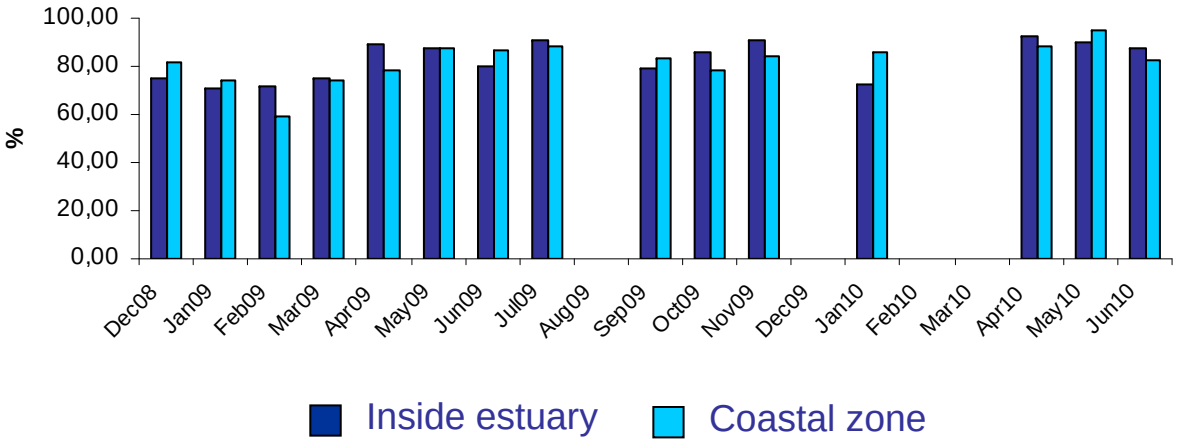
Acartia egg production experiments

Egg production rate



• EPR showed large seasonal variability, ranging from 0.3 to 27 eggs female^{-1} day^{-1} inside estuary and 0.6 to 25 eggs female^{-1} day^{-1} in the coastal zone.

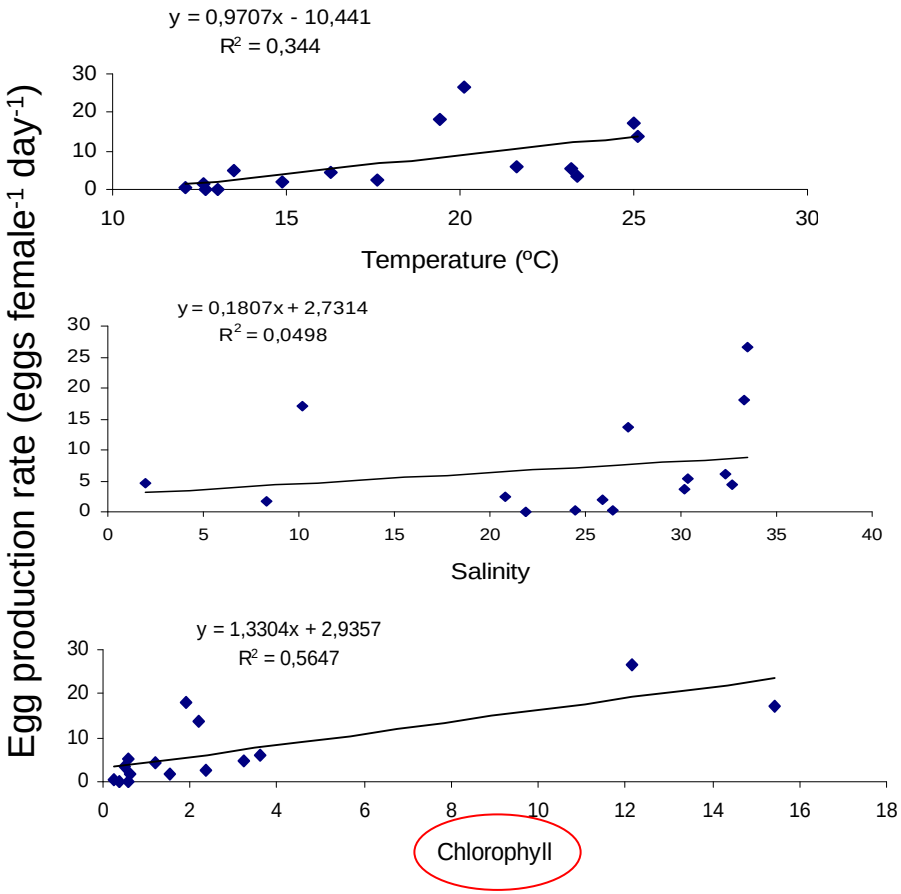
Hatching success



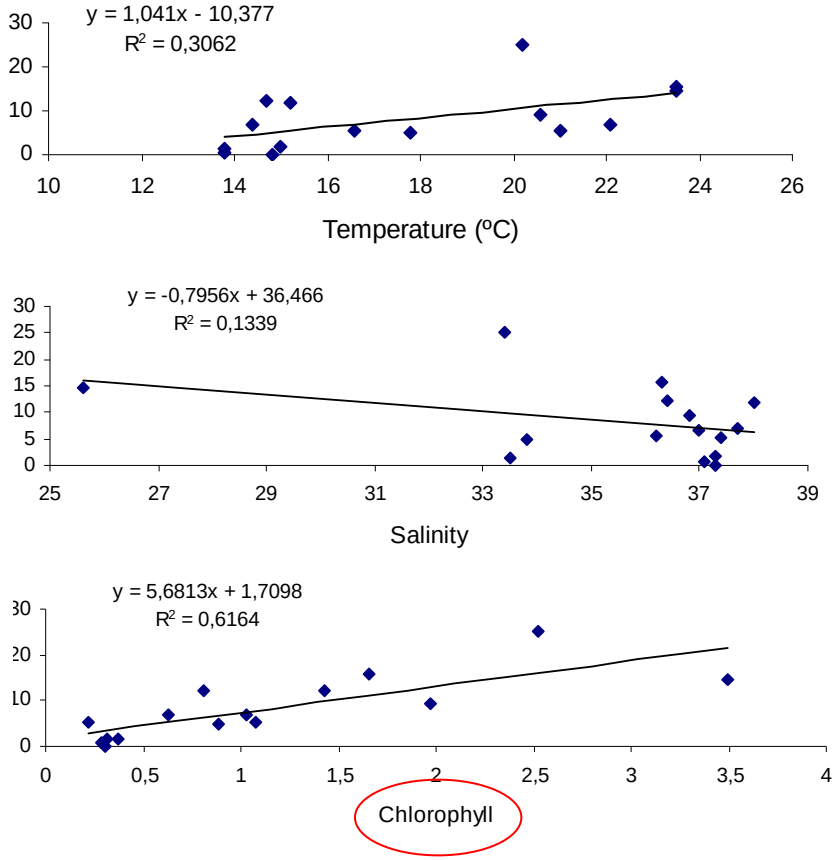
• Hatching success showed no clear temporal trend, with no major differences between sites, ranging from 60 to 94%.

Egg production rate *vs* environmental conditions

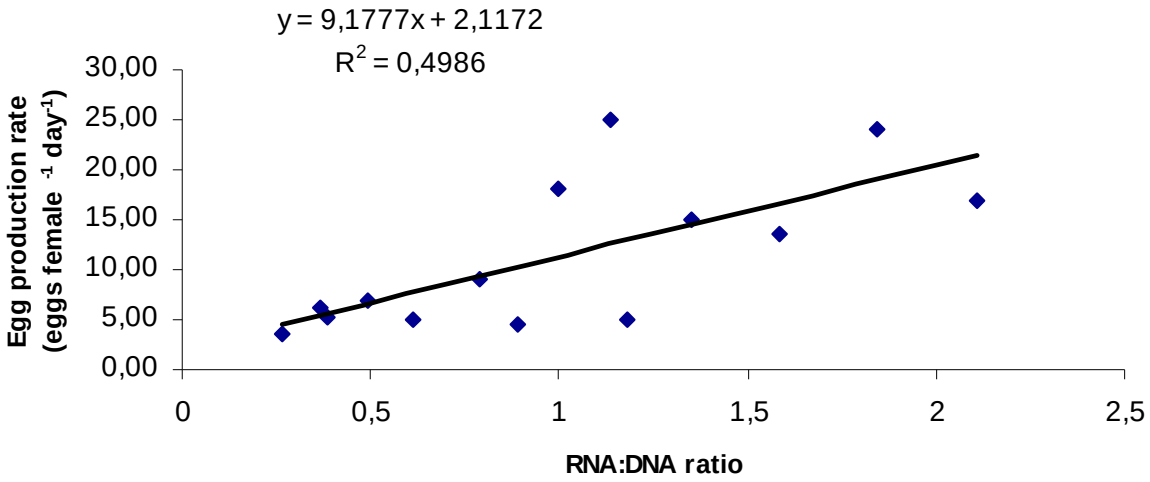
Inside estuary



Coastal area



Egg production rate *vs* RNA:DNA ratio



- There was a significant relationship between egg production rate and RNA:DNA ratio

Conclusions

• Sampling site (salinity dependent) is more important to zooplankton community structure then seasonality, which infers the importance of the river inflow in secondary production

• Higher values of EPR were found in 2010 when comparing with 2009, which could be explained by the extremely high amount of freshwater discharges during 2010 winter months (January to March) that increase the input of nutrients favouring planktonic productivity

• Food availability seems to be the major influence on the EPR

• EPR results are similar to the ones found by Uriarte et al. (2005) for *Acartia clausi* in two Basque estuaries.

• RNA:DNA ratio significant relationship with EPR has been shown in previous studies (Saiz et al, 1998), although the ratio values found are much lower in the present work, probably due to fact that this study was based on field sampling