Zooplankton biomass and abundance in the Coastal Transition Zone off Northwest Africa

Juan Carlos Garijo* and Santiago Hernández-León
Instituto de Oceanografía y Cambio Global, Universidad de Las Palmas de Gran Canaria, Campus de Tafira.
35017, Gran Canaria, Spain. *E-mail: jgarijo@becarios.ulpgc.es


Juan Carlos Garijo

ABSTRACT
The influence of mesoscale activity on zooplankton biomass, abundance, size-fraction distribution and taxonomical composition was studied along two transects crossing an upwelling filament and an anticyclonic eddy in the Coastal Transition Zone off NW Africa. Samples were scanned and analyzed using digital image processing (ZooImage). Our results confirm the influence of the mesoscale structures on the zooplankton distribution. The filament enriched the anticyclonic eddy located offshore, promoting an increase in biomass and abundance of zooplankton. Organisms distributed following a pattern of size, with dominancy of the medium size zooplankton. Copepods were the most abundant group with a distribution widely influenced by the physical conditions in the region.

INTRODUCTION

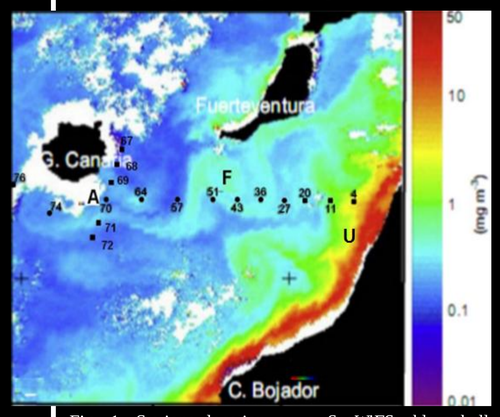


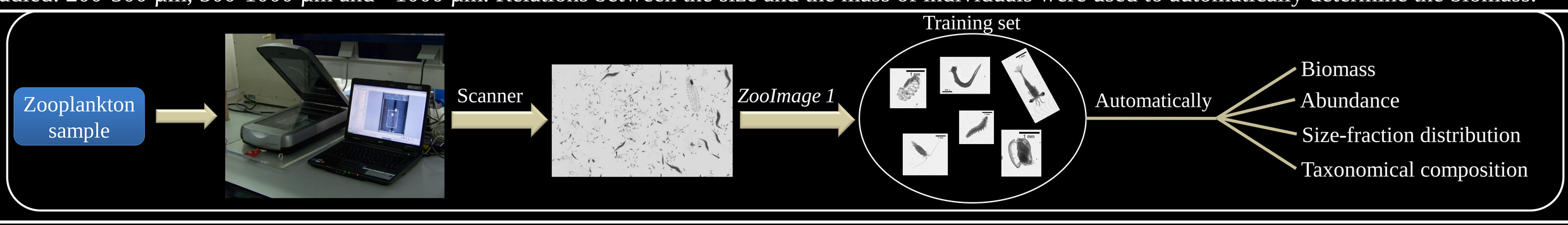
Fig. 1. Stations location on a *SeaWiFS* chlorophyll image.F, A and U stand for filament, anticyclonic eddy and upwelling, respectively.

The **Coastal Transition Zone** (CTZ) off NW Africa has an intense mesoscale oceanographic activity, influencing the plankton transport and distribution in the region (Hernández-León, 1988, 1991; Arístegui et al., 1997; Rodríguez et al., 2001; Arístegui et al., 2004).

Zooplankton plays a key role in the biogeochemical cycles in the ocean, participating in the active **carbon flux** from the surface to the mesopelagic zone and being a significant component of the **biological pump** in the ocean (Hernández-León et al. 2010).

Two transects were carried out from the coastal waters off the NW African upwelling to the offshore waters of the Canary Islands. One objective was to test the efficiency of ***ZooImage 1*** to estimate zooplankton biomass, abundance, size-fraction distribution and taxonomical composition. The second one focused on the determination of the **biological effect** of filaments and eddies on mesozooplankton communities in the CTZ off NW Africa.

MATERIAL & METHODS
Samples were scanned and processed with the software ***ZooImage 1***, ranging from **2 to 10 minutes** per sample. It proportioned one different picture for every particle, which were used to create a ***training set***. It served to the software to **automatically classify** the organisms into the established groups: Chaetognatha, Euphausiid-like, Copepoda, Gelatinous zooplankton and Other Mesozooplankton; the inorganic particles were discarded and three different **size groups** were studied: 200-500 µm, 500-1000 µm and >1000 µm. Relations between the size and the mass of individuals were used to automatically determine the biomass.



RESULTS & CONCLUSIONS

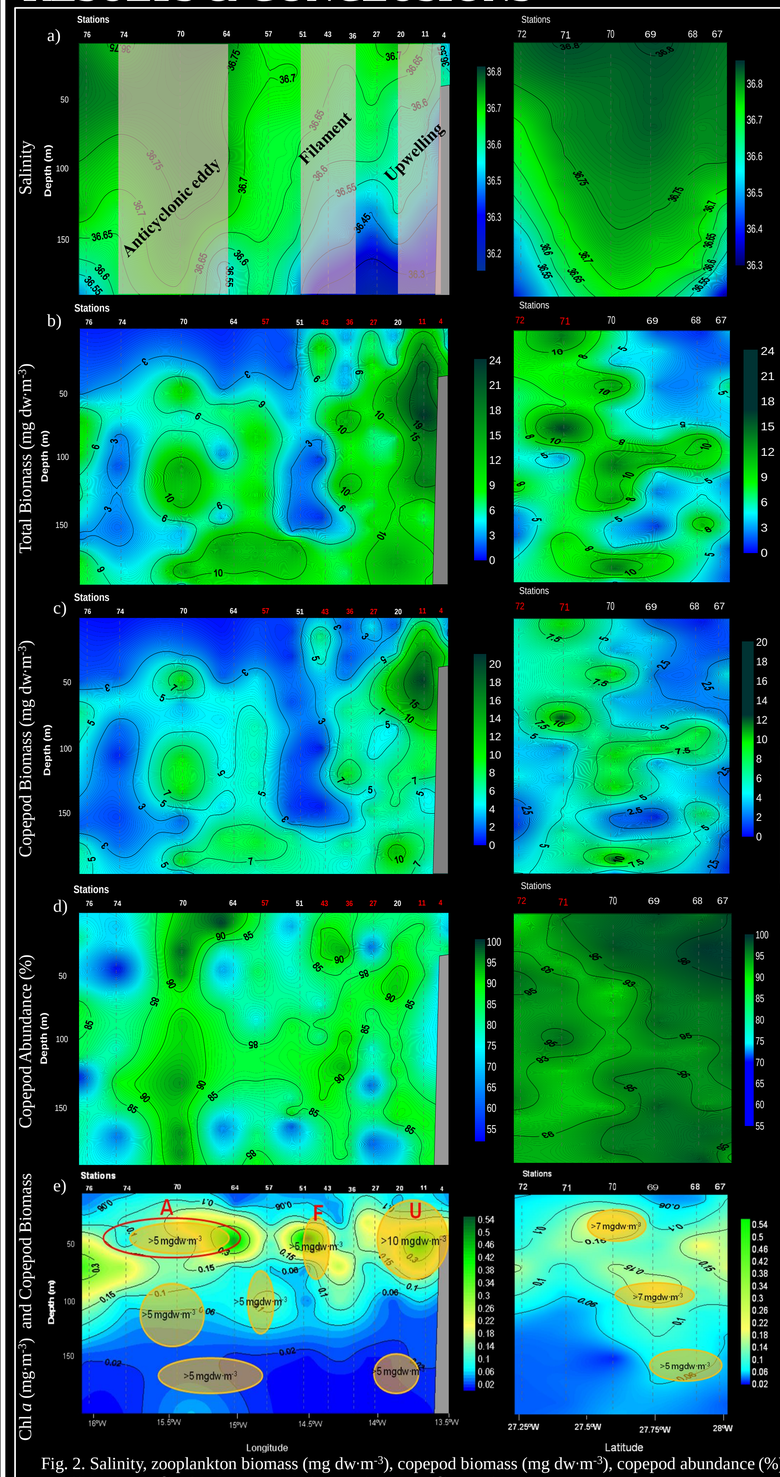


Fig. 2. Salinity, zooplankton biomass (mg dw·m^{-3}), copepod biomass (mg dw·m^{-3}), copepod abundance (%) and Chl *a* (mg·m^{-3}) with the copepod biomass (mg dw·m^{-3}) superimposed, respectively.

1) ZooImage 1 proved to be a helpful tool for this kind of studies, since it supposed a considerably time-saving procedure in comparison with the traditional methodology

2) Influence of the mesoscale structures on the zooplankton distribution

3) The upwelling filament enriched the anticyclonic eddy, promoting an increase in biomass and abundance of zooplankton offshore

4) Within the eddy the organisms were more abundant near the core, decreasing their biomass as it rotated

Abundance (%)	Total	Upwelling	Filament	Anticyclonic eddy
200-500 µm	28.2±9.1	21.1±6.3	31.7±10.5	30.9±9.5
500-1000 µm	61.1±9.1	65.7±5.6	52.4±10.3	63.2±7.9
>1000 µm	10.1±7.5	13.1±8.1	13.9±8.4	6.3±3.4

Table 1. Average (SD) abundance of the different size fractions for the total groups along the study region.

5) Zooplankton distributed following a **pattern of size**, with the largest individuals (>1000 µm) near the upwelling region and the filament, while smaller ones (200-500 µm) were more dominant offshore

6) Dominancy of the **medium-size** organisms along the study region

7) **Copepods** were the most abundant group, with predominance of small and intermediate-size fractions

8) The distribution of chlorophyll, as an indicator of the physical conditions, widely matched with the copepods biomass distribution along the transects

Abundance (%)	Total	Upwelling	Filament	Anticyclonic eddy
Copepod 200-500 µm	39.1±4.8	38.7±2.8	39.2±3.1	37.2±7.8
Copepod 500-1000 µm	40.9±8.8	37.2±2.1	36.7±3.6	49.6±12.9
Copepod >1000 µm	20.1±7.8	24.1±4.7	24.1±6.2	13.1±8.9

Table 2. Average (SD) abundance of the different size groups for copepods along the study region.

Acknowledgements
This work was supported by the ConAfrica Project (CTM2004-02319/MAR) from the Spanish Ministry of Science and Innovation . Juan C. Garijo was supported by a master grant from the Spanish Ministry of Education (nº 8858).

REFERENCES

Arístegui J., Tett P., Hernández-Guerra A., Basterretxea G., Montero M.F., Wild K., Sangrá P., Hernández-León S., Cantón M., García-Braun J.A., Pacheco M., Barton E.D. (1997) The influence of island-generated eddies on chlorophyll distribution: A study of mesoscale variation around Gran Canarias. Deep-Sea Research Part I: Oceanographic Research Papers 44:71-96.//**Arístegui J.**, Álvarez-Salgado X. A., Barton E. D., Figueiras F. G., Hernández-León S., Roy C., Santos A. M. P. (2004) Oceanography and fisheries of the Canary Current/Iberian region of the Eastern North Atlantic. In: Robinson A. R., Brink K. H. (Eds.), The Sea, vol. 14. Harvard University Press, Cambridge, MA.//**Hernández-León S.** (1988) Gradients of mesozooplankton biomass and ETS activity in the wind-shear area as evidence of an island mass effect in the Canary Island waters. Journal of Plankton Research 10(6), 1141-1154.//**Hernández-León S.** (1991) Accumulation of mesozooplankton in a wake area as a causative mechanism of the "island-mass effect". Marine Biology 109:141-147.//**Hernández-León S.**, Franchy G., Moyano M., Menéndez I., Schmoker C., Putzeys S. (2010) Carbon sequestration and zooplankton lunar cycles: Could we be missing a major component of the biological pump? Limnology and Oceanography 55:2503-2512.//**Rodríguez J.M.**, Barton E.D., Eve L., Hernández-León S. (2001) Mesozooplankton and ichthyoplankton distribution around Gran Canaria, an oceanic island in the NE Atlantic. Deep-Sea Research Part I: Oceanographic Research Papers 48:2161-2183.