

**INCREASING DOMINANCE OF THE CALYCOPHORAN SIPHONOPHORE *MUGGIAEA ATLANTICA*
IN DIFFERENT AREAS OF NORTH-WESTERN MEDITERRANEAN AND ADRIATIC SEA.
A POSSIBLE RELATIONSHIP WITH HYDROCLIMATIC CHANGES**

Licandro P. ^{1*}, Albertelli G. ¹, Batistic M. ², Carré C. ³, Daly Yahia M.N. ⁴, Daly Yahia-Kéfi O. ⁵,
Ibanez F. ³, Petrillo M. ¹, Sertorio T. ¹, Souissi S. ⁶

¹ University of Genoa, Dip. Te. Ris, Genoa, Italy - * priscilla@dipteris.unige.it

² Institute of Oceanography and Fisheries, Laboratory of Plankton Ecology, Dubrovnik, Croatia

³ Laboratoire d'océanographie de Villefranche (LOV), Station Zoologique, Villefranche-sur-mer, France

⁴ University of Bizerte, Laboratory of Environment Bio-monitoring, Hydrology and Planctology Research Group, Zarzouna, Tunisia

⁵ Institut National Agronomique de Tunisie, Unité Ecosystèmes et Ressources Aquatiques, H.P.R.G., Tunis, Tunisia

⁶ Ecosystem Complexity Research Group, Station Marine, Université des Sciences et Technologies de Lille, CNRS-UMR 8013 ELICO, Wimereux, France

Abstract

The analysis of a zooplanktonic long-term series (1974-99) in the Ligurian Sea outlined the progressive dominance of the siphonophore *Muggiaea atlantica* on the congeneric *M. kochi*. *M. atlantica*, is one of the main gelatinous carnivorous along the Ligurian coast, established with a high abundance in southern Adriatic in 1996 after a first record in February 1995. Nevertheless there is no clear evidence of a progressive expansion of this species within the Mediterranean basin considering that regular monitoring during 1993-95 in the Bay of Tunis indicated *M. atlantica* as a rare species. The relationship between increasing abundance of *M. atlantica* and hydrological changes driven by climatic forcing in the Ligurian and Southern Adriatic Sea could be hypothesised but further investigations including more extended monitoring zones are still needed.

Keywords: *Muggiaea atlantica*, *Muggiaea kochi*, *Mediterranean*, *time series*, *water temperature*

Calycophoran siphonophores are between the main planktonic carnivorous, being able to reach and maintain very high concentrations also several weeks after a phytoplankton bloom. The analysis of a zooplankton long-term series (twenty years) obtained by monitoring a coastal fixed station in the Ligurian Sea (Villefranche, Fig.1), pointed out a progressive change in the population of these gelatinous carnivorous. Weekly sampling at the point B (depth of 80-150 m) in the Bay of Villefranche-sur-mer between 1974 and 1999 (with an interruption between 1978 and 1983), allowed the observation starting from the 80s of a progressive decrease of *Muggiaea kochi* and *Abylopsis tetragona* and a contemporary increase of *Lensia subtilis* and *Muggiaea atlantica*, the latter reaching up to 4080 anterior nectophores 100 m⁻³ during the season of calycophoran's major abundance (i.e. generally late march-July).

The dominance of *M. atlantica* in the coastal Ligurian Sea during spring-early summer was confirmed by the zooplankton's fortnightly records available between 1985-1995 (no data in 1989-1990) at station C (depth of 80 m) in the Gulf of Tigullio, 40 Km east of Genoa [1]. The similarity between siphonophores populations in the two sites is not surprising as the water mass circulation in both stations B and C is principally driven by the Ligurian Current, usually directed westward.

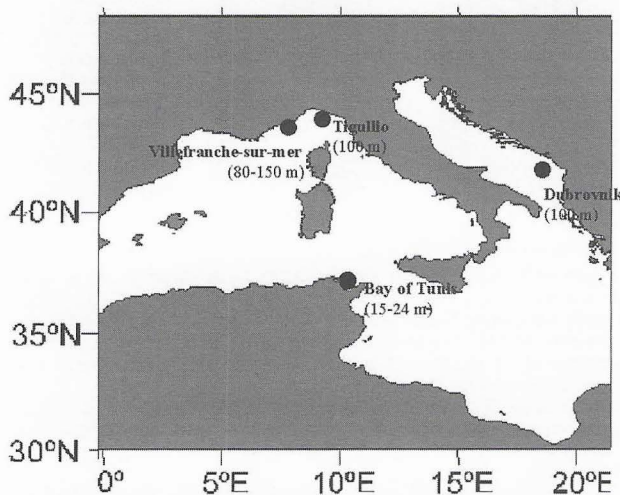


Fig.1. Map of the Mediterranean showing the different sites sampled to study calycophoran siphonophores. The monitoring stations are: Villefranche bay (43°41'N, 07°19'E); gulf of Tigullio (44°17'N; 09°16'E), Dubrovnik (42°38'N; 18°02'E) and the central stations of the Bay of Tunis (from 36°46 to 36°48'N and from 10°21 and 10°24'E). The geographical positions of these sites and the average depths (between parentheses) are shown.

A shift of dominant species within the calycophoran siphonophores was also observed in Southern Adriatic, at a coastal station near Dubrovnik (depth of 100 m) directly exposed to incoming open sea current. A high frequency sampling (each 1-3 weeks) from January to December 1996 indicated that, although it was recorded for the first time in February 1995 [2], one year later the allochthonous species *M. atlantica* was becoming dominant, representing more than 50% of total calycophorans nectophores in spring and late summer (up to 350 ant. nectophores 100 m⁻³).

The increasing importance of *M. atlantica* in both Ligurian and Adriatic Seas coincided with hydrological changes observed in the studied areas. 32 years of records (1967-1999) at Point B in Villefranche-sur-mer, indicated a decrease of water temperature from 1975 to the end of the 80s presumably related to air-sea interaction processes. As well as, water masses in Southern Adriatic from 1987 to 1997 were significantly influenced by modifications in the Ionian Sea related to the Eastern Mediterranean Transient. The latter was a transient macroscale-climatic induced phenomenon for which the replacement of the Adriatic Deep Water (ADW) by the Cretan Sea Overflow Water (CSOW) caused an upward displacement of colder waters and of the associated oxygen minimum and nutrient maximum layers [3].

One can thus hypothesises that, being *M. atlantica* more adapted to colder waters than the congeneric species *M. kochi* [4], the first took advantage on the second with a progressive dominance due to its greater reproductive efficiency.

Implementation of the above mentioned time series and continuous monitoring in other areas of Mediterranean Sea will be fundamental in order to verify this hypothesis, going further the observed changes occurred within the calycophoran siphonophores communities. Monthly sampling in the central part of the Bay of Tunis during December 1993- November 1995 for example, showed that in this coastal area of South Western Mediterranean influenced by Atlantic waters *M. atlantica* was scarce and only occasionally recorded, *Lensia subtilis*, *Lensia multicristata* and *Muggiaea kochi* being dominant. This situation could have been changed afterwards or remained stable meanwhile, suggesting that the dynamics controlling planktonic populations in this area are different.

Acknowledgements. This work is a contribution to IFB Programme 'Biodiversité et Changement Global'.

References

- 1 - Licandro P., Ibanez F., 2000. Changes of zooplankton communities in the Gulf of Tigullio (Ligurian Sea, Western Mediterranean) from 1985 to 1995. Influence of hydroclimatic factors. *J. Plank. Res.*, 22 (12): 2225-2253.
- 2 - Gamulin T., Kršinc F., 1999. Calycophores (Siphonophora, Calycophora) of the Adriatic and Mediterranean Seas. *Nat. Croat. Suppl.*, 9(2) : 1-198.
- 3 - Civitarese G., Gacic M., 2001. Had the Eastern Mediterranean Transient an Impact on the New Production in the Southern Adriatic? *Geophysical Res. Lett.*, 28(8): 1627-1630.
- 4 - Purcell J.E., 1992. Feeding and growth of the siphonophore *Muggiaea atlantica* (Cunningham, 1893). *J. Exp. Mar. Biol. Ecol.*, 62: 39-54.