Gelatinous Zooplankton along the Romanian Shelf - Qualitative and Quantitative Distribution during 2010-2013 *(George Emanuel Harcotă, Florin Timofte, Cristina Tabarcea, Elena Bişinicu)*	"Cercetări Marine" Issue no. 47 Pages 178-184	2017

GELATINOUS ZOOPLANKTON ALONG THE ROMANIAN SHELF -QUALITATIVE AND QUANTITATIVE DISTRIBUTION DURING 2010-2013

George Emanuel Harcotă*, Florin Timofte, Cristina Tabarcea, Elena Bişinicu

National Institute for Marine Research and Development "Grigore Antipa", 300 Mamaia Blvd., RO-900581, Constanta, Romania, telephone: +40 241 543288
**E-mail: gharcota@alpha.rmri.ro*

ABSTRACT

Gelatinous zooplankton plays a key role in the marine area, abundance and biomass fluctuations leading to understanding the ecosystem functions and pressures. In 2010-2013, a number of 111 samples were collected from the Southern to the Northern part of the Black Sea in order to determine the qualitative and quantitative structure and spatial distribution patterns of gelatinous zooplankton. The identified species were represented by the scyphozoan *Aurelia aurita* and the ctenophor *Pleurobrachia pileus* and non-indigenous ctenophores Mnemiopsis *leidyi* and *Beroe ovata.* The species that recorded the highest value of density was represented by *Pleurobrachia pileus,* with a maximum value in 2012, the minimal value being recorded by *Mnemiopsis leidyi* in 2010. Maximum value for biomass was recorded in 2013 by *Aurelia aurita, Beroe ovata* presenting the smallest values. The scyphozoan *Aurelia aurita* is a large species, therefore it reaches high values of biomass. Spatial distribution was influenced by the environmental factors like temperature and salinity.

Key-Words: Gelatinous zooplankton, Black Sea, density, biomass, 2010-2013.

AIMS AND BACKGROUND

Densities of gelatinous zooplankton are of particular importance, becouse while in very high values can have negative effects in low values can be considered as the "regulating factor" of the ecosystem. (Boero et al., 2008).

The paper aims to show how the gelatinous zooplankton plays an

important role in the marine ecosystem, how the density and biomass fluctuations lead to an understanding of the ecosystem functions and how the frequency of species abundance has been influenced by environmental factors like temperature and salinity.

EXPERIMENTAL

Samples were collected from 111 stations, in six expeditions carried out along the Romanian coast in period 2010-2013. The samples were collected on board the R/V Mare Nigrum belonging to the National Institute for Research and Development GeoEcoMar, respectively R/V Akademik of the Institute of Oceanology from Varna IO-BAS, Bulgaria.

Sampling was performed by vertical tows in the water column (from 2 meters above the bottom to the surface), with a Hansen net (70 cm diameter and 300 μm mesh). After sampling, the organisms were immediately measured on board: *Aurelia aurita* (diameter), *Pleurobrachia pileus* (length), *Mnemiopsis leidyi* (width, aboral length, total length), *Beroe ovata* (width, length). The wet density and biomass of gelatinous organisms were expressed as ind.m^{-3} and g.m^{-3} respectively. The calculation of these parameters was performed in accordance with formulas commonly used in the Black Sea, taking into consideration the size of organisms (Anninsky, 2009). The size classes of organisms have been classified according Mutlu, 2009.

RESULTS AND DISCUSSION

In 2010, two expeditions were made in May and September respectively. The species identified during this period were: scyphozoan *Aurelia aurita* and ctenophors *Pleurobrachia pileus*, *Mnemiopsis leidyi* and *Beroe ovata*, the last being observed only in September when he was present in all samples. In May the maximum frequency was registered only by *Pleurobrachia* while in September the only species that did not record the maximum frequency was *Mnemiopsis* (F% = 73%) (Fig. 1).

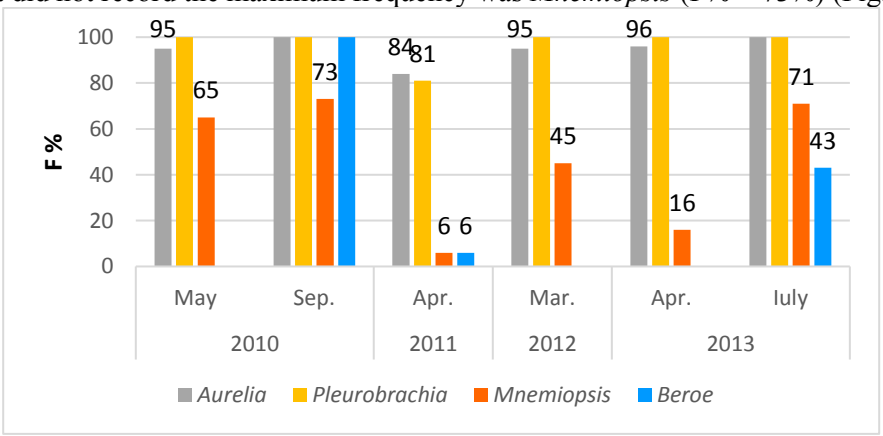

Fig. 1. Species frequency during 2010-2013.

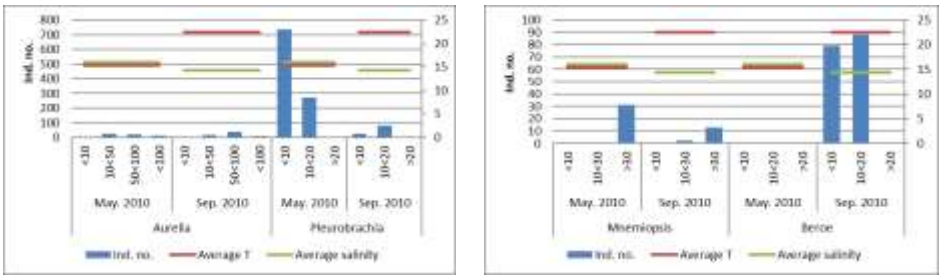

Fig. 2. Relation between size classes of gelatinous zooplankton and average temperature and salinity respectively.

a. native species b. invasive species

Table 1. Average values from 2010.

MOON	YEAR	SEASON	SPECIES	AVERAGE DENSITY ind/mc	AVERAGE BIOMASS g/mc	AVERAGE TEMPERATURE	AVERAGE SALINITY
5	2010	SPRING	*Mnemiopsis leidyi*	0.080	7.404	15.343	16.010
5	2010	SPRING	*Aurelia aurita*	0.198	7.641		
5	2010	SPRING	*Pleurobrachia pileus*	3.012	0.395		
9	2010	AUTUMN	*Mnemiopsis leidyi*	0.114	3.509	22.438	14.322
9	2010	AUTUMN	*Aurelia aurita*	0.600	11.582		
9	2010	AUTUMN	*Pleurobrachia pileus*	0.635	0.202		
9	2010	AUTUMN	*Beroe ovata*	1.393	0.885		

Pleurobrachia pileus recorded the maximum average density of 3,012 ind /m^{-3} and the biomass value of 0.395 g /m^{-3} in May its population being dominated by small individuals (< 10 mm) (Fig. 2). In September, *Beroe ovata* had a maximum average density of 1,392 ind /m^{-3} , his population being dominated by medium individuals (10<20 mm) while *Aurelia aurita* reached the maximum biomass value of 11,582 g /m^{-3} the population being dominated by class size individuals - 50<100mm (Tab.1, Fig. 2, 3).

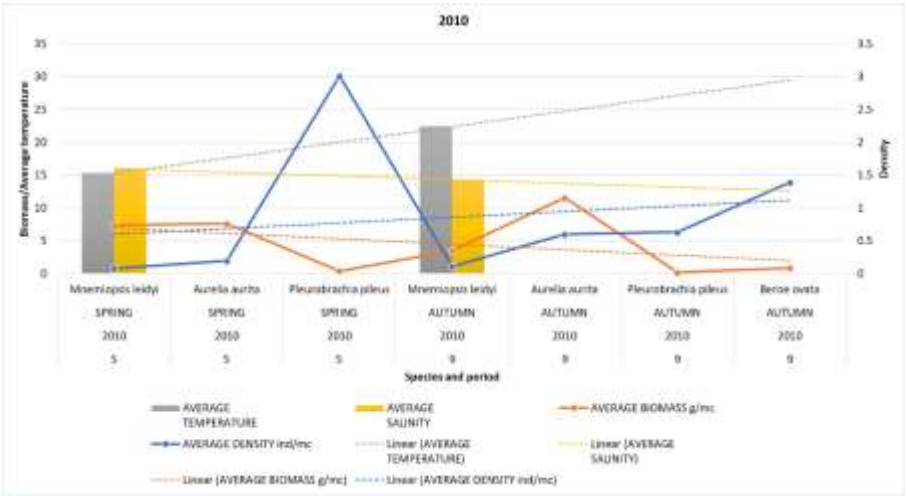

Fig. 3. Density and biomass average in 2010.

Comparing the two seasons of 2010 a variation in average density and biomass of the species can be observed in terms of temperature and water salinity, as the average temperature in the first part of the year was 15.34℃ and the salinity of 16.000 PSU was favorable to the cold water species. In the autumn season the higher water temperature with an average of 22.43℃, lead to an increase of productivity of phytoplankton and zooplankton, bringing a great supply of food for all gelatinous species. While there is no information known specifically on the species *Beroe ovata*, other ctenophores have a seasonal lifespan. One species of ctenophore lives less than a month in the summer, while lasting three months in the winter. Study on the *Beroe ovata* could find seasonally dependent numbers also due to different factors. (Kasuya, et al., 2002).

In April 2011, the native species *Pleurobrachia pileus* and *Aurelia aurita* recorded frequencies of just over 80% (Fig. 1). The highest average values of density (0.78 ind /m^{-3}) and biomass (2.6 g /m^{-3}) were recorded by *Aurelia aurita* although the dominant size class is 10<50 mm. The invasive species *Mnemiopsis leidyi* and *Beroe ovata* were identified isolated in the northern marine waters as a few large size specimens, (Fig. 4, Tab. 2). The minimum values were recorded by *Beroe ovata* with an average density of 0.001 ind/ m^{-3} and biomass of 0.008 g/ m^{-3} respectively (Fig. 5). This situation is due to the warmest marine water on the Sf. Gheorghe profile. The presence of invasive ctenophores in April with very low density and biomass values was also reported in the Black Sea (Shiganova et al., 2003).

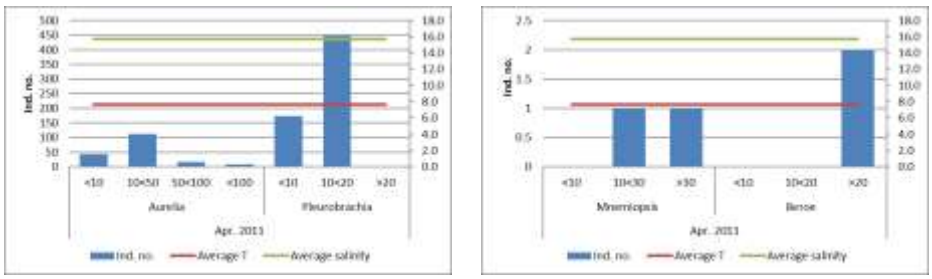

Fig. 4. Relation between size classes of gelatinous zooplankton and average temperature and salinity respectively.
a. native species; b. invasive species

Table 2. Average values from 2011.

MOON	YEAR	SEASON	SPECIES	AVERAGE DENSITY ind/mc	AVERAGE BIOMASS g/mc	AVERAGE TEMPERATURE	AVERAGE SALINITY
4	2011	SPRING	*Mnemiopsis leidyi*	0.002	0.022	7.658	15.702
4	2011	SPRING	*Aurelia aurita*	0.780	2.592		
4	2011	SPRING	*Pleurobrachia pileus*	0.675	0.181		
4	2011	SPRING	*Beroe ovata*	0.002	0.009		

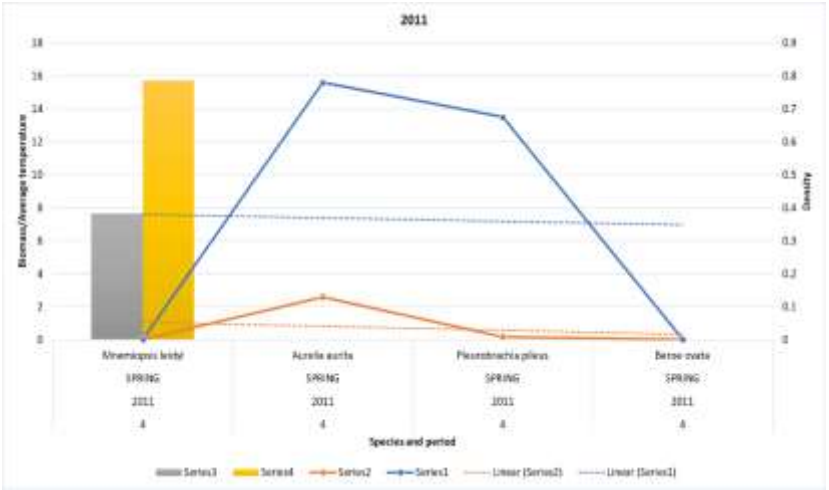

Fig. 5. Density and biomass average in 2011.

In 2012, the expedition for the macrozooplancton was carried out in March. The following species have been identified: *Pleurobrachia pileus* with a frequency of 100%, *Aurelia aurita* and the ctenophor *Mnemiopsis leidyi* (Fig. 1). *Beroe ovata* was not present in the samples this fact being normal for this period of the year due to the temperature.

Table 3. Average data from 2012.

MOON	YEAR	SEASON	SPECIES	AVERAGE DENSITY ind/ mc	AVERAGE BIOMASS g/mc	AVERAGE TEMPERATURE	AVERAGE SALINITY
3	2012	SPRING	*Mnemiopsis leidyi*	0.030	2.502	6.276	17.186
3	2012	SPRING	*Aurelia aurita*	0.756	5.637		
3	2012	SPRING	*Pleurobrachia pileus*	1.682	0.289		

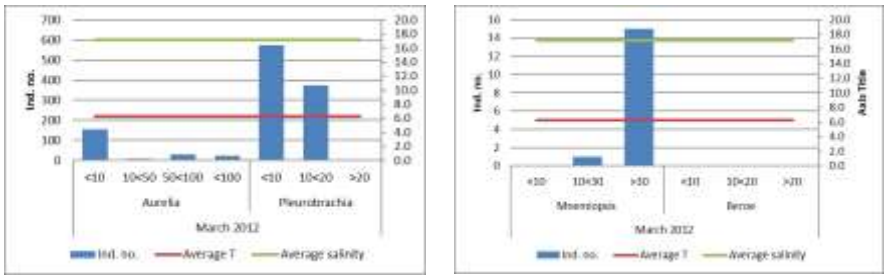

Fig. 6. Relation between size classes of gelatinous zooplankton and average temperature and salinity respectively
a. native species; b. invasive species

The maximum average density and biomass in 2012 was recorded by *Pleurobrachia pileus* with 1.682 ind/$m^{-3}$and *Aurelia aurita* riched with 5.637 g /m^{-3} although Aurelia's population was dominated by small individuals (< 10 mm) (Fig. 6,7). Similar to the situation described in 2011, *Mnemiopsis leidyi* was present in 2012 with an higher average density of 0.03 ind/ m^{-3} and a composition of more uniform size classes, at a lower temperature. *Mnemiopsis leidyi* population development is due to the absence of *Beroe ovata*. This being a natural predator and controlling the invasive population of *Mnemiopsis leidyi*,

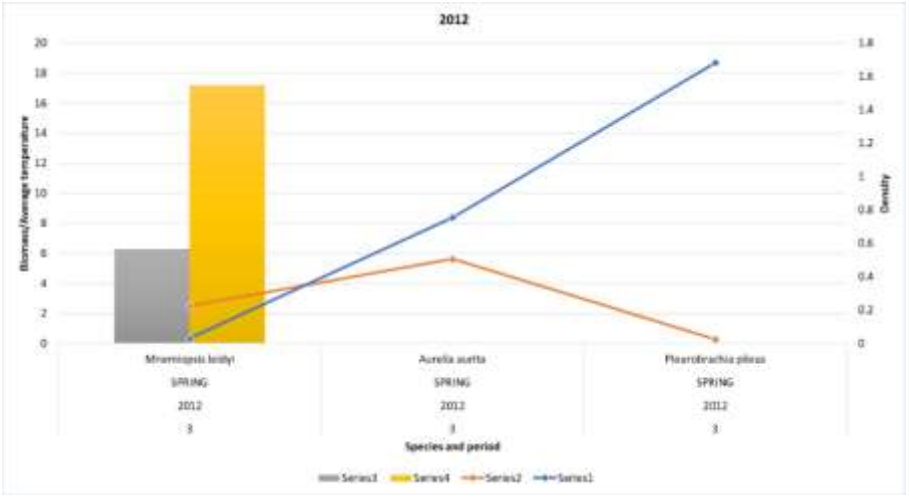

Fig. 7. Density and biomass average in 2012.

In 2013, two expeditions were made in April and July. In April, only three species were identified: *Pleuribrachia pileus* with maximum frequency, *Aurelia aurita* and *Mnemiopsis leidyi*. In July, all four species of interest, the ones mentioned above, and *Beroe ovata* (F%=43%) ctenophore, were recorded (Fig. 1).

Table 4. Average data from 2013.

MOON	YEAR	SEASON	SPECIES	AVERAGE DENSITY ind/ mc	AVERAGE BIOMASS g/mc	AVERAGE TEMPERATURE	AVERAGE SALINITY
4	2013	SPRING	*Mnemiopsis leidyi*	0.008	2.310	10.711	15.852
4	2013	SPRING	*Aurelia aurita*	0.569	8.753		
4	2013	SPRING	*Pleurobrachia pileus*	3.946	0.452		
7	2013	SUMMER	*Mnemiopsis leidyi*	0.651	4.094	23.987	16.437
7	2013	SUMMER	*Aurelia aurita*	0.385	0.470		
7	2013	SUMMER	*Pleurobrachia pileus*	4.310	0.470		
7	2013	SUMMER	*Beroe ovata*	0.159	0.315		

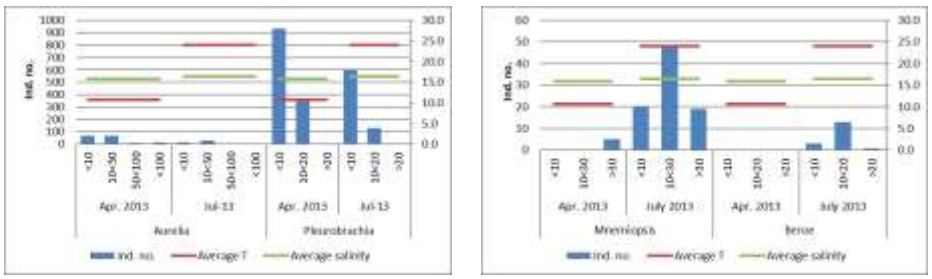

Fig. 8. Relation between size classes of gelatinous zooplankton and average temperature and salinity respectively.

a. native species b. invasive species

Pleurobrachia pileus registered the highest average density in both analyzed period (Tab.4). The maximum average biomass value of was recorded by *Aurelia aurita* (8.75g /m^{-3}) in April. and by *Mnemiopsis leidyi* (4.09 g /$m^{-3)}$ in July (Fig, 9). Also in this year *Mnemiopsis* is present in April due to higher temperature registered (Fig. 8,9).

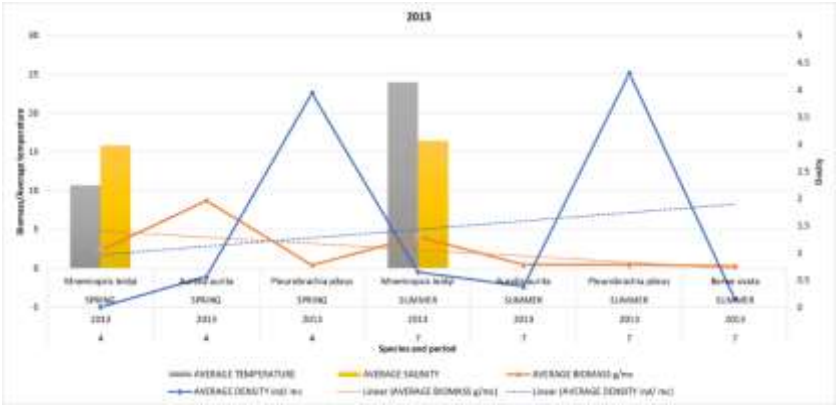

Fig. 9. Density and biomass average in 2013.

Table 5. Average data from 2010 to 2013.

Species	Average density in all years	Average biomass in all years	Average temperature in all years	Average salinity in all years
Mnemiopsis leidyi	0.147302586	3.306969817	14.40223799	15.91805482
Aurelia aurita	0.547940188	6.112724754		
Pleurobrachia pileus	2.376710339	0.331621999		
Beroe ovata	0.517746929	0.403003207		

CONCLUSIONS

Dominance of native species *Pleurobrahia pileus* (> 81%) and *Aurelia aurita* (>84%) in all analyzed seasons. *P. pileus* records the highest average density values - 2.38 ind /m^{-3}. *Aurelia aurita* records the highest average biomass values - 6.11 g /m^{-3}. Invasive *M. leidyi* and *B.ovata* species were present during the summer and autumn seasons recording values of densities and biomass in accordance with environmental factors and their life cycle. Presence of *B. ovata* in isolated big sizes specimens, in April 2011, atypical situation, due to higher temperatures and salinities from that year. The constant presence of *M. leidyi* in March and April 2011-2013 is due to a possible adaptation of the species to the thermal and salinity regime. Higher densities and biomass of *M. leidyi* from 2012 and 2013 were due to the lack of predatory species *B. ovata* in 2012 and to favorable environmental conditions in 2013.

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