Romanian Black Sea Zooplankton and Its Role in the Diet of *Sprattus* in 2016-2017 *(Elena Bișinicu, George Emanuel Harcotă, Aurelia Țoțoiu, Florin Timofte, Gheorghe Radu)*	"Cercetări Marine" Issue no. 47 Pages 185-193	2017

ROMANIAN BLACK SEA ZOOPLANKTON AND ITS ROLE IN THE DIET OF *Sprattus* IN 2016-2017

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ABSTRACT

Sprat, a small pelagic species, plays an important role in the trophic chain, being a major predator on zooplankton. This research shows the role of zooplankton and indicates the main mesozooplanktonic groups found in the stomach content of the analyzed samples. A number of 100 sprat individuals were analyzed, collected from stations along the Romanian Black Sea coast. Researches made in 2016-2017 revealed high values of fodder zooplankton, both as density and biomass. Copepods represented the major bulk of mesozooplanktonic organisms in the analysed years, the maximum value of density 11836 ind.m^3 being recorded in 2017. Meroplankton recorded the highest values of density in 2016, reaching 12772 ind.^{m3}. Cladocerans were better represented in 2016,with a maximum value of 1.2124 ind.^{m3} , other groups reaching higher values of densities and biomass in 2017 with a maximum value of 2522 ind./m^3 After analyzing the stomach content, sprat's diet composition was dominated mainly by Copepoda and meroplankton.The aim of this paper is to show the role of zooplankton in sprat feeding and to provide information regarding the trophic basis in the Romanian Black Sea area.

Key-Words: sprat, zooplankton, stomach content, trophic basis, Copepoda

AIMS AND BACKGROUND

The sprat (*Sprattus sprattus*) is a schooling clupeid fish that is widely distributed in the coastal waters of Europe, covering the Mediterranean, the Black Sea, the Baltic and the North Sea including Norwegian fjords It is a relatively small fish with a short life-span (maximum 16 cm and 5 years, respectively). It plays an important role in the trophic structure of pelagic ecosystems being a major predator on zooplankton and an abundant prey for piscivorous fish (Solberg I., et al., 2015).

In recent years, special attention has been paid to assessing the pelagic fish stock in the waters of the Black Sea coast of Romania. The annual inventory and areas where sprat form seasonally exploitable agglomerations are closely related to the extent to which the population can obtain their food (. Porumb F, Porumb I., 1982).

The availability of suitable food is usually considered to be a key factor in determining the recruitment and growth of fish (Falkenhaug T, Dalpadado P., 2014) Zooplankton communities are crucial to the functioning of marine food webs because of their sheer abundance, high diversity, and vital trophic ecosystem functions (Ginderdeuren K.V., 2013). Zooplankton have vital importance in feeding commercially valuable fish species and their larvae. (Deniz E., Gonolul A., 2016).

This study aims to characterize the mesozooplanktonic community structure and to evaluate the importance of zooplankton for the sprat's diet and it seeks to emphasize the contribution of the food items identified in the fish stomachal content.

EXPERIMENTAL

The analyzed zooplankton samples were collected along the Romanian Black Sea coast (Fig. 1) during surveys organized by NIMRD in the frame of the project "IntelliGent Oceanographically-based short-term fishery FORecastIng applicaTions" (GOFORIT) in June 2016 and April 2017.

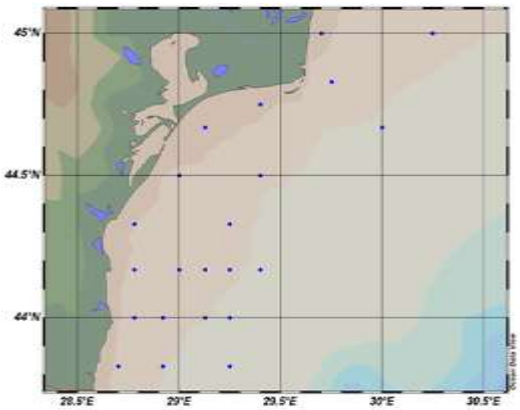

Fig. 1. Zooplankton samples collected along the Romanian Black Sea.

Sprat samples analyzed were collected along the Romanian Black Sea coast, from different stations using a special juvenile trawl and were preserved in formaldehyde 4% or frozen.

Zooplankton samples were collected using the Juday net. Small and abundant species were counted applying sub-sampling techniques, large animals were enumerated in the whole sample. Analysis of mesozooplankton samples for the study of species composition and abundance was performed in a Bogorov chamber under a dissecting stereo-microscope. (A Korshenko, B Alexandrov, 2011).

The study of the food array was performed by analyzing the gastro-intestinal content at sprat (Fig.2) and determining as accurately as possible the type of food

contained in the stomach, by determining the species or groups of species. Stomach content was determined by abdominal dissection of sprat and stomach extraction. The stomachs were weighed, dissected and the constituent food items separated and enumerated under light microscope (Fig. 2) (Totoiu A. et al., 2013).

Fig. 2. Sampling technique for stomach content.

RESULTS AND DISCUSSION

Mesozooplankton community structure

In June 2016, 11 samples were collected to analyse the mesozooplankton community from the Romanian Black Sea area. The mesozooplankton community was represented, from the qualitative point of view by 17 taxa which belong to 13 taxonomic groups (Table 1).

Table 1. Zooplankton species in 2016.

Trophic category	Generic category	Taxonomic group	Species
Nonfodder		Incr.Dinoflagellata	*Noctiluca scintillans*
Fodder	Copepoda	Ord.Calanoida	*Acartia clausi*
			Pseudocalanus elongatus
			Paracalanus parvus
			Centropages ponticus
			Calanus euxinus
		Ord.Cyclopoida	*Oithona similis*
		Ord.Harpacticoida	*Harpacticida sp.*
	Cladocera	Ord.Cladocera	*Pleopis polyphemoides*
	Meroplankton	Cls.Bivalvia	Larvae
		Cls.Maxillopoda (Balanus)	Larvae
		Cls.Gastropoda	Larvae
		Cls.Polychaeta	Larvae
		Cls.Decapoda	Larvae
	Other groups	Incr.Chaetognata	*Parasagitta setosa*
		Cls.Larvacea	*Oikopleura dioica*
		Ord.Mysida	*Mesopodopsis slabberi*

From the quantitative point of view, fodder zooplankton was the main component in the analysed samples, nonfodder zooplankton represented by *Noctiluca scintillans* reaching the highest values of density (2165 ind m^{-3}) and biomass (191 $g.m^{-3}$) only in station 1 (Fig. 3 a, b,c,d).

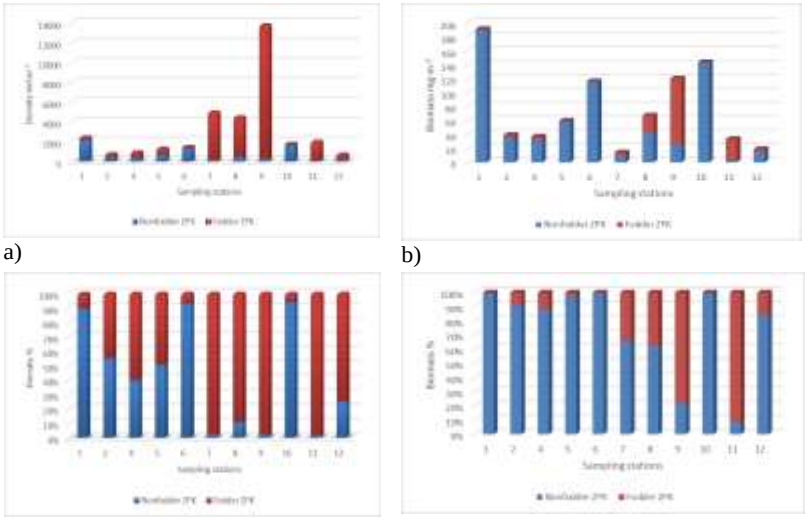

Fig. 3. Qualitative structure of total zooplankton in 2016 (a-density (ind.m^{-3}), b-biomass(mg.m^{-3}), c) density(%), d) biomass (%).

Regarding the fodder zooplankton (Copepoda, Cladocera, Meroplankton, Other groups) meroplankton was the main component, with a maximum of 12772 ind.m-3 and 87 mg.m-3 in station 9 (Fig.4). Copepoda was better represented in station 9 with values of 709 ind.m-3 and 7.7 mg.m-3. (Fig. 4 a,b,c,d)

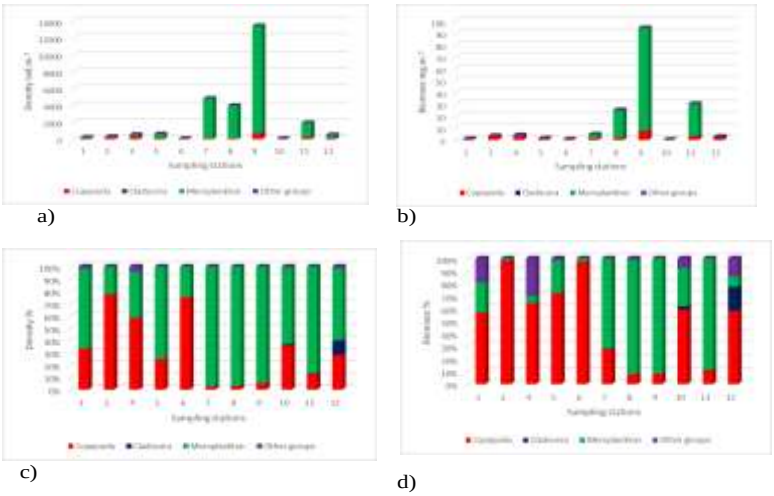

Fig. 4. Qualitative structure of fodder zooplankton in 2017 (a-density (ind.m^{-3}), b-biomass(mg.m^{-3}), c) density(%), d) biomass (%).

In April 2017, 16 samples were collected from the Romanian Black Sea area. The mesozooplankton community was represented, from the qualitative point of view by 16 taxa which belong to 12 taxonomic groups (Table 2).

Table 2. Zooplankton species identified in 2017.

Trophic category	Generic category	Taxonomic group	Species
Nonfodder		Incr.Dinoflagellata	*Noctiluca scintillans*
Fodder	Copepoda	Ord.Calanoida	*Acartia clausi*
			Pseudocalanus elongatus
			Paracalanus parvus
			Centropages ponticus
			Calanus euxinus
		Ord.Cyclopoida	*Oithona similis*
		Ord.Harpacticoida	*Harpacticida sp.*
	Cladocera	Ord.Cladocera	*Pleopis polyphemoides*
	Meroplankton	Cls.Bivalvia	Larvae
		Cls.Maxillopoda (Balanus)	Larvae
		Cls.Polychaeta	Larvae
		Cls.Decapoda	Larvae
	Other groups	Incr.Chaetognata	*Parasagitta setosa*
		Cls.Larvacea	*Oikopleura dioica*
		Ord.Mysida	*Mesopodopsis slabberi*

Fodder zooplankton was the dominant component, with the maximum value of density (13688 ind.m^{-3}) in station 1 and the maximum biomass (272 mg.m^{-3}) in station 31 (Fig. 5 a,b,c,d).

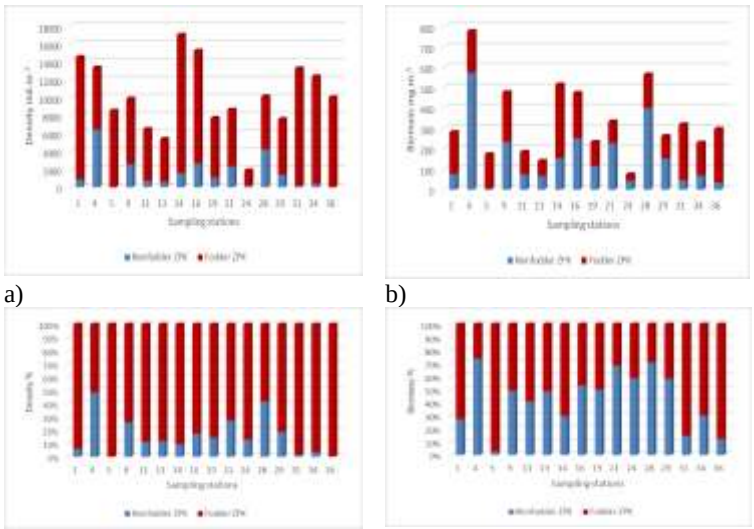

Fig. 5. Qualitative structure of total zooplankton in 2017 (a-density (ind.m^{-3}), b-biomass(mg.m^{-3}), c) density(%), d) biomass (%).

In April 2017, Copepoda constituted the bulk of the zooplankton community with the highest density value (11836 ind.m^{-3}) in station 31. Meroplankton was better

represented in station 14 with 3092 ind.m^{-3}, together with Other groups (2552 ind.m^{-3}) (Fig.6 a,b,c,d).

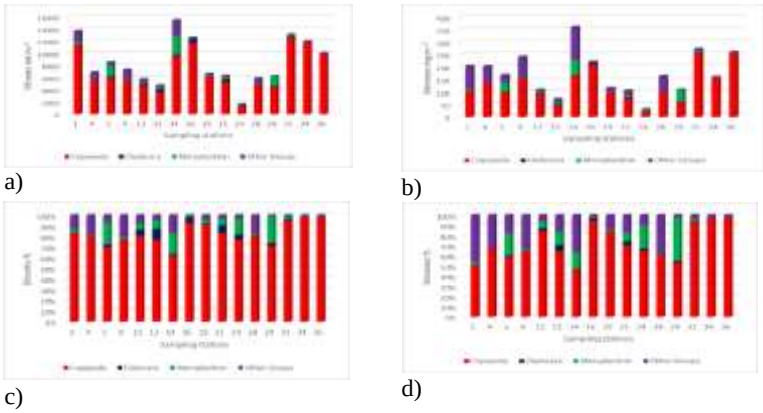

Fig. 6. Qualitative structure of fodder zooplankton in 2017 (a-density (ind.m^{-3}), b-biomass(mg.m^{-3}), c) density(%), d) biomass (%).

Zooplankton as food item for *Sprattus sprattus*

The major groups/species found in sprat stomach samples from 2016 were represented by the following:

- Copepoda
- Copepoda nauplii
- Bivalvia
- Balanus
- Balanus cypris
- *Oikopleura dioica*

Analysis of the sprat's stomachal content revealed a high consumption of Copepoda, in station 16. Another group with high values, Bivalvia, reached its peak in station. Balanus was also found in the stomachal content, being found in stations 5 and 12 (Fig.7.)

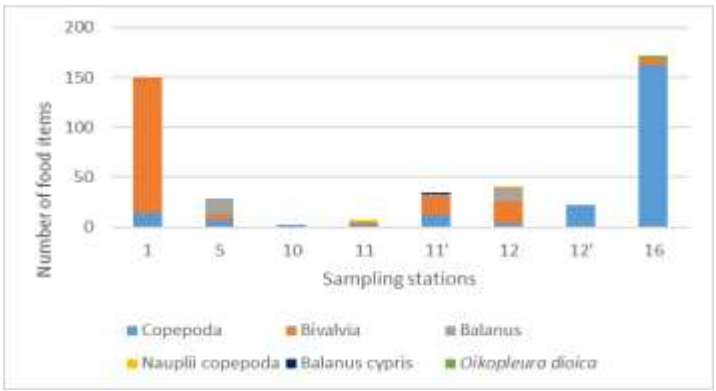

Fig. 7. *Sprattus sprattus* stomachal content in sampling stations in 2016.

Stomach content analysis made in 2016, showed that Copepoda was preferred as food source, being followed by meroplankton (Bivalvia, Polychaeta, Gastropoda,Balanus). In this case from all the meroplanktonic organisms, Bivalvia was main source food for *Sprattus sprattus,* other organisms such as Balanus nauplii and Balanus cypris stages being consumed in smaller quantities (Fig. 8.)

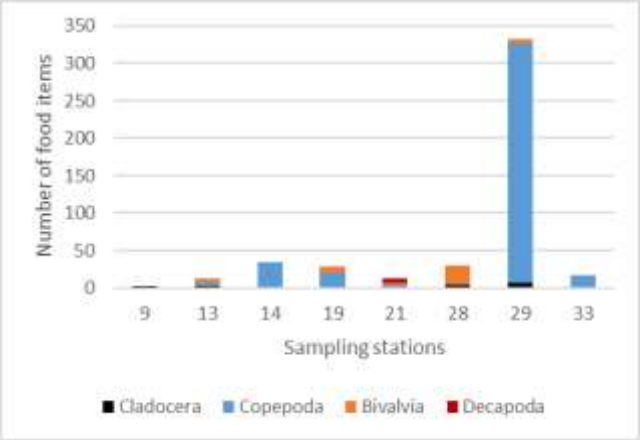

Fig. 8. Zooplankton main groups found in *Sprattus sprattus stomachal* content in 2016.

The major groups/species found in sprat stomach samples from 2017 were represented by the following:

- **Cladocera**

- **Copepoda**

- **Bivalvia**

- **Decapoda**

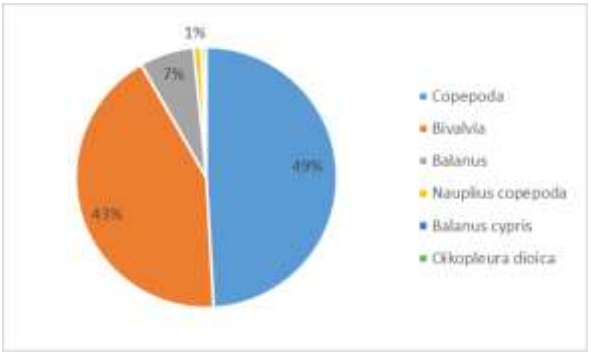

Fig. 9. *Sprattus* stomach content in sampling stations in 2017.

Stomach content analysis made in 2017 revealed that Copepoda was the main food source for *Sprattus sprattus,* with the highest values in station 29. Cladocera reached the highest value only in station 9, in the other sampling stations

recording smaller values. Another important groups found in the samples, Bivalvia, reached the highest value in station 28. Decapoda group, represented by larvae was only present in one station (21) (Fig 9.)

In 2017, Copepoda was the main source of food with a total percentage of 86%, being followed by Bivalvia, with a 10% percentage. Cladocera and Decapoda groups were poorly represented (Fig.10).

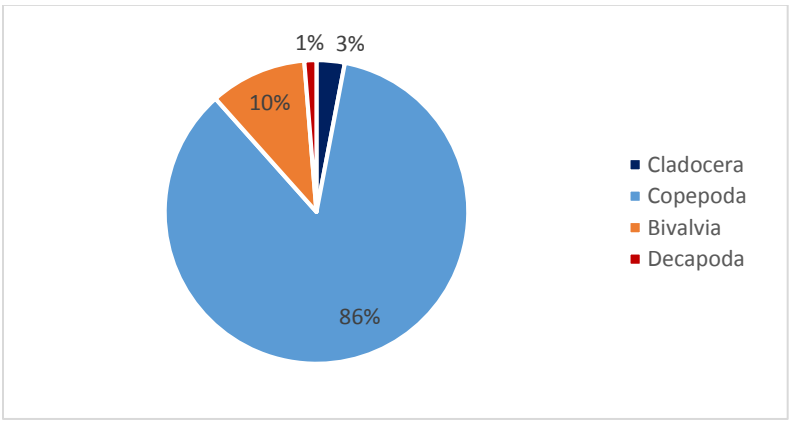

Fig.10. Zooplankton main groups found in *Sprattus sprattus* stomachal content in 2017.

Analyzing the years 2016 and 2017, it is obvious that Copepoda was the main food item consumped by *Sprattus Sprattus*, being followed by Bivalvia. In 2016, the food array was more various, being respresented by 6 groups, whereas in 2017 only 4 main groups were found.In 2016, Copepoda, together with Bivalvia were mainly consumed; in 2017 Bivalvia was consumed in smaller quantities, Copepoda being the major source of food for fish (Fig 11).

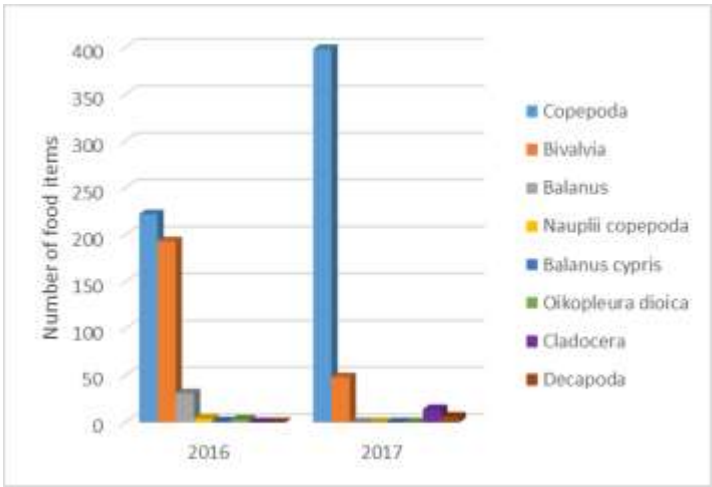

Fig. 11. Zooplankton groups consumed by *Sprattus sprattus* in 2016 and 2017.

CONCLUSIONS

In 2016 fodder zooplankton was dominant, reaching high values in almost all station analyzed, this fact leading to a great amount of food source for sprat. Meroplankton was better represented, reaching high values in all stations and in some of them representing over 90% from the fodder zooplankton. Another important group of fodder zooplankton, Copepoda, reached high values too, these two groups representing the major food source for sprat. Stomach content analysis from 2016 showed that Copepoda was preferred as food source, being followed by meroplankton (Bivalvia, Polychaeta, Gastropoda, Balanus). In this case from all the meroplanktonic organisms, Bivalvia was main source food. The zooplanktonic population from 2017 was represented by fodder zooplankton.The quantitative structure of fodder zooplankton in 2017 varied in the analyzed stations, the four trophic groups (copepoda, cladocera, meroplankton, other groups) representing the basis of the zooplanktonic component. Copepoda group recorded the highest values, being followed by meroplankton and other groups. In 2017, Copepoda was the main source of food with, being followed by Bivalvia.However, in this year Bivalvia was consumed in smaller quantities. In 2016, the food array was respresented by 6 groups, whereas in 2017 only 4 main groups were found.In 2016, Copepoda, together with Bivalvia were mainly consumed; in 2017 Bivalvia was consumed in smaller quantities, Copepoda being the major source of food for fish.

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