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NENCIU MAGDA-IOANA, SIRBU GHEORGHE, TOTOIU AURELIA, RADU GHEORGHE (2018), Forecast and Sensitivity Analysis for the Recruitment/Spawning Stock Biomass Relationship in Black Sea Sprat (*Sprattus sprattus* Linnaeus, 1758), in Book of Abstracts of the GREDIT 2018 GREEN DEVELOPMENT, INFRASTRUCTURE, TECHNOLOGY International Conference, Skopje, FYR Macedonia, 22 - 25 March 2018, ISBN 978-608-4624-27-1, p. 199;

BISINICU ELENA, HARCOTA GEORGE EMANUEL, TOTOIU AURELIA, **NENCIU MAGDA-IOANA**, TIMOFTE FLORIN, RADU GHEORGE (2018), Mesozooplankton in the Romanian Black Sea Area - Food Source for Short-Lived Fish Species, in Book of Abstracts of the GREDIT 2018 GREEN DEVELOPMENT, INFRASTRUCTURE, TECHNOLOGY International Conference, Skopje, FYR Macedonia, 22 - 25 March 2018, ISBN 978-608-4624-27-1, p. 192;

HARCOTA GEORGE-EMANUEL, TIMOFTE FLORIN, BISINICU ELENA, TOTOIU AURELIA, **NENCIU MAGDA IOANA**, RADU GHEORGHE (2018), Influence of Gelatinous Zooplankton on the Distribution of Juvenile Sprat (*Sprattus sprattus* Linnaeus, 1758) in the Northern Part of the Romanian Black Sea Coast, in Book of Abstracts of the GREDIT 2018 GREEN DEVELOPMENT, INFRASTRUCTURE, TECHNOLOGY International Conference, Skopje, FYR Macedonia, 22 - 25 March 2018, ISBN 978-608-4624-27-1, p. 194;

TOTOIU AURELIA, RADU GHEORGHE, **NENCIU MAGDA-IOANA**, PATRICHE NECULAI (2018), Overview of the Health Status of the Main Romanian Black Sea Coast Fish, in Book of Abstracts of the GREDIT 2018 GREEN DEVELOPMENT, INFRASTRUCTURE, TECHNOLOGY International Conference, Skopje, FYR Macedonia, 22 - 25 March 2018, ISBN 978-608-4624-27-1, p. 201;

TOTOIU AURELIA, RADU GHEORGHE, DANILOV CRISTIAN, **NENCIU MAGDA-IOANA** (2018), Quantitative and Qualitative Analysis of Juvenile Fish Populations of the Romanian Black Sea Coast during 2016-2017, in Book of Abstracts of the GREDIT 2018 GREEN DEVELOPMENT, INFRASTRUCTURE, TECHNOLOGY International Conference, Skopje, FYR Macedonia, 22 - 25 March 2018, ISBN 978-608-4624-27-1, p. 204.

ABSTRACTS
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QUANTITATIVE AND QUALITATIVE ANALYSIS OF JUVENILE FISH POPULATIONS OF THE ROMANIAN BLACK SEA COAST DURING 2016 -2017

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INTRODUCTION

The research of fish juveniles in the Romanian marine area contributes to the knowledge of the changes that took place in the qualitative and quantitative structure of the ichthyofauna, the behavior of the different species of fish. The biological and ethological characteristics of the species, the ecological links between commercially important species and the auxiliary species are important elements for their conservation and management. A first measure to conserve species and maintain population density is to establish the level of completion. In these conditions, the study of the distribution and abundance of juvenile fish species is an important part of determining the status of the populations of the species concerned (Radu et al., 2017).

Surveys realized along of the years confirmed that productivity oscillations, namely completion volume, are closely linked with the environmental factors variation, between which decisive are water temperature and quantity and quality of the trophic base. Through modification of the spawning intensity and completion, the fish populations create adaptations of self-control of the shoal size in concordance with degree of food ensuring (Radu et al., 2017).

A certain coincidence between growth of the fish juveniles and the growth of the trophic plankton sometimes constitute one of the most important factors which determine respective generation productivity, as shown by results obtained so far in the frame of the project "IntelliGent Oceanographically-based short-term fishery FORecastIng applicaTions" (GOFORIT) (Nenciu et al., 2016). Therefore, the level of completion of the small pelagic species stocks in the Romanian Black Sea waters has been investigated in relation to the dynamics of abiotic environmental conditions and the evolution of the zooplanktonic trophic base.

MATERIAL & METHODS

During 2016 - 2017, four research expeditions at sea were organized with the research vessel "Steaua de Mare 1" in Romanian waters, as following: in May 2016 and May 2017 - 5 working days with pelagic trawl for sprat and whiting juveniles; in September 2016 and September 2017 - 5 working days with pelagic trawl for anchovy and horse mackerel juveniles.

Sampling of juvenile fish samples was made using the pelagic trawl for juveniles by surface trawling (0-5 m) at 1.5-2 knots speed, the duration of the trawling being 15 minutes and the horizontal opening of the trawl 14 m.

144 sampling haulings with the Danilevski pelagic trawl, designed by the Institute's specialists, were performed (Fig. 1).

Fig. 1. Samplimg for small pelagic fish juveniles (2016-2017).

The biological samples were analysed in the laboratory to establish the quantitative structure of species. The results were expressed as number of specimens/hauling and specimens/Nm^2 and were used to determine the completion of each fish species reserve (Fig. 2).

Fig. 2. Laboratory processing of fish juveniles (2016-2017).

The methodologies and techniques used both for data collecting, checking, processing and analysing, and also for assessment of fish juvenile agglomerations were that usually accepted for Black Sea basin, and in compliance with international methodology (Radu et al., 2017).

ACKNOWLEDGEMENT

The research leading to the results herein presented has been undertaken in the frame of the project "IntelliGent Oceanographically-based short-term fishery FORecastIng applicaTions" (GOFORIT), funded by the Romanian Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI Contract no. 27/2015) through the ERA-COFASP Programme.

UEFISCDI COFASP ERA-net

GOFORIT IntelliGent Oceanographically-based short-term fishery FORecastIng applicaTions

RESULTS & DISCUSSION

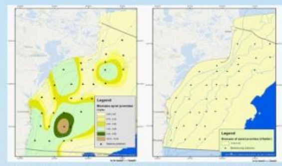

Fig. 3. Distribution of sprat juvenile agglomerations during 2016-2017.

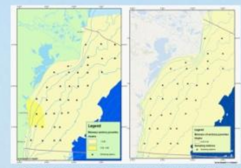

Fig. 4. Distribution and biomass of anchovy juveniles during 2016 and 2017.

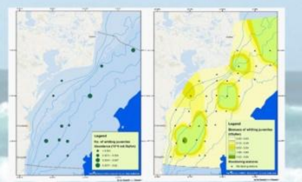

Fig. 5. Abundance (a) and biomass (b) of whiting juveniles in April 2017.

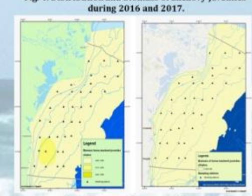

Fig. 6. Distribution and biomass of horse mackerel juveniles during 2016 and 2017.

SPRAT (*Sprattus sprattus* Linnaeus, 1758)

Biological juvenile samples were less significant in 2017 than in 2016 (Fig. 3). The estimated relative abundance for sprat juveniles in May 2017 was less than 57 times than in the same period of the previous year. Overall, sprat juvenile capture was 239 times higher in 2016 than in 2017, and its abundance of 61 times higher.

ANCHOVY (*Engraulis encrasicolus* Linnaeus, 1758)

Anchovy juveniles were more present in the samples analyzed in 2016 compared to the samples collected and analyzed in 2017 (Fig. 4). The biomass of anchovy juveniles was 79.673816 t/area surveyed in September 2016 and 10.588375 t/area surveyed in September 2017. Average catches ranged from 0.024296 t/Nm^2 in 2016 and 0.003228 t/Nm^2 in 2017.

WHITING (*Merlangius merlangus euxinus* Nordmann, 1840)

The whiting juveniles were present in 12 stations out of the 36 collected samples (Fig. 5). The total abundance was 0.00184/10^6 ind./Nm^2 on an area of 3279,202 Nm^2.

HORSE MACKEREL (*Trachurus mediterraneus ponticus* Aleev, 1956)

The horse mackerel juveniles biomass was higher in the southern part of the Romanian coast in September 2017, but with very low values over the same period analyzed in 2016 (Fig. 6). The biomass of horse mackerel juveniles was 94.311224 t/area surveyed in September 2016 and 22.113067 t/area surveyed in September 2017. Average catches ranged from 0.02876042 t/Nm^2 in 2016 and 0.00674 t/Nm^2 in 2017.

JELLYFISH

At the same time, in 2017, the total biomass of jellyfish in the area investigated was 12.7 times higher than in 2016, reaching 268,345 tons (Fig. 7). The overal jellyfish average in 2017 (t/Nm^2) was 18 times higher at depths exceeding 30 m. The barrel jellyfish *Rhizostoma pulmo* recorded very high biomass values in the northern part of the Romanian coastal zone (Fig. 8), strongly correlared with low biomass of fish juveniles.

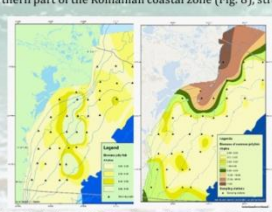

Fig. 7. Distribution of jellyfish agglomerations during 2016 and 2017

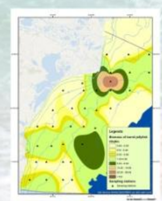

Fig. 8. Distribution of barrel jellyfish agglomerations during 2016 and 2017.

CONCLUSIONS

Using observations recorded in 2016 and 2017, it can be said that the state of the fish stock is quite unstable, with major fluctuations from one year to another, caused by environmental modification and fishing pressure on the fish population. The fluctuations are determined both by environmental modification and fishing pressure on the sprat population, implicitly on spawning stock. The presence of competitors for food but also the temperature during reproduction may be the most important causes for reductions in the number of juveniles. The appearance of *Rhizostoma pulmo* jellyfish in a very large quantity, a major competitor for food, may be one of the main causes for the decrease in the number of horse mackerel and anchovy juveniles. The environmental conditions existing at the Romanian littoral allowed the formation and maintenance of very large agglomerations of gelatinous species, especially common jellyfish and barrel jellyfish. These short life pelagic species need environmentally friendly reproductive growth and development conditions, as well as commercial fishing measures for ensuring restocking and growing stocks.

REFERENCES

NENCIU MAGDA-IOANA, ȚOȚOIU AURELIA, GALAȚCHI MĂDĂLINA, DANILOV CRISTIAN, RADU GHEORGHE (2016), Black Sea Sprat Case Study in the Frame of the GOFORIT Project - "Intelligent Oceanographically-Based Short-Term Fishery Forecasting Applications", in Proceedings of the 16th International Multidisciplinary Scientific Geoconference SGEM 2016 on Water Resources, Forest, Marine and Ocean Ecosystems, 30 June - 6 July 2016, Albena, Bulgaria, Volume II, Book 3, p. 711-718;

RADU GHEORGHE, ȚOȚOIU AURELIA, DANILOV CRISTIAN SORIN, SPÎNU ALINA DAIANA, NENCIU MAGDA-IOANA (2017), Distribution and Abundance of Sprat Juveniles in the Romanian Marine Area during 2016-2017, in Cercetari Marine (Recherches Marines), Issue 47/2017, ISSN 0250-3069, p. 194-204;

OVERVIEW OF THE HEALTH STATUS OF THE MAIN ROMANIAN BLACK SEA COAST FISH

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INTRODUCTION

Several natural and anthropogenic factors act on fish populations, reducing their abundance. In populations in the natural environment, it is difficult to isolate and quantify the effects of any of these factors on the size of the stock, such as predator destruction, lack of food or diseases. By diseases we understand a complex of phenomena and organic manifestations in interrelation with a pathogenic factor, from the moment of contact and until the consequences disappear. One of the major causes of illness can be pollution of seawater, by domestic and industrial discharges, which often leads to losses in the ichthyofauna, especially as a result of asphyxia and intoxication. Bacteria and parasite infestations are also a major issue of concern.

Depending on the nature of the pathogens encountered in turbot, as with other animal organisms, there are specific diseases caused by pathogens (viruses, bacteria, parasites) and non-specific diseases caused by physicochemical, nutritional and constitutional agents. Diseases caused by bacteria are frequent in the demersal fish populations at the Romanian coast, which constitutes a permanent threat to the health of fish stocks. The gravity of a bacteriosis is directly related to the infected dose and to the receptivity of the fish (Radulescu et al., 1976).

Parasitic diseases of marine fish are caused by animal parasites - protozoa, worms and crustaceans. Sources of invasive disease can be sick fish, parasitic fish, infested fish corpses. The invasions spread with parasitic fish through their feeding and spawning migrations, the intermediate hosts of various parasites, specific vectors through water (where parasites often not only survive well, but also multiply) and, finally, by direct contact (Sinderman, 1987).

Although parasitism is common in fish, parasitic diseases manifest themselves only in environmental conditions that allow for the multiplication of parasites and in habitats that favor the transmission of parasites and the persistence of carriers or intermediate hosts (Bagge, et al., 2004).

MATERIAL & METHODS

For the identification of infectious-contagious and parasitic diseases, the biological material consisted of the fish collected along the Romanian coast, from Sulina to Vama Veche (Fig. 1). Between 10 and 20 individuals of fish were tested, depending on the availability of biological material, but also on isolated specimens in the case of turbot, sprat, anchovies and horse mackerel.

The identification of bacteria causing infections in marine fish is carried out by performing cultures from the main affected organs of the fish, especially the liver, blood, kidneys, and internal and external bleeding lesions.

In order to determine the parasitoses, macroscopic and microscopic examinations are carried out on the fish, with the aim of identifying the parasite and the reactions they can cause on the hosts (Amlacher, 1981).

The macroscopic examination was made by naked eye, on the oral cavity, gills and abdominal cavity, where each organ was studied to emphasize potential necrosed areas, cysts, parasites, color changes and other modifications visible by naked eye.

The parasites were viewed with a 10 lens and the 5 and 10 oculars. For the microscopic examination, full preparations were used (small portions of tissues and organs), as well as crushed preparations (squashes) between the blade and the lamella, making the film formed translucid and as thin as possible, allowing the sighting of potential parasites (Fig. 1).

Fig. 1. Identification of bacteria and parasites in fish.

RESULTS & DISCUSSION

The results of the analyzes revealed the presence of cutaneous fibroma, pathogenic bacteria Aeromonas, *Vibrio* (Fig. 4) and *Pseudomonas* (Fig. 3) and the parasites *Trichodina domerguei* Fig. 5.1), *Botriocephalus scorpii* (Fig. 5.2) and *Contracaecum aduncum* (Fig. 5.3).

Cutaneous fibroma has been revealed in a total of 10 specimens of the 30 analyzed. Their presence may be due to environmental conditions, but also to genetic predispositions, this neoplasia being very common over the years i turbot fished at the Romania coast (Fig. 2).

Fig. 2. Turbot individuals affected by skin fibroma.

In a small number of specimens, the three pathogenic bacterial species have been found. They can cause serious illnesses in the populations of turbot. However, infections occurring in the natural environment can not be quantified and evaluated as in the intensive culture medium.

Fig. 3. *Pseudomonas sp.*

Fig. 4. *Vibrio sp.*

ACKNOWLEDGEMENT

The research leading to the results herein presented has been undertaken in the frame of the project "IntelliGent Oceanographically-based short-term fishery FORecastIng applicaTions" (GOFORIT), funded by the Romanian Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI Contract no. 27/2015) through the ERA-COFASP Programme.

RESULTS & DISCUSSION

The three species of parasites present in turbot affected the gills, the liver and the digestive tract. The massive presence of the *Botriocephalus scorpii* worm in some specimens, occupying the entire stomach, caused its lesion and inflammation, mucosal epithelium desquamation, and the toxic substances released by the worms are absorbed and produce intoxication of the whole organism.

The ciliate *Trichodina domerguei* has affected the skin and gills causing erosions of the skin, punctures, ulcerations in the gills, inflammation thereof, destruction of the gill respiratoryr epithelium, abundance of mucus (Table 1).

Table 1 - The degree of parasite of turbot

No. crt.	Parasite species	Invasion extension % infested fish	Invasion intensity No. of parasites/host - %
Clasa *CILIATA*			
1.	*Trichodina domerguei*	0 – 25/ slide	0 - 70
Clasa *CESTODA*			
2.	*Bothriocephalus scorpii*	0 – 100/slide	0 - 100
Clasa NEMATODA			
3.	*Contracaecum aduncum*	0 – 5/ slide	0 - 30

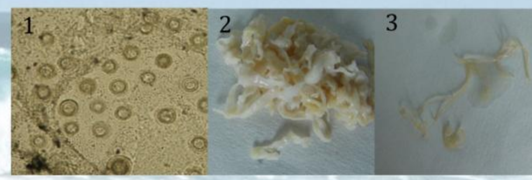

Fig. 5. Parasites identified in investigated fish.

In the fish populations of sprat, anchovies and horse mackerel through the dissections performed, nematodes were found, especially in the form of larvae, and the effects on the affected organs and tissues were assessed.

Contracaecum aduncum parasites the viscera, encapsulated or free in the abdominal cavity, the intestine, the piloric appendage and fish liver. With the aging of the fish, there is an accumulation of larvae, which is why they can reach up to several hundreds/fish.

Porocaecum sp. larvae are located in the muscles near the abdominal cavity of the fish, with increasing the number of parasites along with increasing fish size

Anisakis sp. larvae, immobile nematode worms, parasite encapsulated in the liver, piloric appendages and/or in their mobile form they migrate into various organs of the body, muscles, gonads.

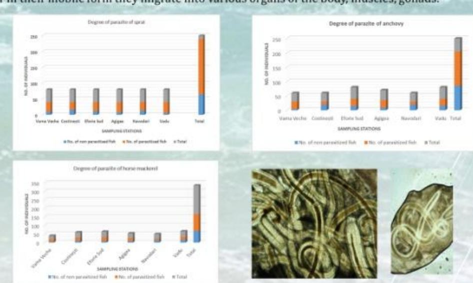

Fig. 6. Degree of parasite infestation in sprat, anchovy and hoste mackerel.

CONCLUSIONS

The analyzes revealed the presence of constitutional diseases, bacterial and parasitic diseases in the fish populations along the Romanian coast, which demonstrates that their health status is affected due to the environmental conditions and historic accumulations of toxins in the sediment. A small number of specimens have been analyzed and we can not tell whether the population is affected to a minor or major extent and what are the effects of these in the natural environment.

The average parasitic intensities in sprat, anchovy and horse mackerel ranged from 9 to 26 parasites/host in large individuals and 2-8 parasites / host in small individuals and mean abundance recorded values from 4 to 13 parasites/fish in large individuals and 2-6 parasites/host, in small individuals. These data confirm the idea of accumulation of nematodes in the fish body with their age increase, causing a change in their health, but without severely affecting the natural populations.

REFERENCES

Radulescu I., Lustun L., Voican I., 1976. Bolile pestilor, Editura Ceres, Bucuresti, 261 p.;

Sinderman C., 1987, on line 2002. Effects of parasites on fish population: Practical Agricultural Management, Vol. XI (2), pp. 53-57;

Amlacher E., 1981. Taschenbuch der Fishkrankheiten, VEB Gustav Fisher Verlang Jena, pp. 1- 474

Bagge A.M., Poulin R., Valtonen E.T., 2004. Fish population size, and not density, as the determining factor of parasite infection: a case study, 128 (Pt3), pp. 305 - 313;

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MESOZOOPLANKTON IN THE ROMANIAN BLACK SEA AREA - FOOD SOURCE FOR SHORT-LIVED FISH SPECIES

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INTRODUCTION

Mesozooplankton, the dominant trophic link between primary production and fish, represents the trophic base for short-lived fish species. The availability of suitable food is usually considered to be a key factor in determining the recruitment and growth of fish[1]. Zooplankton communities are crucial to the functioning of marine food webs because of their sheer abundance, high diversity, and vital trophic ecosystem functions[2].

MATERIAL & METHODS

The analyzed zooplankton samples were collected with the Juday net along the Romanian Black Sea coast (Fig. 1) in June & September 2016 and April & September 2017.
Sprat samples were collected along the Romanian Black Sea coast, using a special juvenile trawl and were preserved in formaldehyde 4% or frozen. The study of the food array (Fig. 2) consisted of a complete identification of the organisms in the gut content[3] and determining as accurately as possible the type of food contained in the stomach.

Fig. 2. Stomach content analysis

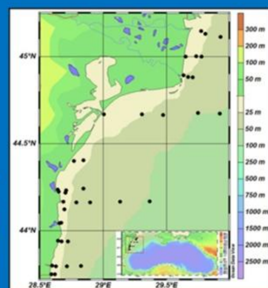


Fig.1. Map of the study area

Table 1. List of identified taxa

Trophic category	Generic category	Taxonomic group	Species	2016 June	2016 September	2017 April	2017 September
Nonfodder		Incr. Dinoflagellata	*Noctiluca scintillans*	*	*	*	*
Fodder	Copepoda	Ord. Calanoida	*Acartia clausi*	*	*	*	*
			Pseudocalanus elongatus	*	*	*	*
			Paracalanus parvus	*	*	*	
			Centropages ponticus	*	*	*	*
			Calanus euxinus	*		*	
		Ord. Cyclopoida	*Oithona similis*	*	*	*	*
			Oithona davisae		*		
		Ord. Harpacticoida	*Harpacticoida sp.*	*		*	
	Cladocera	Cladocera	*Pleopis polyphemoides*	*	*	*	*
			Evadne spinifera		*		*
			Penilia avirostris		*		*
			Pseudevadne tergestina		*		*
	Meroplankton	Cls. Bivalvia	Larvae	*	*	*	*
		Cls. Gastropoda	Larvae	*	*		*
		Cls. Polychaeta	Larvae	*	*	*	*
		Cls. Cirripedia	Balanus	*	*	*	*
		Cls. Decapoda	[illegible]		*	*	*
	Other groups	Incr. Chaetognatha	*Parasagitta setosa*	*	*	*	*
		Cls. Larvacea	*Oikopleura dioica*	*	*	*	*
		Ord. Mysida	*Mesopodopsis slabberi*	*		*	

RESULTS & DISCUSSION

In the analysed period, the mesozooplankton community was respresented by 21 species, Copepoda and Meroplankton recording the highest number of species (Table 1).

In June 2016, the total zooplankton community was represented mainly by fodder zooplankton. Meroplankton, together with Copepoda constituted the major bulk of the zooplankton community (Fig. 3).

In September 2016, fodder zooplankton reached high density and biomass values in all the analyzed sampling stations. Copepoda was best represented, being followed by Cladocera (Fig. 4).

In April 2017, fodder zooplankton was again dominating, as well as Copepoda, with high values in all sampling stations. (Fig. 5)

In September 2017, the same situation is recorded: fodder zooplankton with high values and Copepoda as the main group (Fig. 6).

Fig .3. Mesozooplankton community structure in June 2016

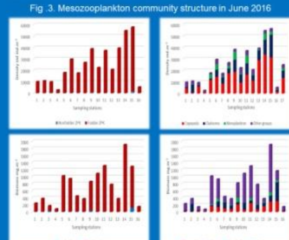


Fig. 4. Mesozooplankton community structure in September 2016

Fig. 5. Mesozooplankton community structure in April 2017

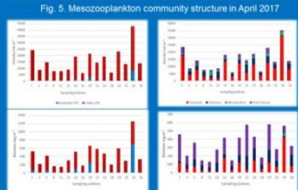
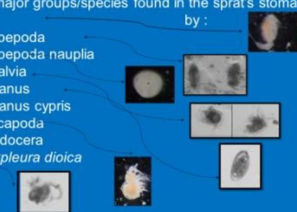


Fig .6. Mesozooplankton community structure in September 2017

RESULTS & DISCUSSION

The major groups/species found in the sprat's stomach were represented by :

- Copepoda
- Copepoda nauplia
- Bivalvia
- Balanus
- Balanus cypris
- Decapoda
- Cladocera
- *Oikpleura dioica*



In 2016 and 2017, Copepoda was preferred as food source, being followed by meroplankton-Bivalvia (Fig 7, 8). However, in 2017 the percentage for Copepoda was higher than in 2016, and lower for Bivalvia. Meroplankton larvae can represent an important food component, especially in the young individuals' diet[4]. In 2016, meroplankton was better represented than in 2017,the number of identified food items being higher, but with smaller values than in 2017 (Fig. 9).

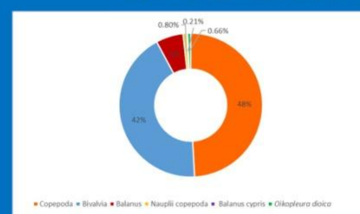


Fig. 7. Zooplankton main groups found in *Sprattus sprattus* stomach content in 2016

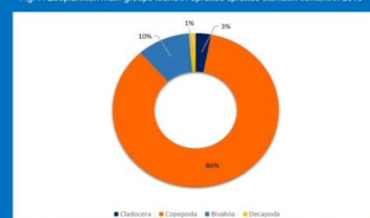


Fig. 8. Zooplankton main groups found in *Sprattus sprattus* stomach content in 2017

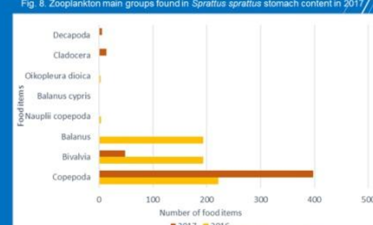


Fig. 9. Food items in 2016-2017

CONCLUSIONS

Fodder zooplankton was best represented both in 2016 and 2017, *Noctiluca scintillans* (nonfodder) reaching low values of density and biomass.
In June 2016, meroplankton constituted the major bulk of the community while in September Copepoda was better represented.
In 2017, both in April and September, Copepoda represented the main group of the community, being followed by meroplankton and other groups.
In 2016 and 2017 sprat preferred Copepoda and meroplankton (Bivalvia) as main food source. However, in 2017 the consumption of Copepoda was much higher than in 2016 while Bivalvia was consumed in lower quantities.

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The research leading to the results herein presented has been undertaken in the frame of the project "IntelliGent Oceanographically-based short-term fishery FORecastIng applicaTions" (GOFORIT), funded by the Romanian Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI Contract no. 27/2015) through the ERA-COFASP Programme.

REFERENCES

1. Falkenhaug T., Dalpadado P. :Diet composition and food selectivity of sprat (*Sprattus sprattus*) in Hardangerfjord, Norway, Marine Biology Research, Vol. **10**, No. **3**, 203-215 (2014)
2. Ginderdeuren K.V. :Zooplankton and its role in North Sea food webs: Community structure and selective feeding by pelagic fish in Belgian marine waters, Institute for Agricultural and Fisheries Research ILVO 226 (2013)
3. I. Ahlbeck, S. Hansson., O. Hjerne.: Evaluating Fish Diet Analysis Methods By Individual-based Modeling. Can J. Fish Aquat. Sci 69: 1184 -1201 (2012)
4. V. Mihneva, V. Raykov, A. Grishin, K. Stefanova: Sprat Feeding In Front Of The Bulgarian Black Sea Coast, MEDCOAST 2015: Vol1, Zoology, 179-181 (2015)

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INFLUENCE OF GELATINOUS ZOOPLANKTON ON THE DISTRIBUTION OF JUVENILE SPRAT (*Sprattus sprattus* Linnaeus, 1758) IN THE NORTHERN PART OF THE ROMANIAN BLACK SEA COAST

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INTRODUCTION

Gelatinous zooplankton plays an important role in the Black Sea ecosystem, with variations of density influenced by temperature, water mass flow and food. Many of these species feed on mesozooplankton and fish larvae (Bisinicu et al., 2017). Densities of gelatinous zooplankton are of particular importance, because ,while in very high values, it can have negative effects, in low values it can be considered as the "regulating factor" of the ecosystem (Harcota et al., 2017). Comparing the abundance and distribution of sprat juveniles with gelatinous zooplankton, a clear negative correlation emerges: whenever gelatinous zooplankton is highly abundant, sprat juveniles' abundance drops. However, other environmental parameters (e.g. temperature) must also be taken into consideration.

MATERIAL & METHODS

In April 2017, gelatinous zooplankton samples were collected from 4 stations from the northern part of the Romanian Black Sea coast (Fig. 1). The presence of sprat juveniles and gelatinous zooplankton varied from one station to another, with three stations in which they were not present, namely the stations located in the northern part of the coast (Gura Portiței).

Zooplankton samples were taken with the Hansen net, from the depths between 10 and 35 meters in the northern part of the Black Sea at the Romanian coast in 2017 (Fig. 6).

Gelatinous zooplankton samples were analyzed aboard the ship. The species identified are represented by the scyphozoan *Aurelia aurita*, and the ctenophores *Pleurobrachia pileus*, *Mnemiopsis leidyi* and *Beroe ovata*.

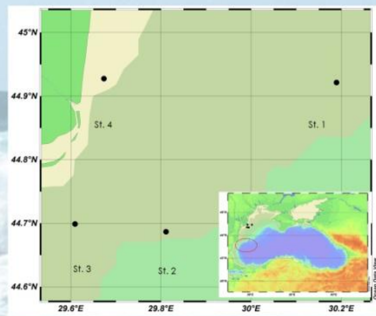

Fig. 1. Stations from the northern part of the Romanian Black Sea coast.

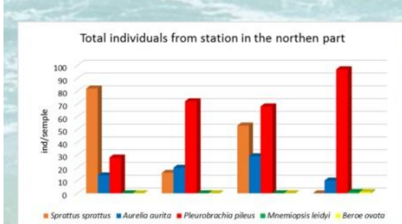

Fig. 2. Total number of species sampled from the northern part.

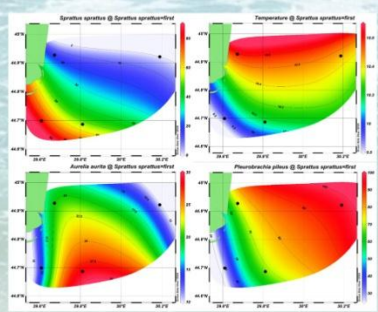

Fig. 3. Distribution of investigate species from the northern part of the Romanian Black Sea coast.

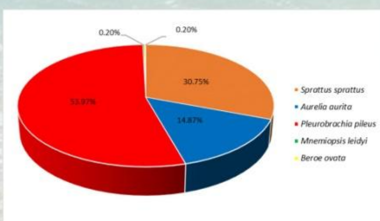

Fig. 5. Total density in percentages of all species identified.

The maps have been produced with the Ocean Data View software (Fig.1, 3).

The maximum density, with a value of 97 ind./sample of *Pleurobrachia pileus* was observed in Station 1 (Fig. 2), correlated with an absence of juvenile sprats, knowing that *P. pileus* is a consumer of fish egg and larvae. In Station 3 (Fig. 3) the maximum density reached 83 ind./sample and the density of the gelatinous zooplankton was very low, which led to an increase in the density values of juvenile sprats (Fig 1, 2, 3, 4).

The *Mnemiopsis leidyi* and *Beroe ovata* ctenophores had the density of 1 individual in all analyzed samples, before the peak development season of these ctenophores.

RESULTS & DISCUSSION

The gelatinous zooplankton recorded the maximum density values for *Pleurobrachia pileus* - 265 individuals in the whole sample - and *Sprattus sprattus* recorded density values of just 151 individuals in the whole sample.

The maximum biomass was recorded by the scyphozoan *Aurelia aurita* and the maximum density was recorded by the ctenophore *Pleurobrachia pileus (Fig. 5).*

Surveys realized along of the years confirmed that productivity oscillations are closely linked with the environmental factors variation, between which decisive are water temperature and quantity and quality of the trophic base. More or less diversified adaptations give fish populations as many means of responding to fluctuations in environmental factors. *Pleurobrachia pileus*, almost ghostly appearance, are voracious predators, feeding on fish eggs and larvae, mollusks, copepod crustaceans, and even other *P. pileus*, where we can explain the lower number of sprat juveniles.

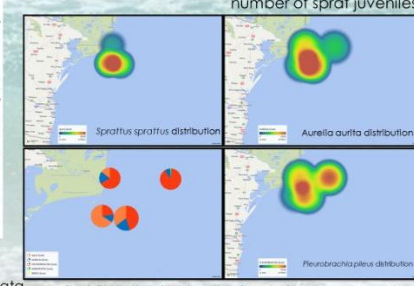

Fig. 4. Distribution of total number of species from the northern part.

Fig. 6. The Hansen net and gelatinous zooplankton.

CONCLUSIONS

The very high densities of the ctenophore *Pleurobrachia pileus* (Station 1) were correlated with the absence of *Sprattus sprattus*. Sprat juveniles were concentrated in Station 3, where the temperature was lower than in the other stations, and the density of the gelatinous zooplankton was also lower.

Overall, where there was a high density of *Preurobrachia pileus* and *Aurelia aurita*, there was a low density or absence of sprat juveniles, which clearly indicates a significant influence of gelatinous zooplankton on small pelagic fish species.

ACKNOWLEDGEMENT

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REFERENCES

Bișinicu E., Harcotă G.E., Țoțoiu A., Timofte T., Radu G. (2017), Romanian Black Sea Zooplankton and its Role in the Diet of Sprattus in 2016-2017, in Cercetari Marine (Recherches Marines), Issue 47/2017, ISSN 0250-3069, p. 185-193;

Harcotă G.E., Timofte F., Tabarcea C., Bișinicu E. (2017), Gelatinous Zooplankton along the Romanian Shelf - Qualitative and Quantitative Distribution during 2010-2013, in Cercetari Marine (Recherches Marines), Issue 47/2017, ISSN 0250-3069, p. 178-184.

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FORECAST AND SENSITIVITY ANALYSIS FOR THE RECRUITMENT/SPAWNING STOCK BIOMASS RELATIONSHIP IN BLACK SEA SPRAT (*Sprattus sprattus* Linnaeus, 1758)

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INTRODUCTION

Fisheries for short-lived species such as sprat are highly variable because they primarily target a low number of age groups within stocks, as well as irregularly recruiting year-classes. As a result, environmental oscillations, which cause major changes in fish productivity, can lead to quick changes in fishing opportunities and stock declines if fishing effort is not reduced accordingly. Such fluctuations are not foreseen or accommodated by management advisory frameworks for sprat fisheries, which generally assume environmental stability and constant productivity. Like most pelagic species, sprat stocks have been heavily influenced by variations in environmental conditions. In recent years, the sprat catches from the Romanian coast of the Black Sea have fluctuated, registering an upward light trend (maintaining around 100 tons). In this context, this paper summarizes the results obtained in the frame of the project **"IntelliGent Oceanographically-based short-term fishery FORecasting applicaTions" (GOFORIT)**, which aims to identify links between the ecology of short-lived fish species (sprat in this case) and climate and oceanographic conditions.

MATERIALS AND METHODS

Table 1: Datasets used

Parameter	Time series	Seasons	Area	Data source
Phytoplankton	1990-2014	Spring, summer, autumn	Central area RO	NIMRD database
Zooplankton	1990-2014	Spring, summer, autumn	Central area RO	NIMRD database
Zooplankton	1980-1999	all	West	Turkey
Zooplankton	1997-2013	all	West	Turkey
Temperature	1963-2014	all	Central area RO	NIMRD database
Temperature	1990-2014	all	West	CEDA database
Temperature	1951-2014	all	West BS	HADLEY database

In order to perform forecasts and sensitivity analysis, for our best multiple correlations, we developed an interactive application, in R language. The general model was multiple linear regression equation. Once the forecasts were completed, sensitivity analysis was performed.

Parameter Computation

The Model: ln(R/SSB) ~ SSB + Phyto

Correlation Coefficient: r = 0.717555283991898 , Correlation is high

Significance Coefficient: p = 0.00148798177787726 , There is a statistically significant correlations between our variables

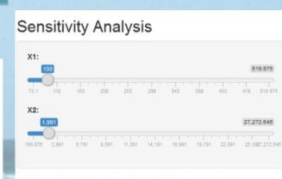
Intercept(a) = -0.358143846481024

Slope(b1) = -0.00208540611676611

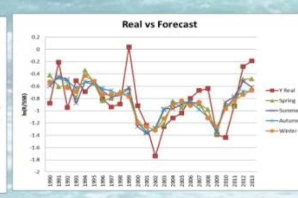
Slope(b2) = 0.000009066043

Regression surface equation: Y = a + b1*X1 + b2*X2 = -0.358143846481024 + -0.00208540611676611 *X1 + 9.06604312945453e-06 *X2

Forecast for ln(R/SSB), season Summer : Y = -0.729681027753249



Model 1: ln(R/SSB) ~ SSB + Phytoplankton



Model 2: ln(R/SSB) ~ SSB + Temperature (Ro)

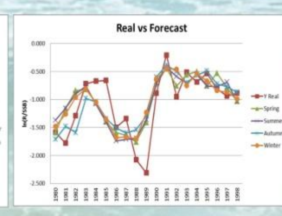
RESULTS AND DISCUSSIONS

We have identified new relationships between ecosystem status (temperature, phytoplankton, and zooplankton) and some parameters like recruitment (R), and spawning stock biomass (SSB) of Black Sea sprat. The highest positive correlations, based on Pearson's r, was: between ln(R/SSB) and SSB with phytoplankton, between ln(R/SSB) and SSB with temperature, and between ln(R/SSB) and SSB with zooplankton. Based on the significance coefficient ($p <= 0.05$) we can conclude that there is a statistically significant correlation between ln(R/SSB) and SSB with phytoplankton, between ln(R/SSB) and SSB with temperature, and between ln(R/SSB) and SSB with zooplankton.

Model 3: ln(R/SSB) ~ SSB + Temperature (CEDA)

Model 4: ln(R/SSB) ~ SSB + Temperature (Hadley)

Model 5: ln(R/SSB) ~ SSB + Zoo



Model 6: ln(R/SSB) ~ SSB + Zoo(Turkey)

Period: 1980 - 1999, Type: Large, Area: NWS

Period: 1980 - 1999, Type: Large, Area: SW

Period: 1980 - 1999, Type: Small, Area: NWS

Period: 1980 - 1999, Type: Small, Area: SW

CONCLUSIONS

The forecast for the models which involve Phytoplankton and Temperature (from different sources) proved to be realistic and, regarding sensitivity analysis, Phytoplankton and Temperature have a major influence on SSB.

Regarding the model with Zooplankton (from Turkey), we have two situations:

a) for the time series 1980-1999, the forecast is very good, moreover for 1992-1998 the forecast lines overlap the real lines; ln(R/SSB) is very sensitive to Zooplankton fluctuations, when SSB has opposite direction compared to Zooplankton, and when SSB and Zooplankton have the same direction, SSB neutralizes the effect of Zooplankton. The exception is the sensitivity analysis for small Zooplankton: ln(R/SSB) is not sensitive to Zooplankton fluctuations.

b) for the time series 1997-2013, the forecast is very bad (unrealistic); ln(R/SSB) is very sensitive to Zooplankton.

REFERENCES

[1] Matloff Norman, 2011. The Art of R programming

[2] STECF. (2013) Assessment of Black Sea stocks (STECF 13-20). STECF STECF 13-20: 1-429

[3] Radu G., Anton E., Golumbeanu M., et al.(2011) State of the Main Black Sea Commercial Fish Species Correlated with the Ecological Conditions and Fishing Effort. Journal of Environmental Protection and Ecology 12:549-557

ACKNOWLEDGMENTS

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