STUDY OF THE ICHTHYOFAUNA DIVERSITY IN THE ROMANIAN SEASIDE AREA

Carmen Georgeta Nicolae [1], Cătălin Păun [1,2] *, Andra-Marina Nuță [1], Monica Marin [1], Elena Pogurschi [1], Gratziela Bahaciu [1], Marius Maftei [1]

[1] University of Agronomic Sciences and Veterinary Medicine of Bucharest,
59 Marasti Blvd., District 1, 011464, Bucharest, Romania
[2] National Institute for Marine Research and Development "Grigore Antipa",
300 Mamaia Blvd., 900581, Constanta, Romania

Abstract
In last years it has been a major change in the quantity and diversity of fish caught in the Black Sea. The study of fish species diversity caught in Romanian seaside area was carried out in June 2016, the data being compared with the 2004-2006 period. In 2004-2006, 10 species were identified from 10 fish families, and in 2016 were identified 16 species from 15 fish families. In 2016, the eudominant species were: Red mullet (Mullus barbatus ponticus), Black Sea horse mackerel (Trachurus mediterraneus), Round goby (Neogobius melanostomus), European anchovy (Engraulis encrasicolus); dominant was Whiting (Merlangius merlangus), and rare were Black Sea shad (Alosa tanaica), Bluefish (Pomatomus saltatrix), Garfish (Belone belone), Long-snouted seahorse (Hippocampus guttulatus), Black scorpionfish (Scorpaena porcus). In 2004-2006, the eudominant species were Round goby (Neogobius melanostomus), European sprat (Sprattus sprattus), Red mullet (Mullus barbatus ponticus); dominants were Black Sea horse mackerel (Trachurus mediterraneus), European anchovy (Engraulis encrasicolus), Turbot (Psetta maeotica), and rare were Starry sturgeon (Acipenser stellatus), European flounder (Platichthys flesus), Common sole (Solea solea). The percentage of global similarity within the specific composition between the samples collected in 2016 and 2004-2006 was 36%. In the two analyzed periods, the common species were Black Sea horse mackerel, European sprat, European anchovy, Whiting, Round goby, Red mullet and Common sole. Data and results obtained from samples taken from fishing grounds serve to compile fishery statistics and carry out work to assess the exploitable potential of the main fish stocks.

Keywords: aquatic environment, biodiversity, Black Sea, fish resource, sustainability.

1. INTRODUCTION

Since old times, fishing has been a major source of food for humanity, providing occupation and economic benefits to those who have practiced it. Along with other sources of food, food resources of the seas will complete protein needs of the population. Fishing is a part of human society and it has important socio-economic and welfare contributions in many regions (Nicolae et al., 2011a).
The Black Sea ichtyofauna has undergone major changes over the last decades, both in the qualitative and quantitative structure, as well as in the behavior of the different species. These changes are consequences of anthropogenic activities, direct by fishing pressure and indirect by the deterioration of environmental conditions, especially in the western part of the sea. Fishery resource management is an integrated process of information collection, analysis, planning, consultation,

decision-making, resource allocation, formulation and implementation of regulations or rules which will govern the fisheries activities in order to ensure the continuity of resource productivity and incomes (FAO, 2015). More than 30-40 years ago, the specialists have drawn attention to the fact that marine resources can be impoverished through irrational competition and the absence of clear and precise regulations, and the consequences can be observed very well today.

At present, one of the main concerns of the world's ichthyology is the problem of the status and dynamics of the reserves of the main fish species of economic value, because the size of fish stocks varies greatly from one year to another as a result of the most diverse causes.

For the Black Sea, annual variations of fish stocks are considerable and are reflected in the annual quantities of captured fish. The establishment of perspectives of the development of marine fisheries and its rational organization is based on the knowledge of the state of the main fish stocks and on the change prediction of these reserves. Romanian Black Sea fishing has a passive character and is limited to a narrow area in front of the seaside where fish behavior is largely influenced by the instability of biotic and abiotic factors. Large variations of abiotic and biotic factors in the Black Sea prevent regular and regular stocking of fish stocks with significant oscillations of annual reserves.

2. MATERIALS AND METHODS

The study of the dynamics of the ichtyofauna caught in trap net in the South and North of the Black Sea was held during the spring of 2016. The observation points, respectively the trap nets that provided the fish sampled, were located in Eforie, Costinesti and Navodari.

The method of randomized samples was used for the study of the Black Sea ichthyofauna in the Romanian seaside area. The samples are a part of the population and provide enough information to characterize the entire population. During May-June 2016 period, 452 fish captured were analyzed in total, 97 fish in Eforie, 94 fish in Costinesti and 261 fish in Navodari (Table 1).

Table 1. List of fish individuals harvested by species in the Romanian seaside stations on May-June, 2016

Fish species (Common name)	Stations / Number of individuals			
	Navodari	Eforie	Costinesti	Total 2016
Garfish	-	1	5	6
Rusty blenny	-	-	1	1
Black Sea horse mackerel	57	12	25	94
European sprat	-	27	20	47
Black Sea shad	3	-	3	6
European anchovy	57	-	1	58
Whiting	-	24	20	44
Three-spined stickleback	-	1	-	1
Round goby	42	22	2	66
Red mullet	99	7	5	111
Cuskeel	-	-	-	0
Bluefish	1	-	7	8
Black scorpionfish	2	-	2	4
Common sole	-	1	1	2
Long-snouted seahorse	-	2	1	3
Greater weever	1	-	1	2
Total	262	97	94	453

The data was compared with data obtained in 2004-2006 (Table 2, Table 3).
These samples were harvested in spring (April, May, June) and autumn (October) in Midia, Vama Veche, Costinesti, Mangalia, Constanta, 2 Mai, Sulina, Sfantu Gheorghe stations on the Romanian coast (Banaru and Harmelin-Vivien, 2011).

Table 2. List of fish individuals harvested by species in the Romanian seaside sample stations on April, May and June, 2005 and 2006

Fish species (Common name)	Stations* / Number of individuals							
	SU	SG	M	CT	Co	MG	2M	VV
Starry sturgeon	1	2	1					
Black Sea horse mackerel					17		3	
Sprat	10	6	35		27		17	
European anchovy		7			10		8	2
Whiting	14	11	26		19	9	9	
Round goby	10	9	17		41	19	18	12
Red mullet	13	1	9		30		7	2
European flounder	7	9	11					
Turbot	24	6	2		2			
Common sole		2	2		12		1	3

*SU = Sulina, SG = Sfantu Gheorghe, M = Midia, CT = Constanta, Co = Costinesti, MG = Mangalia, 2M = 2Mai, VV = Vama Veche

Table 3. List of fish individuals harvested by species in the Romanian seaside sample stations on October, 2004 and 2005

Fish species (Common name)	Stations* / Number of individuals							
	SU	SG	M	CT	Co	MG	2M	VV
Starry sturgeon	1	7						
Black Sea horse mackerel	5						6	
Sprat	18							
European anchovy	6	12						
Whiting	17	14						
Round goby	18	2	10	10			4	
Red mullet	16	7	8					
European flounder	2	2						
Turbot	1	5						
Common sole	6	1						

*SU = Sulina, SG = Sfantu Gheorghe, M = Midia, CT = Constanta, Co = Costinesti, MG = Mangalia, 2M = 2Mai, VV = Vama Veche

It was calculated the percentage of similarity between the three stations in terms of species composition and the percentage of global similarity in terms of specific composition between the caught samples in 2016 and 2004-2006 period, determining the common species caught in 2004-2006 and those captured in 2016 year.
The calculation of similarity between stations was done by the formula: Common species between stations * 100 / Number total of species from both stations.
Global dominance on stations, in 2016 compared to 2004-2006, was calculated with the following formula: Number of individuals of i species * 100 / Total number of individuals of all species.
It is considered that >10% eudominant species, 5.1-10% dominant species, 2.1-5% subdominant species, 1.1-2% rare species, <1.1% accidentally species.

The frequency of fish captured species was calculated with the following formula: F_i = Number of stations with one i fish species * 100 / Total number of stations.

3. RESULTS AND DISCUSSIONS

The study aimed to identifying the current fishery resources component; it has as objective the quantity and quality of the ichthyofauna caught in trap net in the Romanian seaside area. The data and the obtained results from the samples of fishing areas serve to realize the fishery statistics and evaluation the exploitable potential of the main fish stocks.

In June, 2016, it was collected a total of 16 species belonging to 15 families in Eforie, Costinesti and Navodari stations in Romanian seaside area (Table 4).

Table 4. List of caught fish species in the Romanian seaside stations on June, 2016

Family	Common name	Scientific name
Belonidae	Garfish	*Belone belone* (Linnaeus, 1761)
Blenniidae	Rusty blenny	*Parablennius sanguinolentus* (Pallas, 1814)
Carangidae	Black Sea horse mackerel	*Trachurus mediterraneus ponticus* (Aleev, 1956)
Clupeidae	European sprat	*Sprattus sprattus* (Linnaeus, 1758)
Clupeidae	Black Sea shad	*Alosa tanaica* (Grimm, 1901)
Engraulidae	European anchovy	*Engraulis encrasicolus* (Linnaeus, 1758)
Gadiidae	Whiting	*Merlangius merlangus* (Linnaeus, 1758)
Gasterosteidae	Three-spined stickleback	*Gasterosteus aculeatus* (Linnaeus, 1758)
Gobiidae	Round goby	*Neogobius melanostomus* (Pallas, 1814)
Mullidae	Red mullet	*Mullus barbatus ponticus* (Essipov, 1927)
Ophidiidae	Cuskeel	*Ophidion rochei* (Müller, 1845)
Pomatomidae	Bluefish	*Pomatomus saltatrix* (Linnaeus, 1766)
Scorpaenidae	Black scorpionfish	*Scorpaena porcus* (Linnaeus, 1758)
Soleidae	Common sole	*Solea solea* (Linnaeus, 1758)
Syngnathidae	Long-snouted seahorse	*Hippocampus guttulatus* (Cuvier, 1829)
Trachinidae	Greater weever	*Trachinus draco* (Linnaeus, 1758)

Compared to 2016 in 2004-2006 period, it was collected a total of 10 species belonging to 10 fish families (Table 5).

Table 5. List of species caught in Romanian seaside stations on 2004-2006 period

Family	Common name	Scientific name
Acipenseridae	Starry sturgeon	*Acipenser stellatus* (Pallas, 1771)
Carangidae	Black Sea horse mackerel	*Trachurus mediterraneus ponticus* (Aleev, 1956)
Clupeidae	European sprat	*Sprattus sprattus* (Linnaeus, 1758)
Engraulidae	European anchovy	*Engraulis encrasicolus* (Linnaeus, 1758)
Gadiidae	Whiting	*Merlangius merlangus* (Linnaeus, 1758)
Gobiidae	Round goby	*Neogobius melanostomus* (Pallas, 1814)
Mullidae	Red mullet	*Mullus barbatus ponticus* (Essipov, 1927)
Pleuronectidae	European flounder	*Platichthys flesus* (Linnaeus, 1758)
Scophtalmidae	Turbot	*Psetta maeotica* (Pallas, 1814)
Soleidae	Common sole	*Solea solea* (Linnaeus, 1758)

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In 2016 year, the specific diversity (number of fish species) was 8 species in Navodari, 14 in Costinesti and 9 in Eforie. The percentage of similarity (in terms of the composition of species) has been raised between Năvodari and Costinesti (53%) and between Eforie and Costinesti (53%) and decreased between Navodari and Eforie (21%).

By comparison, in 2004-2006 period, the specific diversity (number of fish species) was 10 species in Sulina, 9 species in Sfantu Gheorghe and Midia, 8 species in Costinesti, 7 species in 2 Mai, 4 species in Vama Veche, 2 species in Mangalia and one species in Constanta. The station with the largest number of individuals was Sulina, and station with the lowest number was Constanta (Table 2, Table 3). The Starry sturgeon individuals were released in the sea.

The percentage of overall similarity within the specific composition of the samples in 2016 and 2004-2006 was 36%. The common species in the two periods were Black Sea horse mackerel, European sprat, European anchovy, Whiting, Round goby, Red mullet, and Common sole.

In terms of dominance, it is known that this index expresses the greater or smaller role played by a species in biocoenosis. Species with high frequency and high numerical abundance are considered to be dominant species. According to the calculations, in 2016, the eudominant fish species were Red mullet, Black Sea horse mackerel, Round goby, European anchovy; dominant fish species were Whiting, and rare fish species were Black Sea shad, Bluefish, Garfish, Long-snouted seahorse, Black scorpionfish (Figure 1). In 2004-2006 period the eudominant fish species were Round goby, European sprat, Red mullet; Black Sea horse mackerel, European anchovy, Turbot were dominant fish species; Starry sturgeon, European flounder, Common sole were rare fish species (Figure 2).
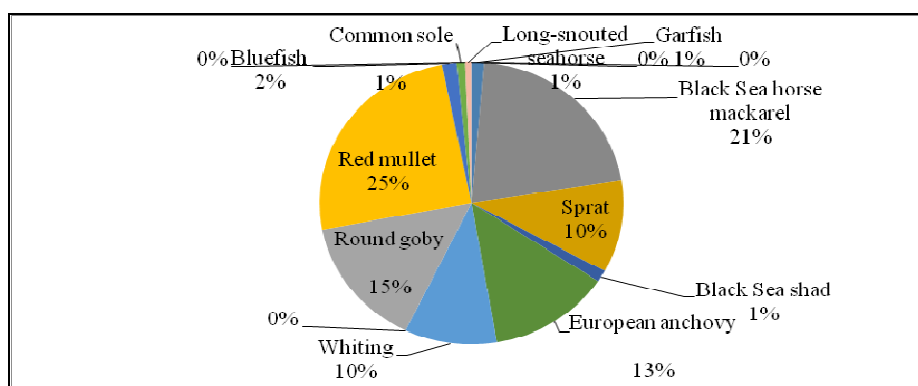

Figure 1. The percentages of species dominance in 2016 in the samples harvested in the Romanian seaside. Species with percent <1% were not indicated.
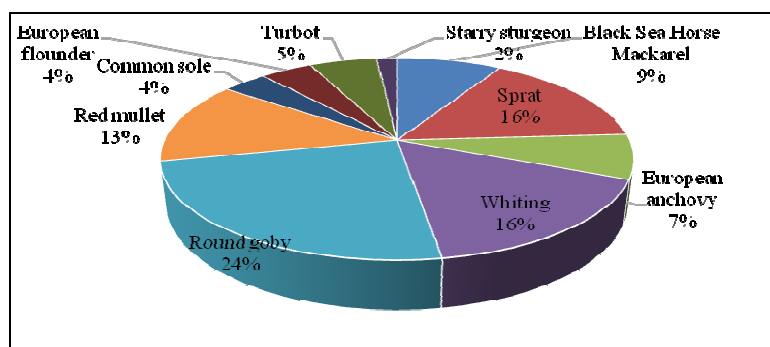

Figure 2. The percentages of species dominance in 2004-2006 period in the samples harvested in the Romanian seaside. Species with percent <1% were not indicated.

Qualitative and quantitative structure of catches in the Romanian marine area had an evolution variable depending on the condition of fish populations and fishing effort developed by the type of tool caught used (Nicolae et al., 2011b). In Figures 3 and 4 it is represent the percentages of fish species dominance, per years and sampling stations.
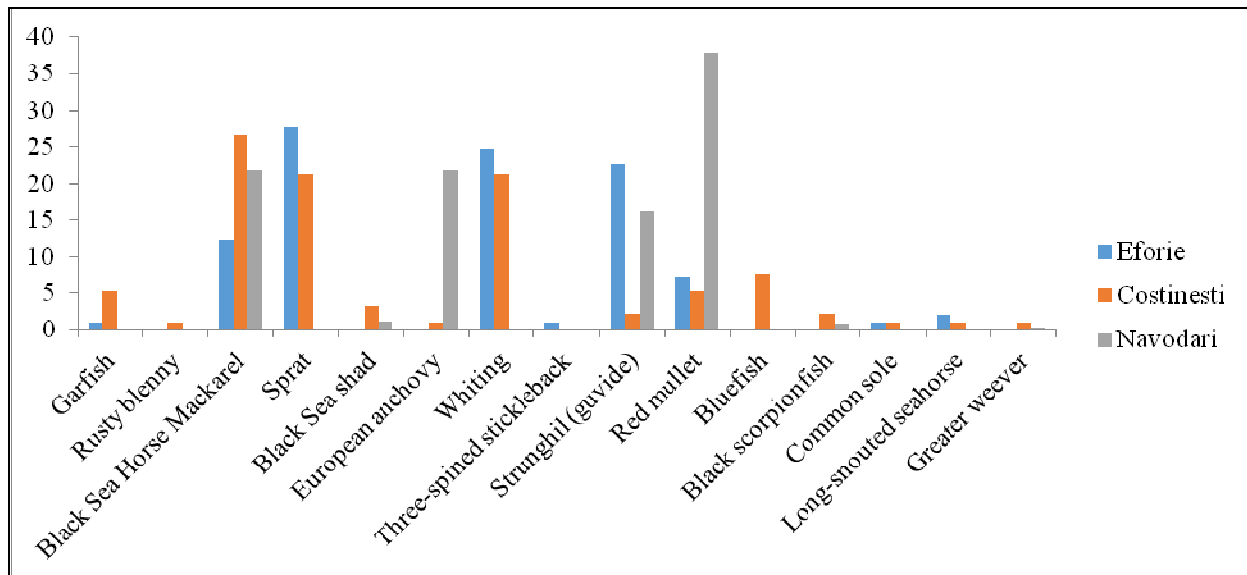

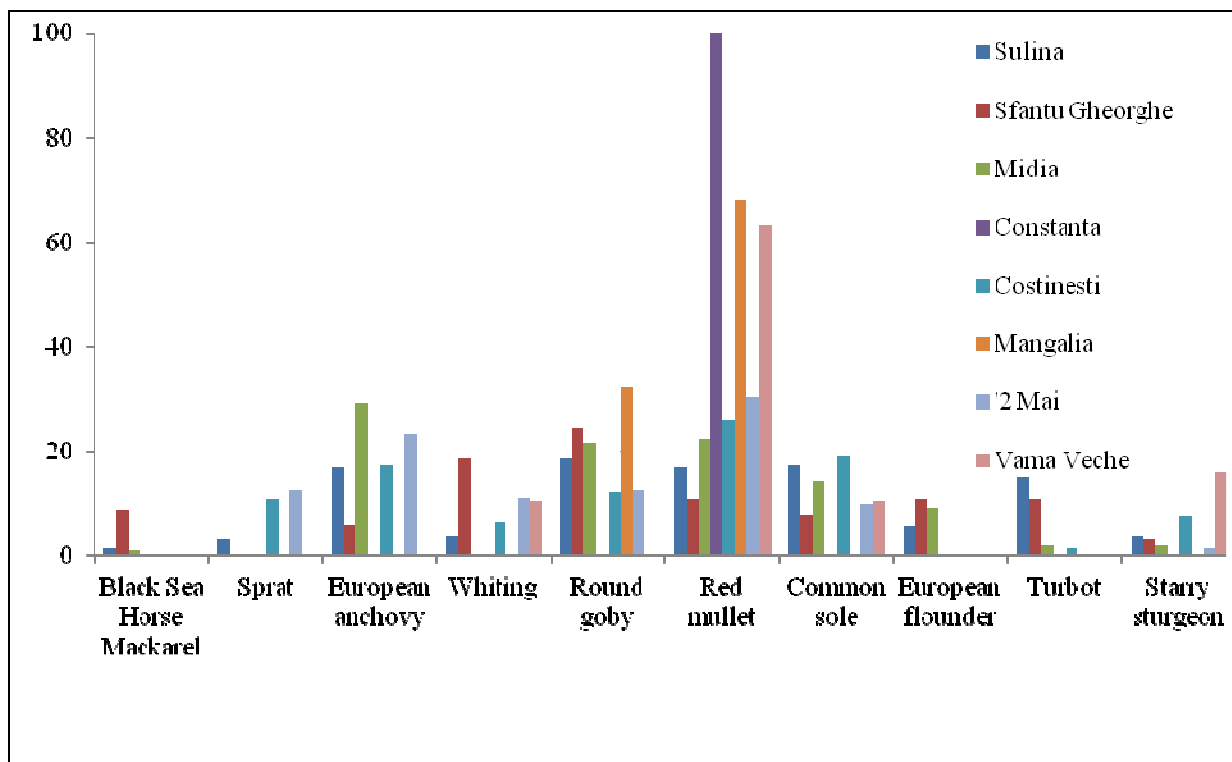*Figure 3. Percentage of species dominance in stations, 2016 year*

Figure 4. Percentage of species dominance in stations, 2004-2006 period

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*Corresponding author, E-mail address: cpaun@alpha.rmri.ro

As it can see the percentage of the highest dominance in both periods was for Red mullet fish species.

The frequency of the species in stations in 2016 compared to 2004-2006 period showed that the most common fish species were Black Sea horse mackerel, Round goby, and Red mullet, while Common sole, Starry sturgeon, Garfish, Greater weever, and Three-spined stickleback were rarely encountered (Figure 5).
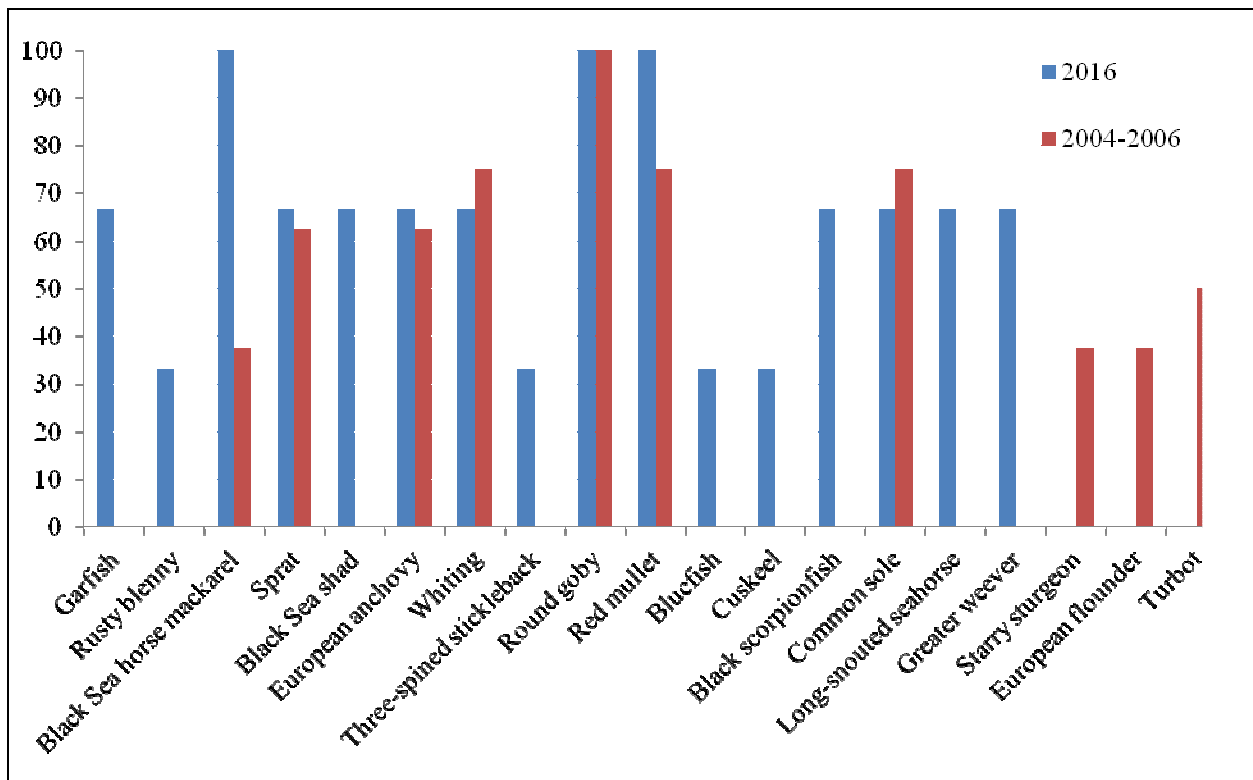

Figure 5. The frequency percentage of the species in 2016 and 2004-2006 period,
in the samples harvested in all stations on the Romanian seaside

Regarding Figure 5, it is noted that the percentage of Whiting and Common sole was higher in 2004-2006 as compared to 2016, while the percentage of Red mullet was higher in 2016 as compared to 2004-2006.

4. CONCLUSIONS

In the Romanian seaside are, catches and fishing efficiency fluctuated from one year to another, depending on the fishing effort (number of trap nets, number of actual fishing days), the evolution of the hydro-climatic conditions, the state of stocks of the main species and the anthropic factors.

The catch fish species structure only partly reflected the specific composition of the Black Sea ichthyofauna; it is effect to the used trap net, the environmental conditions and the relationship between the different species.

It can be said that there has been an improvement in the diversity of species caught in 2016 compared to the 2004-2006 period. In 2016 year it was identified 16 fish species belonging to 15 fish families, and in 2004-2006 period it was identified 10 fish species were belonging to 10 fish families.

The small species with short life cycles continued to be dominant in catches (Black Sea horse mackerel, Round goby, Red mullet).

5. ACKNOWLEDGEMENTS

6. REFERENCES

Banaru D., Harmelin-Vivien, M. (2011). Influence of Danube River Inputs on the Trophic Functioning of Coastal Ecosystems in the North-Western Black Sea. In A.L. Ryann and N.J. Perkins, eds, *The Black Sea: Dynamics, Ecology and Conservation* (pp.1-55), Nova Science Publisher, Inc. N.Y.

FAO (2015). *Technical guidelines for responsible fisheries*, Suppl. 3. Retrieved February 28, 2018, from http://www.fao.org/3/a-i4740e.pdf

Nicolae, C.G., Maximov, V., Radu, Gh., Nicolaev, S., Zaharia, T., Niță, V., Popa, D., Popa R.A., Maftei M., Udroiu, N.A. (2011a). Fisheries management in the context of Romanian seaside area of sustainable use of fisheries resources. *Scientic papers, Animal science, Bucharest, Seria D, LVI*, 53-57.

Nicolae, C.G., Maximov, V., Radu, Gh., Zaharia, T., Niță, V., Micu, D., Cristea, V., Popa, R.A., Popa, D. (2011b) - Study on the dynamics of fish catches in the romanian marine waters during 1950-2009. *Lucrări Ştiinţifice Seria Zootehnie*, *56 (16)*, 635- 640.