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PELAGIC SURVEYS AT THE ROMANIAN BLACK SEA (GSA 29) IN 2018

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ABSTRACT

The last-decade changes in the Black Sea ecosystem have contributed to the deterioration of the structural and functional components of the marine ecosystem (Maximov V. *et al.*, 2014, 2018). For most fish species on the Romanian seaside, the formation of fish aggregations and the availability of fish forfishing are strongly influenced by the variation in environmental conditions. Fisheries resource management is an integrated process of gathering information, analyzing, planning, consulting, decision-making, allocating resources, and formulating and implementing regulations or rules governing fisheries to ensure the continuity of resource productivity and revenue and other objectives. This paper presents the results obtained in the pelagic expeditions (spring and autumn season) realized in 2018. Data and information regarding the biomass and abundance for the species sprat, picked dogfish and jellyfish are presented.
Key-Words: Black Sea, sprat, dogfish, jellyfish, distribution, spring, autumn, abundance, biomass

AIMS AND BACKGROUND

The Romanian fishing fleet is operating in the area of competence of the Regional Fisheries Management Organisations - G.F.C.M, Area 37 - Mediterranean and Black Sea, Sub-area 37.4, Division 37.4.2, GSA 29 [Maximov V. and all, 2018, Romanian Tehnical Raport 2018 and 2019]. The Romanian fishing area is comprised between Sulina and Vama Veche; coastline extends for over 240 km, which can be divided into two main geographical and geomorphologic sectors:

♦ the northern sector (about 158 km in length) lies between the secondary delta of the Chilia branch and Constanta, constituted of alluvial sediments;

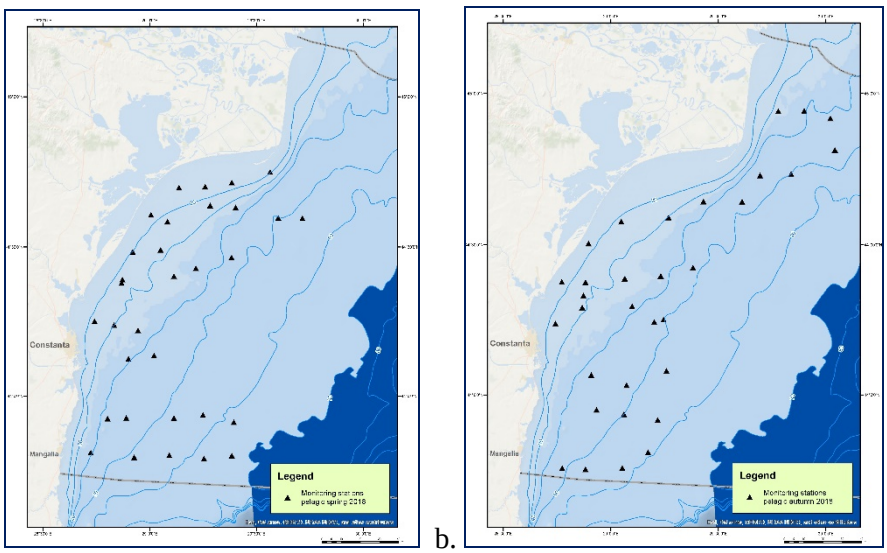
♦ the southern sector (about 85 km in length) lies between Constanta and Vama Veche characterised by promontories with active, high cliffs, separated by large zones with accumulative beaches often protecting littoral lakes.

Knowing the biology, structure and productive potential of pelagic fish species are essential given that the biological features of marine bioresources must be the basis for their conservation and management (Maximov V., 2011; Maximov V. 2018). The biological and ethological characteristics of the pelagic species, the ecological links between commercially important pelagic species are important elements for their conservation and management.

EXPERIMENTAL

For correctly assessment of the tendencies and changes occurred in the pelagic stocks abundance from one survey to the other one, or from one year to the other one, the standard fishing and assessment techniques were utilized, so that the results can be reproduced and compared. The methodologies and techniques used both for data collecting, checking, processing and analysing and for assessment of pelagic fish agglomerations were that usually accepted for Black Sea Basin, and in compliance with international methodology (Maximov V and Radu E, 2006, Radu Gh. and all, 2006, Maximov V and all. 2018,).

- ♦ period: 05 – 12 June and 01 - 09 October 2018
- ♦ type of fishing vessel: B-410 (***STEAUA DE MARE 1***);
- ♦ distribution of sampling stations (Fig. 1);



a. b.

Fig. 1. The distribution of sampling stations in spring (a) and autumn period (b).

♦ characteristics: pelagic trawls: 36/26-59 m; horizontal trawl opening - 20 m; vertical trawl opening 11-12 m; no. trawls: 32 + 31; 20.1 - 66.4 m depth; trawl speed 3.0-3.2 knots; time trawling 30 min; catch 50 – 2,000 kg.
♦ for estimating the fishable sprat crowds biomass, the holistic method of survey trawling was used and the pelagic trawl was used for sampling.

In the assessment were used the parameters like: hauling speed; horizontal trawl opening; hauling time and hauling level. The biological samples taken were preserved in formaldehyde 4% and then analyzed in the laboratory to establish the quantitative structure on species. The results were expressed in number of specimens/hauling and specimens/Nm2 and were used to determine the completion of each fish species reserve. The distribution of the juveniles was done by marking on the distribution maps of the catch values obtained through sampling haulings with the juvenile trawl.

RESULTS AND DISCUSSION

In pelagic fishing conducted with pelagic trawl in the Romanian Black Sea waters, other complementary fish species beside sprat have occurred (number of identified species was 21): sprat (*Sprattus sprattus L.*); European anchovy (*Engraulis encrasicholus L.*); turbot (*Psetta maxima maeotica L.*); whiting (*Merlangius merlangus ponticus* N.); Mediterranean horse mackerel (*Trachurus mediterraneus S*); picked dogfish (*Squalus acanthias* L.); red mullet (*Mullus barbatus ponticus*); Caspian shad (*Alosa tanaica G*); bluefish (*Pomatomus saltatrix L.*); flathead grey mullet (*Mugil cephalus* L); jellyfish (*Aurelia aurita L.*); knout goby (*Mesogobius batrachocephalus* L.); rapa whelk (*Rapana venosa*); common shrimp (*Cragon crangon L.*) and other species.

Estimated total biomass and abundance:

a. Sprattus sprattus (European sprat):

Spring - in the **32** sample trawlings made with the pelagic trawl, on an area of **2,800** Nm², the average values of the catches were of about **0.01-68.6** t/Nm² (Table 1). The maximum value was recorded in the Constanta - Sf. Gheorghe sectors (0-50 m depth). The estimated biomass for sprat crowds, in the research a area, was of about **42,599 tons** (Fig. 2 a)**.**

Table 1. Assessment of sprat agglomerations (tons), in June 2018

Depth range (m)	***0 – 30 m***	***30 – 50 m***	***50 - 70 m***	***Total***
Investigated area (Nm^2)	575	1000	1225	2800
Variation of the catches (t/ Nm^2)	1.372 - 68.6	0 - 8.86	0 - 0.069	0 - 68.6
Average catch (t/ Nm^2)	26.451	2.451	0.0283	8.52
Biomass of the fishing agglomerations (t)	**15209**	**2451**	**34.70**	**23855**
Biomass extrapolated on the Romanian shelf (t)				**42,599**

a. b.

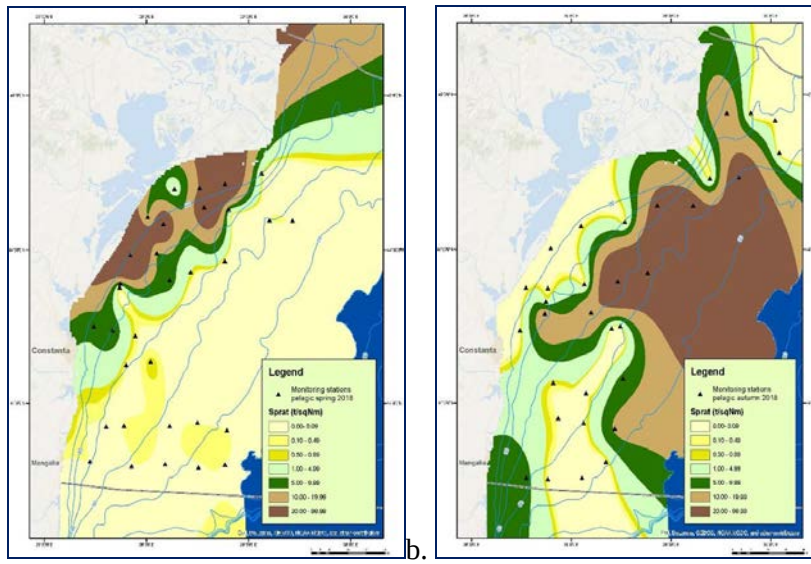


Fig. 2. The distribution of the sprat agglomerations in spring (a) and autumn period (b), pelagic trawl survey, in Romanian area.

Biomass (t) and abundance (thounsands of individuals) of sprat - structure of biomass and abundance by length (Fig. 3) and age distribution (Fig. 4).

a. b.

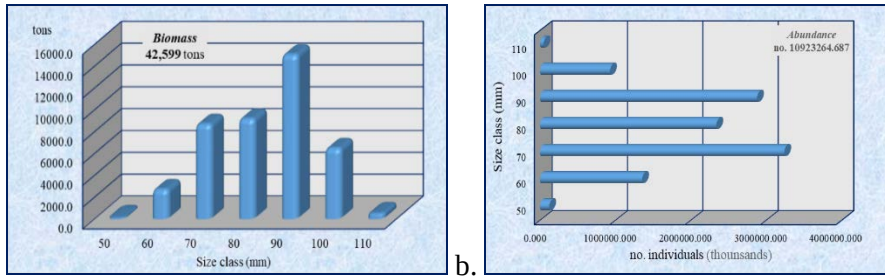
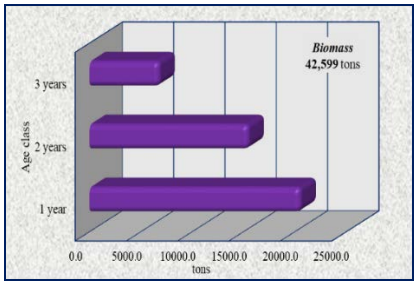


Fig. 3. Structure by length of biomass (a) and abundance (b) of sprat during spring survey.

a. 

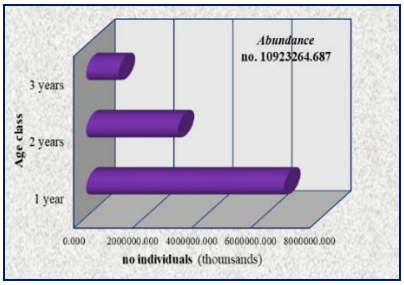
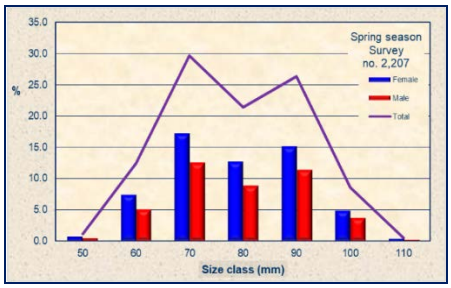
b. 

Fig. 4. Structure by age of biomass (a) and abundance (b) of sprat during spring survey.

The analysis of structure by lengths and mass of sprat during survey, has highlighted the presence of mature specimens and a high homogeneity of populations. The length of sprat individuals are within the limits of classes of length 50.0-115.0 mm / 0.73–10.06 g. The dominant classes are those of 70.0-90.0 mm / 2.48–4.96 g (Fig. 5a). The dominant females 58.18 %, males (41.82 %). The average body length was 83.44 mm and the average mass of 3.90 g. Age composition of sprat catches indicates the presence of fish from 1 to 3 years. Most of the individuals caught are 1 years old (61.5 % of all specimens analyzed), followed by those of 2 years (28.4 %) and 3 years (10.1 %) (Fig. 5b).

a. 

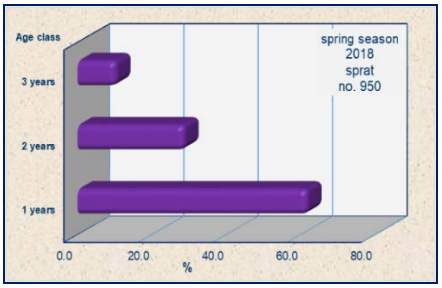
b. 

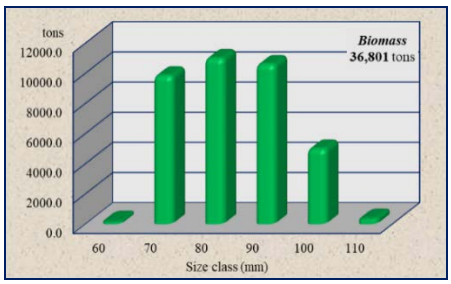
Fig. 5. Structure by lengths (a) and age (b) of sprat during spring survey.

Autumn - in the **31** sample trawlings made with the pelagic trawl, on an area of **2,038** Nm², the average values of the catches were of about 0-43.908 t/Nm² (Table 2). The maximum value was recorded in the Sf. Gheorghe - Mangalia (30–70 m) sectors. The estimated biomass of sprat was about **36,801 tons** (Fig. 2b).

Table 2. Assessment of sprat agglomerations (tons) in October 2018

Depth range (m)	***0 – 30 m***	***30 – 50 m***	***50 - 70 m***	***Total***
Investigated area (Nm^2)	**625**	**1112.5**	**300**	**2037.5**
Variation of the catches (t/ Nm^2)	0	0 - 43.908	0 - 31.079	0 - 43.908
Average catch (t/ Nm^2)	0	10.08	6.749	7.36
Biomass of the fishing agglomerations (t)	0	11219	2024	16983
Biomass extrapolated on the Romanian shelf (t)				**36,801**

Biomass (t) and abundance (thounsands of individuals) of sprat - structure of biomass and abundance by length (Fig. 6) and age distribution (Fig. 7)

a. 

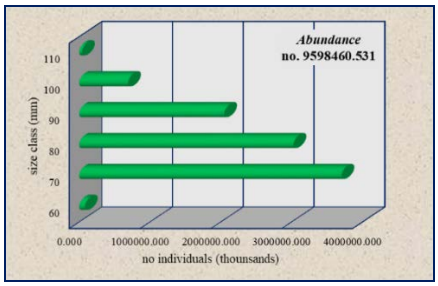
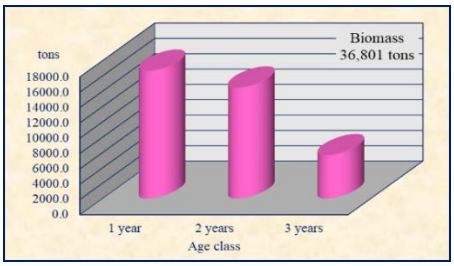
b. 

Fig. 6. Structure by lengths of biomass (a) and abundance (b) of sprat during autumn survey.

a. 

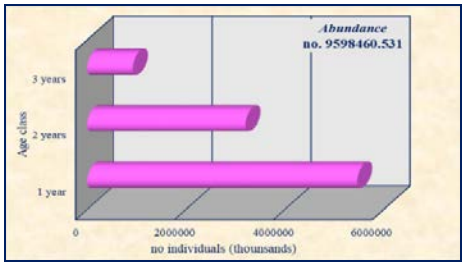
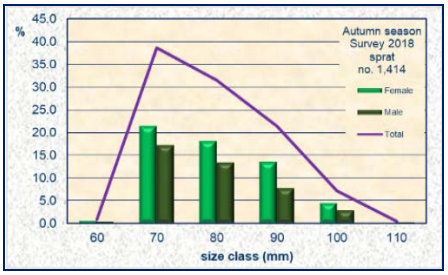
b. 

Fig. 7. Structure by age of biomass (a) and abundance (b) of sprat during autumn survey.

The length of sprat individuals are within the limits of classes of length 65.0-115.0 mm / 1.85–8.12 g. The dominant classes are those of 75.0-95.0 mm / 2.77–4.87 g (Fig. 8a). The dominant females 58.13 %, males (41.87 %). The average body length was 84.84 mm and the average mass of 3.84g. Age composition of sprat catches indicates the presence of individuals from 1 to 3 years. Most of the individuals caught are 1 years old (58.7 % of all specimens analyzed), followed closely by those of 2 years (32.4 %) and 3 years (8.9 %) (Fig. 8b).

a. 

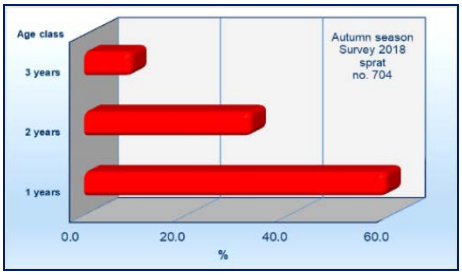
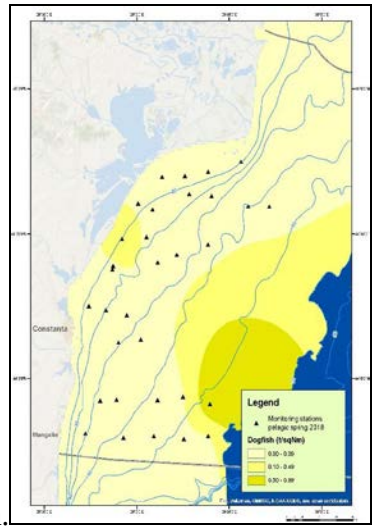
b. 

Fig. 8. Structure by lengths (a) and age composition (b) of sprat during autumn survey.

b. Squalus acanthias (picked dogfish)

Spring - in the 32 sample trawlings made with the pelagic trawl, on a surface of **2,800** Nm², the average values of the catches were of about **0-0.926 t**/Nm² (Table 3). The maximum value was recorded in the Constanta-Cape Tuzla sectors (50-70 m) (Fig. 9a). The estimated biomass in the research area was of about **223** tons.

a. 

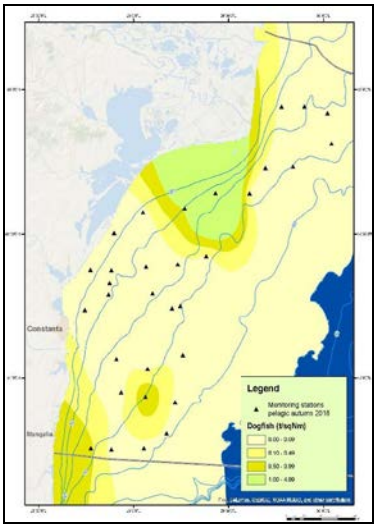
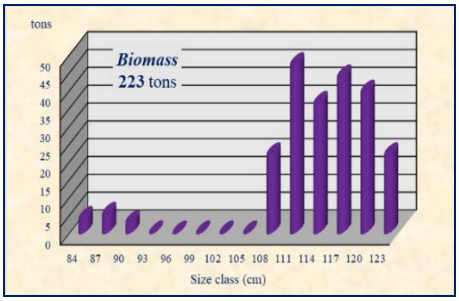
b. 

Fig. 9. The distribution of the picked dogfish agglomerations in the spring (a) and autumn (b) period, pelagic trawl survey, in Romanian area.

Table 3. Assessment of dogfish agglomerations (tons), in June 2018, Romanian area

Depth range (m)	*0 – 30 m*	*30 – 50 m*	*50 - 70 m*	*Total*
Investigated area (Nm^2)	575	1000	1225	2800
Variation of the catches (t/ Nm^2)	0-0.473	0	0-0.926	0-0.926
Average catch (t/ Nm^2)	0.0525	0	0.106	0.045
Biomass of the fishing agglomerations	30	0	130	125
Biomass extrapolated on the Romanian shelf (t)				**223.00**

Biomass and abundance (thousands of individuals) of picked dogfish - structure of biomass and abundance by length (Fig. 10) and age distribution (Fig. 11).

a. 

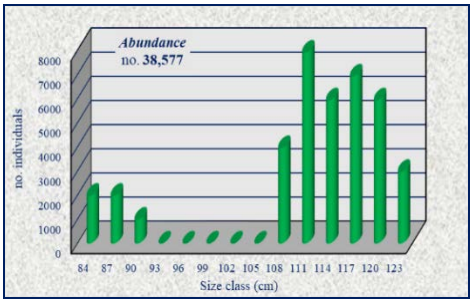
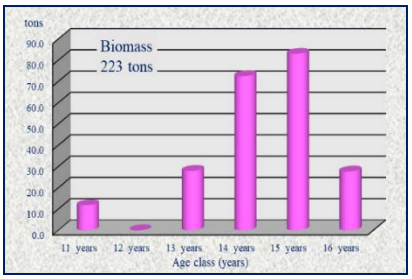
b. 

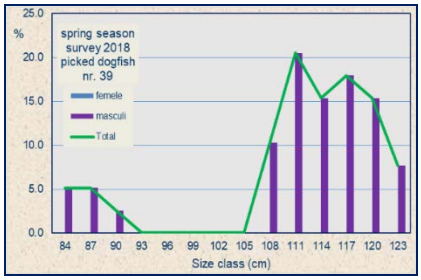
Fig. 10. Structure by lengths of biomass (a) and abundance (b) of picked dogfish during spring survey.

a. 

b. 

Fig. 11. Structure by age of biomass (a) and abundance (b) of picked dogfish during autumn survey.

The length of picked dogfish individuals are within the limits of classes of length 84.0-123.0 cm / 2,042–7,398 g. The dominant classes are those of 111.0-120.0 cm/5,964–6,658 g (Fig. 12a). The average body length was 112.88 cm and the average mass of 5,781 g. Age composition of picked dogfish catches indicates the presence of individuals from 11 to 16 years. Most of the individuals caught are 15 years (33.3 % of all specimens analyzed) and 14 years old (30.8 %), and 12 years (12.8 %) (Fig. 12b).

a. 

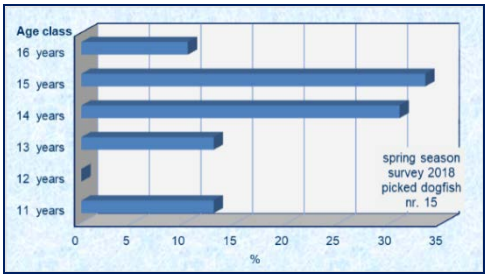
b. 

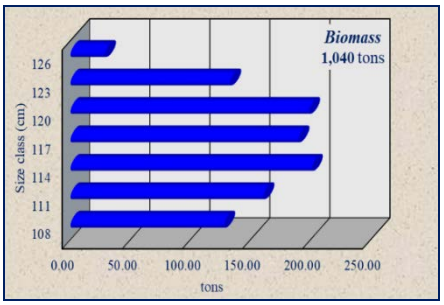
Fig. 12. Structure by lengths (a) and age composition (b), of picked dogfish, during spring survey.

Autumn **-** in the 31 sample trawlings made with the pelagic trawl, on a surface of 2.038 Nm², the average values of the catches were of about 0-13.721 t/Nm² (Table 4). The maximum value was recorded in the Mangalia - Saturn sectors (30-50 m) and Gura Portița - Sf. Gheorghe sectors (30-70 m)(Fig. 9b). The estimate biomass for the dogfish crowds, in the research area, was of about **1,040** tons**.**

Table 4. Assessment of dogfish agglomerations (tons), in October 2018, in Romanian area

Depth range (m)	***0 – 30 m***	***30 – 50 m***	***50 - 70 m***	***Total***
Investigated area (Nm^2)	625	1112.5	300	2037.5
Variation of the catches (t/ Nm^2)	0	0-4.289	0-0.549	0-4.289
Average catch (t/ Nm^2)	0	0.339	0.0686	0.208
Biomass of the fishing agglomerations (t)	0	378	21	480
Biomass extrapolated on the Romanian shelf (t)				**1,040.0**

Biomass and abundance (thousands of individuals) of picked dogfish - structure of biomass and abundance by length (Fig. 13) and age distribution (Fig. 14).

a. 

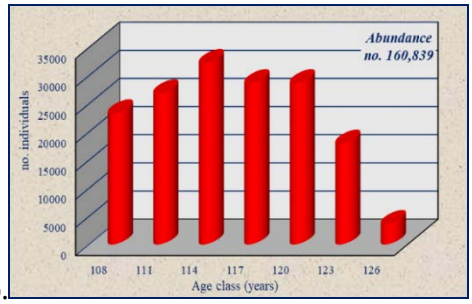
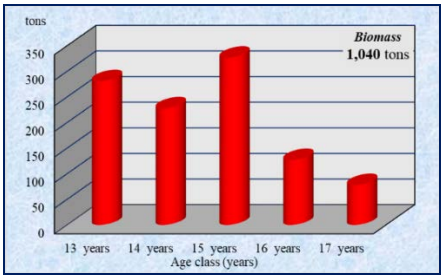
b. 

Fig. 13. Structure by lengths of biomass (a) and abundance (b) of picked dogfish during autumn survey.

a. 

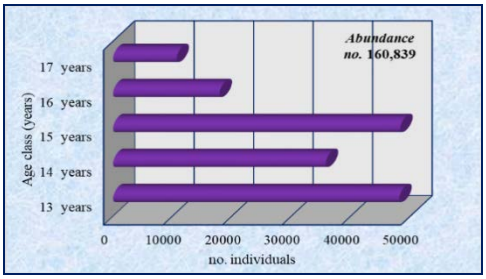
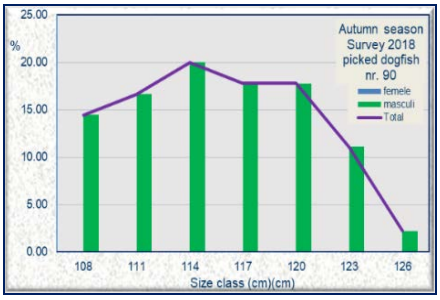
b. 

Fig. 14. Structure by age of biomass (a) and abundance (b) of picked dogfish during autumn survey.

The length of dogfish individuals are within the limits of classes of length 108.0-126.0 cm / 5,745–8,150 g. The dominant classes are those of 111.0-120.0 cm / 6,287–7,650 g (Fig. 15a). The average body length was 117.0 cm and the average mass of 6,466 g. Age composition of sprat catches indicates the presence of individuals from 13 to 17 years. Most of the individuals caught are 15 years (34.1 % of all specimens analyzed) and 13 years old (27.0 %), (Fig. 11b).

Spring - sweeping area procedures were conducted on a surface of **2,800** Nm^2. The average values of jellyfish catches were situated in the limits between 0,685-41.164 t/Nm^2 (Table 5). They revealed that jellyfish had a flat distribution in large area between Sulina - Gura Portița sectors (0.685-41.164 t/Nm^2/depth 0-50 m and Cape Midia-Mangalia sectors (3.436-20.582 t/Nm^2/depth 30-50 m (Fig. 16a). The estimated biomass for the Romanian shelf was about **43,736** t.

a. 

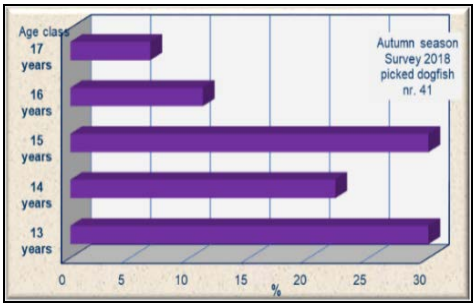
b. 

Fig. 15. Structure by lengths (a) and age composition (b), of picked dogfish, during autumn survey.

*c. **Aurelia aurita*** (jellyfish)

Table 5 Assessment of jellyfish agglomerations (tons), in June 2018, Romanian area

Depth range (m)	***0 – 30 m***	***30 – 50 m***	***50 - 70 m***	***Total***
Investigated area (Nm^2)	575	1000	1225	2800
Variation of the catches (t/ Nm^2)	0.685-41.164	3.436-20.582	0.686-13.721	0.685-41.164
Average catch (t/ Nm^2)	11.510	9.85	4.268	8.747
Biomass of the fishing agglomerations	6618	9850	5229	24492
Biomass extrapolated on the Romanian shelf (t)				**43,7**

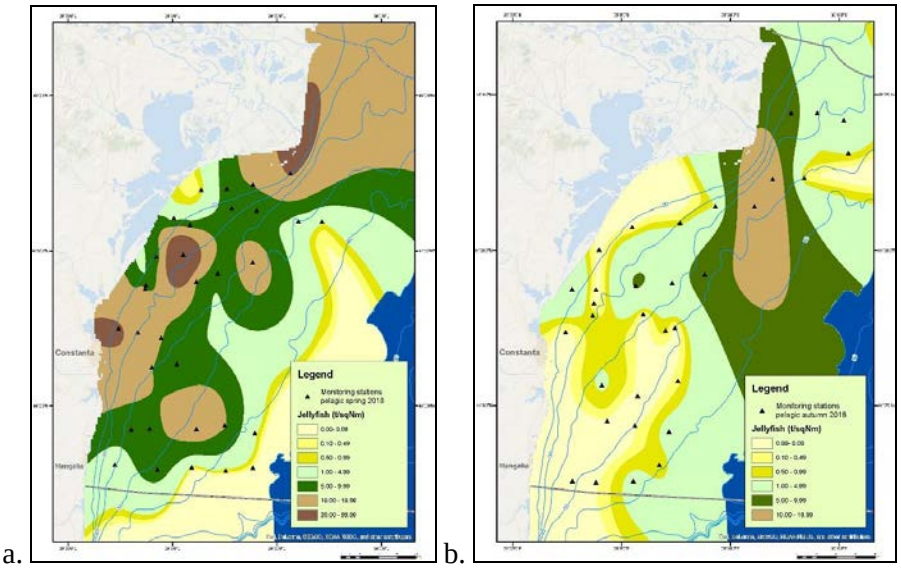


Fig. 16. The distribution of the jellyfish agglomerations in the spring (a) and autumn (b) period, pelagic trawl survey, in Romanian area.

Autumn - in the **31** sample trawlings made with the pelagic trawl, on a surface of **2,038** Nm^2, the average values of the catches were of about **0 - 14.888** t/Nm^2 (Table 6). The maximum value was recorded in the Sf. Gheorghe-Managalia sectors (50-70 m) (Fig. 16b). The estimated biomass for the jellyfish crowds, in the research area, was of about **10,999 tons**.

Table 6. Assessment of jellyfish agglomerations (tons), in October 2018, Romanian area

Depth range (m)	*0 – 30 m*	*30 – 50 m*	*50 - 70 m*	*Total*
Investigated area (Nm^2)	625	1112.5	300	2037.5
Variation of the catches (t/ Nm^2)	0-3.308	0-14.888	0-1.425	0-14.888
Average catch (t/ Nm^2)	0.551	3.478	0.559	2.2
Biomass of the fishing agglomerations (t)	345	3869	168	5076
Biomass extrapolated on the Romanian shelf (t)				**10,999.0**

The agglomeration biomass of the main species from Romanian littoral

The swept area method is used for assessment of the biomass of fishing agglomerations of sprat, picked dogfish and jellyfish based on the statistic processing of productivity data obtained in sampling trawling and industrial trawling. The calculated biomasses by swept area for main species at the Romanian littoral ranged between sprat (30,917 tons and 68,887 tons), dogfish (223 t and 5,635 t) and jellyfish (10,999 t and 43,736 t).

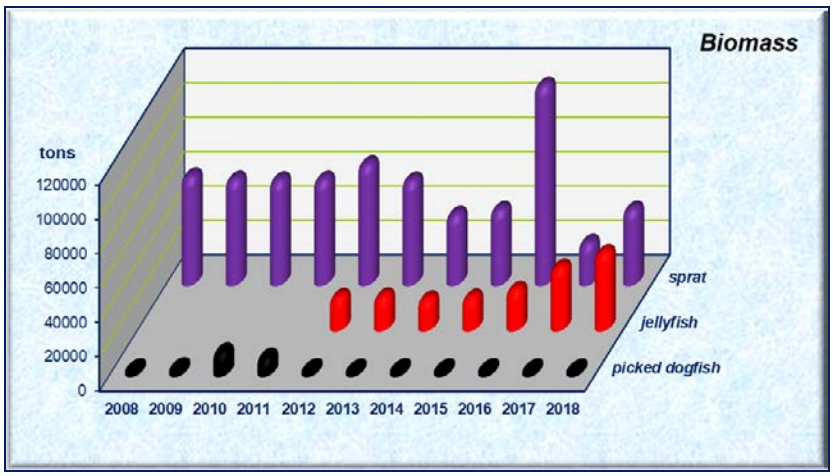


Fig. 17. The agglomeration biomass of the main pelagic species from Romanian littoral.

CONCLUSIONS

The present paper draws the pelagic species management at the Romanian Black Sea littoral in order to find the ways to protect this valuable resource and to sustain its exploitation. Modern fisheries management is often referred to as a governmental system of appropriate management rules based on defined objectives and a mix of management means to implement

the rules, which are put in place by a system of monitoring control and surveillance.

The study presents the estimates of abundance, biomass and distribution of two target fish species (sprat and picked dogfish), obtained by the holistic method of survey trawling was used in the Romanian Black Sea area, up to 75 m depth.

The calculated biomasses by swept area for main species at the Romanian littoral ranged between: sprat (43,599 tons/spring and 36,801 tons/autumn season), picked dogfish (223 t/spring and 1,040 t/autumn) and jellyfish (43,736 t/spring and 10,999 t/autumn).

The length of sprat individuals are within the limits of classes of length 50.0-115.0 mm/0.73–10.06 g, in spring sesson and 65.0-115.0 mm/1.85–8.12 g, in autumn sesson. The dominant classes are those of 70.0-95.0 mm/2.48–4.96 g. The dominant females 58.13 %. The average body length was 83.44/84.84 mm and the average mass of 3.84/3.90 g. Age composition of sprat catches indicates the presence of individuals from 1 to 3 years.

The length of picked dogfish individuals are within the limits of classes of length 84.0-123.0 cm/2,042–7,398 g, in spring sesson and 108.0-126.0 cm/ 5,745–8,150 g, in autumn sesson. The dominant classes are those of 111.0-120.0 cm/5,964–7,650 g. The dominant males. The average body length was 112.9/117.0 cm and the average mass of 5,781/6,466 g. Age composition of piched dogfish catches indicates the presence of individuals from 11 to 17 years.

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