ASSESSMENT OF THE FISHING AGGLOMERATIONS AND SPAWNING BIOMASS IN THE ENVIRONMENTAL CONDITIONS OF 2006

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ABSTRACT

Set up of the fishing agglomerations and availability for fishing are strong influenced by environmental conditions variation. These changes in the fish availability must be treated with considerable attention because can be interpreted as modifications in the stock size, inducing incorrect decisions in the management activity.

Main species targeted for assessment of the fishing agglomerations biomass was sprat, but were taken into account also other species like turbot, spiny dogfish, red mullet, whiting. In this reason were realized three surveys in April, July and October, the paper presenting the obtained results.

Take into account that in time of sampling with industrial trawl, trawl for juveniles or ichthyoplanktonic net was observed a very large quantity of jelly fish, its biomass was assessed in the surveying area, establishing its influence degree on fishing agglomerations. Distribution and abundance of the two species (sprat and jelly fish) are opposite, jelly fish blocking setting up of the fish agglomerations in the surveyed area.

KEY WORDS : Black Sea, Romanian littoral, sprat, jellyfish, turbot, spiny dogfish, whiting, biomass, distribution and abundance, fishing agglomeration

INTRODUCTION

Fishery resources management is an integrated process of gathering of the information, analysis, planning, consultation, taking of the decisions, resources allocation and rules or regulations implementation which will govern the fishery activity for to insure the income realization and the resources productivity and other goals (FAO, 1997).

In marine context, the sustainability is referring both to resources as well as to fishing activity what exploits them (CHRISTIE, 1993) and must have in view that in many respects the sustenance of the resources and the sustenance of the fishing activity are independent goals.

Also, must have in view that beside of fishing activities, other human activities, also climatic changes which affect the marine environment and accordingly, limits marine bio-resources.

Data and information are necessary for the formulation of fishery policy, the formulation of the management plans and determination of the management actions. Its are essential in taking of decisions, therefore is very important as management authorities to be sure that collected data are correctly analysed, disseminated where they are better utilized and suitable used in taking of decisions.

For majority of fish species from Romanian littoral, set up of the fishing agglomerations and availability for fishing are strong influenced by environmental conditions variation. These changes in the fish availability must be treated with considerable attention because can be interpreted as modifications in the stock size, inducing incorrect decisions in the management activity.

The modality of data gathering for fisheries management varies substantial, depending among other things of fishing nature, personnel, facility availability, and the socio-economic importance of the fishing. Indifferent what methods are used, the quantity and quality of collected data will have a direct influence on resources management. The prompt supply and due time of the data and information to be taken decisions and undertakes suitable actions is essential for an effective fishery management.

Spatial distribution of the fishery resources is dynamic, having seasonal changes and sometimes enough pronounced from year to year. The changes in distribution can induce changes in the fishing coefficient, this can be misinterpreting as changes in the resources abundance, leading to the incorrect decisions making in the management action. Therefore, the CPUE data (catch per effort unit) will be not utilized lonely without some additional information on geographical distribution and stock distribution trend.

Also, the environmental conditions variation can influence fish availability for fishing through, e.g. its dispersion on much larger spaces, doing it less available for fishing or concentrating it in the areas where is much easier for fishing. These changes in the fish availability must be treated with considerable attention because can be interpreted as modifications in the stock size, inducing incorrect decisions in the management activity and excessive and instable catches.

MATERIALS AND METHODS

For correct estimation of the trends and changes appeared in the stocks abundance from a survey to another or from a year to another one, in the research were utilized standard fishing techniques which remained constants or were calibrated from a survey to another one.

The stock productive potential is best understood through scientific analysis based on agreed concepts at regional/international level, utilizing standard methodologies to obtain outcomes, which can be reproduced and compared (RADU G., 2006).

Main species targeted for assessment of the fishing agglomerations biomass was sprat, but were taken into account also other species like turbot, spiny dogfish, red mullet, whiting, etc.

The utilized method was swept area, for sampling was used the commercial pelagic trawl in the demersal variant. Have been taking into account the following parameters:

- hauling speed: 3 Nm;
- horizontal trawl opening: 23m;
- hauling time: 60 minutes;

Taking into consideration that in the sampling time with commercial trawl as well as with trawl for juvenile fish and ichtyoplanktonic net have been observed a high quantity of jellyfish, have been evaluated its biomass in the survey area, establishing the influence degree on fishing agglomerations.

To assess the jellyfish agglomerations, using the trawl for juveniles, have been used the following parameters:

- hauling speed: 2 Nm;
- horizontal trawl opening: 14m;
- hauling time: 15 minutes;
- hauling level: 0-5m;

To calculate the agglomerations biomass of jellyfish in the biggest part of the water column, have been used samples collected with Bongo net. For this were taken into account the following parameters:

- net diameter: 0.6m;
- number of rotations registered by flowmeter;

On the whole, in 2006, the samples situation for the assessment of the fish and jelly fish agglomerations is presented in table 1.

Table 1

Samples distribution in time

Species	Sprat	Horse mackerel	Other species	Jellyfish		
Month / Gear	Commercial trawl				Trawl for juveniles	Bongo net
April	x				x	x
May	x			x		
July	x			x		x
October		x	x	x	x	x

The obtained results are presented in tables and maps. In tables are included data related to: area surface (Nm^2, m^2); average biomass per surface unit (g/m^2, t/Nm^2); range of biomass variation per surface unit and total biomass (t). The maps contain the surveyed surfaces, on polygons, the colours having different significance function of biomass per surface unit (g/m^2), such as:

0	0.01-0.4	0.5-1.0	1.0-5.0	5.0-10.0	10.0-20.0
20.0-100.0	100.0-500.0	> 500			

For assessment of the reproductive biomass was used the Parker method, the parameters taken into account being: total abundance of the eggs in every survey, average individual prolificacy, percent of the female spawner weight which are spawning, percent of the female weight in the reproductive agglomeration.

RESULTS AND DISCUSSIONS

In April, was realized only six sampling trawling with commercial trawl because the weather was unfavourable in the survey period. The surveyed area was about 1523 Nm^2, being comprised between the isobaths of 11m and 50m (Table 2, Fig. 1). Sprat catch ranged between 20 kg and 200 kg, being smaller comparatively with jellyfish catch (Tables 3,4).

Table 2

Assessment of the sprat agglomerations in April 2006, sampling gear - commercial trawl

No. polygon	Polygon area (Mm^2)	Polygon area (m^2)	Average (g/m^2)	Range (g/m^2)	Average (t/Mm^2)	Total tons in polygon
I	899	30,844826x10^8	0,273	0,16-0,39	0,937	842,36
II	623,75	21,400957x10^8	1,365	1,17-1,56	4,683	2921,02
TOTAL	1522,75	52,245784x10^8				3763,38

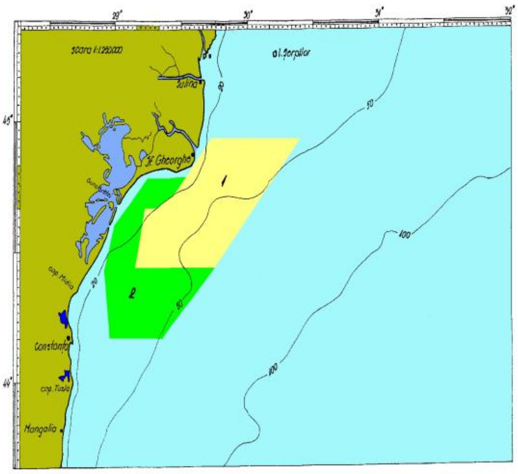

Fig. 1 - Sprat distribution and abundance in April 2006

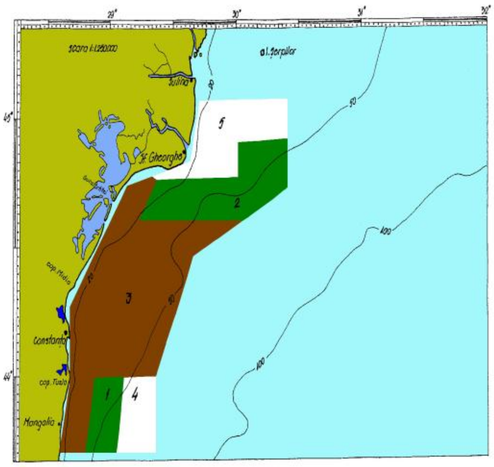

Fig. 2 – Jellyfish distribution and abundance in April 2006, sampling gear – trawl for juveniles

Sprat biomass, on the surveyed area, was assessed at 3,763 tons, extrapolated to 10,380 tons for shelf area up to 50 Nm from seashore. The obtained biomass has values of tree-four times less than former years (RADU *et al*., 2006; STAICU *et al*., 2006). The situation can partially explained through extreme jellyfish agglomerations that removed sprat from area. Jellyfish biomass computed for the area surveyed with the trawl for juveniles (3012 Nm^2) was estimated to 102,625 tons, extrapolated to 143,115 tons for shelf area up to 50 Nm from seashore. To see what happens on whole water column, the samples have been taken with Bongo net. Rte obtained results are presented in table 4 and Fig. 3, the values are huge, attaining in some places more than 3,000 tons/Nm^2. In these conditions, an efficient commercial fishing is almost impossible.

Table 3

Assessment of the jellyfish agglomerations in April 2006, sampling gear - trawl for juveniles

No. polygon	**Polygon Area (Mm^2)**	**Polygon area (m^2)**	**Average (g/m^2)**	**Range (g/m^2)**	**Average (t/Mm^2)**	**Total tons in polygon**
I	195,5	$6,707635x10^8$	6,35	6,35	21,787	4259,36
II	575	$19,728337x10^8$	8,095	6,66-9,53	27,774	15970,305
III	1550,75	$53,206468x10^8$	15,486	9,54-19,04	53,133	82395,99
IV	212,5	$7,290907x10^8$	0	0	0	0
V	478	$16,400253x10^8$	0	0	0	0
TOTAL	3011,75	$103,333600x10^8$				102625,4

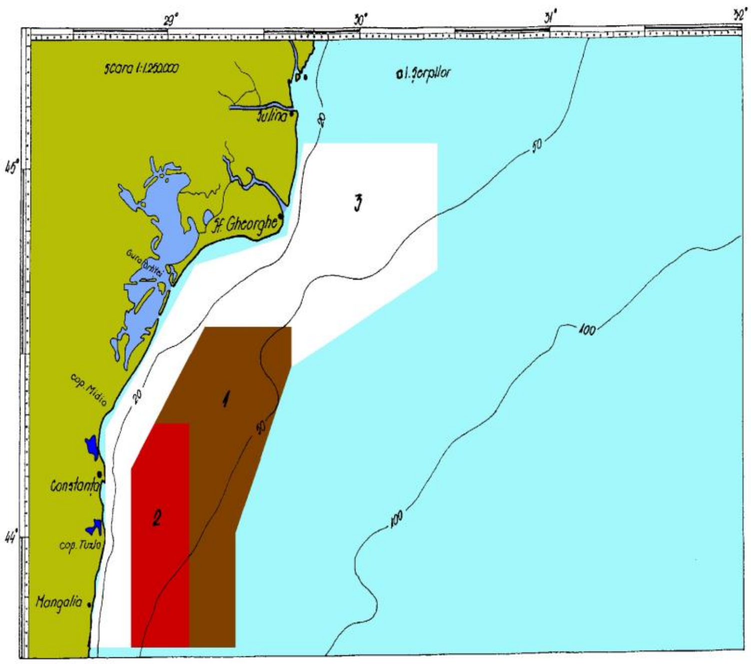

Fig. 3 – Jellyfish distribution and abundance in April 2006, sampling gear – Bongo net

Table 4

Assessment of the jellyfish agglomerations in April 2006, sampling gear - Bongo net

No. polygon	**Polygon area (Mm^2)**	**Polygon area (m^2)**	**Average (g/m^2)**	**Range (g/m^2)**	**Average (t/Mm^2)**	**Total tons in polygon**
I	807,5	$27,705447x10^8$	58,71	23,44-92,2	201,43	162654,73
II	491,0	$16,846285x10^8$	905,3	833,3-977,3	3106,1	1525095,10
III	1649,5	$56,594596x10^8$	0	0	0	0
TOTAL	2948	$101,146328x10^8$				1687749,83

From the ones three figures (Fig. 1, 2, 3) we can observe that sprat had slight agglomerations only in the areas where the jelly fish was concentrated in the surface layer (Fig. 2).

In May, the situation remains enough difficult from fishery point of view, however observing a slight improvement against previous month. The conclusion was obtained from 13 sampling trawling with commercial trawl on depths ranged between 11m and 47m, sprat catch being between 0 kg and 700 kg. In the areas where the jellyfish quantity was large, sprat was in small quantities (Tables 5, 6, Fig. 4, 5).

Table 5

Assessment of the sprat agglomerations in May 2006, sampling gear - commercial trawl

No. polygon	**Polygon area (Mm^2)**	**Polygon area (m^2)**	**Average (g/m^2)**	**Range (g/m^2)**	**Average (t/Mm^2)**	**Total tons in polygon**
I	715	$24,531759x10^8$	0,0-0,32	0,0-0,08	0,11	78,65
II	160	$5,489624x10^8$	0,585	0,51-0,66	2,01	321,6
III	607,5	$20,843417x10^8$	3,065	1,88-5,48	10,52	6.390,9
TOTAL	1482,5	$50,864800x10^8$				6.791,15

Biomass of the sprat agglomerations computed for a surveyed area of 1483 Nm^2 was of 6,791 tons, extrapolated to 19,240 tons for shelf area up to 50 Nm from seashore.

In the summer period, **in July,** the phenomenon repeated, the situation being almost same as in May (Tables 7, 8, 9; Fig. 6, 7, 8).

Table 6

Assessment of the jellyfish agglomerations in May 2006, sampling gear - commercial trawl

No. polygon	Polygon area (Mm^2)	Polygon area (m^2)	Average (g/m^2)	Range (g/m^2)	Average (t/Mm^2)	Total tons in polygon
I	120,0	$4,117218x10^8$	0,27	0,23-0,31	0,93	111,60
II	478,0	$16,400253x10^8$	2,58	2,27-3,13	8,86	4235,08
III	195,0	$6,690479x10^8$	11,74	11,74	40,28	7854,60
IV	210,0	$7,205132x10^8$	0,085	0,05-0,12	0,29	60,90
V	254,0	$8,714779x10^8$	8,59	7,51-9,66	29,46	7482,84
VI	206,0	$7,0678913x10^8$	0,3	0,0-0,47	1,03	212,18
TOTAL	1.463,0	$50,195752x10^8$				19957,2

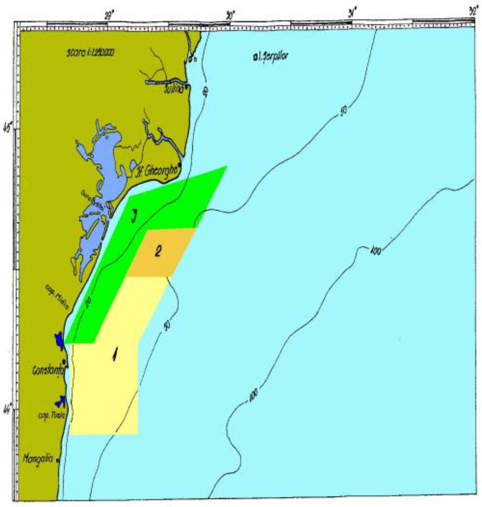

Fig. 4 – Distribution and abundance of The sprat agglomerations in May 2006

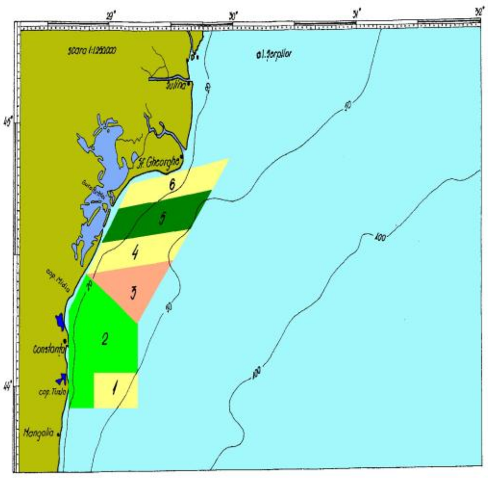

Fig. 5 – Distribution and abundance of the jellyfish agglomerations in May 2006 sampling gear - commercial trawl

Sprat biomass was estimated at 5,900 tons on a surveyed area of 1,680 Nm^2, extrapolated to 14,750 tons for shelf area up to 50 Nm from seashore.

Both in May and July, the values obtained for sprat biomass have been at least half against previous years (RADU *et al.*, 2006). Main cause being environmental conditions which permitted agglomeration of the jellyfish at the Romanian littoral, hindering formation and removing sprat agglomerations (RADU *et al.*, 1995, 1996-1997).

Catches of other species were negligible, being impossible their assessment through swept area method.

Table 7

Assessment of the sprat agglomerations in July 2006, sampling gear - commercial trawl

No. Polygon	**Polygon area (Mm^2)**	**Polygon area (m^2)**	**Average (g/m^2)**	**Range (g/m^2)**	**Average (t/Mm^2)**	**Total tons in polygon**
I	140,0	4,803421 $x10^8$	2,27	2,27	7,79	1.090,60
II	810,5	27,808378 $x10^8$	0,098	0,0-0,23	0,335	271,52
III	629,5	21,598241 $x10^8$	1,37	1,1-1,56	4,69	2.952,36
IV	100,0	3,431015 $x10^8$	4,62	4,62	15,85	1.585,00
TOTAL	1680	57,641055$x10^8$				5.899,47

Table 8

Assessment of the jellyfish agglomerations in July 2006, sampling gear - commercial trawl

No. polygon	**Polygon area (Mm^2)**	**Polygon area (m^2)**	**Average (g/m^2)**	**Range (g/m^2)**	**Average (t/Mm^2)**	**Total tons in polygon**
I	136,5	4,683336$x10^8$	0	0	0	0
II	803,3	27,561345$x10^8$	2,64	1,49-3,91	9,06	7.277,90
III	660,25	22,653278$x10^8$	0,124	0,0-0,23	0,43	283,91
IV	81,0	2,779122$x10^8$	14,08	14,08	48,31	3.913,11
TOTAL	1681,05	57,677081$x10^8$				11.474,92

Table 9

Assessment of the jellyfish agglomerations in July 2006, sampling gear - Bongo net

No. polygon	**Polygon area (Mm^2)**	**Polygon area (m^2)**	**Average (g/m^2)**	**Range (g/m^2)**	**Average (t/Mm^2)**	**Total tons in polygon**
I	532,5	18,270156 $x10^8$	0	0	0	0
II	510,5	17,515333 $x10^8$	14,61	9,46-22,11	50,13	25.591,37
III	124,3	4,264752 $x10^8$	79,6	79,6	273,11	33.947,57
IV	814,1	27,931895 $x10^8$	239,9	139-397,9	823,21	670.175,26
V	156,8	5,379832 $x10^8$	674,7	674,7	2.314,91	362.977,89
TOTAL	2138	73,355105 $x10^8$				1092692,09

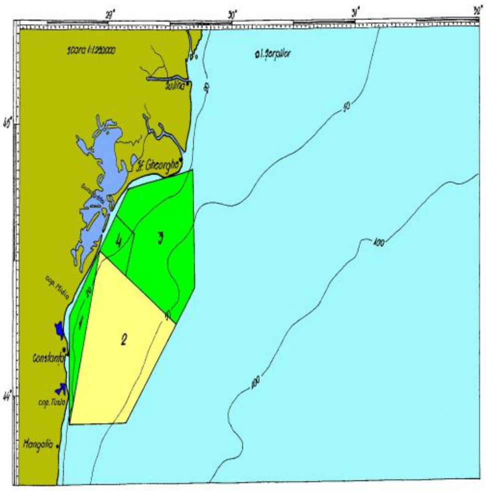

Fig. 6 -Distribution and abundance of the sprat agglomerations in July 2006

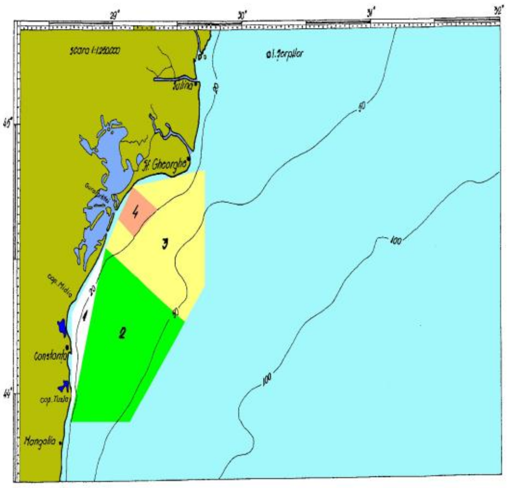

Fig. 7 – Distribution and abundance of the jellyfish agglomerations in July 2006 - commercial trawl

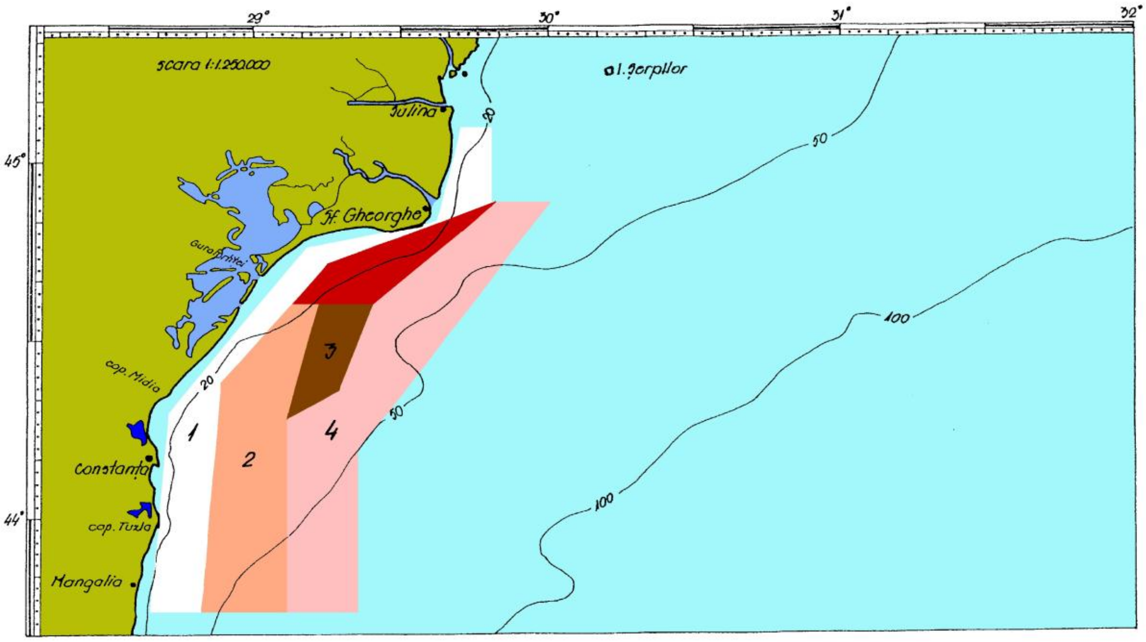

Fig. 8 – Jellyfish distribution and abundance in July 2006, sampling gear – Bongo net

Considering eggs presence in the samples from Bongo net, lonely species for which could to calculate spawner biomass was anchovy. Was took into account July, being the best period for spawning of the thermophilic fish species. Comparing the outcome with the obtained values from previous years (Table 10) results that the year 2006 was extremely unfavourable for these species (RADU E *et al*., 2004, 2006).

Table 10

Anchovy spawner biomass

Year	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2006**
Biomass (t)	11000	20000	10000	15000	20000	19000	19000	3050

Given the previous situation, anchovy spawner biomass dropped up to six times. Same situation was also for horse mackerel.

CONCLUSIONS

In summary to the ones above presented, we can say:

- For majority of pelagic species from Romanian littoral setting up of the fishing agglomerations and availability for fishing are strong influenced by the environmental conditions variation.

- These changes in the fish availability must be treated with considerable attention because can be interpreted as modifications in the stock size, inducing incorrect decisions in the management activity.

- High percent of the pelagic species (sprat, anchovy, horse mackerel, etc) in the catches and also their constancy explains by and large high oscillations of the yearly catches at the Romanian littoral, all the more so the fishing is realized in a limited coastal area where the conditions of maintain of the fish agglomerations are extremely of variable.

- The environmental conditions existing to the Romanian littoral allowed formation and maintaining of very large agglomerations of gelatinous species, especially jellyfish.

- Because of jellyfish agglomerations, the spring - summer period of the year 2006 was extremely unfavourable for fishing with vessels.

- Distribution and abundance of the two species (sprat and jellyfish) are opposite, jellyfish blocking setting up of the fish agglomerations in the surveyed area.

- In the summer period the situation ameliorated slight, but the sprat biomass, the principal species in the commercial fishing with vessels, was half against previous years.

- On Romanian shelf, function of environmental conditions, fishing sprat agglomerations was appreciated in the previous years at about 60,000 tons, allowing a total allowable catch (TAC) of about 10,000 tons.

- Considering that, the year 2006 was an accident from point of view of environmental conditions, we can recommend as the sprat TAC to remain to the level of 10,000 tons.

- If in the previous years, the anchovy spawner biomass has shown a slight trend of recovery after the collapse from 90's years, 2006 was enough unfavourable for this species.

- Horse mackerel population had very much of suffered after 90's years (because of fishing and environmental conditions), the catch at the Romanian littoral decreasing very much.

- Both for anchovy and horse mackerel, the real protection problem is placing in the wintering area (Turkey and Georgia) where the fishing activity is realized without any regulation for TAC and fishing effort.

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