

# **REPORT**

## **REGARDING THE CONSERVATION OF MIGRATORY SHARK SPINY DOGFISH *SQUALUS* *ACANTHIAS* FROM THE BLACK SEA**

**SIGNATORY PARTY: ROMANIA  
DESIGNATED AUTHORITY FOR THE MEMORANDUM OF  
UNDERSTANDING ON THE CONSERVATION OF MIGRATORY  
SHARKS (MoU): NATIONAL INSTITUTE FOR MARINE RESEARCH  
AND DEVELOPMENT “GRIGORE ANTIPA”**

**NATIONAL FOCAL POINT OF MoU: DR. GHEORGHE RADU  
NATIONAL INSTITUTE FOR MARINE RESEARCH AND DEVELOPMENT  
“GRIGORE ANTIPA**

**NATIONAL FOCAL POINT OF CONVENTION ON THE CONSERVATION OF  
MIGRATORY SPECIES OF WILD ANIMALS: DR. NELA MIAUTA  
MINISTRY OF ENVIRONMENT AND FORESTS  
DIRECTORATE OF BIODIVERSITY**

# REPORT

## REGARDING THE CONSERVATION OF MIGRATORY SHARK SPINY DOGFISH *SQUALUS ACANTHIAS* FROM THE BLACK SEA

ORDER: SQUALIFORMES  
FAMILY: SQUALIDAE

*SQUALUS ACANTHIAS* Linnaeus, 1758

SINONIME: *Acanthorhinus acanthias* Blainville, 1816  
*Acanthias vulgaris* Risso, 1826  
*Acanthias acanthias* Bonaparte, 1838  
*Spinax vulgaris* Guichenot, 1850  
*Squalus acanthias* Smitt, 1895  
*Squalus barbouri* Rivero, 1936

FAO cod: Taxonomic cod: 1090100704  
Alphanumeric cod: DGS  
Cod of group: 38

### *Distribution area, conditions and migration routes*

Spiny dogfish (*Squalus acanthias*) inhabits the whole Black Sea shelf at the water temperatures 6-15°C, Fig. 1 and Fig. 2. It undertakes extensive migrations. In autumn feeding migrations are aimed at the grounds of the formation of the wintering concentrations of anchovy and horse mackerel in the vicinity of the Crimean, Caucasus and Anatolian coasts. With their disintegration, Spiny dogfish (*Squalus acanthias*) disperses all over the shelf.

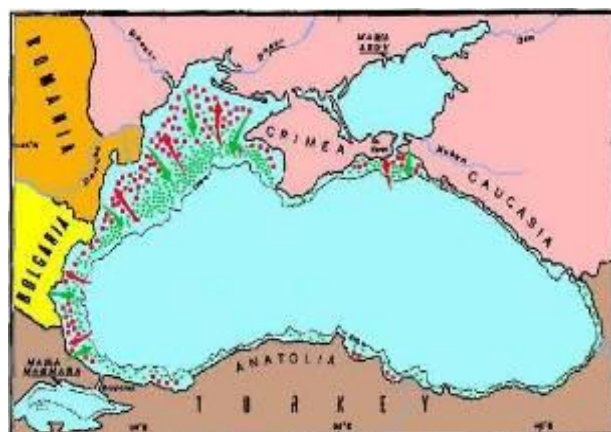
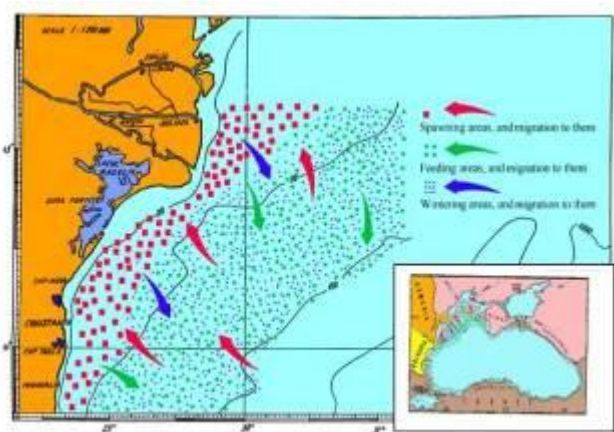


Fig. 1 Distribution and migration routes of the Spiny dogfish (*Squalus acanthias*) at Romanian littoral

Fig. 2 Distribution and migration routes of the Spiny dogfish (*Squalus acanthias*) at Black Sea level.

Reproductive migrations of viviparous spiny dogfish (*Squalus acanthias*) take place towards the coastal shallows with two peaks of intensity - in spring and autumn. The autumn migration for reproduction covers more individuals usually.

Spiny dogfish (*Squalus acanthias*) belongs to long-living and viviparous fish, therefore reproduction process includes copulation and birth of fries. Near the coasts of Bulgaria, Georgia, Romania, Russian Federation and Ukraine the intense spawning season is in March-May. Two peaks of birth of juveniles can be distinguished - spring period (April-May) and summer-autumn (August-September, Serobaba *et al.*, 1988). To give birth of juveniles the females approach the coastal zone in depth 10-30m (Maklakova, Taranenko, 1974). At this time males keep separately from females in depth 30 - 50 m.

The birth of spiny dogfish (*Squalus acanthias*) juveniles takes place at the temperature of water 12 - 18°C.

In autumn spiny dogfish (*Squalus acanthias*) aggregates into large schools, accompanying anchovy and horse mackerel which migrate to wintering grounds along eastern and western coast.

During wintering the densest concentrations are observed where spiny dogfish feeds intensively. They are associated, above all, with major wintering areas of anchovy in the waters of Georgia and Turkey. In the northwestern Black Sea, in the waters of Ukraine and Romania, in depth from 70-80 m down to 100-120 m, abundant wintering concentrations of spiny dogfish (*Squalus acanthias*) are also observed where they are located on the grounds of whiting and sprat concentrations (Kirnosova, Lushnicova, 1990).

### Growth and Maturity

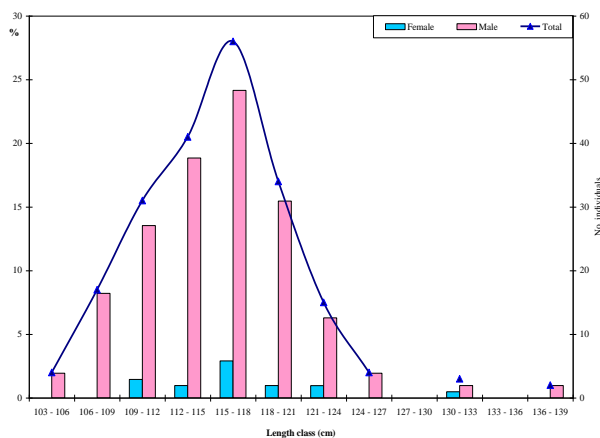
Spiny dogfish (*Squalus acanthias*) is a major demersal predator, reaching in the Black Sea the length of about 1.50 m. In Romanian waters, structure analysis of length and mass classes of Spiny dogfish catches revealed the presence of large specimens, ranging from 90-130 cm length, with average mass values ranging from 3000-14950g, the dominant classes 109-121cm /5755-7990 g, the average length of the body was 114.91 cm and average weight of 7388 g.

Overall sex ratio of males was significantly positive with a rate of 84.29% compared to only 15.61%, as were females. Coefficients in length-weight relationship:

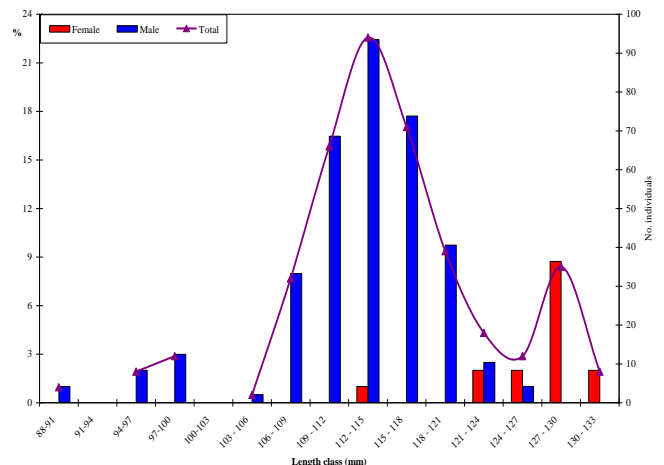
$a = 0.0117$ ;  $b = 2.76$ ;

Natural mortality  $M = 0.258 - 0.31$

The population data of Spiny dogfish (*Squalus acanthias*) at the Romanian Black Sea area are given in the figures bellow - Length frequency data - Figs. 3 ÷ 4 and average weights per length class - Figs. 5 ÷ 6 (Maximov *et al.*, 2010; Radu *et al.*, 2011a).



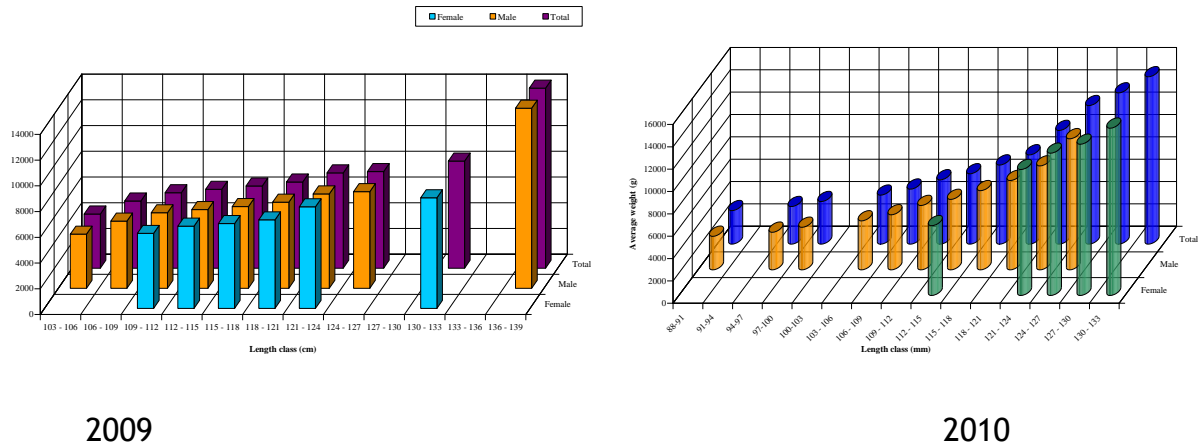
2009



2010

**Fig.3 Length frequency data for spiny dogfish (*Squalus acanthias*) at Romanian littoral in 2009**

**Fig.4 Length frequency data for spiny dogfish (*Squalus acanthias*) at Romanian littoral in 2010**



**Fig.5 and 6 Spiny dogfish (*Squalus acanthias*) mean weights (g) per length class and gender in 2009 and 2010, Romanian Black Sea area.**

Life-history parameters and food diet of spiny dogfish (*Squalus acanthias*) from the SE Black Sea were also studied (Demirhan and Seyhan, 2007). Spiny dogfish at age 1 to 14 years old were observed, with dominance of 8 years old individuals for both sexes. The length (L)-weight (W) relationship was  $W = 0.0040 \cdot L^{2.95}$  and the mean annual linear and somatic growth rates were 7.2 cm and 540.1 g, respectively.

The estimated parameters in VBGF were:  $W_{\infty} = 12021$  (g),  $L_{\infty} = 157$  (cm),  $K = 0.12$  (year<sup>-1</sup>) and  $t_0 = -1.30$  (year).

The size at first maturity was 82 cm for males and 88 cm for females. Mean biennial fecundity was also found to be 8 pups per female.

The relationships fecundity (F)-length (L), fecundity (F)-weight (W) and fecundity (F)-age (A) were found to be:

$$F = -17.0842 + 0.2369 \cdot L \quad (r=0.93)$$

$$F = 0.3780 + 0.0018 \cdot W \quad (r=0.89)$$

$$F = -0.7859 + 1.1609 \cdot A \quad (r=0.94), \text{ respectively.}$$

## Fisheries

### Description of the fishing grounds and GSA

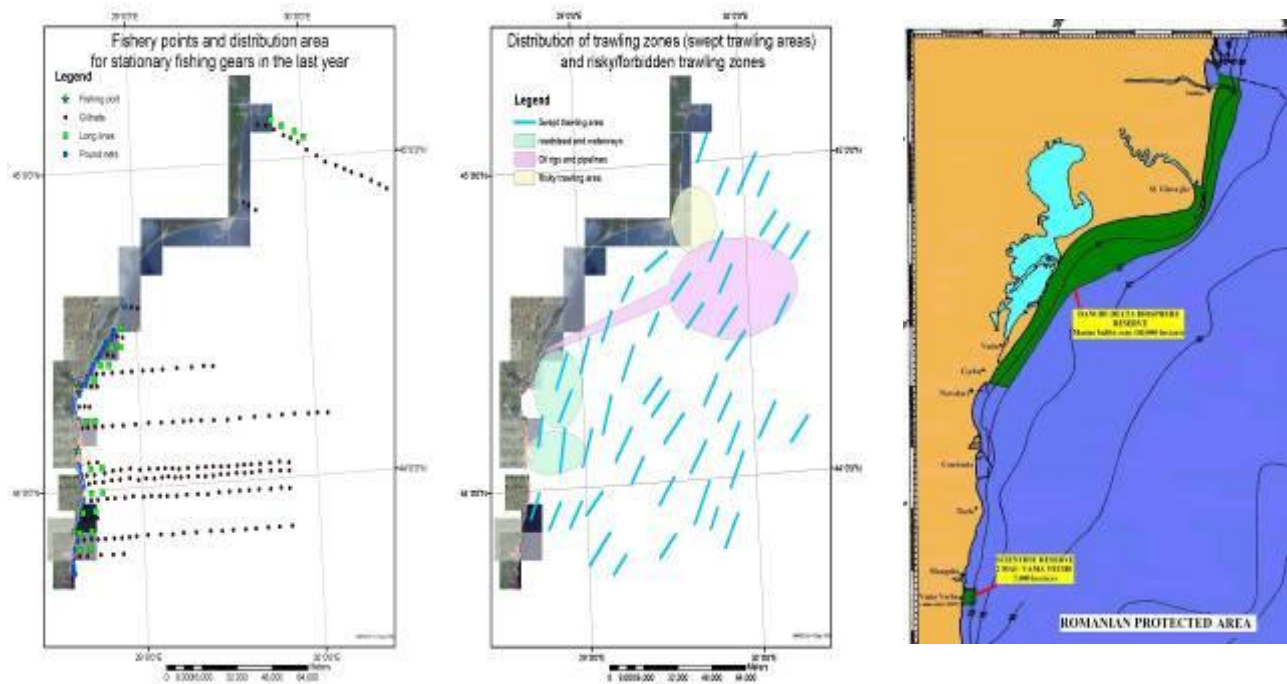
The Romanian fishing fleet was operating in the area of competence of the Regional Fisheries Management Organisations - G.F.C.M., Area 37 - Mediterranean and Black Sea, Sub-area 37.4., Division 37.4.2, GSA 29.

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:

- 1/ the northern sector (about 158 km in length) lies between the secondary delta of the Chilia branch and Constantza, constituted of alluvial sediments;
- 2/ the southern sector (about 85 km in length) lies between Constantza and Vama-Veche characterised by promontories with active, high cliffs, separated by large zones with accumulative beaches often protecting littoral lakes.

The distance from the sea shore to the shelf limits (200 m depth) varies from 100 to 200 km in the northern sector and to 50 km in the southern one.

The submarine slope of the shelf is very gentle in the north, while in the southern sector the slope increase very quickly (Fig. 7-9).



**Fig. 7** Fishery points and distribution areas for stationary fishing gears at Romanian littoral

**Fig.8** Distribution of trawling zones

**Fig.9** Romanian protected areas

The shallow waters up to 20 m depth of the northern part are included in the “Danube Delta” Biosphere Reserve (declared through the Low no. 82/1993).

The marine zone of the "Danube Delta" - Biosphere Reserve constitutes a traditional zone for spawning and feeding for transboundary species as well as a passage route for anadromous species (sturgeons, Danube shad).

In the South part of littoral is situated also the Vama Veche - 2 Mai reserve with the surface of 5,000 hectares (Fig.9).

The marine Reserve “2 Mai - Vama Veche” is an area with a high diversity of the biotopes and biocoenosis, being settled on the migration routes of the main pelagic and benthic fish and marine mammals.

### **General description**

In the coastal zone of the Romanian marine sector with small depth, fishing with fixed gear is characterized by the concentration of activity mainly in the first three/four months of the season (April-July), when usually the turbot (the most important commercial fish) migrates to the coastal area for reproduction and other species migrate for feeding.

In generally, total fishing season being of about eight months.

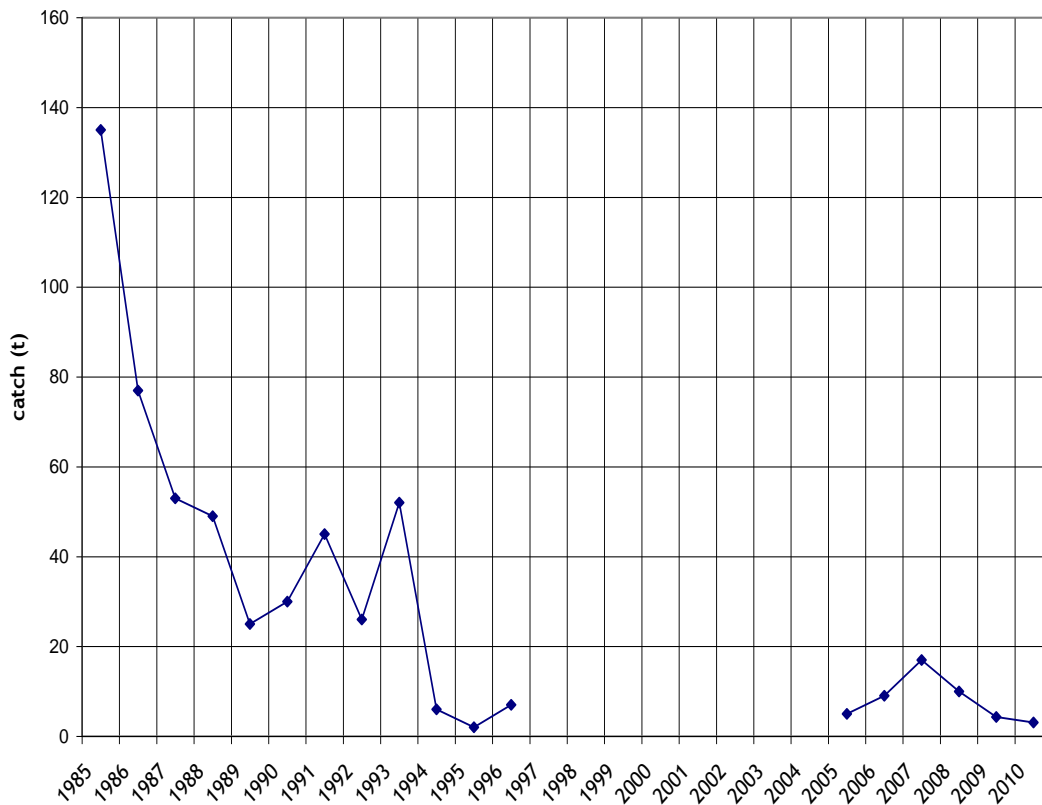
The capture level and the level of fishing productivity differs from one year to another, depending on the fishing effort (number of pound nets, number of gill nets and effective fishing days), and also depends on the evolution of hydro climatic conditions and at last but not least, the state of fish stocks (Maximov et al.,2006; Radu G., 2011).

The structure on species of the catches mirrored only partly the composition of Black Sea ichtyofauna from the Romanian sector, because the type of gear conditions the ratio between the different fish species.

### Catches

In the Romanian fisheries, Spiny dogfish (*Squalus acanthias*) was mainly as by-catch in the trawlers catches. When the number of trawlers has been high, also the dogfish catches were higher.

After 1989, the number of operational trawlers decreased and the Spiny dogfish catches have the same tendency (Fig. 10).



**Fig. 10 Spiny dogfish (*Squalus acanthias*) catches at the Romanian littoral (t)**

In the last years, Spiny dogfish (*Squalus acanthias*) is a target species for dogfish gillnets. In the waters of Romania, most of Spiny dogfish is harvested in spring and autumn months (Radu G., 2011; Radu et al., 2011b)

In the Black Sea, the largest catches of Spiny dogfish are along the coasts of Turkey, although this fish is not a target species of fisheries, being harvested as by-catch in trawl and purse seine operations mainly in the wintering period.

In the 1989-1995 annual catches of Turkey are 1055-4558 t (Shlyakhov V. and Daskalov G., 2008).

In subsequent years, they have decreased about 2 times and did not exceed 2400 t. In the waters of Ukraine most of Spiny dogfish (*Squalus acanthias*) is harvested in spring and autumn months by target fishing with gill-nets of 100 mm mesh-size, long-lines, and as by-catch of sprat trawl fisheries.

As in Turkish waters, in the last 20 years the maximum annual catches of Spiny dogfish (*Squalus acanthias*) are observed in 1989-1995, reaching 1200-1300 t.

After 1994 the catches went down being between 20 and 200 t, Spiny dogfish lost its commercial importance in recent years.

In the last 20 years, the decrease of Spiny dogfish landing may be due to over-fishing.



In the rest of countries Spiny dogfish is harvested mainly as by-catch, annual catches are usually lower than the Ukraine (Daskalov et al., 2009, 2011; Shlyahov V. and Daskalov G., 2008).

The maximum annual catches of Spiny dogfish in 1990-2005 were: Romania - 52 t (1992), Russian Federation - 183 t (1990), Georgia - 550 t (1998), Bulgaria - 126 t (2001). It should be noted that in the waters of Romania and Bulgaria, the highest catches were observed in the early 2000's (BSC, 2008).

In Romania, the catches decreased very much because of decreasing of the trawling effort (Maximov et al., 2006, 2010; Radu et al., 2011a, 2011b; Radu, 2011).

The landings of Spiny dogfish (*Squalus acanthias*) by countries are given on Fig.11.

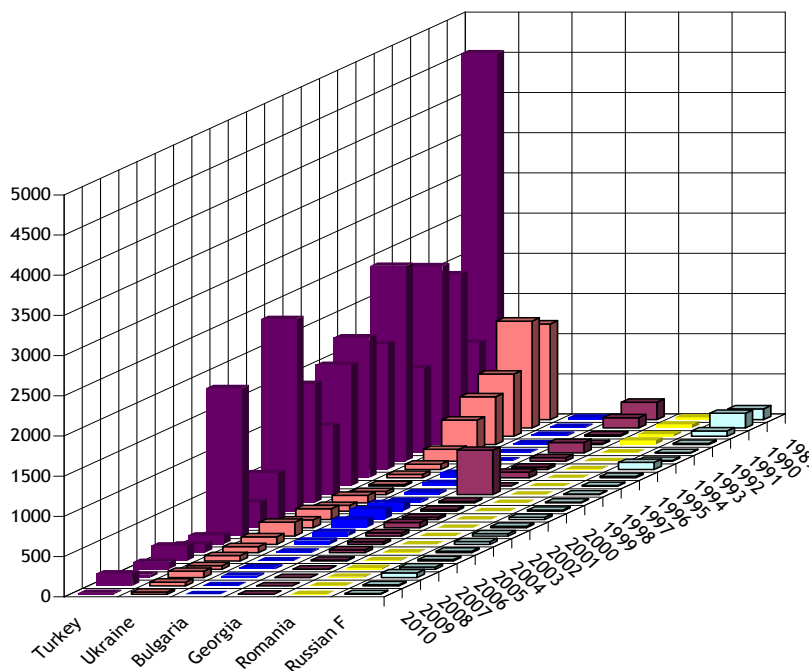


Fig.11 Spiny dogfish landings by countries (FAO Fisheries Statistics, BSC statistics)

**Scientific Surveys**

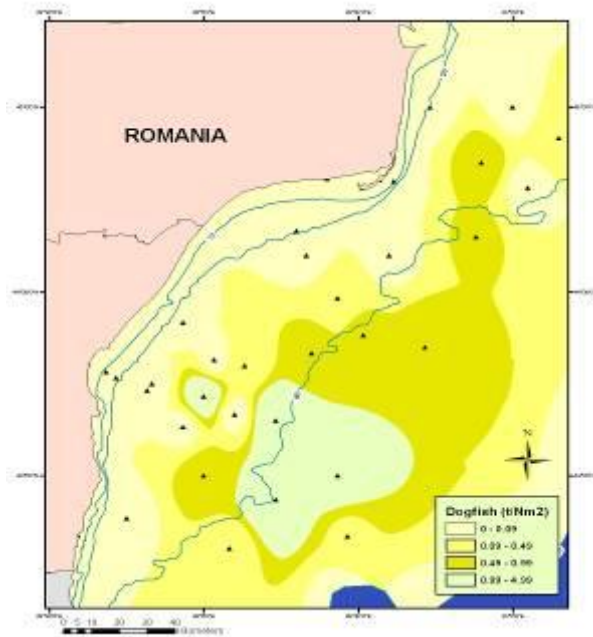
In Romania, the swept area method is used for evaluation the Spiny dogfish fishing agglomerations biomass, based on the statistic processing of productivity data obtained in sampling trawling.

In the Table 1 are given the values of spiny dogfish fishing agglomerations biomass at Romanian littoral.

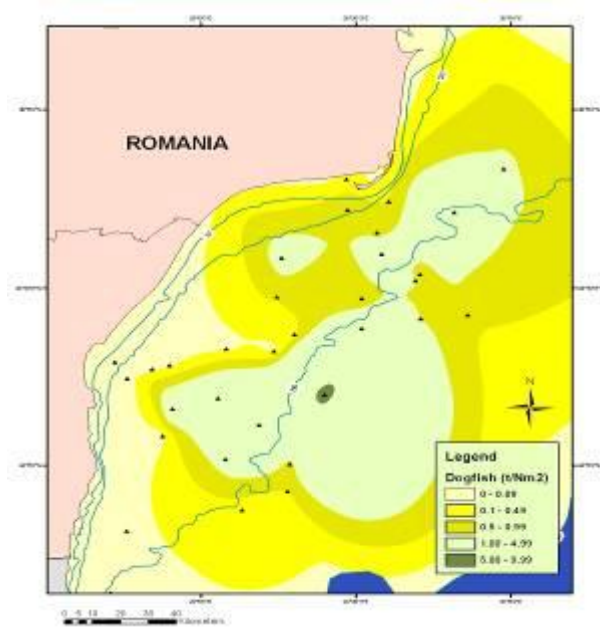
The values of spiny dogfish fishing agglomerations biomass at Romanian littoral

Year	2009	2010	2011
Spiny dogfish biomass (t)	967-2.541	5.635 - 13.051	1.173 - 1.619

In Fig.12 and Fig. 13 is the distribution of Spiny dogfish (*Squalus acanthias*) agglomeration during demersal trawl survey in May 2009 and 2010, in the Romanian Black Sea area.

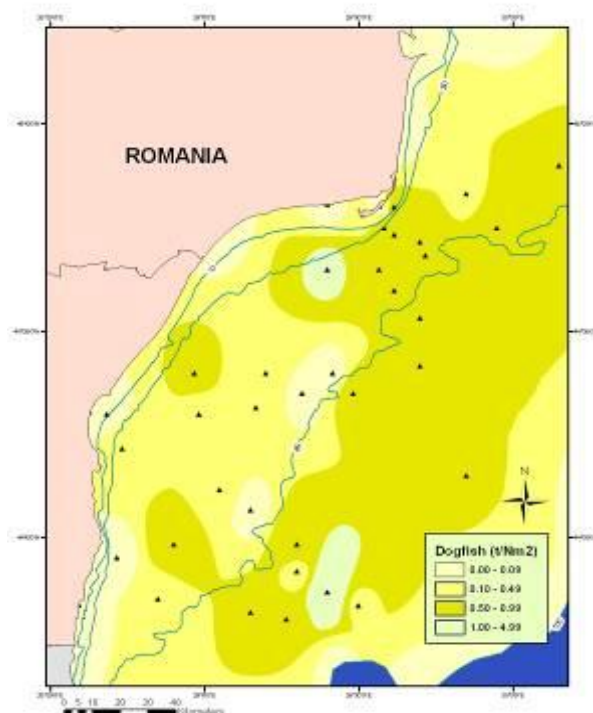


2009

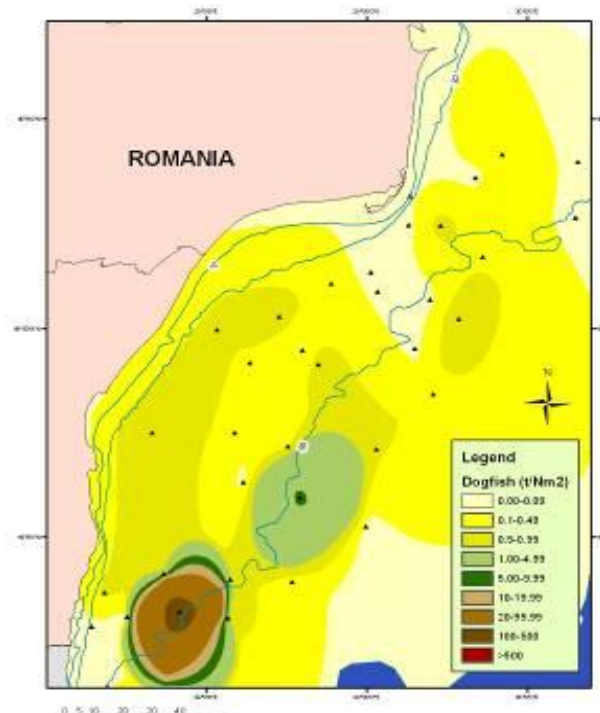


2010

Fig. 14 and 15 Distribution of Spiny dogfish (*Squalus acanthias*) catches during demersal trawl survey in November 2009 and 2010, in the Romanian Black Sea area.



2009



2010

In Romanian waters the agglomerations are distributed on entire shelf, but especially at depth more than 20 m. Two peaks of intense spawning and of birth of juveniles are in spring and autumn period at Romanian littoral. In front of Romanian littoral, the biomass of Spiny dogfish (*Squalus acanthias*) seems to increase in the last years.



### **Management regulations**

Romanian fisheries regulatory framework includes between others the following:

- ❖ Law No. 23/2008 on Fishing Fund, Fishery and Aquaculture;
- ❖ Annual Order on the Fishing Prohibition;
- ❖ Order No. 342/2008 on minimal size of the aquatic living resources;
- ❖ Order No. 449/2008 on technical characteristics and practice conditions for fishing gears used in the commercial fishing.

Regarding Spiny dogfish (*Squalus acanthias*), for protecting the reproduction and rehabilitation of the stock were adopted the following measures (Radu G. and Nicolaev S., 2010):

- ✓ in the period April - June, 60 days, the fishing is prohibited;
- ✓ it is banned to use the trawl in marine zone under the 20 m depths;
- ✓ mesh size for dogfish gillnets: a = 100 mm, 2a = 200 mm;
- ✓ minimum admissible length in catches is 120 cm (TL).

In the Black Sea Fishes list IUCN status presented on the Black Sea Commission website ([www.blacksea-commission.org](http://www.blacksea-commission.org)) is included and categorized *Squalus acanthias* as follows (Table 2).

**The IUCN status of spiny dogfish in the Black Sea countries**

**Table 2.**

Country	BG	GE	RO	TU	RF	UKR
IUCN status	N/A	LC	NT	EN	N/A	NT

LC - Least Concerned

NT- Near Threatened

EN- Endangered

N/A - No Data

Historical analysis shows that the state of spiny dogfish stock has been influenced not only by fishing which was at quite high level due to the bigger number of trawlers and high levels of the spiny dogfish by-catch.

The state of the species has also been influenced by ecological changes due to eutrophication and *Mnemiopsis leiydi* invasion and outburst in Black Sea. Comb jelly conquered with small pelagic fish for the food.

Simultaneously, the small pelagic fishes are important trophic base for the dogfish in the Black Sea.

We assume the decrease of the small pelagic stocks due to overexploitation and eutrophication processes which have a strong impact on the top predators including Elasmobranchs in the Black Sea (BSC, 2008, Daskalov et al., 2009, 2011; Radu et al., 2011a,b; Shlyahov V. and Daskalov G., 2008).

### **Short term considerations**

The main characteristics of Spiny dogfish (*Squalus acanthias*) stock in the Black Sea and peculiarities of the management at regional level:

- ❖ migratory specie has spawning, feeding and wintering habitats located in the economic exclusive zone of different states;

- ❖ there are strong technical interactions, being exploited by different types of fishing boats and gear and biological features, with complex predator-prey interactions involving most exploited species;
- ❖ due to their relatively low commercial interest and sometimes low number of specimens caught, Spiny dogfish (*Squalus acanthias*) are most of the times a component of the by-catch in fisheries targeting most commercially valuable species;
- ❖ in the Black Sea area is a common practice to don't report the catches and this situation may exceed the officially reported;
- ❖ presently there is no regional fishery management organization in the Black Sea area, the fisheries regulatory framework is promoted by each coastal country being not harmonized at regional level, even in the case of shared or migratory species;
- ❖ the lack of an adequate management in the Black Sea fisheries is also evidenced by the fact that in spite of decline of stocks, the fishing effort continued to increase;
- ❖ the fishing is carried out in a competitive framework without any agreement between the countries on limits to fishing;
- ❖ there are large differences in the economic and technical structure of the fleets exploiting the fishery resources of the Black Sea among the countries, making regional cooperation a more demanding exercise;
- ❖ the development of small-scale fisheries needs a new and transboundary approach by national authorities;
- ❖ the fishery research in the Black Sea region remains sparsely equipped and funded.

***For the future management of this resource at regional level we shall take into consideration the following aspects:***

- the improvement of catch statistics regarding *Squalus acanthias* in the Black Sea is needed;
- joint surveys (6 Black Sea countries) are recommended to follow the distribution patterns, spawning areas, catch/effort unit (CPUE), biomass estimations, diet, maturity indices etc.
- a better knowledge of the species (distribution, migration, reproduction, fecundity);
- catch information is vital for the successful management of this species;
- strengthening the regional legal framework for sustainable management;
- establishing a regional organization through negotiation on signing of legally binding documents for fisheries;
- common policy of Black Sea countries for development of small-scale fisheries sector including harmonized fisheries regulation measures;
- developing and implementing regionally agreed fish stock assessment methodologies;
- harmonizing the development strategies of the fishing sector with those of environmental protection, through implementing the concept regarding the fishing management based on the ecosystemic approach and the FAO Code of Conduct for a responsible fishing;
- development of specific indicators for the Black Sea to monitor and assess the state of key resources/habitats;
- undertake concerted actions to combat illegal fishing and to establish regional consultation mechanisms between the Black Sea coastal states;

- increase/designate the protected marine areas of regional significance and establish a network for the Black Sea.

## Conclusions

- ✓ The spiny dogfish (*Squalus acanthias*) inhabiting the Romanian marine waters is a migratory species, with long life cycle, whose stock is strongly influenced by the environmental conditions and fishing effort size.
- ✓ The stock is common for the majority of Black Sea riparian states (shared stock); accordingly the management of stock has to be made at regional level, establishing the total admissible catch (TAC).
- ✓ The catches, both regionally and nationally level, are clearly decreasing, due to the over-exploitation and the use of inappropriate fishing gear;
- ✓ In compliance with the IUCN criteria, the *Squalus acanthias* species is considered near threatened.
- ✓ State of spiny dogfish (*Squalus acanthias*) stock at the Romanian littoral and also at Black Sea level is on going to be re-evaluated, following that the necessary measures will be proposed.
- ✓ In order to protect and rehabilitate the population of this species at the whole Black Sea level and for a sustainable management, we consider opportune a common assessment of the stock size at regional level, by all riparian countries and function by the conclusions we can propose more complex measures.

## References

- ❖ BSC, 2011 - Fishes list IUCN status [www.blacksea-commission.org](http://www.blacksea-commission.org)
- ❖ BSC, 2008. State of the Environment of the Black Sea (2001-2006/7). Edited by Temel Oguz. Publications of the Commission on the Protection of the Black Sea Against Pollution (BSC) 2008-3, Istanbul, Turkey, 448 pp.
- ❖ Daskalov G., V. Raykov, M. Panayotova, G. Radu, V. Maximov, V. Shlyakhov, E. Duzgunez and H.-J.Rätz, 2009 - Scientific, Technical and Economic Committee for Fisheries. Report of the SGMED-09-01 working group on the review of advice on Black Sea Stocks for 2009. EUR - Scientific and Technical Research series. Joint Research Centre - ISSN 1018-5593. 158 pp <http://stecf.jrc.ec.europa.eu>
- ❖ Daskalov G., Cardinale M., Aysun Gümüş, Duzgunes E., Genç Y., Maximov V., Mikhaylyuk A., Panayotova M., Radu G., Raykov V., Shlyakhov, V., Zengin M., Yankova, M., and Rätz, H.-J, 2011 - Scientific, Technical and Economic Committee for Fisheries. Assessment of Black Sea Stocks, Publications Office of the European Union EUR - Scientific and Technical Research series, p. 56, ISSN 1831-9424 (online), ISSN 1018-5593(print) <http://stecf.jrc.ec.europa.eu>;
- ❖ Demirhan, S., Seyhan, K., 2007 - Maturity and Fecundity of Spiny Dogfish (*Squalus acanthias* L., 1758) in the Eastern Black Sea, Turk. J. Zool., 31, (2007), 301- 308.
- ❖ Kirnosova I. P., Lushnicova V. P., 1990 - Feeding and food requirements of spiny dogfish (*Squalus acanthias* L.). Biological resources of the Black Sea. collected papers - USSR, Moscow: VNIRO, 45-57. (in Russian)
- ❖ Maklakova I.P., Taranenko N.F.,1974 - Some information on biology and distribution of spiny dogfish and Raja rays in the Black Sea and recommendations for their fisheries. -USSR, Moscow, VNIRO Proceedings, vol. 104, p.27-37. (in Russian)

- ❖ Maximov V., G. Radu, I. Staicu, 2006 - Contributios to the knowledge of the biological characteristics of the some demersal fish from the Romanian marine area. Cercetari Marine (Recherches Marines), v. 36, p. 153-172.
- ❖ Maximov V., E. Pătraș, L. Oprea, G. Radu, T. Zaharia, C. Sion (Badalan) 2010- *Contributions to the knowledge of the biological characteristics of main marketable fish species from the Black sea romanian area, between 2005-2009*, Journal of Environmental Protection and Ecology (JEPE), vol. 3, p. 90-999, - <http://www.jepe.gr> -, ISSN 1311-5065.
- ❖ Radu G., S. Nicolaev, 2010 - The regulation of Black Sea fish stocks. International Association for Danube Research- IAD Danube News 22-5. Editor DANUBE NEWS Alumnus: Swiss Federal Institute of Aquatic Science and Technology (Eawag), Ueberlandstrasse 133; CH-8600 Dübendorf, Switzerland.
- ❖ Radu G, Eugen Anton, Mariana Golumbeanu, Violin RAYKOV, V. Yankova, M. Panayotova, M. Shlyahov, Vl. Zengin, M. 2011a - Evolution and State of the Black Sea Fishery Correlated with Ecological Conditions and Fishing Effort. Journal of Environmental Protection and Ecology (JEPE), vol. 12, No. 2, p. 549-558, - <http://www.jepe.gr> -, ISSN 1311-5065.
- ❖ Radu G., 2011- Romanian Fishery Report 2010. 14<sup>th</sup> regular FOMLR AG meeting of the BSC, Black Sea Commission Permanent Secretariat Premises, Istanbul, Turkey, 19-20<sup>th</sup> of September, 2011.
- ❖ Radu G., S. Nicolaev, V. Maximov, E. Anton, 2011b - The Dynamics of Marine Fisheries at the Romanian Coast During 1950-2009. The joint 3rd biannual Black Sea Scientific Conference and up-grade BS-Scene Project Joint Conference. “Black Sea Outlook” Conference 31 October - 4 November 2011.
- ❖ Radu G., V. Maximov, E. Anton, 2011c - Research on the status of the dogfish (*Squalus acanthias*) population in the Romanian marine area. Summary data on dogfish at Black Sea level. FAO/GFCM Workshop on Stock Assessment of Selected Species of Elasmobranchs in the GFCM Area. Brussels, Belgium, 12-16 December 2011.
- ❖ Serobaba I.I., Domashenko G.P., Yuriev G.S., Malyshev I.I., Gapishko A.I., Shlyakhov V.A., Kirillyuk M.M., Kaminer K.M., Domashenko Yu.G., Vinarik T.V., Timoshek N.G., Kirnosova I.P., Mikhailyuk A.N., Korkosh N.I., Akselev O.I., Chashchin A.K., Zhigunenko A.V., Litvinenko N.M., 1988. Commercial Fishery Description of the Black Sea (section Characteristics of the commercial species - Description of fishing grounds). AzcherNIRO, Publishing House of the Chief Department of Navigation and Oceanography of the Ministry of Defense for the Ministry of Fisheries of the USSR, 48-96 (in Russian).
- ❖ Shlyakhov V. A., Daskalov G. M., 2008 - Chapter 9 The state of marine living resources/ State of the Environment of the Black Sea (2001-2006/7), Edited by Temel Oğus. Publication of the Commission on the Protection of the Black Sea Against Pollution (BSC). - Istanbul, Turkey, 2008.-3.- pp. 321-364.