State of the Black Sea Spiny Dogfish (*Squalus acanthias* Linnaeus, 1758

1. Basic Identification Data

Scientific name: *Squalus acanthias*	Common name: Spiny/Picked Dogfish	ISSCAAP Group: 38
Geographical sub-area: 29		
Stock assessment method: trawl survey, VIT and YPRLEN 2.1		
Authors: Gheorghe RADU and Valodea MAXIMOV with consultancy for data from STECF/BS stock assessment working group		
Affiliation:National Institute for Marine Research and Development "Grigore Antipa" Constanta		

2. Stock identification and biological information

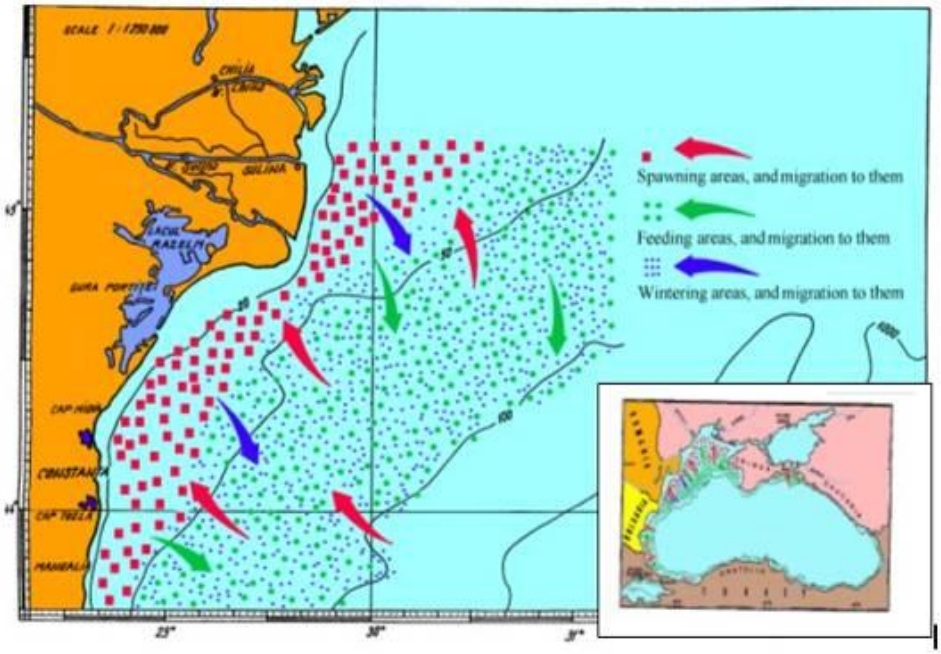
2.1 Stock unit

Piked dogfish inhabits the whole Black Sea shelf at the water temperatures 6 – 15ºC – Fig. 2.1.1 and Fig 2.1.2. 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 picked dogfish disperses all over the shelf. Reproductive migrations of viviparous picked dogfish take place towards the coastal shallows with two peaks of intensity – in spring and autumn. The autumn migration for reproduction covers more individuals usually (Radu G.and Radu E., 2008).

Piked dogfish 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 – 30 m (Maklakova, Taranenko, 1974). At this time males keep separately from females in depth 30 – 50 m. The birth of picked dogfish juveniles takes place at the temperature of water 12 – 18°C.

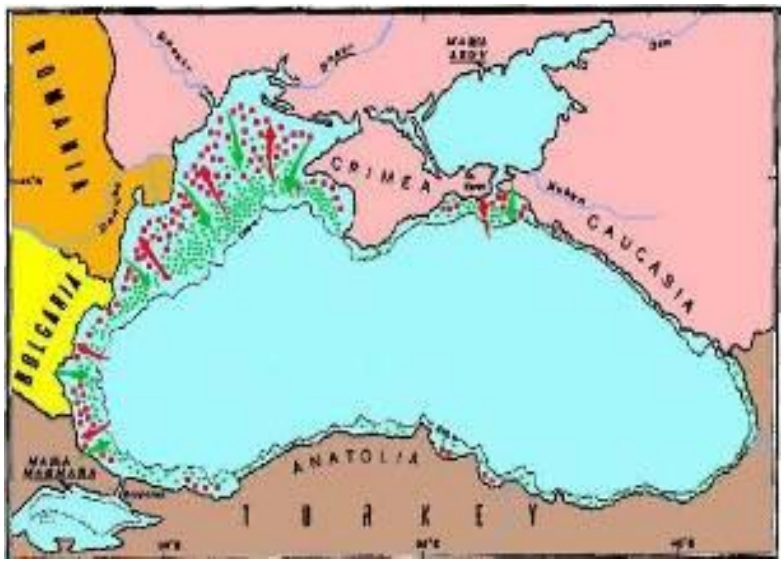
In autumn piked dogfish aggregates into large schools, accompanying anchovy and horse mackerel, which migrate to wintering grounds along eastern and western coast. During wintering the densest concentrations of picked dogfish are observed, where picked dogfish feeds intensively. They are associated, above all, with major wintering areas of anchovy in the waters of Georgia and Turkey.

In the North-western Black Sea in the waters of Ukraine and Romania in depth from 70-80 m down to 100-120 m abundant wintering concentrations of picked dogfish are also observed, where they are located on the grounds of whiting and sprat concentrations (Kirnosova, Lushnicova, 1990).



(Radu G., 2003)

Fig. 21.1 Distribution and migration routes of the piked dogfish at Romanian littoral (Radu et al.,2008, 2010).



(Ivanov L. and Beverton R.J.H., 1985)

Fig. 2.1.2 Distribution and migration routes of the piked dogfish at Black Sea level.

2.2 Growth and maturity

Piked dogfish is a major demersal predator, reaching in the Black Sea the length of about 1.50 m. According to investigations conducted in former USSR waters, Kirnosova, (1993) found that the piked dogfish maximum age is 20 years. The parameters in VBGF and natural mortality parameters are:

Males: $K=0.029$ $t_0=-3.84$; $L_\infty=272$ cm; $W_\infty=47$ kg; $M=0.20 \div 0.23$

Females: $K=0.026$ $t_0=-3.32$; $L_\infty=303$ cm; $W_\infty=196$ kg; $M=0.15 \div 0.20$

Age and length, at which 50% of individuals are mature, are 10.49 years and 87.57 cm for males and 11.99 years and 102.97 cm for females, respectively. Mean biennial fecundity is 19.4 eggs and 12.9 pups. The linear relationship between fecundity and length is: $F_e = 0.09 \times TLp + 2.12$ ($r = 0.5$) for pups and $F_o = 0.27 \times T\,Lp - 21.59$ ($r = 0.7$) for eggs

(Demirhan and Seyhan, 2007).

Ukrainian data for the period 1971-2001 are: L_∞=282; t_0 = -3.6684 (year); a = 0.00000677; b =2.9593. For period 2002 – 2012 a= 0.00000640; b= 3.0000

Romanian data for 2011 are the following: $L\infty$ =136.3 cm; t_0=−1.30 (year); a = 0.0117; b = 2.76694; k = 0.191(year^{-1}); M = 0.258 (Radu, 2011).

Life-history parameters and food diet of picked dogfish (*Squalus acanthias*) from the SE Black Sea were studied (Demirhan and Seyhan, 2007). Picked dogfish at age 1 to 14 years old were observed, with dominance of 8 years old individuals for both sexes. The length–weight relationship was W=0.0040*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_∞=12021 (g), L_∞=157 (cm), K=0.12 (year^{-1}) 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–length, fecundity–weight and fecundity–age were found to be:

F=−17.0842+0.2369*L (r=0.93)

F=0.3780+0.0018*W (r=0.89)

F =−0.7859+1.1609*A (r=0.94), respectively.

In conformity with Ukrainian data, the maturity ogive for last years is the following:

Year/ Age	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
2011	0	0	0	0	0	0	0	0	0.10	0.25	0.45	0.55	0.75	0.95	1.0	1.0	1.0	1.0	1.0

Maturity ogive from Romanian data (Radu et al., 2011b)

Year/ Age	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
2011	0	0	0.45	0.7	0.95	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table2. 1: Maximum size, size at first maturity and size at recruitment at Romanian littoral in 2010-2011

Somatic magnitude measured (LH, LC, etc)*			Lt	Units*	cm
Sex	Fem	Mal	Both	Unsexed	
Maximum size observed			157		Reproduction season: Spring and autumn
Size at first maturity	88	82	85		Reproduction areas: BS shelh, coastal zone
Recruitment size			75		Nursery areas: coastal zone

Table-2.2: Growth and length weight model parameters

			Sex			
		Units	female	male	both	unsexed
Growth model	L∞	cm			157	
	K				0.12	
	t0				-1.31	
	Data source	Turkish data				
Length weight relationship	a				0.0117	
	b				2.76694	
M (vector by length or age)					M = 0.1-0.2	
sex ratio (% females/total)	15.6%					

In Romanian waters the overall sex ratio of males was significantly positive with a rate of 84.29% compared to only 15.61 females (Maximov et al., 2008b; 2010a,b). In Bulgarian waters, the majority of the piked dogfish were females.

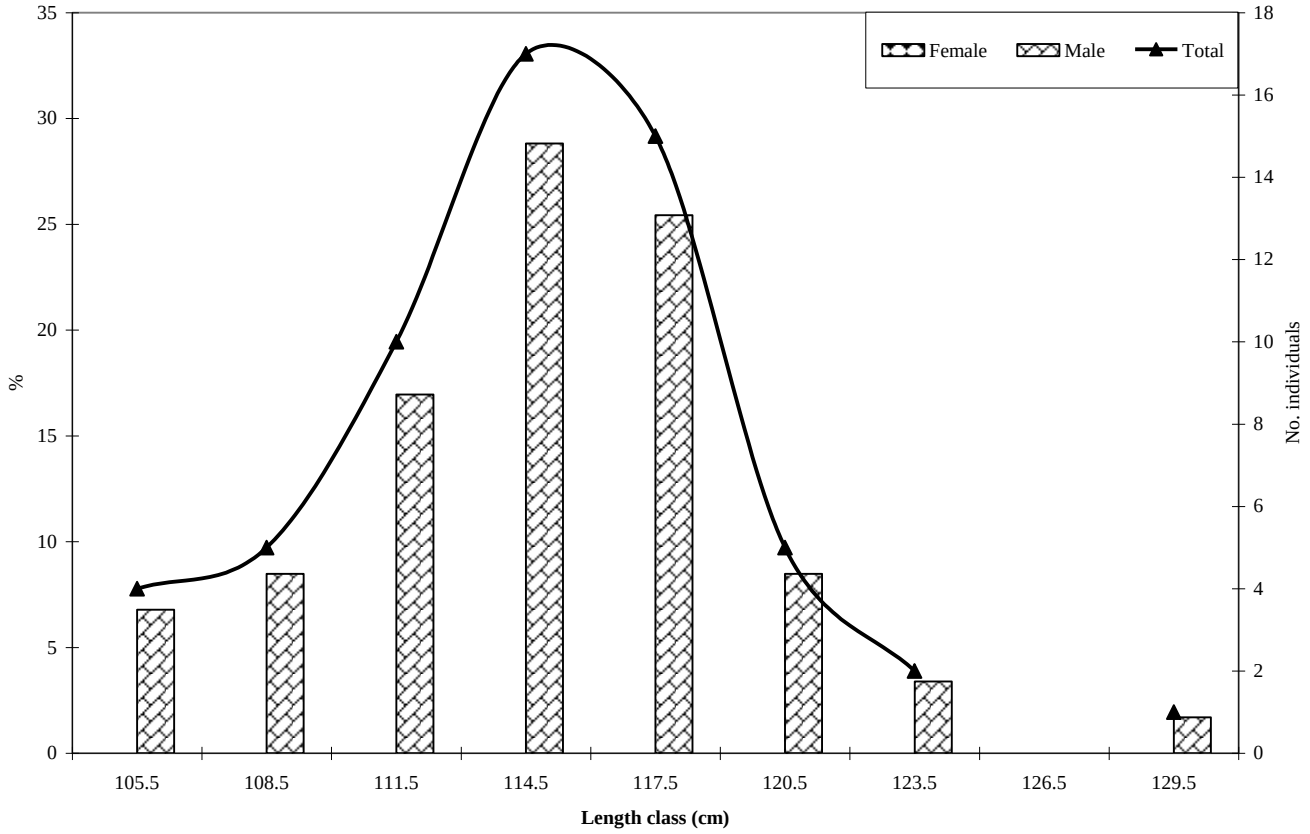


Fig.2.2.1: Structure on length classes for dogfish in 2011, total catches in Romanian area

3. Fisheries information

3.1 Description of the fleet

3.1.1 Table Bulgarian and Romanian Dogfish catches in 2008-2011

Country	Year	Vessel length	Gear	Mesh size range	Fishery	GSA	Species	Catche (t)	Discards (t)
BUL	2008	VL0006	LLS	400DXX	DEMSP	SA 29	DGS	0.7	0
BUL	2008	VL0612	LLS	400DXX	DEMSP	SA 29	DGS	7.9	0
BUL	2008	VL1218	LLS	400DXX	DEMSP	SA 29	DGS	7.3	0
BUL	2008	VL1824	OTM	20D40	SPF	SA 29	DGS	6.8	0
BUL	2009	VL2440	OTM	20D40	SPF	SA 29	DGS	31.4	0
BUL	2009	VL0006	LLS	400DXX	MDPSP	SA 29	DGS	2.4	0
BUL	2009	VL0612	LLS	400DXX	MDPSP	SA 29	DGS	3.4	0
BUL	2009	VL1218	LLS	400DXX	MDPSP	SA 29	DGS	2.7	0
BUL	2010	VL1218	OTM	20D40	SPF	SA 29	DGS	53	0
BUL	2010	VL1824	OTM	20D40	SPF	SA 29	DGS	2.9	0

BUL	2010	VL0006	LLS	400DXX	MDPSP	SA 29	DGS	3.9	0
BUL	2010	VL0612	LLS	400DXX	MDPSP	SA 29	DGS	50.8	0
BUL	2011	VL0612	LLS	400DXX	MDPSP	SA 29	DGS	4.9	0
BUL	2011	VL0612	LLD	400DXX	MDPSP	SA 29	DGS	8.8	0
BUL	2011	VL0612	OTM	20D40	SPF	SA 29	DGS	1	0
BUL	2011	VL1218	GNS	50D100	MDPSP	SA 29	DGS	1	0
BUL	2011	VL1218	LLS	400DXX	MDPSP	SA 29	DGS	23.4	0
BUL	2011	VL1218	OTM	20D40	SPF	SA 29	DGS	6.4	0
BUL	2011	VL1218	LLD	400DXX	MDPSP	SA 29	DGS	19.9	0
BUL	2011	VL1824	LLS	400DXX	MDPSP	SA 29	DGS	9.9	0
BUL	2011	VL1824	OTM	20D40	SPF	SA 29	DGS	1.9	0
BUL	2011	VL1824	LLD	400DXX	MDPSP	SA 29	DGS	1.3	0
BUL	2011	VL2440	OTM	20D40	SPF	SA 29	DGS	3018	0
ROM	2008	VL1224	GNS	100D400	DEMF	SA 29	DGS	1.054	0
ROM	2008	VL0612	GNS	100D400	DEMF	SA 29	DGS	8.079	0.103
ROM	2008	VL0006	GNS	100D400	DEMF	SA 29	DGS	1.047	0
ROM	2009	VL2440	GNS	100D400	DEMF	SA 29	DGS	0.415	0
ROM	2009	VL1824	GNS	100D400	DEMF	SA 29	DGS	0.06	0
ROM	2009	VL0612	GNS	100D400	DEMF	SA 29	DGS	3.763	0
ROM	2009	VL0006	GNS	100D400	DEMF	SA 29	DGS	0.092	0
ROM	2010	VL0612	GNS	100D400	DEMF	SA 29	DGS	3.069	0
ROM	2011	VL1824	GNS	100D400	DEMF	SA 29	DGS	0.5	0
ROM	2011	VL0612	LLS	none	DEMF	SA 29	DGS	1.766	0
ROM	2011	VL0612	GNS	100D400	DEMF	SA 29	DGS	1.544	0.26
ROM	2011	VL0006	GNS	100D400	DEMF	SA 29	DGS	0.155	0

In 2011, only Romania gives data regarding number of gillnets on vessel length:

Table 3.1.2 Number of fishing gillnets for dogfish in the Romanian area

Vessel length (m)	Number of gillnets for dogfish
< 6m	10
6-12 m	205
18-24 m	50
Total	265

In last years, only Romania gives data regarding commercial CPUE for 2009-2011 period and CPUE in at sea surveys for 2010 and 2011.

Table 3.1.3 Romanian CPUE in commercial fishing.

YEAR	**Fishing**	**CPUE**
2009		
LOA 6-12	gillnets	0.24 kg/gear/day
LOA 18-24	gillnets	0.40 kg/gear/day
LOA 24-40	gillnets	0.89 kg/gear/day
2010		

LOA 6-12	gillnets	0.18 kg/gear/day
2011		
LOA 6-12	gillnets	0.248kg/gear/day
LOA 18-24	gillnets	0.91 kg/gear/day

3.3 Catches as used in the assessment

3.3.1 Catches as used in the assessment – 2011 data (N)

Age class	Bulgaria	Georgia	Romania	Russian Federation	Turkey	Ukraine
1						
2						
3						
4						
5						
6						
7	36	1	4	3	25	29
8	152	6	16	14	106	122
9	168	7	18	16	117	134
10	460	18	48	44	320	369
11	633	25	67	60	441	508
12	555	22	58	53	387	446
13	752	30	79	71	524	604
14	604	24	63	57	420	484
15	652	26	69	62	454	523
16	869	34	91	82	605	697
17	503	20	53	48	350	403
18	190	7	20	18	132	152
19	48	2	5	5	34	39
20						
Total	5622	222	591	533	3914	4511

3.3.2 Catches as used in the assessment – average 1989-2011 data (N)

Age class	Bulgaria	Georgia	Romania	Russian Federation	Turkey	Ukraine
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	60	0	34	1019	232
8	0	253	0	143	4298	979
9	0	279	0	157	4744	1081
10	0	767	0	432	13021	2967
11	0	1055	0	595	17924	4083
12	462	926	133	522	15727	3583

13	595	1254	170	707	21299	4852
14	3039	1007	871	568	17096	3895
15	2180	1087	625	613	18465	4207
16	198	1449	57	817	24609	5607
17	132	838	38	472	14231	3242
18	0	317	0	179	5380	1226
19	0	81	0	45	1369	312
20	0	0	0	0	0	0
Total	**6606**	**9373**	**1893**	**5285**	**159182**	**36265**

3.2 Historical trends

In the Black Sea the largest catches of piked dogfish are along the coasts of Turkey, although this fish is not a target species of fisheries, being yielded 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, Daskalov, 2008). In subsequent years, they have decreased about 2 times and did not exceed 2400 t.

In the waters of Ukraine most of piked dogfish 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 picked dogfish are observed in 1989-1995, reaching 1200-1300 t. After 1994 the catches went down being between 20 and 200 t.

In the rest of countries piked dogfish is harvested mainly as by-catch, annual catches are usually lower than the Ukraine. The maximum annual catches of picked dogfish in 1989-2005 were: Bulgaria - 126 t (2001), Georgia - 550 t (1998), Romania - 52 t (1992), Russian Federation - 183 t (1990).

It should be noted that in the waters of Bulgaria, the highest catches were observed in the early 2000's. In Romania dogfish is caught mainly as by-catch of the sprat trawl fishery. The catches decreased very much because of decreasing of the trawling effort (Maximov et al., 2008, 2010; Radu et al., 2009, 2010).

In Turkey piked dogfish lost its commercial importance in recent years. In the last 20 years, the decrease of dogfish landing may be may be due to over-fishing (Demirhan , phD thesis,)

Table 3.2 Picked Dogfish catches in the Black Sea area (BSC2011, BS stock assessment working group, 2011,2012)

Year	Bulgaria	Georgia	Romania	Russian Federation	Turkey	Ukraine	TOTAL
1989	28	217	30	135	4558	1191	**6159**
1990	16	128	45	183	1059	1330	**2761**
1991	21	18	26	67	2017	775	**2924**
1992	15	14	52	15	2220	595	**2911**
1993	12	131	6	5	1055	409	**1618**
1994	12	45	2	11	2432	148	**2650**
1995	80	31	7	90	1562	67	**1837**
1996	64	71	5	19	1748	44	**1951**
1997	40	1	5	9	1510	20	**1585**
1998	28	550	5	6	855	38	**1482**
1999	25	18	5	9	1478	94	**1629**
2000	102	21	5	12	2390	71	**2601**
2001	126	27	5	27	576	134	**895**
2002	100	65	5	19	316	97	**602**

2003	51.3	40	5	29	184	172	**481.3**
2004	47.2	31	5	34	211	93	**421.2**
2005	14.5	35	5	19	102	75	**250.5**
2006	6.226	10	9	17	193	67	**302.226**
2007	23.98	2	17	32	91	45	**210.98**
2008	22.75	0.4	10	59	35	79	**206.15**
2009	9.46	1.5	4	14	159	47	**234.96**
2010	42	1.5	3	8.54	16	27	**98.04**
2011	38.06	1.5	4	3.61	26.5	30.537	**104.207**

3.3 Management regulations

Romanian fisheries regulatory framework includes between others the following laws:

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

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

- in 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 = 100mm, 2a = 200 mm;
- minimum admissible length in catches is 120cm (TL)

In the Black Sea Fishes list IUCN status presented on the Black Sea Commission website (www.blacksea-commission.org) is included and categorized *Squalus acanthias* as follows (Table 3.3.1.1) in the BSC, 2011:

Table 3.31.1. .The IUCN status of spiny dogfish in the Black Sea countries

Country	**BG**	**GE**	**RO**	**RF**	**TR**	**UK**
IUCN status	N/A	LC	NT	N/A	EN	NT

LC - least concerned; NT- near threatened; EN- endangered; N/A – no data

3.4 Reference points

Reference Points	F	YPR	SSB/R	TSB/R
F-zero	0.000000	0.000000	19036.640242	27482.638943
F0.1	0.227000	1630.065081	7333.681895	15746.881160
F-max	1.100000	1854.713847	1905.248354	10231.715141
F at 25% of MSP	0.389000	1790.293295	4768.058109	13161.086947

Mean Fc = 0.255 for the period 1989-2011
Mean Fc = 0.262 for 2011

4 Fisheries independent information

4.1 Swept area method

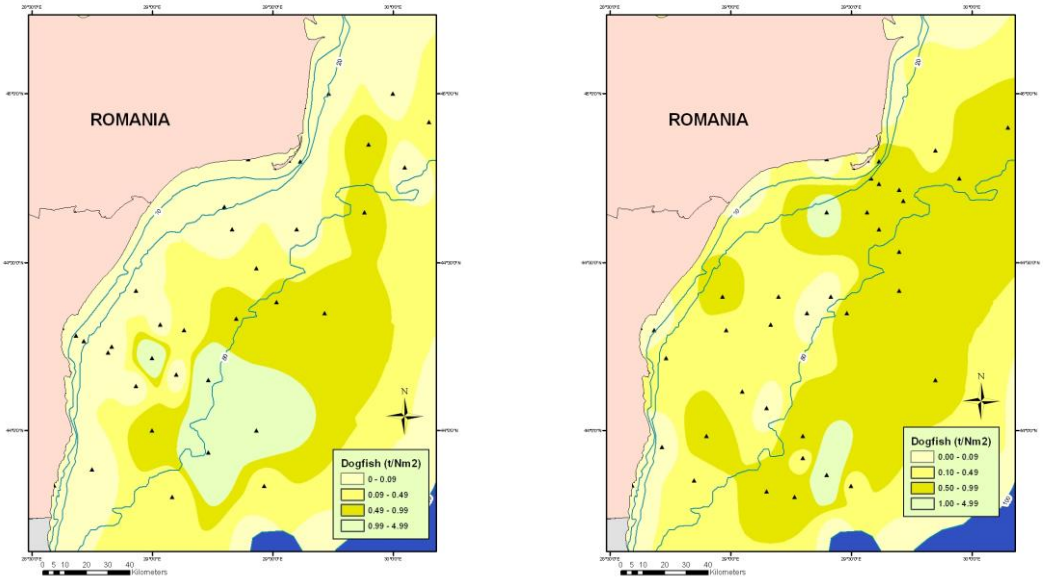
4.1.1 Brief description of the chosen method and assumptions used

In the Romanian waters was used the bottom trawl 22/27-34 with horizontal opening of 13m. The average speed of the vessel was of 2.3-2,5 knots, the trawling time was standardized at 60 minutes. Have been registered the following elements: geographical coordinates for trawling points, water depth (m), the average trawling speed (knots), time of trawling, total catch and structure on species. For every trawling was taken one random sample for small size species and for big species like turbot and dog-fish each specimens were registered and measured.

Having data regarding horizontal opening of the trawl, trawling speed and time have been calculated the surveyed area, catch per surveyed area, extrapolated catch per square Nm for each species and biomass.

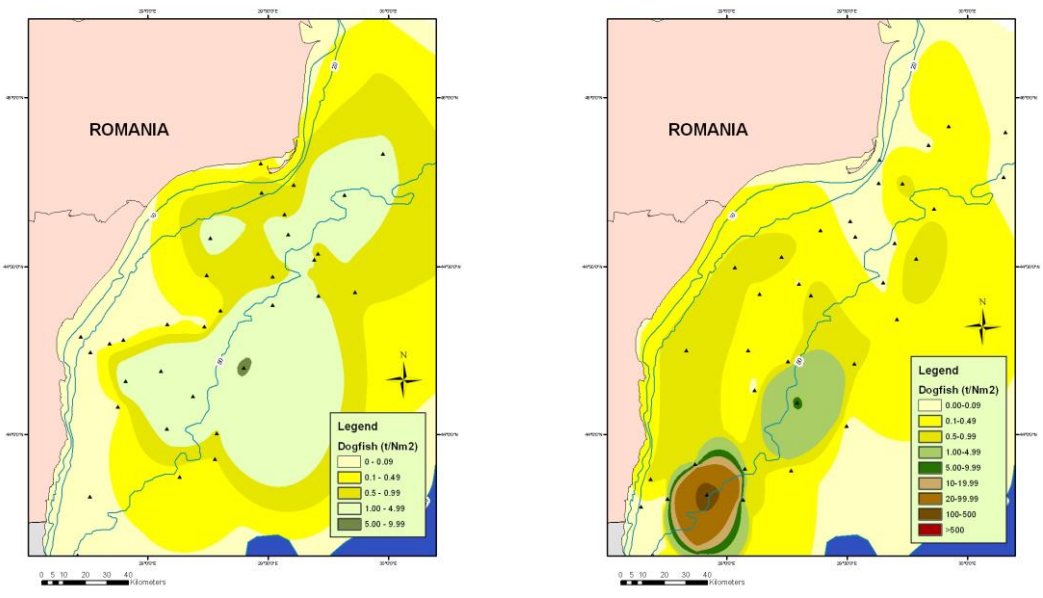
4.1.2 Spatial distribution of the resources

In Romanian waters the agglomerations are distributed on the entire shelf, but especially at depth deeper than 20m. Two peaks of intense spawning and of birth of juveniles are in spring and autumn period at Romanian littoral.



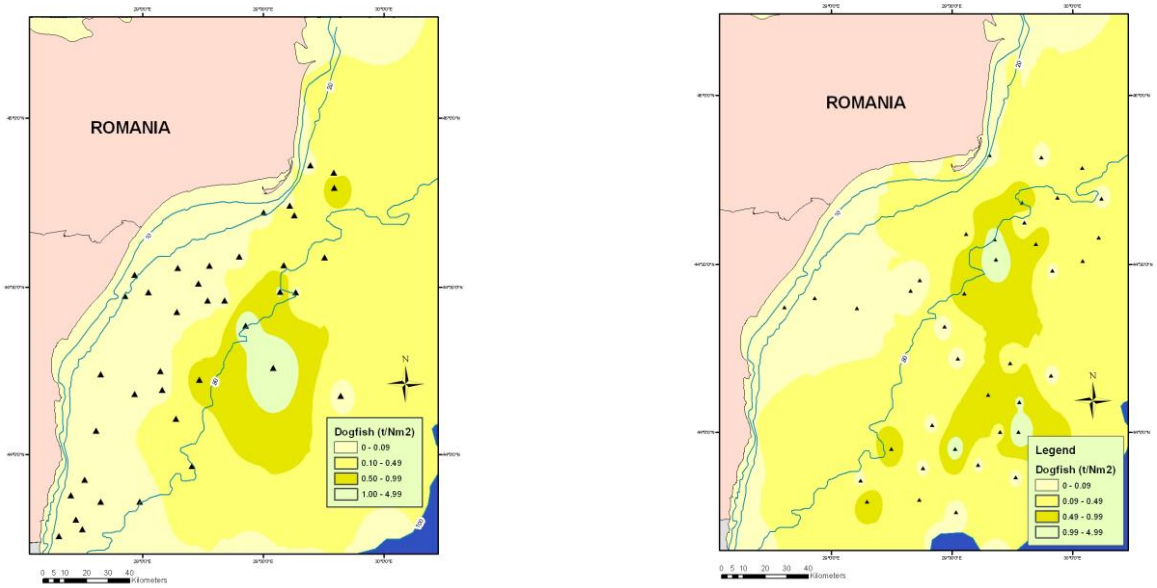
2009 – spring 2009 – autumn

Fig. 4.1.2.1. Distribution of picked dogfish agglomeration during demersal trawl survey in 2009, Romanian Black Sea area.



2010- spring 2010 –autumn

Fig. 4.1.2.2. Distribution of piked dogfish catches during demersal trawl survey in 2010, Romanian Black Sea area.



2011- Spring 2011- autumn

Fig 4.1.2.33.1.1.3. Distribution of piked dogfish catches during demersal trawl survey in 2011, Romanian Black Sea area.

4.1.3 Historical trends

In the former USSR and later in Ukraine, to assess the piked dogfish stock, the swept area technique using bottom trawl surveys, as well as dynamic model of an isolated population, were applied (Shlyakhov, 1997). The abundance and biomass of picked dogfish in the waters adjacent to Georgia, the Russian Federation and Ukraine were assessed. Whole population of picked dogfish in 1972 – 1992 was assessed by VPA. The obtained results from stock assessments for whole Black Sea (Prodanov *et al.*, 1997, Daskalov 1998), the former USSR and Ukrainian waters (Shlyakhov, Charova, 2006) in 1989 – 2005 are presented in table 4.1.3.1

According to the assessments, in 1989 – 2005 the stock of picked dogfish in the shelf area of the Black Sea and in Ukraine waters tends to be gradually reduced. Observed dynamics

of stock corresponds with increasing CPUE in Turkish waters.

Table. 4.1.3.1 Commercial stock of picked dogfish in the Black Sea and along the coast of the former USSR and in the water of Ukraine, th. tones.

Years	Whole Black Sea shelf	Waters of Ukraine, the Russian Federation and Georgia		Waters of Ukraine	
	VPA	Trawl survey	Modeling	Trawl survey	Modeling
1989	117.8	58.5	63.5	34.6	-
1990	112.9	58.7	63.2	48.8	-
1991	97.9	17.2/69.9*	64.0	14.4/58.5*	-
1992	90.0	62.9	60.3	56.9	-
1993	-	-	57.1	30.2	-
1994	-	-	52.9	36.0	42.1
1995	-	-	-	-	37.6
1996	-	-	-	-	32.1
1997	-	-	-	-	31.0
1998	-	-	-	32.0	30.8
1999	-	-	-	-	28.0
2000	-	-	-	-	24.3
2001	-	-	-	-	22.3
2002	-	-	-	-	21.0
2003	-	-	-	-	22.1
2004	-	-	-	-	22.3
2005	-	-	-	-	21.0

* stock assessment is reduced to the average area of the registration (survey) zone.

According to the assessments of Prodanov *et al.* (1997) and Daskalov (1998) picked dogfish stock has increased until 1981, after that it began to decrease. The authors explained the increase in picked dogfish with the increased abundance of main food species (whiting, sprat, anchovy and horse mackerel), and its subsequent reduction partially with intensification of the dogfish fishery during the period 1979 – 1984.

In Romanian waters the swept area method was applied for stock assessment of piked dogfish. Results for estimated piked dogfish biomasses in spring and autumn of 2009- 2011 in Romanian waters are given in the following tables (Maximov et al.2010a,b; Radu et al. 2010, 2011a,b, Radu, 2011). In May 2009 the biomass of dogfish was evaluated at 741 t, extrapolated to 967 t for the shelf till 50 Nm from the shore. In May 2010 the biomass of dogfish was evaluated at 2437 t, extrapolated to 5635 t for the shelf till 50 Nm from the shore. In the autumn period the biomass agglomeration increased at 2541 t (2009) and 13051 tons (2010).

Table 4.1.3.2 Assessment of piked dogfish biomass in spring 2009 by demersal trawl, Romanian Black Sea area.

No. polygon	Surveyed area (Nm^2)	Range (t/Nm^2)	Average (t/Nm^2)	Total t in polygon (t)	Notes
1	1,227.13	0.00	0.00	0.0	Extrapolated at 967 t for the shelf till 50 Nm from shore
2	242.25	0.27 – 0.43	0.35	84.78	
3	165.00	0.23 – 0.28	0.26	42.90	
4	116.00	0.28	0.28	32.48	
5	724.25	0.53 0.76	0.63	456.27	
6	478.25	0.23 – 0.28	0.26	124.35	
7	265.63	0.00	0.0	0.00	

Total	3,218.5			740.78	

Table 4.1.3.2 Assessment of dogfish agglomeration in the Romanian area in spring 2010, sampling gear demersal trawl

No. polygon	**Polygon area (Nm^2)**	**Range (t/Nm^2)**	**Average (t/Nm^2)**	**Total tons in polygon(t)**	**Total on the shelf (t)**
1	630.50	0.00	0.00	0.00	Extrapolated at 5635 tons for the shelf till 50 Nm from shore (about 5000 Nm2), including the new area (near Snake Island)
2	567.75	0.21-1.41	0.63	357.68	
3	216.75	0.24-0.68	0.47	101.87	
4	1155.00	0.56-5.62	2.11	2437.00	
Total	2570			2897.00	

Table 4.1.3.3. Assessment of picked dogfish biomass by demersal trawl in autumn 2009, Romanian Black Sea area.

No. polygon	**Surveyed Area(Nm^2)**	**Range (t/Nm^2)**	**Average (t/Nm^2)**	**Total t in polygon (t)**	**Notes**
1	926.25	0.26 – 0.81	0.41	379.76	Extrapolated at 2,541 t for the shelf till 50 Nm from shore
2	2,404.13	0.39 – 2.04	0.68	1,634.81	
Total	**3,330**			**2,015**	

Table 4.1.3.4 Assessment of dogfish agglomeration in the Romanian area in the autumn 2010, sampling gear demersal trawl

No. polygon	**Polygon area (Nm^2)**	**Range (t/Nm^2)**	**Average (t/Nm^2)**	**Total tons in polygon(t)**	**Total on the shelf (t)**
1	40	164.48	164.48	6579.2	Extrapolated at 13051 tons for the shelf till 50 Nm from shore (about 5000 Nm2), including the new area (near Snake Island)
2	56	5.82	5.82	325.9	
3	1201	0.00-0.89	0.46	552.5	
4	315	0.00	0.00	0.00	
5	570	0.00	0.00	0.00	
6	868	0.28-1.01	0.58	503.44	
TOTAL	**3050**			**7961.04**	

Table 4.1.3.5 Assessment of dogfish agglomeration in the Romanian area in the spring 2011, sampling gear demersal trawl

Range of depths (m)	**0 - 30**	**30-50**	**50-70**	**Total**
Area (Nm^2)	675	1050	500	2225
Range of t/ Nm^2	0.00 – 0.00	0.00 – 1.11	0.00 – 2.53	
Biomass (t)	00.00	205.8	316	522.3*

* extrapolated at 1173 tons

Table 4.1.3.6 Assessment of dogfish agglomeration in the Romanian area in the autumn 2011, sampling gear demersal trawl

Range of depths (m)	**0 - 30**	**30-50**	**50-70**	**Total**
Area (Nm^2)	650	1225	1700	3575
Range of t/ Nm^2	0.00 – 0.00	0.00 – 1.53	0.00 – 2.53	
Biomass (t)	00.00	561.86	650.969	1212.8

* extrapolated at 1696 tons

5 Ecological information

5.1 Protected species potentially affected by the fisheries

5.2 Environmental indexes

6 Stock assessment

6.1 Name of Model VIT and YPR-LEN 3.1

I used the VIT program for estimation of abundance and fishing mortality and YPR-LEN (NOAA Fisheries Toolbox Version 3.1) for obtaining the reference points for dogfish in the Black Sea.

The program VIT is conceived for the analysis of fisheries where the available information is limited. VIT is designed for the analysis of marine populations, exploited by one or several gears, based on single species' catch data (structured by age or size). The main assumption underlying the model is that of steady state, because the program works with pseudo-cohorts and it is therefore not suitable for historical data series.

The program uses the catch data and ancillary parameters for rebuilding the population of the species and the mortality vectors affecting it by means of Virtual Population Analysis (VPA).

Once the virtual population has been rebuilt, an analysis of the fishery can be carried out with the aid of several tools: Comprehensive VPA results, Yield-per-Recruit analysis based on the fishing mortality vector, analysis of sensitivity to parameter values and transition analysis. The latter permits non-equilibrium analysis of how a shift in exploitation regime is reflected in the fisheries. All these tools can be applied to specific studies of competition among fishing gears.

6.1.1 Model assumptions

The VIT software was applied to assess population parameters based on pseudocohort analyses of average 1989-2011 data and 2011 data.

The two scenarios were run with the following parameters:

$L_\infty = 157cm$

$k = 0.12$

$t_0 = -1.31$

a = 0.0117
b = 2.769
M = 0.15

6.1.2 Scripts

6.1.3 Results

The VIT software was applied to assess population parameters based on pseudocohort analyses of average 1989-2011 data (6.1.3.1) and 2011 data (Table 6.1.3.2). In the first variant the main share in total catch was represented by Turkey and Ukraine and in the last option the main share is divided between Bulgaria, Turkey and Ukraine.

Three scenarios were run with M = 0.1, M=0.15, and, M = 0.2. The presented results are with M = 0.15.

From average of the catches by countries in the last 23 years (1989-2011), have been obtained Fc = 0.255, and SSB = 410 579 t, while for 2011 data the Fc = 0.262, SSB = 35263t.

Table 6.1.3.1 Summary results for 1989 -2011 data

---	**Catch mean age**	**Catch mean length**	**Mean F**	**Global F**	**Total catch**	**Catch/ D%**	**Catch/ B%**	**B/R**	**28368.24**
Total	13.985	130.65	0.255	0.069	1.04E+11	38.4	9.36	SSB/R	10489.63
BG	14.69	133.811	0	0	1.79E+08	0.07	0.02	Y/R	2654.105
GE	13.984	130.646	0.001	0	3.4E+08	0.13	0.03	Y/R BG	4.568
RO	14.69	133.811	0	0	14769381	0.01	0	Y/R GE	8.699
RF	13.984	130.643	0	0	1.08E+08	0.04	0.01	Y/R RO	0.377
TR	13.984	130.644	0.241	0.065	9.81E+10	36.28	8.84	Y/R RF	2.766
UK	13.984	130.645	0.013	0.003	5.09E+09	1.88	0.46	Y/R TR	2507.542
								Y/R UK	130.152

Current Stock Mean Age	10.353
Current Stock Critical Age	8
Virgin Stock Critical Age	8
Current Stock Mean Length	116.558
Current Stock Critical Length	105.63
Virgin Stock Critical Length	105.63
Number of recruits, R	39141358.44
Mean Biomass, Bmean (g)	1.11037E+12
Spawning Stock Biomass, SSB (g)	4.10579E+11
Biomass Balance, D	2.70558E+11
Natural death/D	61.6
Bmax/Bmean	14.09
Turnover, D/Bmean	24.37

Table 6.1.3.2 Summary results for 2011 data.

Summary Results 2011data for Spiny Dogfish								
---	Total	BG	GE	RO	RF	TR	UK	
Catch mean age	13.985	13.985	13.984	13.98	13.995	13.985	13.984	
Catch mean length	130.647	130.647	130.663	130.629	130.684	130.646	130.646	
Mean F	0.262	0.122	0	0.001	0.001	0.059	0.078	
Global F	0.08	0.037	0	0	0	0.018	0.024	
Total catch	3.776933E+09	1.756456E+09	2.735266E+06	1.940849E+07	1.578777E+07	8.517023E+08	1.130843E+09	
Catch/D%	47.07	21.89	0.03	0.24	0.2	10.62	14.09	
Catch/B%	10.71	4.98	0.01	0.06	0.04	2.42	3.21	

B/R	SSB/R	Y/R	Y/R BG	Y/R GE	Y/R RO	Y/R RF	Y/R TR	Y/R UK
31761.055	31761.055	3401.773	1581.989	2.464	17.481	14.22	767.103	1018.517
Current Stock Mean Age	10.503							
Current Stock Critical Age	9							
Virgin Stock Critical Age	10							
Current Stock Mean Length	117.205							
Current Stock Critical Length	111.439							
Virgin Stock Critical Length	116.591							
Number of recruits, R	1110283.68							
Mean Biomass, Bmean	3.526378E+10							
Spawning Stock Biomass, SSB	3.526378E+10							
Biomass Balance, D	8.023541E+09							
Natural death/D	52.93							
Bmax/Bmean	13.29							
Turnover, D/Bmean	22.75							

Table 6.1.3.3 Reference points

Reference Points	F	YPR	SSB/R	TSB/R
F-zero	0.000000	0.000000	19036.640242	27482.638943
F0.1	0.227000	1630.065081	7333.681895	15746.881160
F-max	1.100000	1854.713847	1905.248354	10231.715141
F at 25% of MSP	0.389000	1790.293295	4768.058109	13161.086947

Mean Fc = 0.255 for the period 1989-2011
Mean Fc = 0.262 for 2011

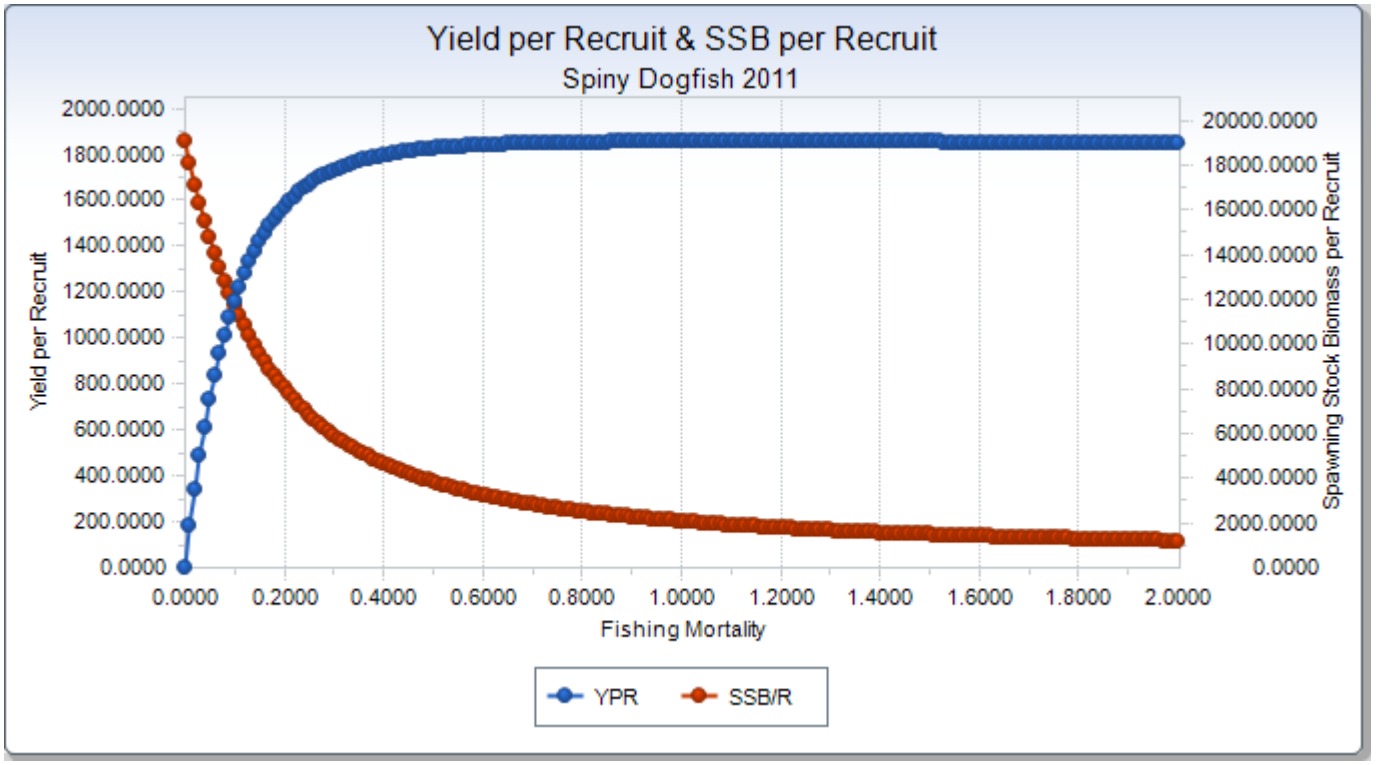


Fig. 6.1.3.4 Fishing Mortality related to Y/R and SSB/R

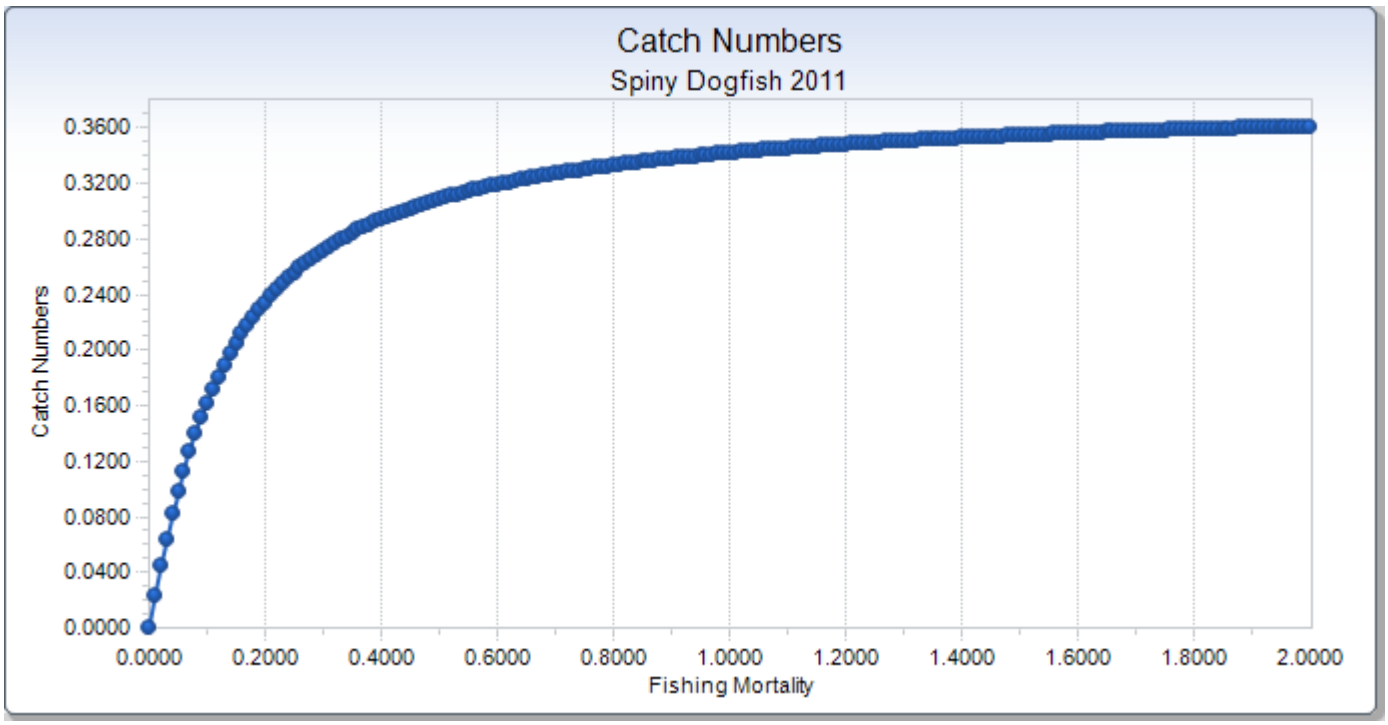


Fig. 6.1.3.5 Fishing Mortality related to catch numbers

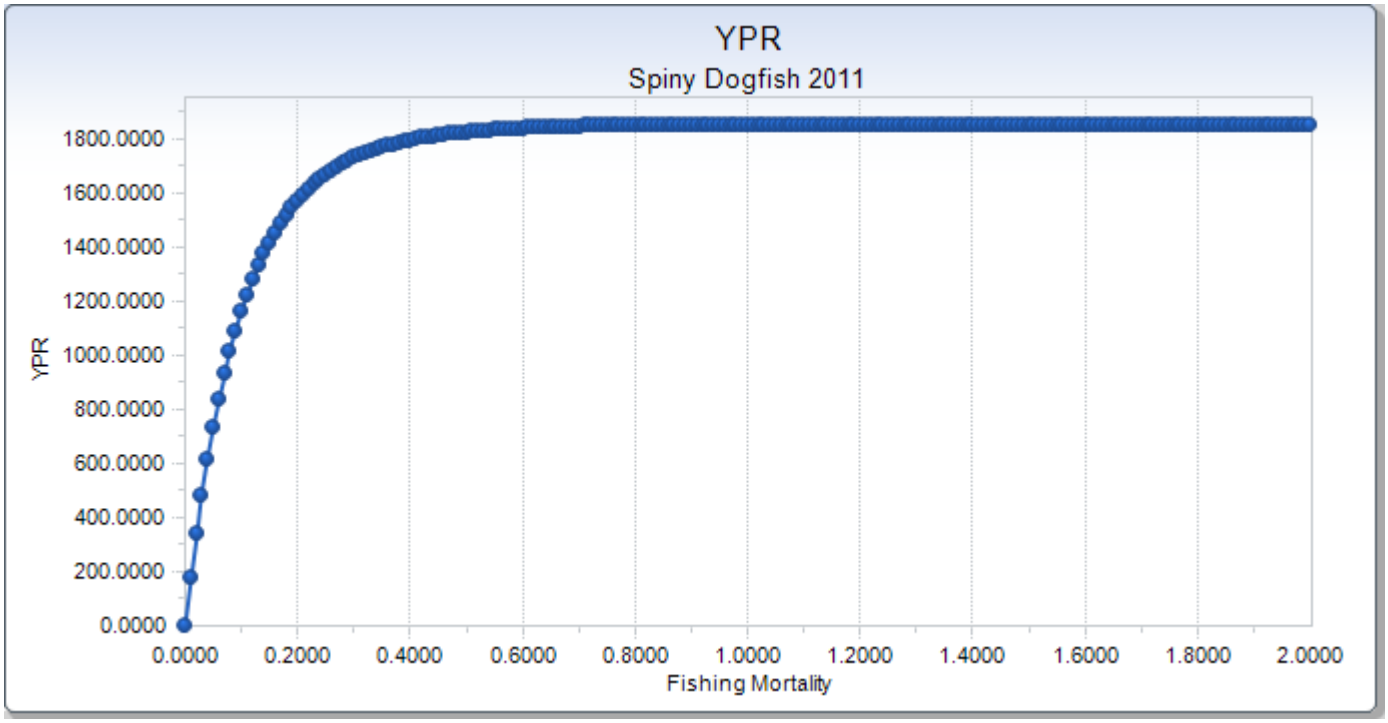


Fig. 6.1.3.6 Fishing Mortality related to YPR

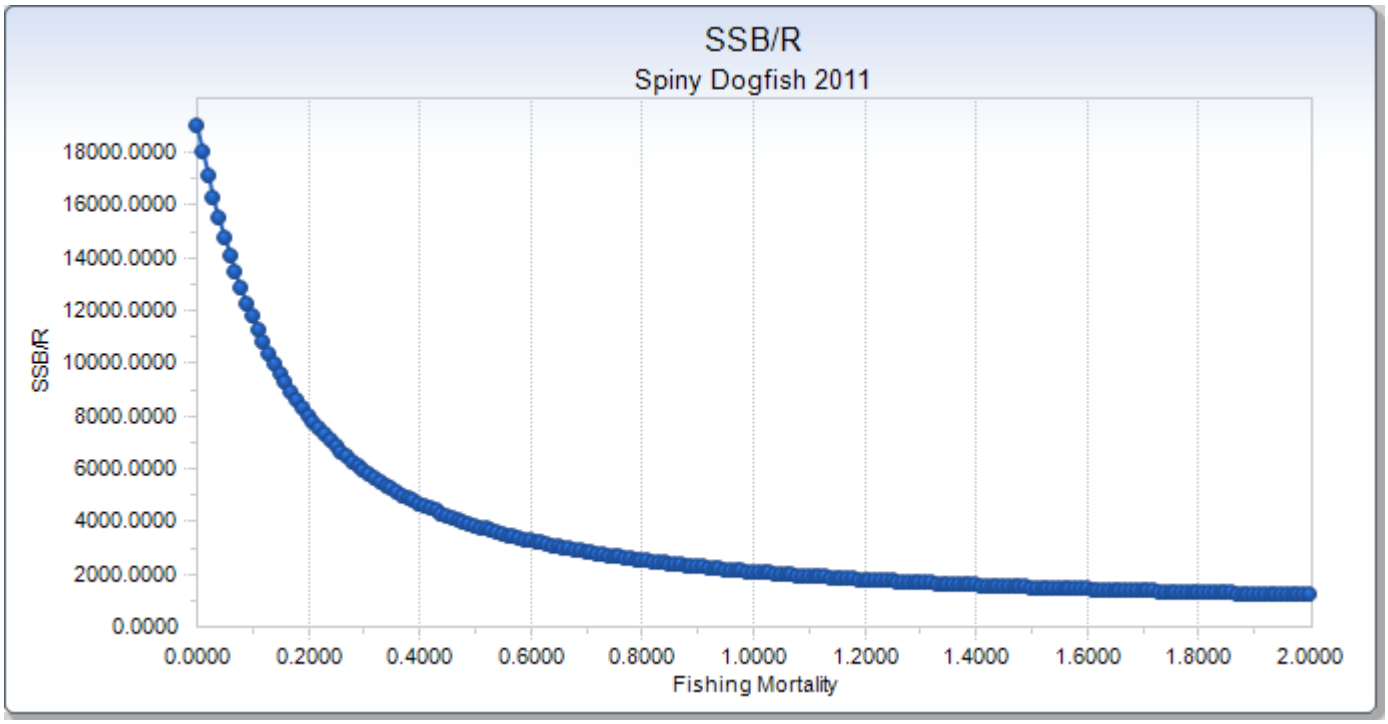


Fig. 6.1.3.7 Fishing Mortality related toSSB/R

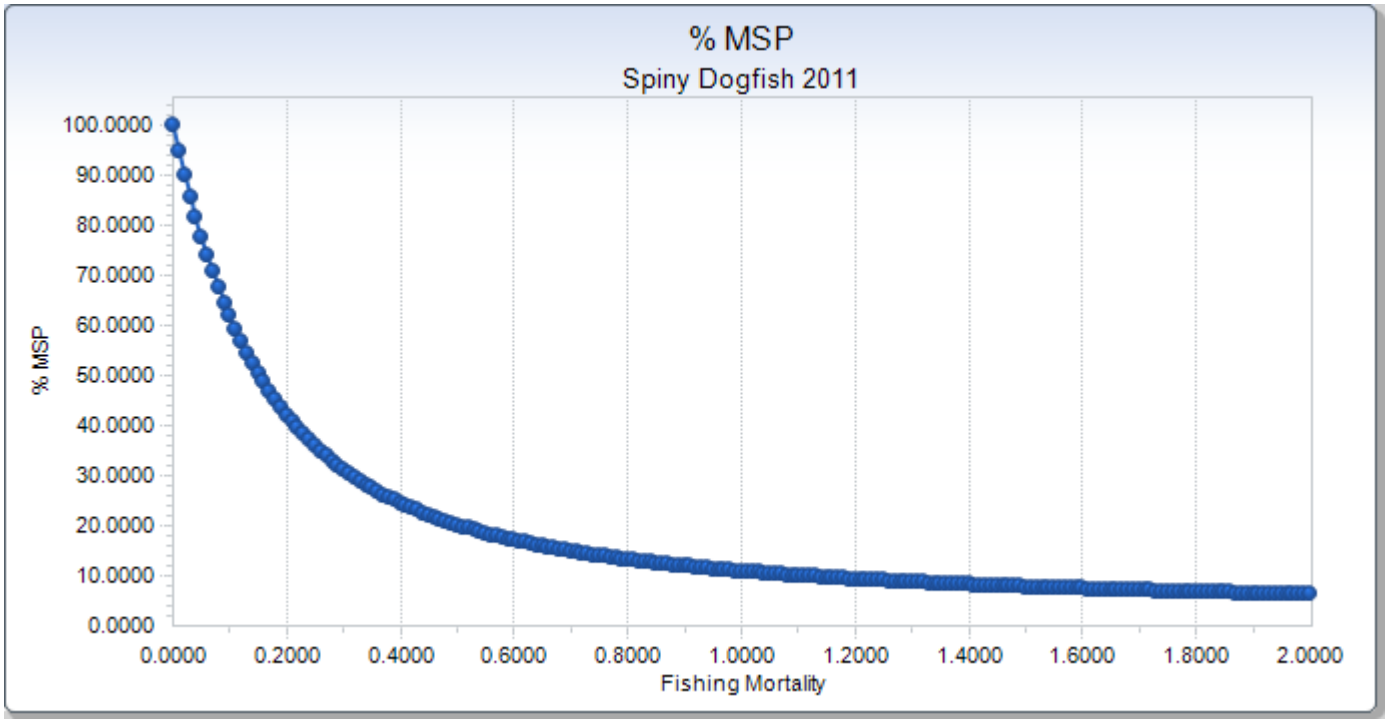


Fig. 6.1.3.8 Fishing Mortality related to % MSP

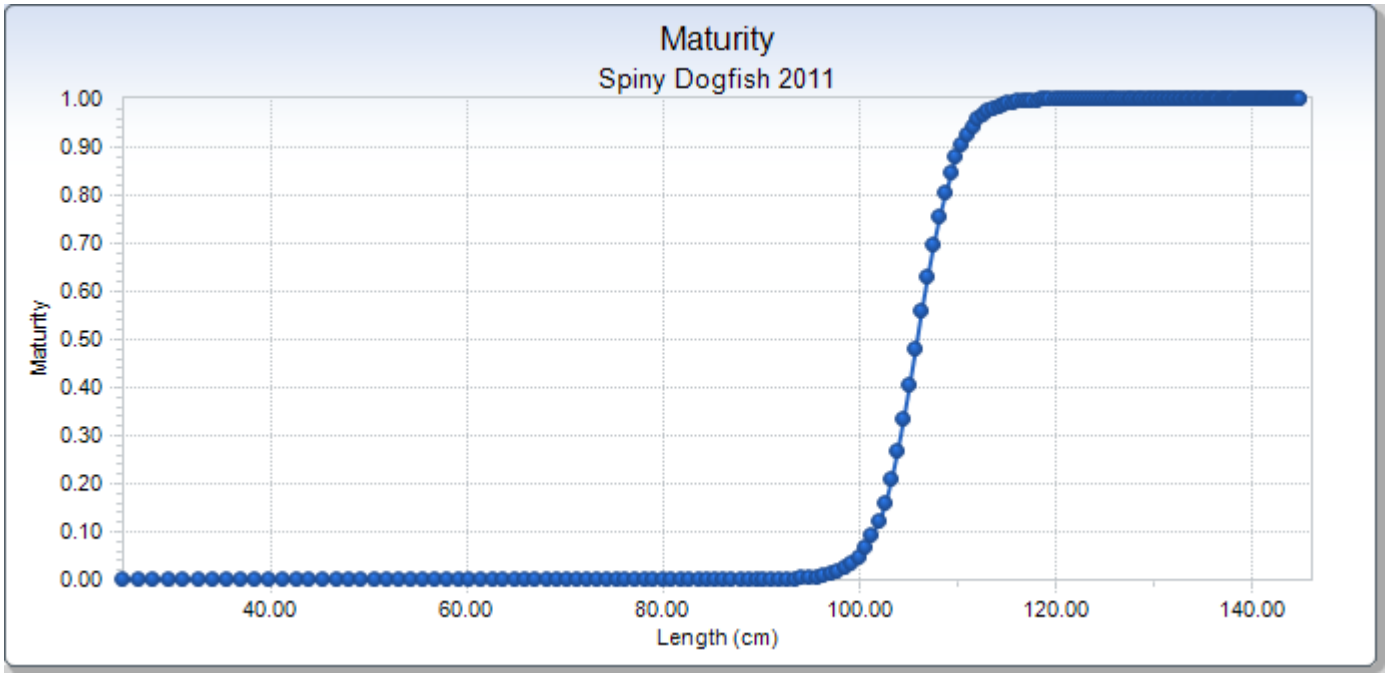


Fig. 6.1.3.9 Length related to maturity

6.2 Robustness analysis

6.3 Assessment quality

7 Stock predictions

7.1 Short term predictions

Comparing the obtained results it seems that in a period of 20 years the stock biomass has decreased almost of 30 times. On the other hand historical estimates for 1972-1992

(including a period of pre-industrial exploitation) using XSA and tuned by survey data have shown maximum SSB of about 100 000t (Daskalov 1998) that is 4 times less than the average SS B estimated here for 1989-2011.
We estimated $F_{0.1}$ = 0.227 (Fmsy proxy) as a limit reference point consistent with high long term yields and low risk of fishery collapse for dogfish in the Black Sea. Taking into account that the current F = 0.262 the stock is considered to be overexploited.

7.2 Medium term predictions

7.3 Long term predictions

8 Draft scientific advice

Gaps that need to be addressed in the near future include:

- Low quality of the input data for assessments (in terms age and size composition, fishing effort, CPUE and research surveys);
- The lack of quality survey information deteriorates the estimates of the current population parameters (abundance and mortality) in stock assessments and decreases the reliability of the short term predictions and management advice.
- Insufficient knowledge of stock units
- Lack of knowledge, evaluations and monitoring programs for assessing the IUU and discards
- Lack of reliable frameworks of assessing and standardizing of the commercial fleets fishing effort and CPUE

Management advice and recommendations

- Reducing fishing mortality;
- Improve selection pattern;
- Close spawning seasons in spring and autumn;
- Obligation for pregnant females to be discarded;
- Regional management measures

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