Stock Assessment Form Demersal species

Reference year: 2021
Reporting year: 2022

Migratory species lives in cold water. Concerning spatial and temporal distribution, researches have demonstrated that dogfish has two seasons to approaching of the shore: first in April - June and second in October - November at a depth ranged between 20-50m (function of water temperatures). In the winter and spring time, dogfish inhabiting the marine areas with depths over 65m until 120m.

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 usually covers more individuals.

This species is long-lived, late maturing, and have low fecundity, which means that the stock has very limited capability to rebound quickly once it becomes depleted. Further, the landings of piked dogfish have dropped steadily and dramatically since the start of the reported landings series, from about 6,000 t in1989, 3000t in 1990 to only 61 t in 2014. In 2015 the catch increased at 212 tones due to Bulgarian catch (133t), but in 2016 and 2017 the total catch decreased again at 131t and 108t. In 2021, reported catches were 21t.

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 bycatch. 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 have a strong impact on the top predators including Elasmobranches in the Black Sea.

Picked dogfish as a long-living predator as compared with other fishes in the Black Sea has the increased ability to accumulate toxic pollutants – heavy metals and chlorine organic compounds. We also connect the described above deterioration of reproductive ability of females with negative impact of pollutants, although for final evidence special research is required.

Stock Assessment Form

Uploader:

Stock assessment form

1 Basic Identification Data

Scientific name:	Common name:	ISCAAP Group:
Squalus acanthias Linnaeus, 1758	Piked dogfish	38
1st Geographical sub-area:	2nd Geographical sub-area:	3rd Geographical sub-area:
[GSA_29]	[GSA_29]	[GSA_29]
4th Geographical sub-area:	5th Geographical sub-area:	6th Geographical sub-area:
[GSA_29]	[GSA_29]	[GSA_29]
1st Country	2nd Country	3rd Country
Bulgaria	Georgia	Romania
4th Country	5th Country	6th Country
Russian Federation	Turkey	Ukraine
Stock assessment method: (direct, indirect, combined, none)		
direct- trawl survey, indirect-VPA, surplus production model		
Authors:		
George Tiganov[1], Feriha Tserkova[2], Claudia Musumeci[3], Alessandro Ligas[3]		
Affiliation:		
1_ National Institute for Marine Research "Grigore Antipa", Romania 2_ Institute of Fish Resources-Varna, Bulgaria 3_Consorzio per il Centro Interuniversitatio di Biologia Marina, CIBM, Italy		

The ISSCAAP code is assigned according to the FAO 'International Standard Statistical Classification for Aquatic Animals and Plants' (ISSCAAP) which divides commercial species into 50 groups on the basis of their taxonomic, ecological and economic characteristics. This can be provided by the GFCM secretariat if needed. A list of groups can be found here:

http://www.fao.org/fishery/collection/asfis/en

Direct methods (you can choose more than one):

- Trawl survey

Indirect method (you can choose more than one):

- Statistical catch at age model (a4a)

Combined method: you can choose both a direct and an indirect method and the name of the combined method (please specify)

2 Stock identification and biological information

Piked dogfish inhabits the whole Black Sea shelf at the water temperatures 6 – 15º 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 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. The major grounds for reproduction of picked dogfish in the Ukrainian waters are located in Karkinitsky Bay, in front of Kerch Strait and in Feodosia Bay.

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).

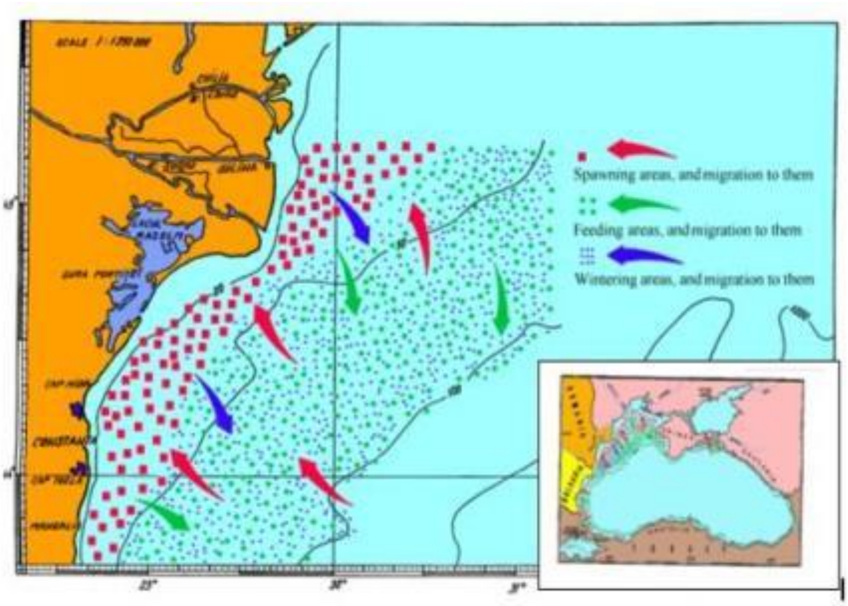


Fig. 1 Distribution and migration routes of the piked dogfish at Romanian littoral

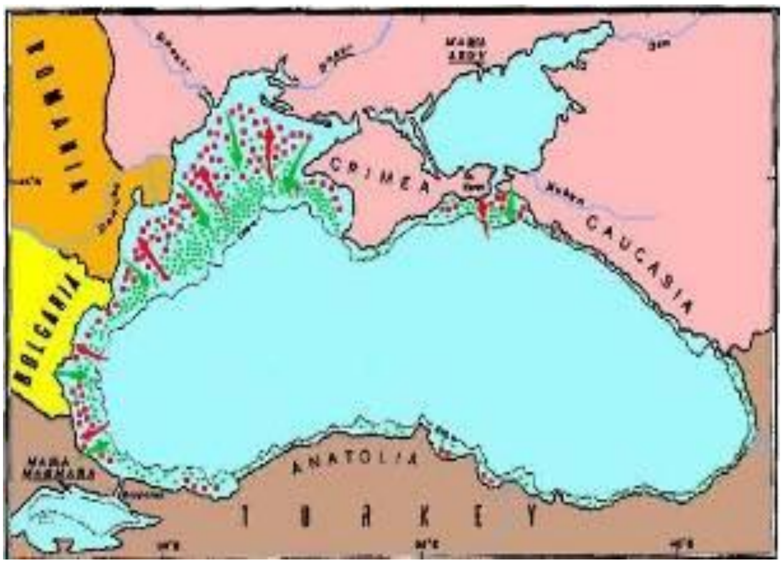


Fig. 2 Distribution and migration routes of the piked dogfish at Black Sea level.

2.1 Stock unit

In the Romanian and Bulgarian area, by swept area was assessed the biomass and abundance of the spring and autumn .

2.2 Growth and maturity

Table 2.2-1: Maximum size, size at first maturity and size at recruitment.

Somatic magnitude measured (LT, LC, etc)			Lt	Units	cm
Sex	Fem	Mal	Combined	Reproduction season	March-May
Maximum size observed			141	Recruitment season	April - May August-September
Size at first maturity	80	60		Spawning area	Shelf area, 10-30m
Recruitment size to the fishery			90	Nursery area	All shelf area

Table 2-2.2: M vector and proportion of matures by size or age (Combined)

Size/Age	Natural mortality	Proportion of matures
21-30/0+	*0.68*	*0.0*
31-35/1, 1+	*0.68*	*0.0*
36-40/2, 2+	*0.42*	*0.0*
41-50/3, 3+	*0.30*	*0.35*
51-55/4, 4+	*0.24*	*0.375*
56-60/5, 5+	*0.20*	*0.425*
61-65/6, 6+	*0.14*	*0.475*
66-70/7, 7+	*0.15*	*0.525*
71-80/8, 8+	*0.15*	*0.575*
81-85/9, 9+	*0.15*	*0.625*
86-90/10, 10+	*0.15*	*0.675*
91-100/11, 11+	*0.15*	*0.725*
101-105/12, 12+	*0.15*	*0.775*
106-110/13, 13+	*0.15*	*0.875*
111-115/14, 14+	*0.15*	*0.975*
116-120/15, 15+	*0.15*	*1.0*
121-125/16, 16+	*0.15*	*1.0*
126-130/17, 17+	*0.15*	*1.0*
131-135/18, 18+	*0.15*	*1.0*
136-140/19, 19+	*0.15*	*1.0*
141-145/20, 20+	*0.15*	*1.0*

Table 2-2.4: Growth and length weight model parameters

			Sex			
		Units	**female**	**male**	**Combined**	**Years**
Growth model	**L_∞**	cm			....	
	K				.....	
	t_0				.....	
	Data source	National Data Collection Program				
Length weight relationship	**a**				....	
	b				.....	
	M (scalar)				....	
	sex ratio (% females/total)	.....				

Growth

Piked dogfish is a major demersal predator, reaching 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_∞=272 cm; W_∞=47 kg; M=0.20÷0.23

Females: K=0.026 t_0=-3.32; L_∞=303 cm; W_∞=196 kg; M=0.15÷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: $F_e = 0.09$ x TLp + 2.12 (r = 0.5) for pups and $F_e = 0.27$ x TLp - 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 the ten years are presented in the following table

Table 2.2.5 Piked dogfish growth parameters in the Romanian marine area

Parameter	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Linf	157	156	152.63	136.84	127.37	148.42	125.3	151.58	134.74	132.63
a	0.016977	0.061086	0.0185	0.004213	0.150598	0.0185	0.001506	0.00142	0.011	0.002
b	2.696436	2.41368	2.672849	2.986004	2.22151	2.6728	2.115	2.734	2.786	3.113
K	0.153	0.134	0.134	0.168	0.2086	0.158	0.208	0.247	0.276	0.22
to	-1.136	-0.9304	-0.975	-0.787	-0.544	-0.323	-0.504	-0.441	-0.4	-0.532

Maturity

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*L2·95 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 t0=−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 given in previous yers, the maturity ogive is the following:

Table 2.2.6 Maturity ogive after Ukrainian scientists

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	0.0	0.0	0.0	0.0	0.1	0.25	0.45	0.55	0.75	0.95	1.0	1.0	1.0	1.0	1.0

Table 2.2.7. Maturity ogive from Romanian data

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	0.45	0.7	0.95	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Natural mortality

For calculation of natural mortality (M) has been utilized Pauly's M empirical equation:

$log(M) = -0.0066-0.279log(L_\infty) + 0.6543log(k) =+ 0.4634log(T)$

where:

L_∞) is the asymptotic length measured in total length;

K is the VBGF growth constant;

T is the mean annual habitat.

The Romanian values used in the last years are presented in the table

In the following table is presented natural mortality for piked dogfish in the Romanian Black Sea area for the period 2015-2021

Table 2.2.8 Natural mortality for piked dogfish in the Romanian Black Sea area

Parameters	2015	2016	2017	2018	2019	2020	2021
M	0.271	0.319	0.15	0.14	0.226	0.261	0.21

Natural mortality for piked dogfish after Ukrainian data is shown in the following table

Table 2.2.9 Natural mortality for piked dogfish after Ukrainian data is shown in the following table

Age	0	1	2	3	4	5	6	7	8	9	10
M	0.68	0.68	0.42	0.3	0.24	0.2	0.14	0.12	0.1	0.09	0.07

Age	11	12	13	14	15	16	17	18	19	20
M	0.05	0.09	0.16	0.49	0.51	0.52	0.6	0.6	0.6	0.6

3 Fisheries information

3.1 Description of the fleet

Identification of Operational Units exploiting this stock. Use as many rows as needed

Fishing effort

Data regarding the fleet are given by Bulgaria and Romania.

In Romania year after year the activity of active fishing decreased gradually to the point where, in 2015 from 20 vessels with LOA between 24-40 m registered in the 90s, in last years in the Fishing Fleet Register, only one or two vessel were active for a very short period of time. In 2015, the total number of boats/vessels registered was 151, from which only 127 have been active, most of them having LOA of 6 - 12 m (79,53%). In 2016, the number of active vessels was 121, 3 of them being bigger than 24m. Most of them being between 6-12m (94). Were used mainly gillnets and long lines. The fisheries of this small fleet are typically artisanal type as multi-species and multi-gear fisheries, fishermen switching from one gear to another several times throughout the year. In 2017, number of the vessels have been 135, but none aimed at shark fishing. Official statistics of picked dogfish catches landed on ports in 2018 is 0.512 t (512 kg), 2019 is 0.576 t (576 kg), 2020 is 0.880 t (880 kg) and for 2021 is 0.667 t (667 kg). Fishing only as a complementary species, TAC for the year - 13.5 t.

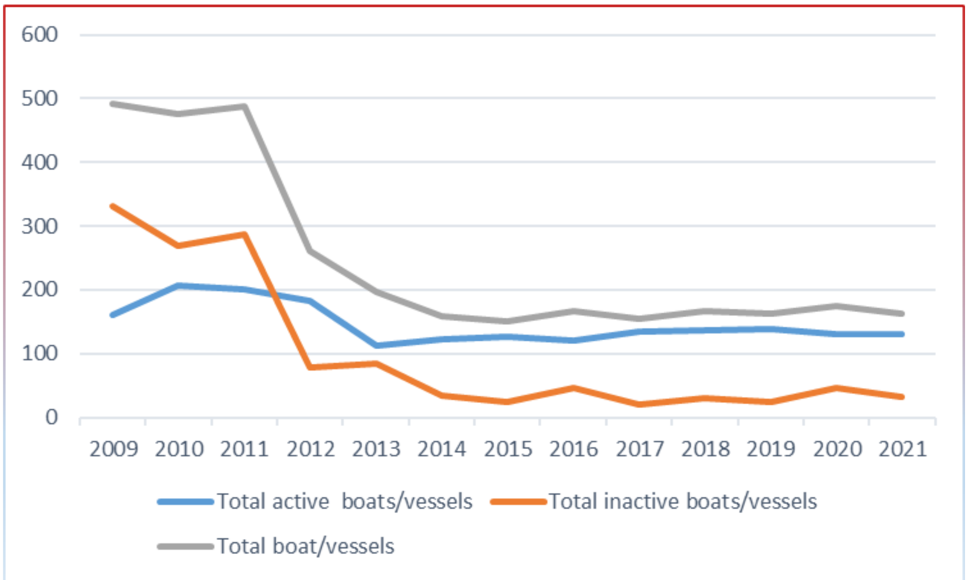


Fig. 3.1.1 Number of the active and passive fishing vessels in Romania

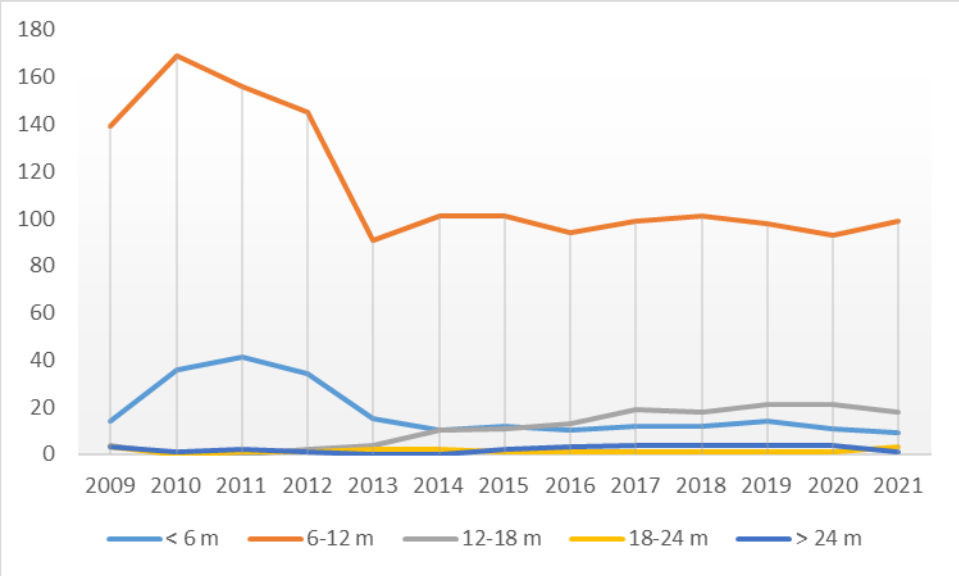


Fig. 3.1.2 Number of the active fishing vessels on length classes in Romania

Regarding fishing gears, only Bulgaria and Romania provided data. There are different types of fishing gears for the active and passive fishery practiced in the inshore and offshore coastal fishery. The passive fishing gears include the equipments for catching in general the fish migrating for spawning and feeding in shallow waters, namely:

- long lines and bottom lines;
- gillnets for the Danube shad, turbot, mugilidae and gobies;
- sea pound nets.

Another category of fishing equipments used in the Romanian coastal zone includes the active fishing gear:

- beach seine;
- beam trawl;
- pelagic trawl.

In Romania, in 2015, the number of trap nets (29), turbot gillnets (2,360), shad gillnets (319), gobies gillnets (153), dogfish gillnets (170), beam trawl 35, pelagic trawl 3, etc. In 2016, the number of dogfish gillnets being of 138. In 2017, has been not report by Romania gill nets for dogfish, species was caught only like bycatch, so the number of trap nets (33), turbot gillnets (2681), shad gillnets (332), gobius gillnets (135), beam trawls (60) and pelagic trawls (2), etc. In 2018 the number of fishing gear by gear type was: turbot gillnets (3336), trap nets (34), shad gillnets (257), gobius gillnets (149), beam trawls (74), pelagic trawls (4), etc, respectively in 2019: turbot gillnets (3739), trap nets (31), shad gillnets (479), gobius gillnets (56), beam trawls (76), pelagic trawls (5), etc. For the year 2020 the situation of the fishing gears used at the Romanian coast was as follows: turbot gillnets (4031), trap nets (33), shad gillnets (384), gobius gillnets (60), beam trawls (70), pelagic trawls (12), so for the reference year 2021 the fishing gears used are : turbot gillnets (3931), trap nets (35), shad gillnets (424), handlines (47), longlines (10), beam trawls (57) and pelagic trawls (19).

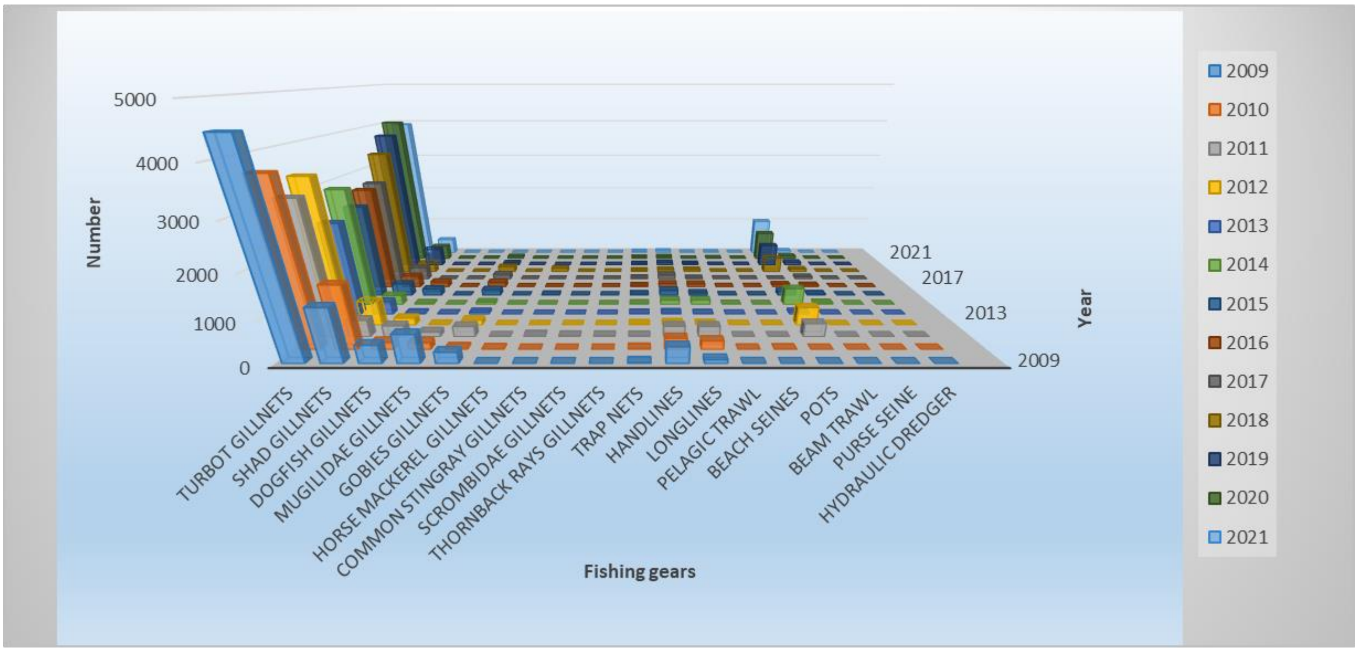


Fig.3.1.3 Number of the fishing gears in Romania

The GFCM/BSSGSA was not provided with quantitative information on fishing effort by all riparian countries. In the last years only Bulgaria and Romania provided data regarding the fishing effort for dogfish and CPUE. The number of vessels fishing gillnets for dogfish dropped from 265 in 2011 to 170 in 2015.

In this Report, Romania also presents the evolution of the gill nets number on vessel length classes for the last years (2013-2016). The CPUE is presented on fishing gears and vessels length for the last years (2011-2016).

Table 3.1.1 Number of fishing gillnets for dogfish in the Romanian area

Vessel length (m)	Number of gillnets for dogfish in 2011	Number of gillnets for dogfish in 2012	Number of gillnets for dogfish in 2013	Number of gillnets for dogfish in 2014	Number of gillnets for dogfish in 2015	Number of gillnets for dogfish in 2016
< 6m	10	-	-	2	-	-
6-12 m	205	110	-	10	55	60
12-18m	-	-	-	-	115	78
18-24 m	50	50	-	20	-	-
24-40 m	-	-	25	-	-	-
Total	**265**	**160**	**25**	**32**	**170**	**138**

Since 2017, Romania does not have a fishery targeting dogfish, is caught only like bycatch. In the following table is presented the Romanian CPUE in commercial fishing.

Table 3.1.2 Romanian CPUE in commercial fishing, 2013 -2021 period

YEAR	**Fishing gear**	**CPUE**
2013		
LOA 6-12 m	long lines	20.65 kg/gear/day /
LOA 24-40 m	pelagic trawl	123.45 kg/gear/day
LOA 24-40 m	gillnets	8.91 kg/gear/day
2014		
LOA <6m	gillnets	7 kg/gear/day
LOA 6m-12m	gillnets	1.066 kg/gear/day
LOA 6m-12m	long lines	1.125 kg/gear/day
LOA 12-18m	gillnets	1.443 kg/gear/day
LOA 12-18m	trawl	5.608 kg/gear/day
LOA 24-40m	trawl	3.867 kg/gear/day
2015		
LOA 6m-12m	gillnets	0.825 kg/gear/day
LOA 6m-12m	long lines	12.5 kg/gear/day
LOA 12-18m	gillnets	10.915kg/gear/day
LOA 12-18m	trawl	25.33 kg/gear/day
2016		
LOA 6m-12m	gillnets	2.52 kg/gear/day
LOA 12-18m	gillnets	1.88 kg/gear/day
LOA <6m	long lines	0.77 kg/gear/day
LOA <6m	pound nets	0.317 kg/gear/day
2017		
LOA 6m-12m	gillnets	1.84 kg/gear/day
LOA 12-18m	gillnets	0.11 kg/gear/day
LOA 6m-12m	gillnets	19.40 kg/gear/day
LOA 6m-12m	long lines	46.66 kg/gear/day
LOA 24-40m	pelagic trawl	13.50 kg/gear/day
LOA 6m-12m	pound nets	10.00 kg/gear/day
2018		
LOA 6m-12m	gillnets	0.12 kg/gear/day
LOA 6m-12m	pound nets	2.30 kg/gear/day
LOA 6m-12m	long lines	21.40 kg/gear/day
LOA 12-18m	gillnets	0.13 kg/gear/day
2019		
LOA 6m-12m	gillnets	0.0016 kg/gear/day
LOA 6m-12m	pelagic trawl	0.005 kg/gear/day
2020		
LOA 6m-12m	gillnets	2.28 kg/gear/day
LOA 6m-12m	pound nets	59.00 kg/gear/day
2021		
LOA 6m-12m	gillnets	19.571 kg/gear/day
LOA 6m-12m	longlines	33.167 kg/gear/day
LOA 12m-18m	beam trawl	7.357 kg/gear/day

YEAR	Fishing gear	CPUE
LOA 12m-18m	pelagic trawl	1.083 kg/gear/day
LOA 12m-18m	longlines	42.5 kg/gear/day

Table 3.1.3 Bulgarian CPUE in commercial fishing, 2008 - 2021

2008	**landings in KG**	**days at sea**	**number of vessels**	**Kg/day**	**kg/vessel**
GNS	7109	112	7	63.473	1015.571
LLD	11852	133	22	89.113	538.727
LLS	1297	5	1	259.400	1297.000
2009					
GNS	2062.6	24	11	85.942	187.509
LLD	4116.4	44	8	93.555	514.550
LLS	1308	14	6	93.429	218.000
OTM	1723	55	15	31.327	114.867
2010					
GNS	4850	54	15	89.815	323.333
LLD	41775	185	21	225.811	1989.286
LLS	12199	63	12	193.635	1016.583
OTM	18309.25	310	35	59.062	523.121
2011					
GNS	2113	43	13	49.140	162.538
LLD	30741.8	310	24	99.167	1280.908
LLS	38702	430	22	90.005	1759.182
OTM	9480	196	25	48.367	379.200
2012					
GNS	315.5	18	7	17.528	45.071
LLD	14599.35	170	19	85.879	768.387
LLS	12614.5	194	21	65.023	600.690
OTM	1143.8	36	10	31.772	114.380
2013					
GNS	1367	24	10	56.958	136.700
LLD	24898.45	211	26	118.002	957.633
LLS	3896	194	23	20.082	169.391
OTM	802.8	26	12	30.877	66.900
2014					
GNS	6795	2	2	3397.500	3397.500
LLD	26601.7	212	26	125.480	1023.142
LLS	393	55	12	7.145	32.750
OTM	210	2	2	105.000	105.000
SB	10	1	1	10.000	10.000
2015					
LLD	119833.1	237	36	505.625	3328.697

2008	landings in KG	days at sea	number of vessels	Kg/day	kg/vessel
LLS	13208.6	41	7	322.161	1886.943
2016					
GNS	5	1	1	5.000	5.000
LLD	76623	262	26	292.454	2947.038
LLS	6239.9	92	16	67.825	389.994
OTM	611	8	5	76.375	122.200
2017					
LLD	42047.4	218	22	192.878	1911.245
LLS	8404	102	12	82.392	700.333
2018					
GNS	461	22	10	21	46.100
LLD	6026.2	85	24	70.896	251.091
LLS	3447	116	21	29.715	164.142
OTM	158	15	7	10.533	22.571
2019					
LHM	7.5	1	1	7.5	7.5
LLD	11464.7	285	55	40.227	208.449
LLS	5287.8	149	32	35.488	165.243
OTM	5	1	1	5	5
2020					
GNS	16760.35	217	-	77.236	-
LLD	16879.3	172	-	98.135	-
LLS	11516.2	186	-	61.915	-
OTM	1495.7	61	-	24.516	-
TBB	860	15	-	57.333	-
2021					
LLD	16148.1	-	-	-	-
LLS	3504.1	-	-	-	-

Table 3-1.4: Description of operational units exploiting the stock (Romania in 2021, Bulgaria 2021)

	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*	Romania	29	PG	GNS	Demersal	Turbot, dogfish
Operational Unit 2	Romania	29	PG	LLS	Demersal	Rays, dogfish
Operational Unit 3	Romania	29	PG	TBB	Demersal	Rapa whelk, dogfish
Operational Unit 4	Romania	29	PMP	OTM	Pelagic	Sprat, anchovy, horse mackerel
Operational Unit 4	Bulgaria	29	PG	LLD	[ISCAAP Group]	Dogfish
Operational Unit 5	Bulgaria	29	PG	LLS	[ISCAAP Group]	Dogfish

Table 3.1-5: Catch, bycatch, discards and effort by operational unit in the reference year 2021 (kg)

Operational Units*	Fleet (n° of boats)*	Catch (T or kg of the species assessed)	Other species caught (names and weight)	Discards (species assessed)	Discards (other species caught)	Effort (units)
RO (2021)	3	274				320 gillnets
RO (2021)	1	199				2 longlines
RO (2021)	1	103				2 beam trawls
RO (2021)	1	26				1 pelagic trawl
RO (2021)	1	85				2 longlines
BG (2021)	-	16148.1				LLD
BG (2021)	-	3504.1				LLS
Total		20339.2				

3.2 Historical trends

Fisheries

General description of the fisheries

In the Black Sea the largest catches of picked 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., 2008b, 2010b; Radu et al., 2009b, 2010a,b).

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

In the last years increased the importance of the catches in Bulgaria and Russia, these being more than 96% from total Black Sea catches.

Catches

Data regarding landings at age, mean weight at age in the landings, maturity at age and natural mortality at age, growth parameters and mortality rates, maturity ogives at age including information for 2020, were provided to the GFCM/BSSGSA by Romania and Bulgaria. Georgia has no data and Ukrainian colleagues provided data for Ukraine and Russian Federation. Turkey has no data for 2020, the fishing of the dogfish being prohibited.

Landings

The landings of Piked dogfish by countries are given in the following table.

Table 3.2.1 Piked dogfish landings in tons by countries (FAO Fisheries Statistics, GFCM Capture, BSC data, input from experts).

YEAR	ROMANIA	BULGARIA	TURKEY	UKRAINE	GEORGIA	RUSSIA	TOTAL
1989	30	28	4558	1191	217	135	6159
1990	45	16	1059	1330	128	183	2761
1991	26	21	2017	775	18	67	2924
1992	52	15	2220	595	14	15	2911
1993	6	12	1055	409	131	5	1618
1994	2	12	2432	148	45	11	2650
1995	7	80	1562	67	31	90	1837
1996	5	64	1748	44	71	19	1951
1997	5	40	1510	20	1	9	1585
1998	5	28	855	38	550	6	1482
1999	5	25	1478	94	18	9	1629
2000	5	102	2390	71	21	12	2601
2001	5	126	576	134	27	27	895
2002	5	100	316	97	65	19	602
2003	5	51	184	172	40	29	481
2004	5	47	211	93	31	34	421
2005	5	15	102	75	35	19	251
2006	9	6	193	67	10	17	302
2007	17	24	91	45	2	32	211
2008	10	23	35	79	0.4	59	206
2009	4	9	159	47	1.5	14	235
2010	3	42	16	18	1.5	9	89
2011	4	38	27	22	1.5	4	96
2012	2	29	25	6	1.5	6	69
2013	9	31	25	7	1.5	4	77
2014	2	34	3	3	1.5	18	62
2015	13	133	0	4	NA	6	156
2016	3	83	0	5	NA	40	132
2017	2	50	0	2	NA	0	54
2018	0.5	10	0	0.8	NA	0	11
2019	0.6	17	0	0.95	NA	41	59
2020	0.9	48	0	0.278	NA	22	71
2021	0.7	19.7	0	0.8	NA	NA	21.15

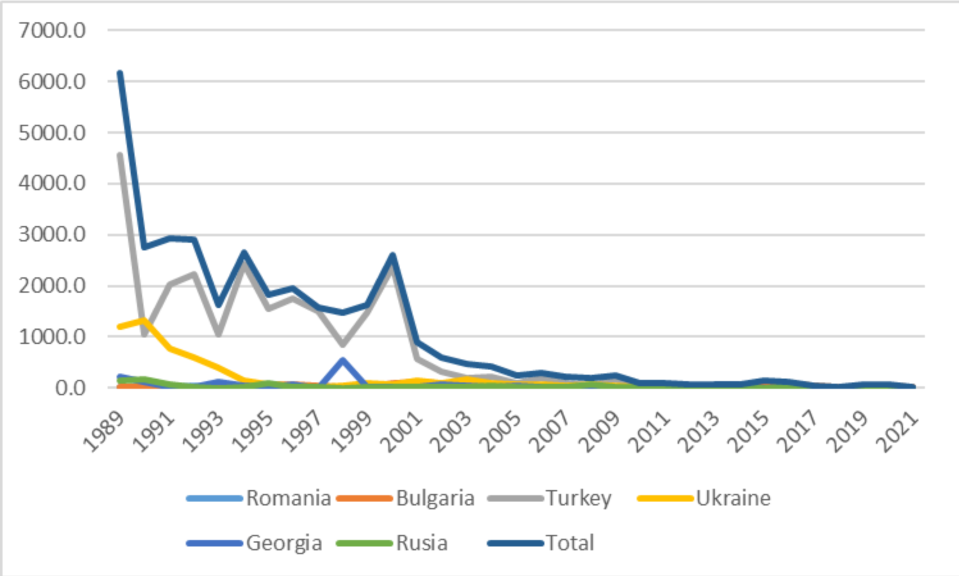


Fig. 3.2.2 Dogfish catches in the Black Sea area by countries (t)

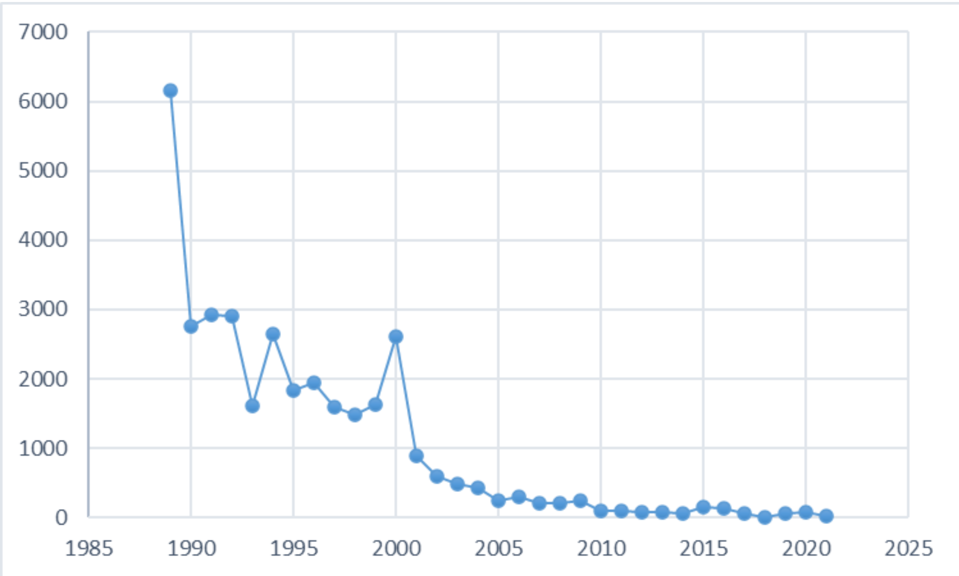


Fig. 3.2.3 Total catch (t) of dogfish in the period 1989-2021 in the Black Sea area

Discards

For GFCM/SGSABS have not been reported discards for piked dogfish

3.3 Management regulations

Table 3.3.1 Specific management measures

Country	Specific management measures
Bulgaria	Minimum landing size 90 cm (TL)
Georgia	Caught only as bycatch, target fisheries, including longlines, prohibited since 2015 Minimum landing size 85 cm (SL) Regulated for trawls and seines through TACs
Romania	Caught only as bycatch, mainly by gillnets using mesh sizes of 100 mm Minimum landing size 120 cm (TL) Fishing prohibited from 15 Mar-30 Apr Catching spawning females prohibited throughout the year
Russian Federation	Allowed with bottom-set gillnets, with mesh size greater or equal to 120 mm Minimum landing size 85 cm (SL)
Turkey	Fishing prohibited since 2016
Ukraine	Caught as by-catch only , bottom trawling -prohibited. Gillnets for piked dogfish (100 – 150 mm mesh size) and longlines -prohibited since 2017. Restrictions in number for 45–70 mm gillnets – 280 units (most dangerous for youngsters of sturgeons, turbot and piked dogfish); - total ban of such small meshed gillnets in the period 15 June - 15th October. ***Tendrovskiy Bay***:- totally prohibited all year round for all gear. ***Karkinistki Bay:*** all gillnets except turbot nets (180-200 mm) are prohibited all year round; Minimum landing size 85 cm (S

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 in the BSC.

Table 3.3.2 IUCN status of piked dogfish in the Black Sea countries

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

3.4 Reference points

Table 3.4.1: List of reference points and empirical reference values previously agreed (if any)

Indicator	Limit Reference point/empirical reference value	Value	Target Reference point/empirical reference value	Value	Comments
B					
SSB					
F					
Y					
CPUE					
Index of Biomass at sea					

4 Fisheries independent information

4.1 Scientific survey

4.1.1 Brief description of the direct method used

Description of the survey and method applied. One of several tables would have to be chosen: Trawl.

Direct methods: trawl based abundance indices

Table 4.1-1: Trawl survey basic information (RO)

Survey	Demersal 2021	**Trawler/RV**	Research vessel
Sampling season	spring and autumn		
Sampling design	random stratified		
Sampler (gear used)	demersal trawl		
Cod –end mesh size as opening in mm	7mm		
Investigated depth range (m)	15-70m		

Table 4.1-2: Trawl survey sampling area and number of hauls (spring) 2021

Stratum	**Total surface (km^2)**	**Trawlable surface (km^2)**	**Swept area (km^2)**	**Number of hauls**
0-30m	475	1990		12
30-50m	950	4350		14
50-70m	800	6450		14
Total 0-70 m)	2225	12790		40

Map of hauls positions

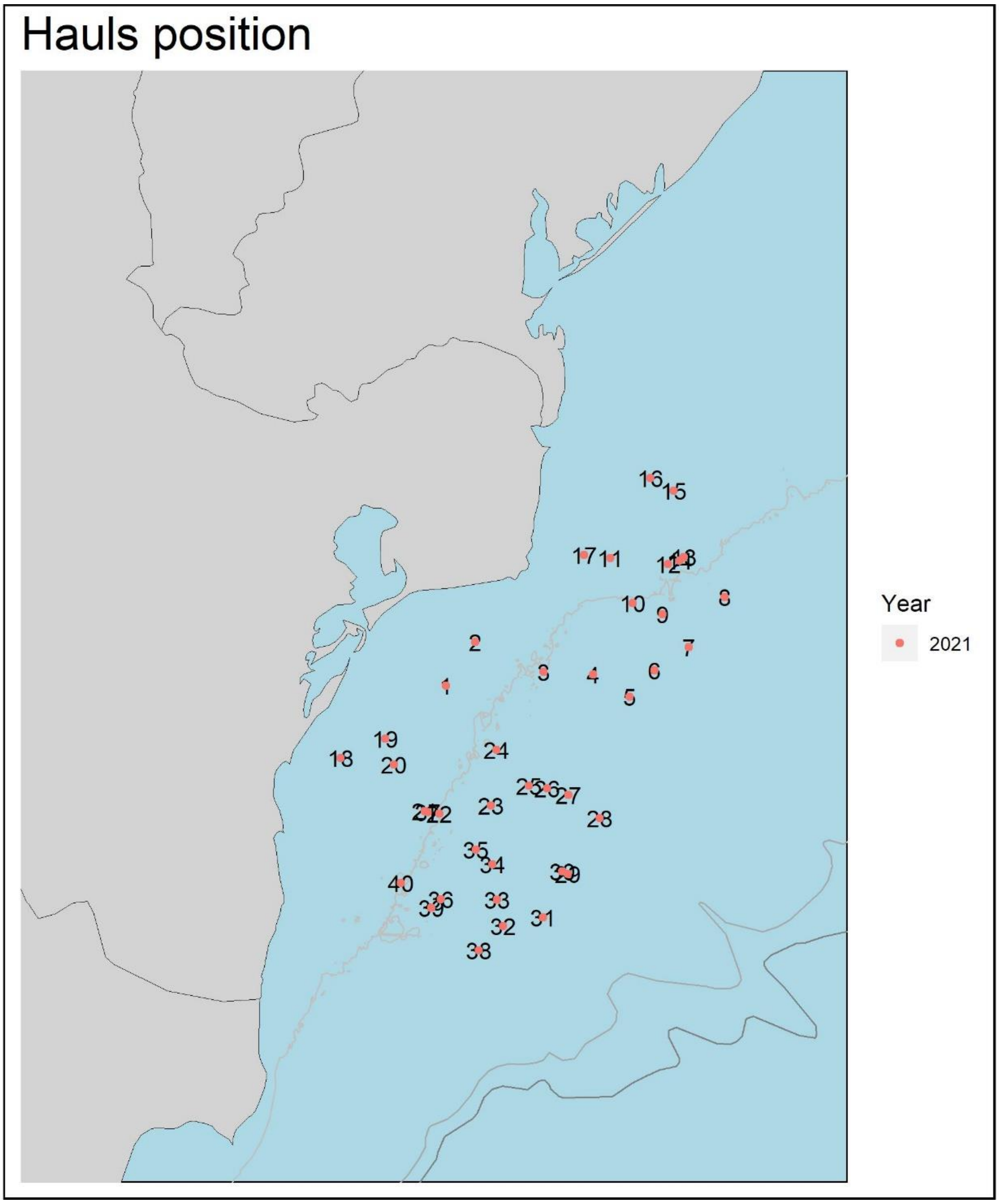


Table 4.1-3: Trawl survey abundance and biomass results (spring) 2021

Depth Stratum	Years	kg per Km^2	CV or other	N per Nm^2	CV or other
0-30m	2021	83			
30-50m	2021	87			
50-70m	2021	355			
Total (0-70m)	2021	175			

*

Table 4.1-4: Trawl survey sampling area and number of hauls (autumn) 2021

Stratum	Total surface (km^2)	Trawlable surface (km^2)	Swept area (km^2)	Number of hauls
0-30m	475	1990		10
30-50m	950	4350		14
50-70m	800	6450		16
Total 0-70 m)	2225	12790		40

Map of hauls positions

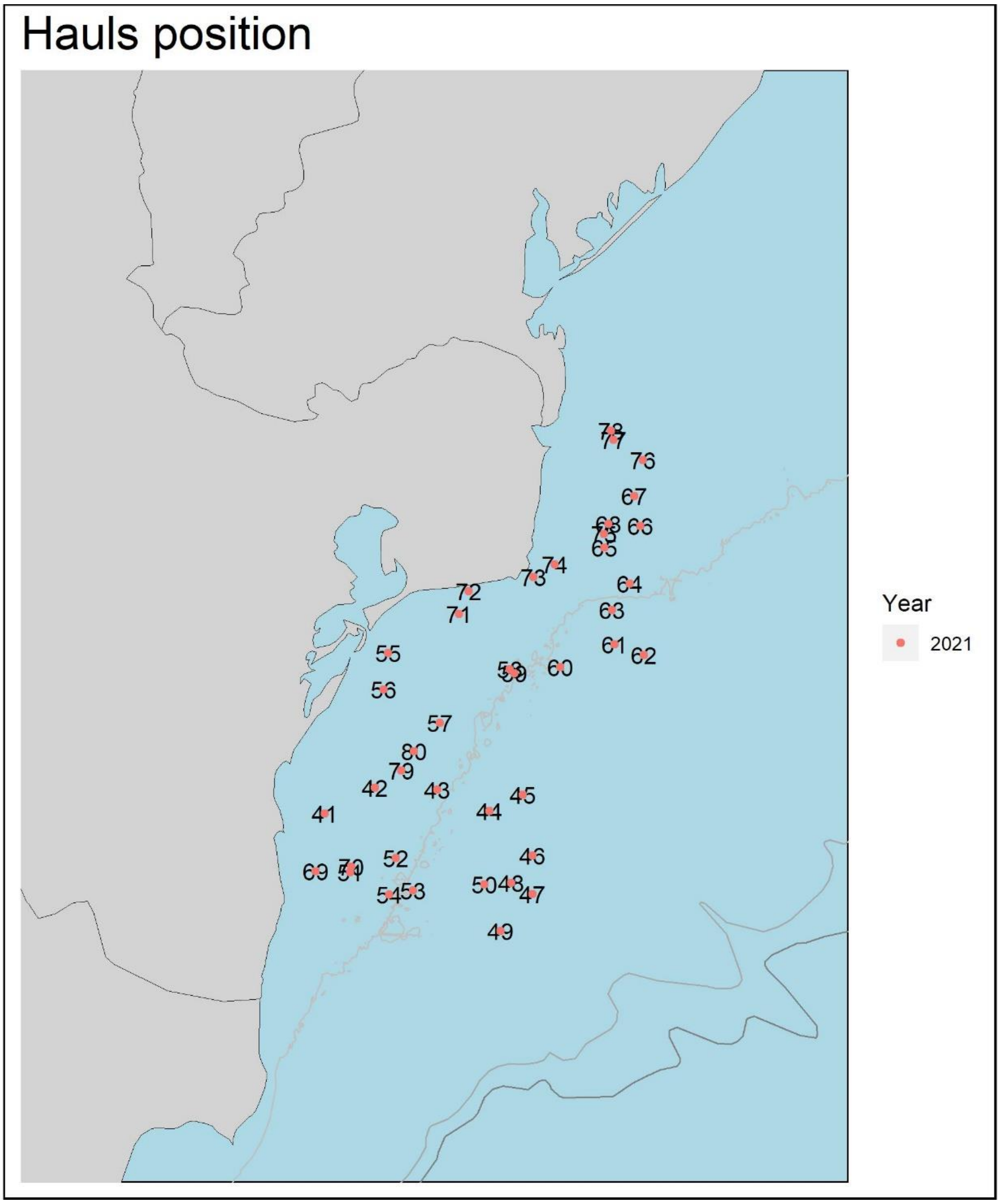


Table 4.1-5: Trawl survey abundance and biomass results (autumn) 2021

Depth Stratum	Years	kg per Km^2	CV or other	N per Nm^2	CV or other
0-30m	2021	94			
30-50m	2021	16			
50-70m	2021	160			
Total (0-70m)	2021	90			

Scientific surveys

For GFCM/SGSABS Romania and Bulgaria presented data on surveys at sea for dogfish

Methods

In Romanian and Bulgarian waters the swept area method was applied for stock assessment of piked dogfish.

Geographical distribution

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.

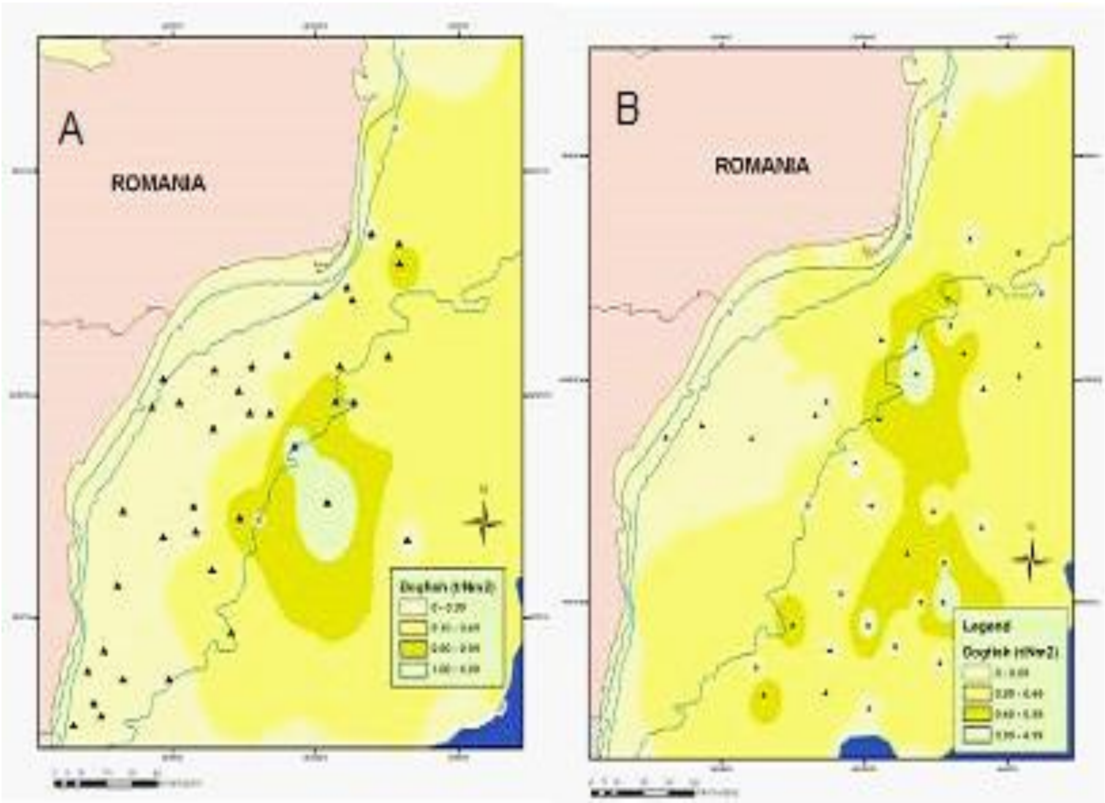


Fig. 4.1.1 Distribution of the dogfish agglomerations in the spring and autumn period 2011, Romanian littoral

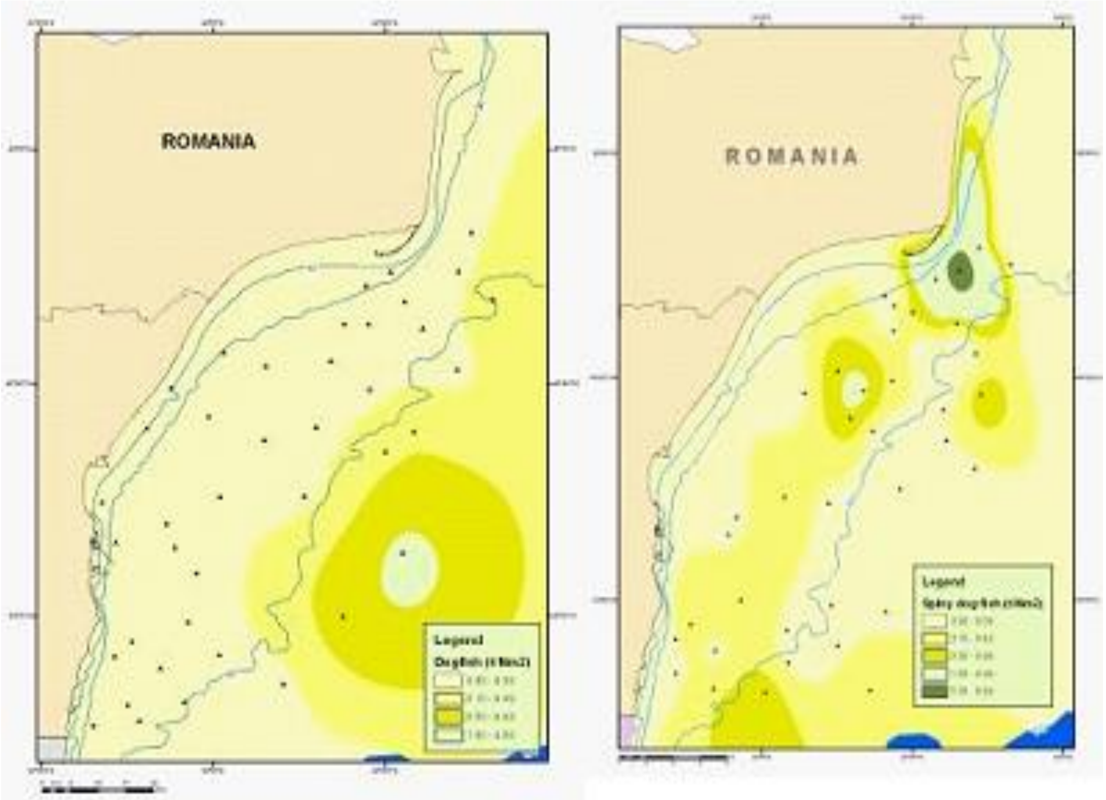


Fig. 4.1.2 Distribution of the dogfish agglomerations in the spring and autumn period 2012, Romanian littoral

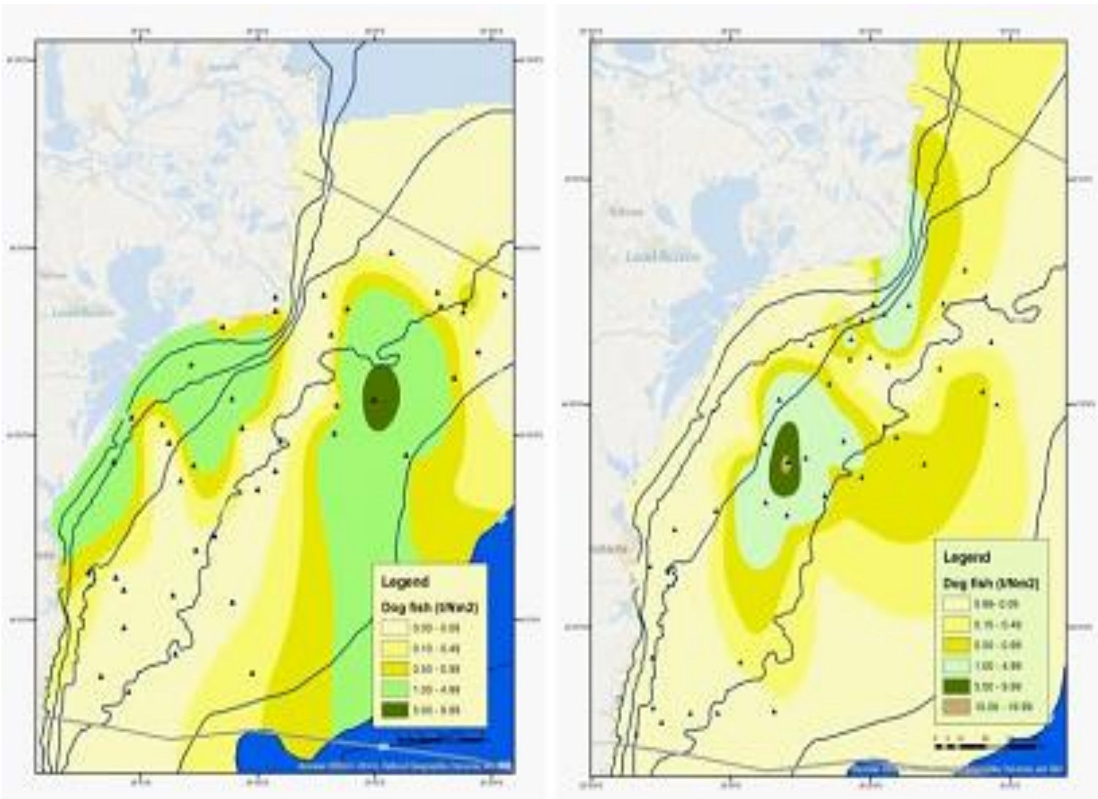


Fig. 4.1.3 Distribution of the dogfish agglomerations in the spring and autumn period 2013, Romanian littoral

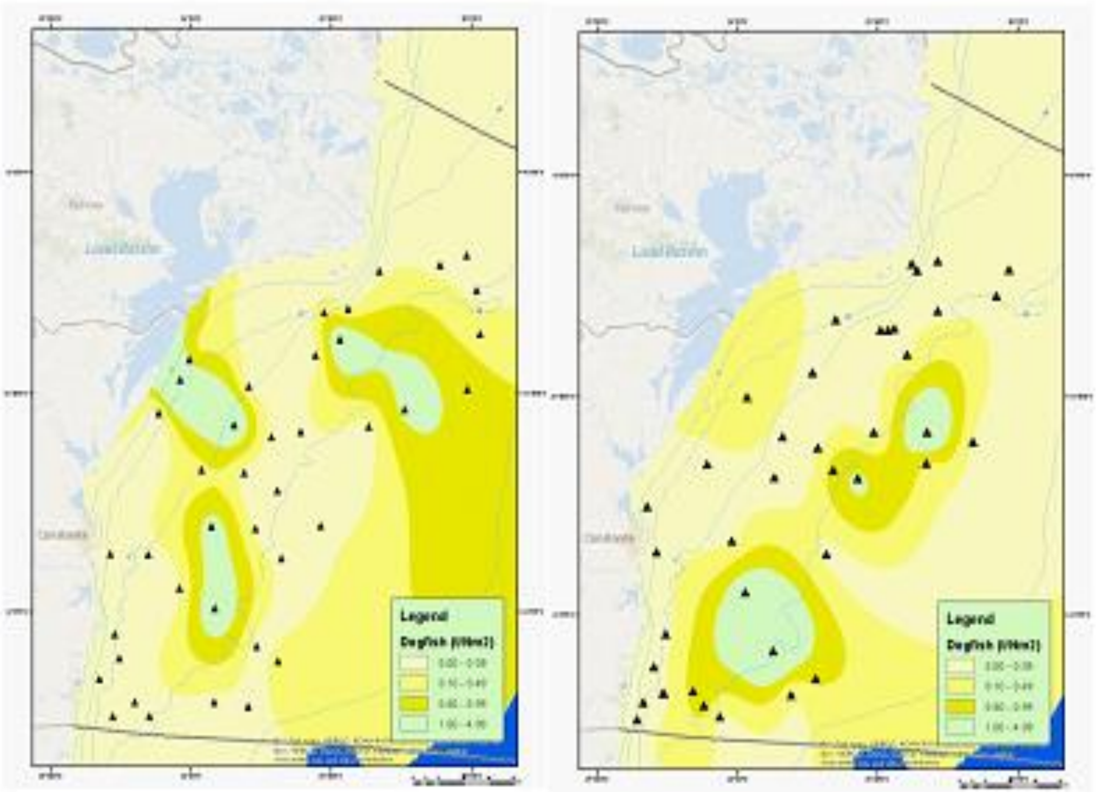


Fig. 4.1.4 Distribution of the dogfish agglomerations in the spring and autumn period 2014, Romanian littoral

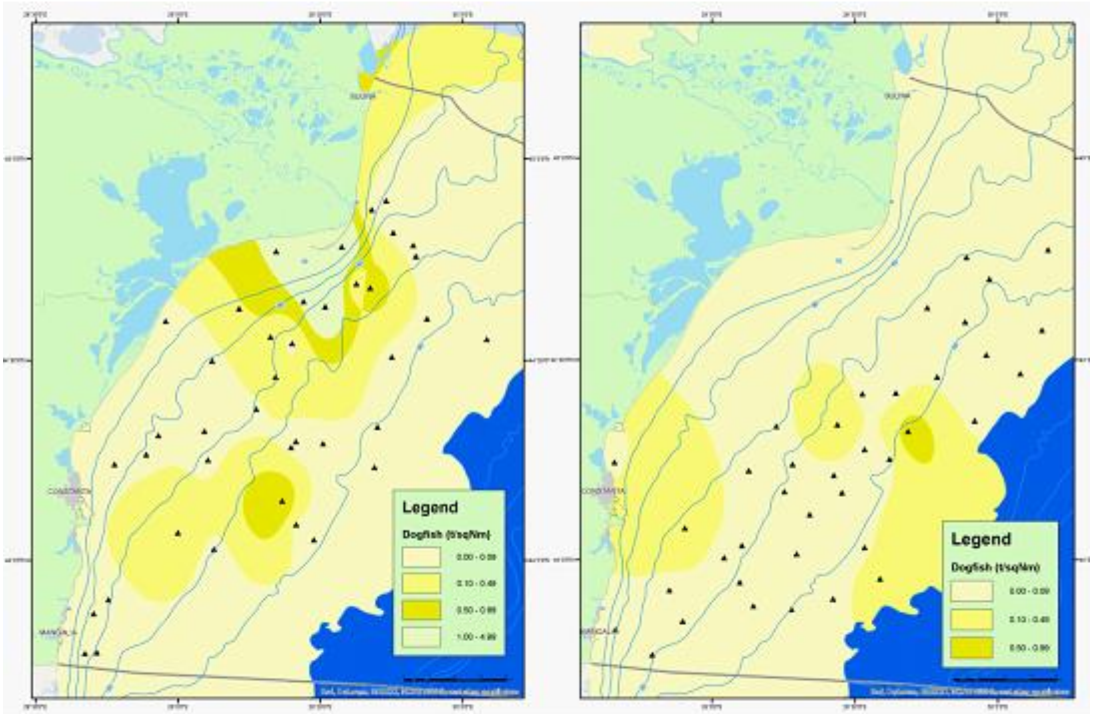


Fig. 4.1.5 Distribution of the dogfish agglomerations in the spring and autumn period 2015, Romanian littoral

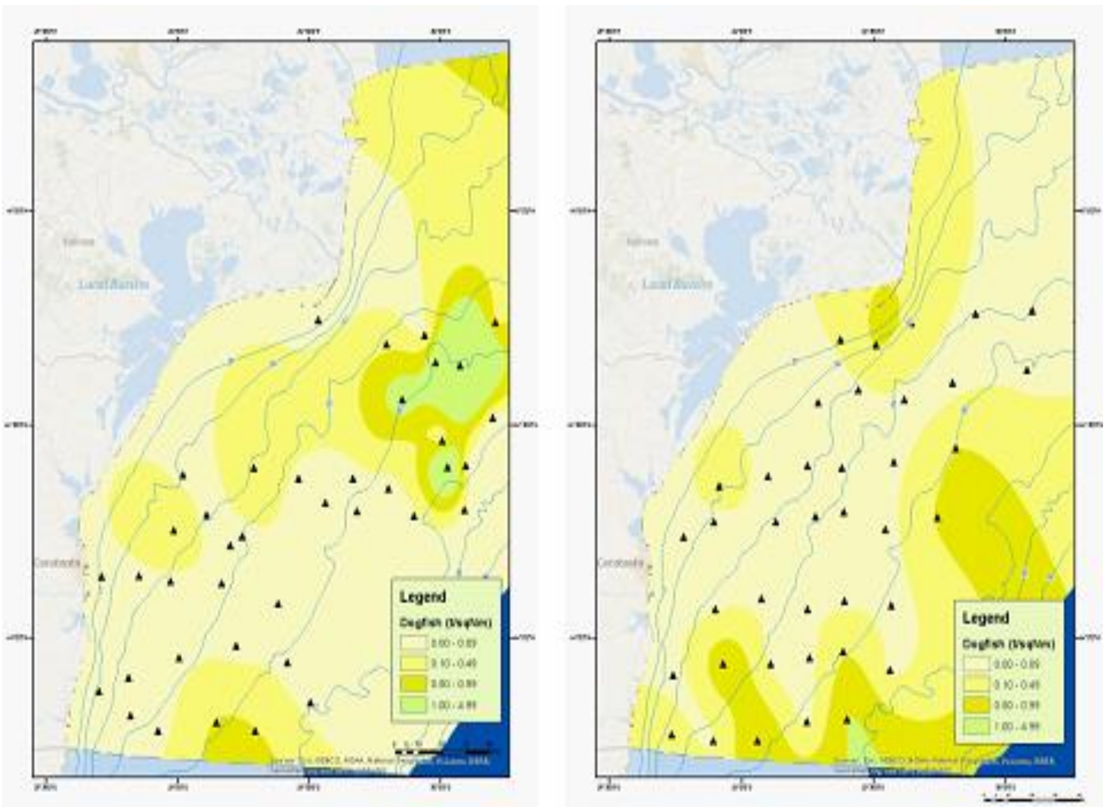


Fig. 4.1.6 Distribution of the dogfish agglomerations in the spring and autumn period 2016, Romanian littoral

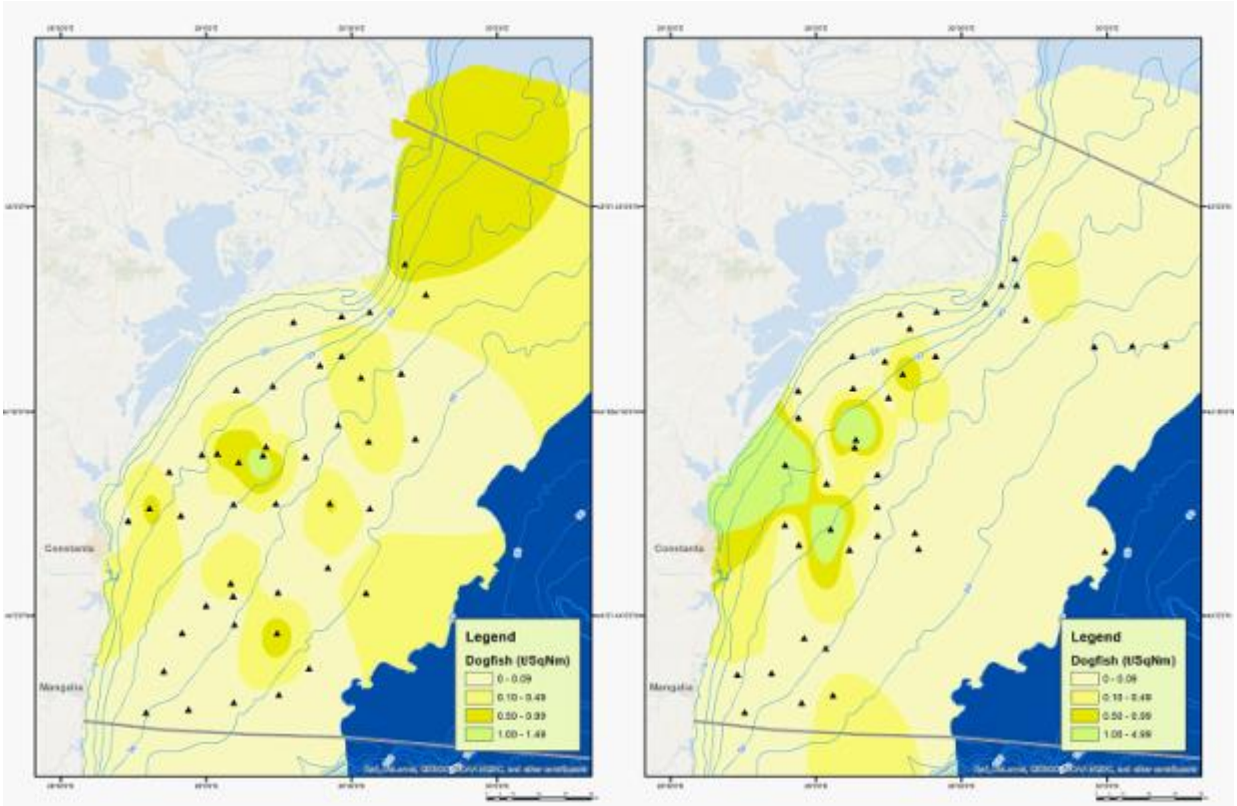


Fig. 4.1.7 Distribution of the dogfish agglomerations in the spring and autumn period 2017, Romanian littoral

a. b.

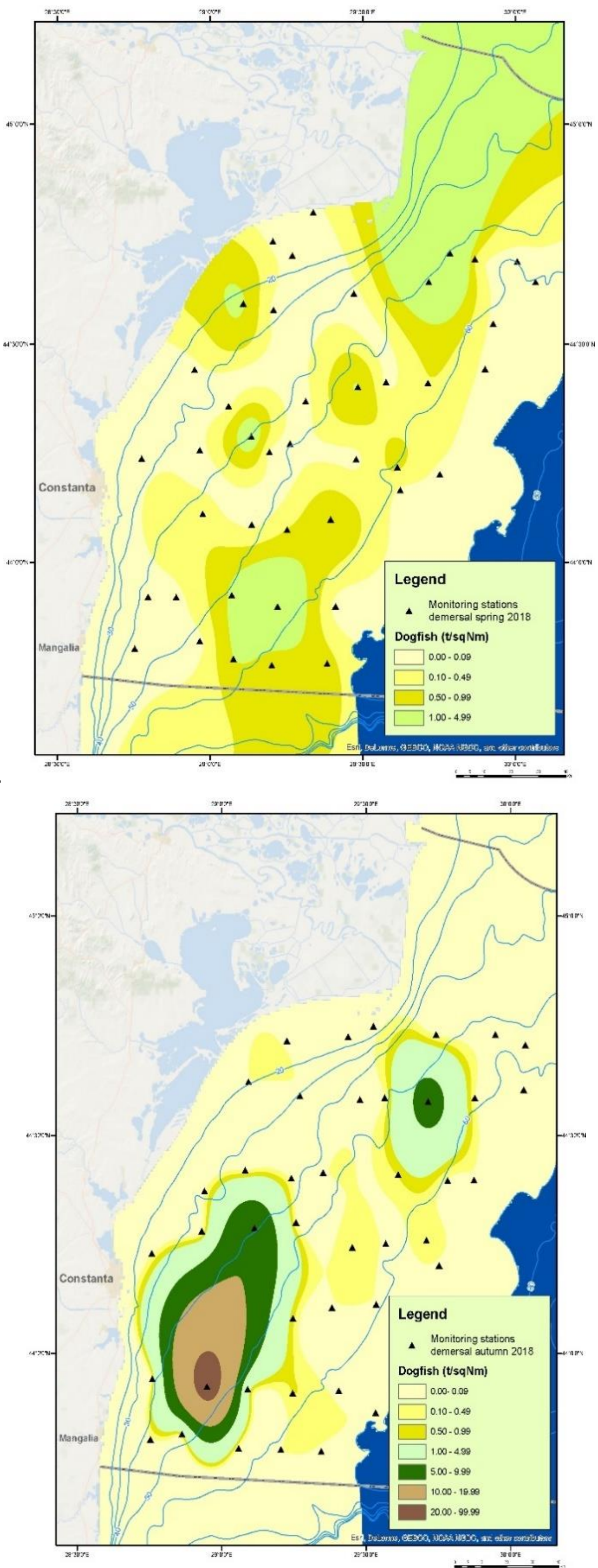
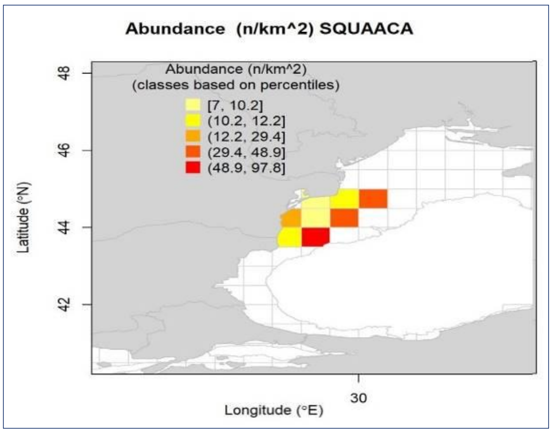
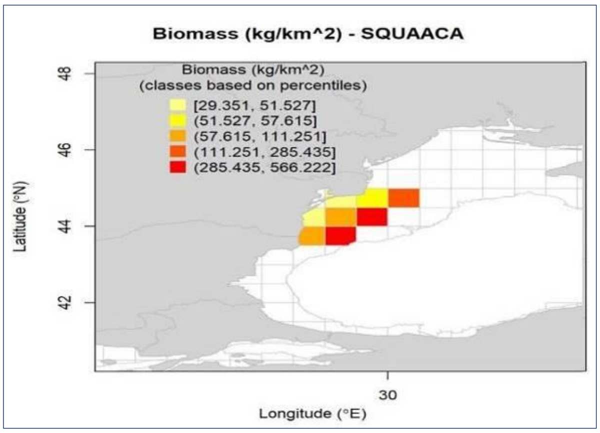


Fig. 4.1.8 Distribution of the dogfish agglomerations in the spring and autumn period 2018, Romanian littoral

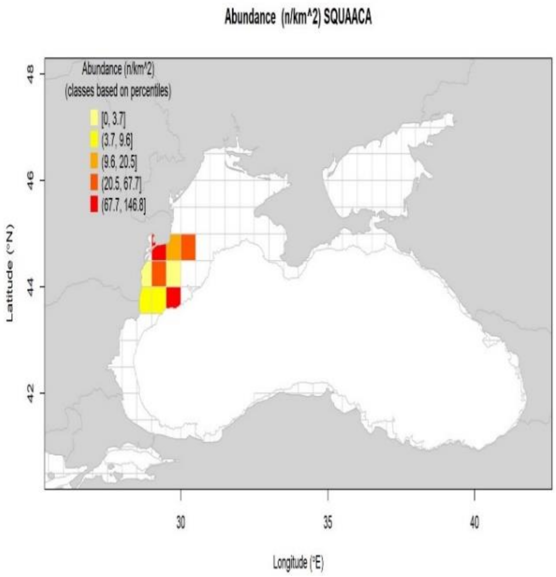


a.



b.

Fig. 4.1.9 Distribution of the dogfish agglomerations in the spring period 2019, Romanian littoral



a

b

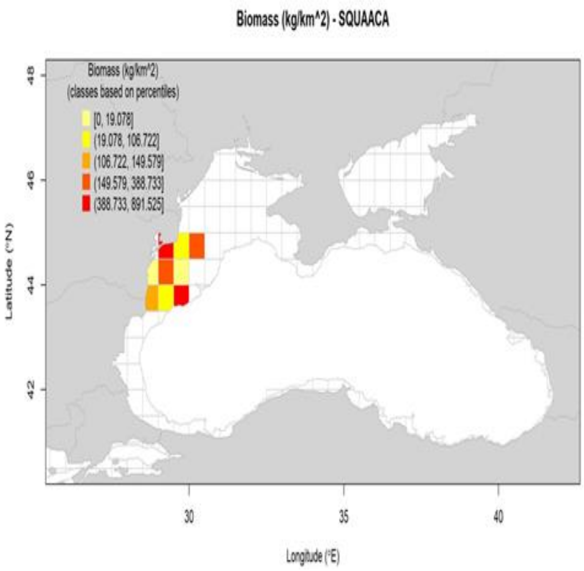


Fig. 4.1.9 Distribution of the dogfish agglomerations in the spring period 2020, Romanian littoral

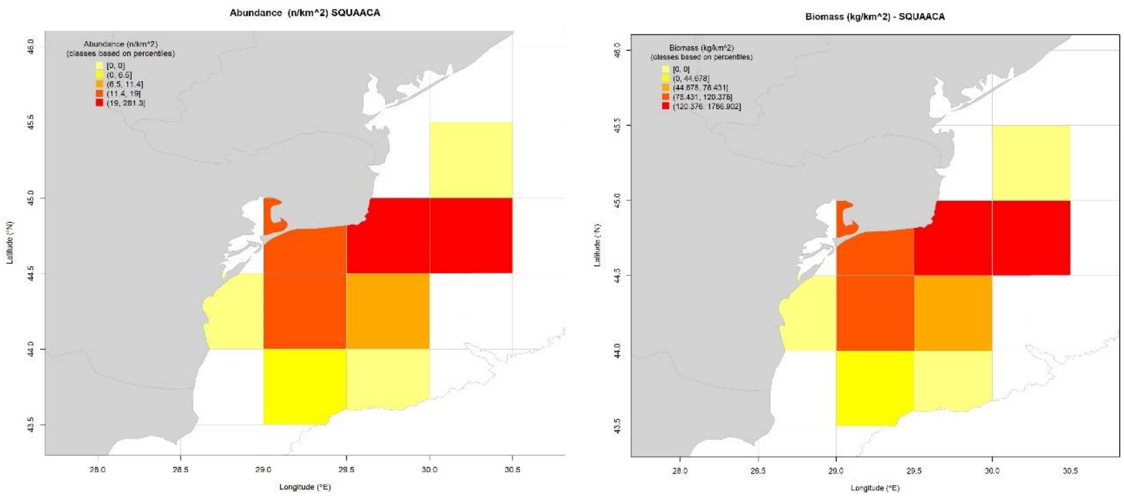


Fig. 4.2.0 Distribution of the dogfish agglomerations in the spring period 2021, Romanian littoral

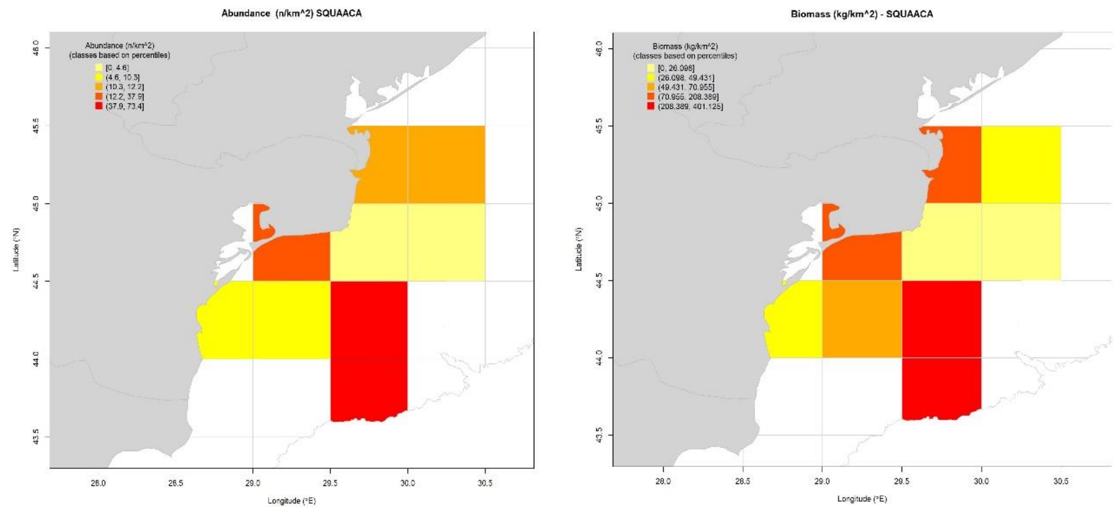
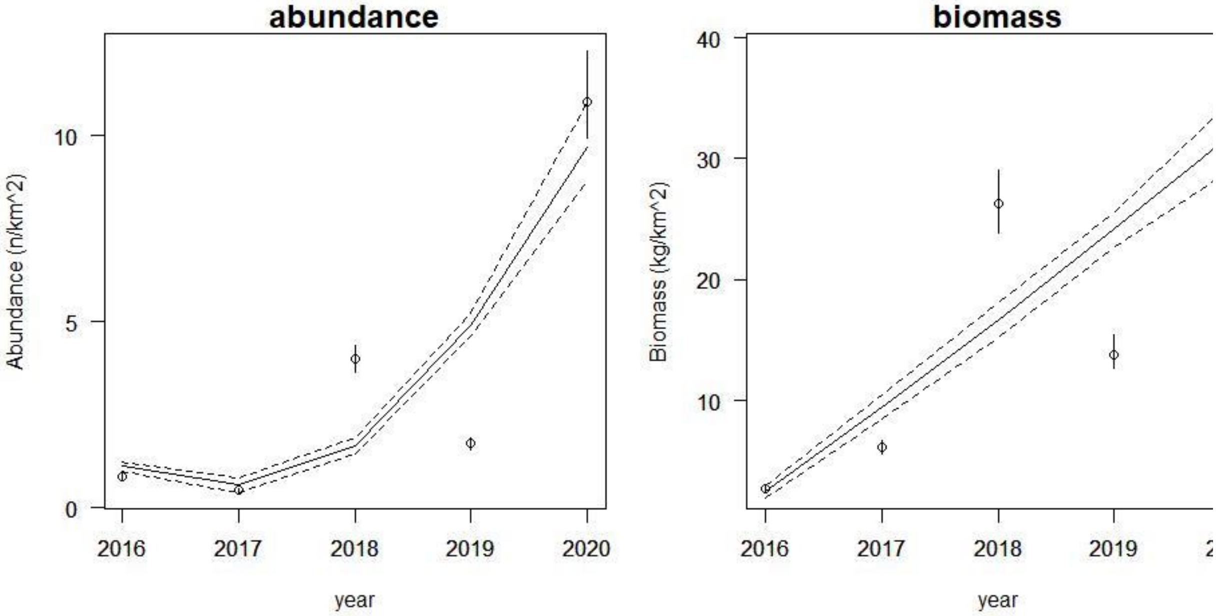
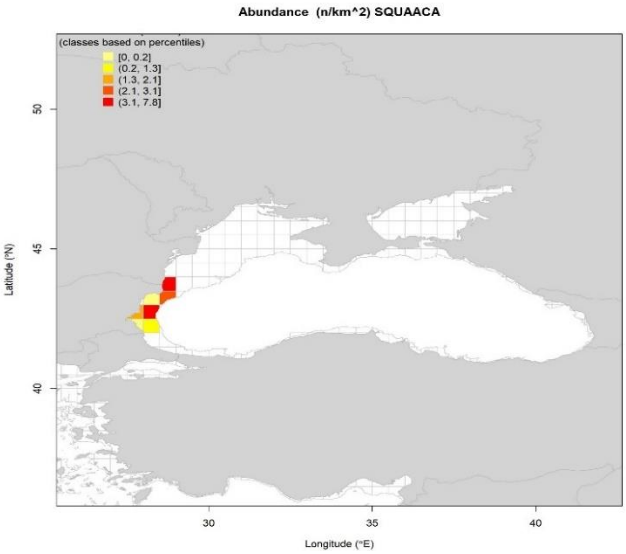


Fig. 4.2.1 Distribution of the dogfish agglomerations in the autumn period 2021, Romanian littoral

Fig. 4.2.2 The distribution of the points where the presence of the shark was reported at the Bulgarian seaside in spring and autumn 2017





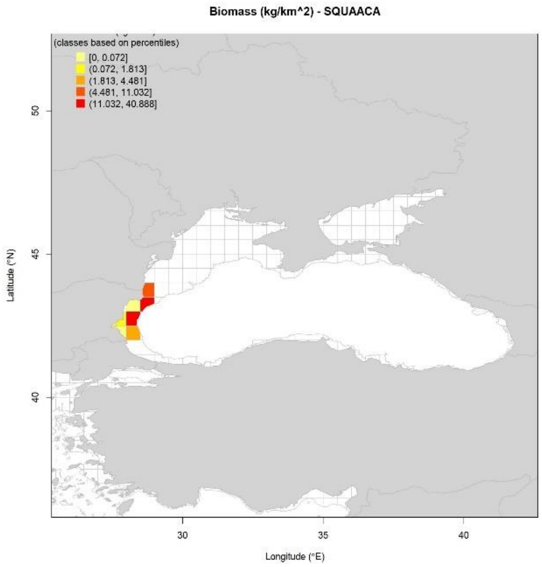
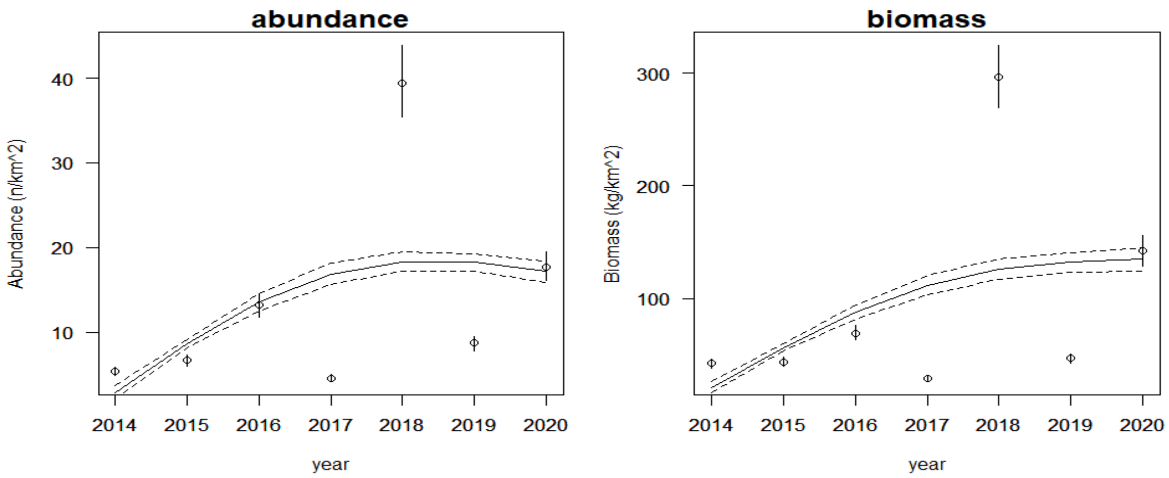


Fig. 4.2.3 Distribution of the dogfish agglomerations in the spring period 2016 - 2020, Bulgarian littoral



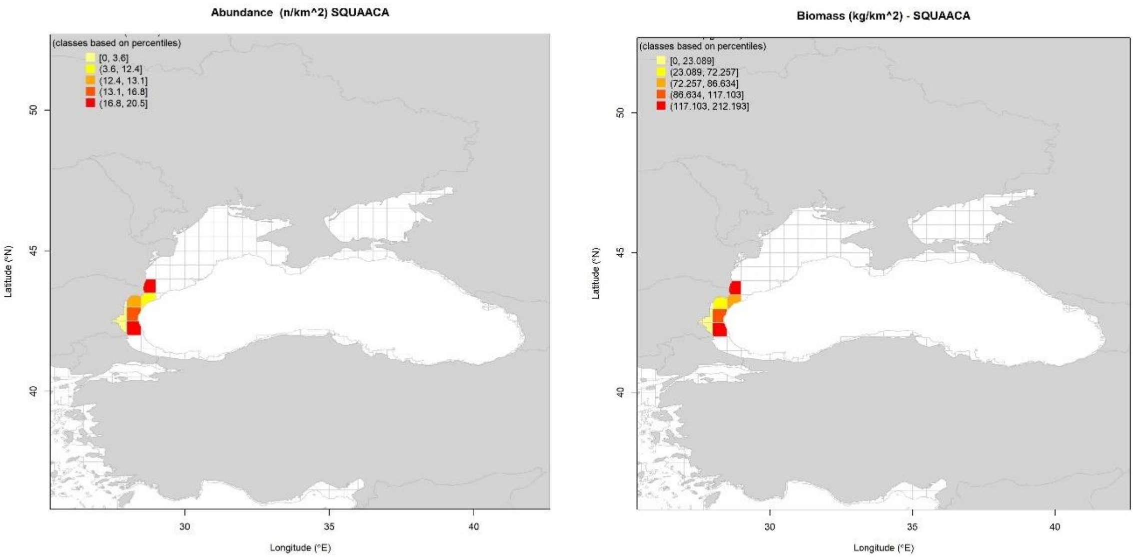


Fig. 4.2.4 Distribution of the dogfish agglomerations in the autumn period 2014 - 2020, Bulgarian littoral

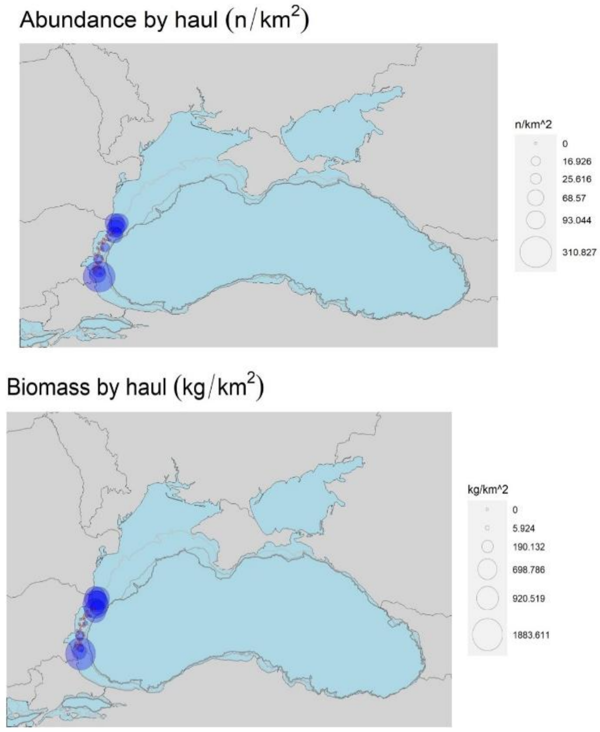


Fig. 4.2.5 Distribution of the dogfish agglomerations in 2021 by haul, Bulgarian littoral

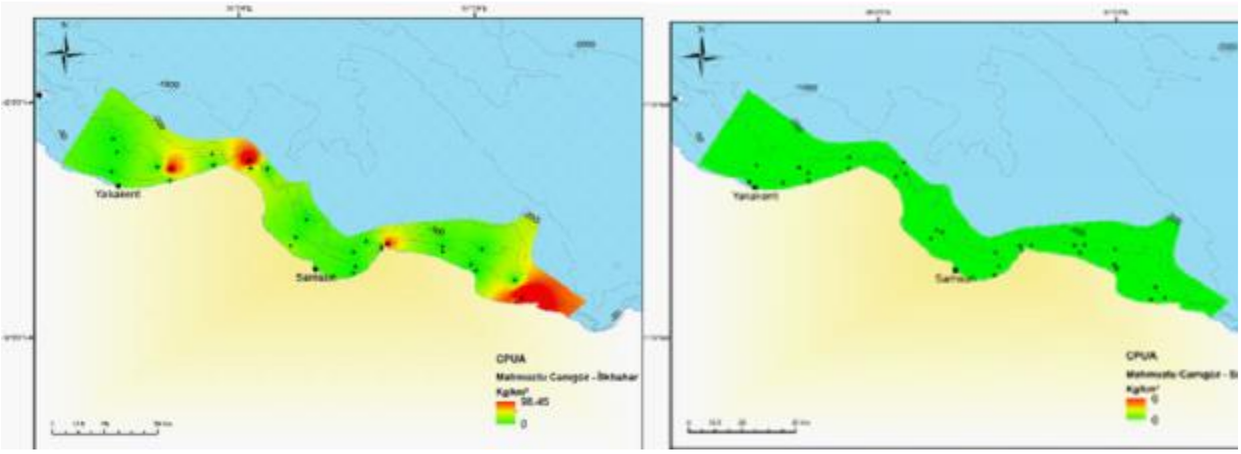


Fig. 4.2.3 Distribution of dogfish at the Turkish littoral in spring and autumn 2017

Trends in abundance and biomass

Results for estimated piked dogfish biomasses in May and November of 2011- 2021 in Romanian waters are given in the following tables.

Table 4.1.4 Estimated piked dogfish biomasses (t) in spring and autumn in Romanian waters

Species	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Piked dogfish	1173-1690	1436-1159	3181-4483	1520-1267	1243 –235	1550 -747	930-1222	223-1040	2674	3907	1945-4135

Table. 4.1.5 CPUE for the piked dogfish at sea surveys for Romanian Black Sea area

YEAR	2012		2013		2014		2015		2016		2017	
Period	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Range (kg/hour)	1.1-19.2	1.5-134	5.5-115.8	0.95-200	4.25 - 50.3	5.45-39.21	0-31.47	0-12.25	0-45	0-15.75	5.2-26.9	2.5-50.1

YEAR	2018		2019		2020		2021	
Period	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
Range (kg/hour)	2.2-43.7	1.6-37.8	0.8-52.1		5.2-40.6		14.4 - 69.8	14.4 - 49.8

Table 4.1.6 Assessment of dogfish agglomerations in the spring 2012, demersal trawl survey, Romanian area

Depth range (m)	0 - 30m	30 – 50m	50-70 m	Total
Investigated area (Nm^2)	663.62	1065	517.37	2245.99
Variation of the catches (t/ Nm^2)	0.00-0.062	0.00-0.365	0.00-0.75	0.00-0.75
Average catch (t/ Nm^2)	0.005	0.016	0.432	
Biomass of the fishing agglomerations (t)	3.468	17.69	223.81	244.97
Biomass extrapolated the Romanian shelf (t)				1436.34

Table 4.1.7 Assessment of dogfish agglomerations in the autumn 2012, demersal trawl survey, Romanian area

Depth range (m)	0 - 30m	30 – 50m	50-70 m	Total
Investigated area (Nm^2)	754.58	1294.12	807	2855.7
Variation of the catches (t/ Nm^2)	0.30-1.35	0.00-1.60	0.00-0.86	0.00-1.60
Average catch (t/ Nm^2)	0.736	0.372	0.161	
Biomass of the fishing agglomerations (t)	754.85	482.324	130.53.4	1169.086
Biomass extrapolated the Romanian shelf (t)				1515.883

Table 4.1.8 Assessment of dogfish agglomerations in the spring 2013, demersal trawl survey, Romanian area

Depth range (m)	0 - 30m	30 – 50m	50-70 m	70-100m	Total
Investigated area (Nm^2)	650	1225	1350	50	3300
Variation of the catches (t/ Nm^2)	0.325-2.264	0.00-4.272	0.00-6.878	0.013-0.019	0.00-6.878
Average catch (t/ Nm^2)	1.19033	0.530778	0.607833	0.015583	0.63622
Biomass of the fishing agglomerations (t)	773.7167	650.2028	820.575	1.16875	2099.53
Biomass extrapolated the Romanian shelf (t)					3181.119

Table 4.1.9 Assessment of dogfish agglomerations in autumn 2013, demersal trawl survey, Romanian area

Depth range (m)	0 - 30m	30 – 50m	50-70 m	Total
Investigated area (Nm^2)	625	1075	450	2150
Variation of the catches (t/ Nm^2)	0.00-0.308	0.00-11.404	0.00-1.32	0.00-11.40
Average catch (t/ Nm^2)	0.060333	1.5042	0.386714	0.896522
Biomass of the fishing agglomerations (t)	37.70833	1617.015	174.0214	1927.522
Biomass extrapolated the Romanian shelf (t)				4482.609

Table 4.1.10 Assessment of dogfish agglomerations in the spring 2014, demersal trawl survey, Romanian area

Depth range (m)	0 - 30m	30 – 50m	50-70 m	70-100m	Total
Investigated area (Nm2)	625	1150	825		2600
Variation of the catches (t/ Nm2)	0-2.86	0-1.64	0-1.1		0-2.86
Average catch (t/ Nm2)	0.65	0.343	0.149		0.304
Biomass of the fishing agglomerations (t)	406.62	394.23	123.27		790.22
Biomass extrapolated the Romanian shelf (t)					1519.67

Table 4.1.11 Assessment of dogfish agglomerations in autumn 2014, demersal trawl survey, Romanian area

Depth range (m)	0 - 30m	30 – 50m	50-70 m	Total
Investigated area (Nm2)	625	1150	875	2650
Variation of the catches (t/ Nm2)	0-0.33	0-1.56	0-2.23	0-2.23
Average catch (t/ Nm2)	0.048	0.143	0.532	0.2533
Biomass of the fishing agglomerations (t)	30.29	164.75	466.34	671.32
Biomass extrapolated the Romanian shelf (t)				1266.643

Table 4.1.12 Assessment of dogfish agglomerations in the spring 2015, demersal trawl survey, Romanian area

Depth range (m)	0 - 30m	30 – 50m	50-70 m	Total
Investigated area (Nm^2)	625	1225	1500	3250
Variation of the catches (t/ Nm^2)	0.0-2.13	0.0-1.11	0.0-2.09	0.0-2.13
Average catch (t/ Nm^2)	0.558	0.195	0.167	0.248
Biomass of the fishing agglomerations (t)	348.75	238.875	250.5	806
Biomass extrapolated the Romanian shelf (t)				1243

Table 4.1.13 Assessment of dogfish agglomerations in autumn 2015, demersal trawl survey, Romanian area

Depth range (m)	0 - 30m	30 – 50m	50-70 m	Total
Investigated area (Nm^2)	625	1050	2075	3750
Variation of the catches (t/ Nm^2)	0.0	0.0-0.35	0.0-0.727	0.0-0.727
Average catch (t/ Nm^2)	0.0	0.0445	0.0508	0.047
Biomass of the fishing agglomerations (t)	0	46.725	105.41	176.25
Biomass extrapolated the Romanian shelf (t)				235

Table 4.1.14 Assessment of dogfish agglomerations in spring2016, demersal trawl survey, Romanian area

Depth range (m)	0 - 30m	30 – 50m	50-70 m	Total
Investigated area (Nm^2)	600	1125	1500	3225
Variation of the catches (t/ Nm^2)	0	0-0.463	0-0.902	0-0.902
Average catch (t/ Nm^2)	0	0.102	0.395	0.310
Biomass of the fishing agglomerations (t)	0	114.833	593.922	999.843
Biomass extrapolated the Romanian shelf (t)				1550.145

Table 4.1.15 Assessment of dogfish agglomerations in autumn 2016, demersal trawl survey, Romanian area

Depth range (m)	0 - 30m	30 – 50m	50-70 m	Total
Investigated area (Nm^2)	600	1125	1275	3000
Variation of the catches (t/ Nm^2)	0-0.126	0-0.401	0-1.020	0-1.020
Average catch (t/ Nm^2)	0.063	0.096	0.195	0.149
Biomass of the fishing agglomerations (t)	37.9059	109.115	249.159	448.308
Biomass extrapolated the Romanian shelf (t)				747.181

Table 4.1.16 Assessment of dogfish agglomerations in May 2017, demersal trawl survey , Romanian area

Depth range (m)	0 - 30m	30 – 50m	50-70 m	Total
Investigated area (Nm^2)	475	950	800	2225
Variation of the catches (t/ Nm^2)	0-0.704	0-1.597	0-0.727	0-1.597
Average catch (t/ Nm^2)	0.170	0.259	0.126	0.186
Biomass of the fishing agglomerations (t)	80.848	246.319	101.151	413.951
Biomass extrapolated the Romanian shelf (t)				930.239

Table 4.1.17 Assessment of dogfish agglomerations in October 2017, demersal trawl survey, Romanian area

Depth range (m)	0 - 30m	30 – 50m	50-70 m	Total
Investigated area (Nm^2)	400	875	325	1600
Variation of the catches (t/ Nm^2)	0-0.3264	0-3.4	0-0.154	0-3.264
Average catch (t/ Nm^2)	0.251	0.374	0.0154	0.244
Biomass of the fishing agglomerations (t)	100.444	327.546	5.035	487.465
Biomass extrapolated the Romanian shelf (t)				1222.894

Table 4.1.18 Assessment of dogfish agglomerations in June 2018, demersal trawl survey, 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	0-0.92
Average catch (t/ Nm^2)	0.0525	0	0.106	0.045
Biomass of the fishing agglomerations (t)	30	0	130	125
Biomass extrapolated the Romanian shelf (t)				223.0

Table 4.1.19 Assessment of dogfish agglomerations in October 2018, demersal trawl survey, 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	0-0.92
Average catch (t/ Nm^2)	0.0525	0	0.106	0.045
Biomass of the fishing agglomerations (t)	30	0	130	125
Biomass extrapolated the Romanian shelf (t)				1,040.

Table 4.1.20 Assessment of dogfish agglomerations in May 2019, demersal trawl survey, Romanian area

Depth range (m)	*0–30 m*	*30–50 m*	*50-70 m*	*Total*
Investigated area (Km^2)	2,260	6,300	9,240	17,80
Variation of the catches (t/ Km^2)	0-0.0	0-0.205	0-0.936	0-0.46
Average catch (t/ Km^2)	0.0	0.053	0.256	0.122
Biomass of the fishing agglomerations (t)	0.00	261.97	1898.49	2160.4
Biomass extrapolated the Romanian shelf (t)				2674.9

Table 4.1.21 Assessment of dogfish agglomerations in May 2020, demersal trawl survey, Romanian area

Depth range (m)	*0–30 m*	*30–50 m*	*50-70 m*	*Total*
Investigated area (Km^2)	1990	4350	6450	12790
Variation of the catches (t/ Km^2)	0.00 – 0.993	0.00-0.536	0.00-0.891	0.00-0.9
Average catch (t/ Km^2)	0.431	0.112	0.152	0.232
Biomass of the fishing agglomerations (t)	1058.29	557.14	1132.10	2743.5
Biomass extrapolated the Romanian shelf (t)				3907.1

Table 4.1.22 Assessment of dogfish agglomerations in May 2021, demersal trawl survey, Romanian area

Depth range (m)	*0–30 m*	*30–50 m*	*50-70 m*	*Total*
Investigated area (Km^2)	1990	4350	6450	12790
Variation of the catches (t/ Km^2)	0.000 – 0.166	0.000-0.951	0.144-6.981	0.000 6.981
Average catch (t/ Km^2)	0.083	0.087	0.355	0.175
Biomass of the fishing agglomerations (t)	203.99	430.65	2627.47	3262.1
Biomass extrapolated the Romanian shelf (t)				**4135.4**

Table 4.1.23 Assessment of dogfish agglomerations in October 2021, demersal trawl survey, Romanian area

Depth range (m)	*0–30 m*	*30–50 m*	*50-70 m*	*Total*
Investigated area (Km^2)	0.000 – 0.324	0.000-	0.144-	0.000
Variation of the catches (t/ Km^2)	0.094	0.016	0.160	0.090
Average catch (t/ Km^2)	230.99	80.13	1185.01	1496.1
Biomass of the fishing agglomerations (t)	0.000 – 0.324	0.000-	0.144-	0.000
Biomass extrapolated the Romanian shelf (t)				**1945.7**

Table 4.1.24 Assessment of dogfish agglomerations by biomass and abundances indices obtained by Biondex for years 2016- 2020, demersal trawl spring surveys, Bulgarian area

		Spring	
year	MIW	biomass	abundance
2016	2.265778	2.6771452	0.831914892
2017	3.982222	6.0842376	0.475331064
2018	2.912222	26.290826	4.00850372
2019	4.702667	13.822125	1.720796676
2020	3.964102	35.668871	10.92306717

Table 4.1.25 Assessment of dogfish agglomerations by biomass and abundances indices obtained by Biondex for years 2014- 2020, demersal trawl autumn surveys, Bulgarian area

		Autumn	
year	MIW	biomass	abundance
2014	7.804	42.602335	5.379967783
2015	7.958952	43.558729	6.637307781
2016	5.582448	69.204623	13.23544497
2017	6.353778	28.964512	4.531655851
2018	6.95131	296.02182	39.45152532
2019	3.701196	46.9991	8.695488007
2020	6.717119	142.54354	17.66745031

Table 4.1.26 Assessment of dogfish agglomerations by biomass and abundances indices obtained by Biondex for years 2021, demersal trawl surveys, Bulgarian area

Bulgaria	BioIndex 3.2-R	Autumn survey data IFR-Varna		
	year	mean biomass	sd	CV
	2021	172.3928956	61.41736715	0.356263911
Biomass by strata	year	Biomass_1	Biomass_2	Biomass_3
	2021	61.43316284	324.4206555	136.3171078
	BioIndex 3.2-R	Autumn survey data IFR-Varna		
	year	mean abundance	sd	CV
	2021	20.5179381	7.453356499	0.363260502
Abundance by strata	year	Abundance_1	Abundance_2	Abundance_3
	2021	6.834766865	43.65358344	11.36765319

Table 4.1.27 Assessment of dogfish agglomerations by biomass and abundances indices obtained by Biondex for years 2017 - 2021, demersal trawl surveys, Turkish area

year	Abundance_1	Abundance_2	Abundance_3	SD_1	SD_2	SD_3	CV_1	CV_2	CV_3
2017	0	0	0	0	0	0	0	0	0
2018	0	0	0	0	0	0	0	0	0
2019	0	39.7939475	18.32874112	0	19.79252	10.07352	0	0.497375	0.549602
2020	0	90.19819563	4.028252533	0	82.61864	5.481153	0	0.915968	1.360678
2021	25.03385406	32.29465194	3.320559977	24.33973873	21.81152	3.279635	0.972273	0.675391	0.987675

Table 4.1.28 Turkish CPUA (Kg/Km^2) in 2017 surveys

	Strata	Kg/Km^2
Spring 2017	0-20 m	122.337
	20-50 m	546.413
	50-100 m	110.37
Autumun 2017	strata	Kg/Km^2
	0-20 m	0
	20-50 m	0
	50-100 m	0

Trends in abundance by length or age

For GFCM/SGSABS only Romania presented data.

The lengths of piked dogfish individuals were within the limits of classes of length 102.0 -127 cm / 3950.0 – 9500.0 g. The dominant classes were 114.0 - 118.0 cm / 6100.0 – 6700.0 g (Fig. xx). Males were dominant – 88.89%, compared to females (11.11 %). The average body length was 117.85 cm and the average weight 6535.18 g.

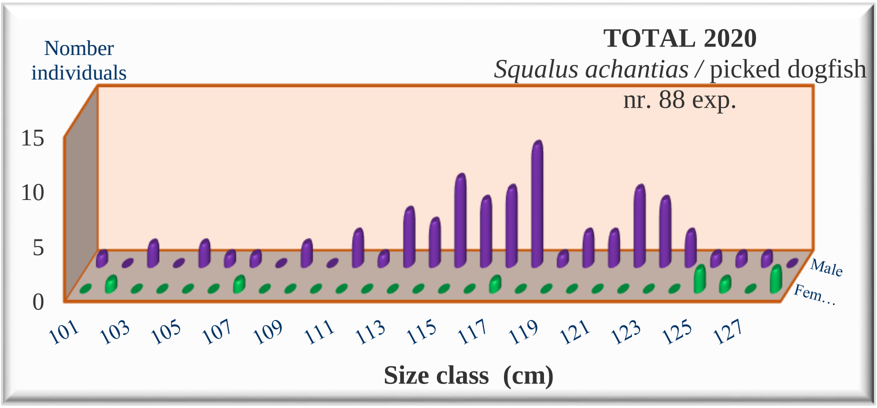


Figure 4.2.4 Structure by lengths of piked dogfish, during the spring survey 2020

Age composition of piked dogfish catches indicates the presence of individuals from 12 to 18 years old. Most of the individuals caught were 14 years old (22.73%) and 15 years (21.59 %) of all specimens analyzed), followed closely by those of 13 years (17.05%), 16 years (14.27%), 17 years (11.36%) and 18 years (6.82 %).

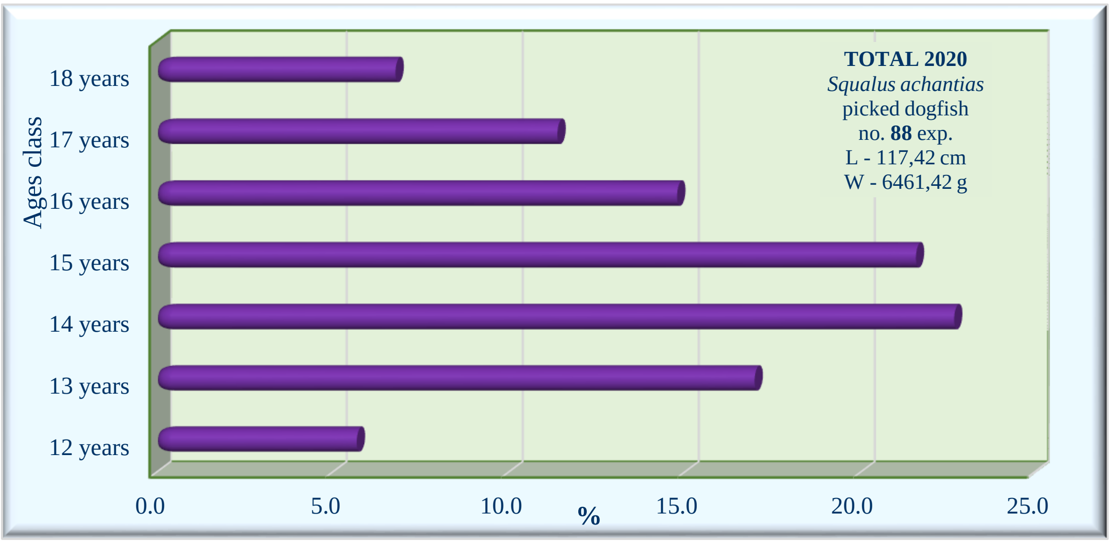


Figure 4.2.5 Structure by age composition of piked dogfish, during spring survey 2020

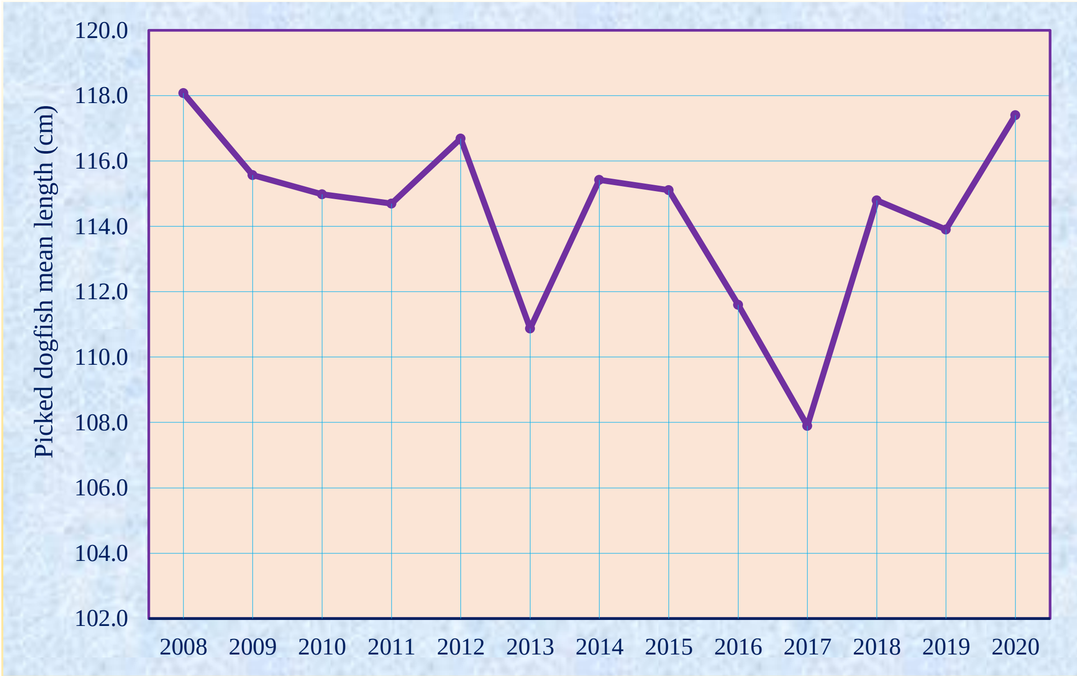


Fig. 4.2.6 The average length of dogfish in the period 2008 – 2020

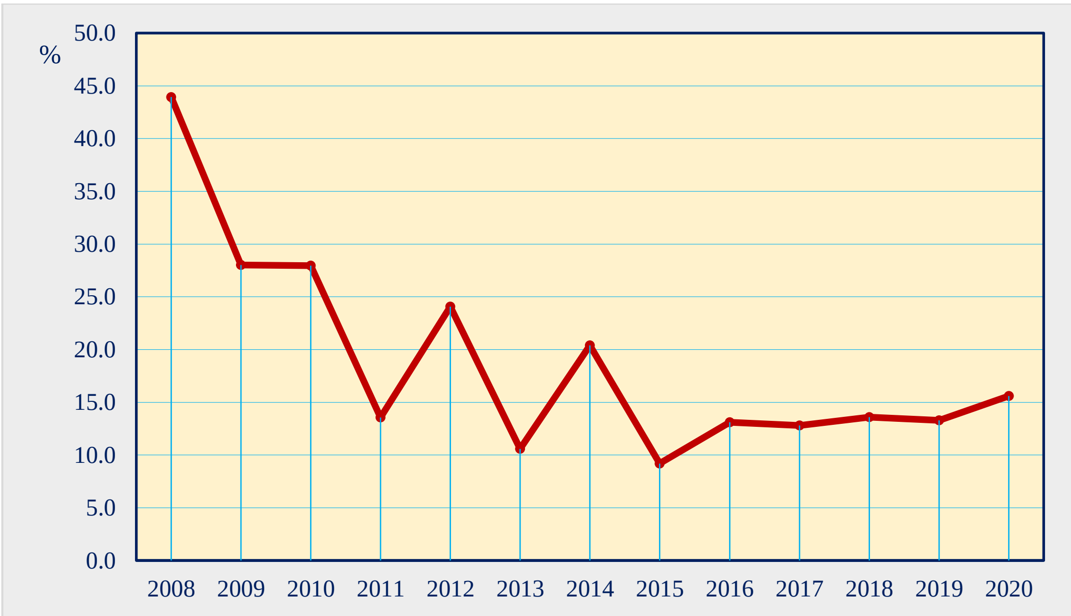


Figure 4.2.7 Percentage of dogfish specimens larger than the average size at first sexual maturation

4.1.2 Spatial distribution of the resources

Include maps with distribution of total abundance, spawners and recruits (if available)

4.1.3 Historical trends

YEAR	ROMANIA	BULGARIA	TURKEY	UKRAINE	GEORGIA	RUSSIA	TOTAL
1989	30	28	4558	1191	217	135	6159
1990	45	16	1059	1330	128	183	2761
1991	26	21	2017	775	18	67	2924
1992	52	15	2220	595	14	15	2911
1993	6	12	1055	409	131	5	1618
1994	2	12	2432	148	45	11	2650
1995	7	80	1562	67	31	90	1837
1996	5	64	1748	44	71	19	1951
1997	5	40	1510	20	1	9	1585
1998	5	28	855	38	550	6	1482
1999	5	25	1478	94	18	9	1629
2000	5	102	2390	71	21	12	2601
2001	5	126	576	134	27	27	895
2002	5	100	316	97	65	19	602
2003	5	51	184	172	40	29	481
2004	5	47	211	93	31	34	421
2005	5	15	102	75	35	19	251
2006	9	6	193	67	10	17	302
2007	17	24	91	45	2	32	211
2008	10	23	35	79	0.4	59	206
2009	4	9	159	47	1.5	14	235
2010	3	42	16	18	1.5	9	89
2011	4	38	27	22	1.5	4	96

YEAR	ROMANIA	BULGARIA	TURKEY	UKRAINE	GEORGIA	RUSSIA	TOTAL
2012	2	29	25	6	1.5	6	69
2013	9	31	25	7	1.5	4	77
2014	2	34	3	3	1.5	18	62
2015	13	133	0	4	NA	6	156
2016	3	83	0	5	NA	40	132
2017	2	50	0	2	NA	0	54
2018	0.5	10	0	0.8	NA	0	11
2019	0.6	17	0	0.95	NA	41	59
2020	0.9	48	0	0.278	NA	22	71
2021	0.7	19.7	0	0.8	NA	NA	21.15

5 Ecological information

5.1 Protected species potentially affected by the fisheries

Not available

5.2 Environmental indexes

Not provided

6 Stock Assessment

Owing to issues related to data availability and analysis, the stock assessment work was performed after the meeting of the SGSABS ended and is thus to be considered preliminary. Advice is provided on a precautionary basis.

6.1 a4a

6.1.1 Model assumptions

The evaluation in 2022 was done applying a statistical catch at age model, a4a (assessment for all; Jardim et al., 2014) to the time series starting in 1989 to 2021. Instead of updating the XSA model, a statistical catch at age model was chosen to estimate the uncertainty in the data. Landings data by age are available only for the most recent years and only for Bulgaria and Romania. Romania has the longest time series, with age readings starting in 2014, while Bulgaria started recording length measurement data only since 2017 (but with a gap year in 2018). Age data previous to 2014 were reconstructed assuming that the age distribution was constant across time. As tuning indices (spring-autumn) only the Romanian data (2014-2021) were used, considering that data available from the Bulgarian surveys (spring and autumn) have a time series of only two years (2019-2021) which is not informative enough to be kept in the model.

6.1.2 Scripts

The script used to run the assessment is available on the GFCM sharepoint.

6.1.3 Input data and Parameters

A major issue was observed in the catch numbers-at-age matrix. Very large values of sum of products (SOPs) were highlighted, indicating major problems in the preparation of the data. In order to at least attempt some trials with an age-based model (SCAA with a4a), a correction based on the SOPs was made on the catch numbers-at-age matrix.

The catch-at-age structure after the SOP correction and those of the surveys used as tuning information (Romanian survey in autumn and spring) are shown (Figs. 6.1.3.1-6.1.3.3), together with the internal cohort consistencies (Figs. 6.1.3.4-6.1.3.6). The good internal consistency of catches is an artifact due to the use of most recent age-structure for the whole time series of data. The consistency of the two surveys is very poor.

Table 6.1.3.1. Catch numbers-at-age matrix as prepared during the data preparation meeting.

age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
11	0.334	0.334	0.334	0.150	0.150	0.159	0.159	0.159	0.158	0.158	0.088
12	75.216	75.216	75.216	33.718	33.718	35.709	35.709	35.550	35.550	35.550	19.760
13	299.183	299.183	299.183	134.120	134.120	142.038	142.038	141.406	141.406	141.406	78.597
14	297.177	297.177	133.221	133.221	133.221	141.086	141.086	140.458	140.458	140.458	78.070
15	158.534	158.534	71.069	71.069	71.069	75.264	75.264	74.930	74.930	41.648	41.648
16	93.182	93.182	41.772	41.772	41.772	44.238	44.238	44.042	44.042	24.479	24.479
17	52.982	52.982	23.751	23.751	25.153	25.153	25.153	25.042	25.042	13.919	13.919
18	40.290	40.290	18.061	18.061	19.128	19.128	19.128	19.042	19.042	10.584	10.584
age	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
11	0.088	0.144	0.144	0.144	0.100	0.100	0.106	0.106	0.086	0.086	0.086
12	19.760	32.363	32.363	32.363	22.434	22.434	23.826	23.826	19.357	19.357	19.357
13	78.597	128.728	128.728	89.235	89.235	89.235	94.773	94.773	76.994	76.994	76.994
14	78.070	127.865	127.865	88.637	88.637	88.637	94.138	94.138	76.478	76.478	71.508
15	41.648	68.212	68.212	47.285	47.285	47.285	50.219	50.219	40.798	40.798	38.147
16	24.479	40.093	40.093	27.793	27.793	29.517	29.517	29.517	23.980	23.980	22.422
17	13.919	22.796	22.796	15.803	15.803	16.783	16.783	16.783	13.635	13.635	12.749
18	17.335	17.335	17.335	12.017	12.017	12.763	12.763	12.763	10.368	10.368	9.695
age	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
11	0.080	0.080	0.088	0.088	0.884	4.659	0.141	0.049	0.049	0.033	0.000
12	18.099	18.099	19.894	19.894	28.517	33.035	31.058	8.744	8.890	13.743	0.380
13	71.991	71.991	79.131	79.131	187.481	137.219	125.218	40.707	40.901	41.221	0.856
14	71.508	71.508	78.601	78.601	230.966	139.196	124.512	40.415	40.901	54.964	0.000
15	38.147	38.147	41.931	41.931	121.871	62.291	22.600	20.074	19.540	52.193	0.634
16	22.422	22.422	24.646	24.646	73.660	35.116	13.395	12.423	12.472	35.711	0.761
17	12.749	14.013	14.013	14.013	27.034	20.116	7.602	7.068	7.116	27.454	0.476
18	9.695	10.656	10.656	10.656	15.179	15.179	5.758	5.223	3.611	16.482	0.222

Table 6.1.3.2. Reported catches (t) against catches estimated by the sum of products (SOPs) between the catch numbers-at-age matrix and mean weight-at-age. The SOP correction values is also shown.

year	Reported catches (t)	SOP (t)	SOP correction
1989	6159	6159.0	1.00
1990	2761	6159.0	**2.23**
1991	2924	3771.3	1.29
1992	2911	2761.0	0.95
1993	1618	2780.4	1.72
1994	2650	2924.0	1.10
1995	1837	2924.0	1.59
1996	1951	2911.0	1.49
1997	1585	2911.0	1.84
1998	1482	2374.0	1.60
1999	1629	1618.0	0.99
2000	2601	1668.5	**0.64**
2001	895	2650.0	**2.96**
2002	602	2650.0	**4.40**
2003	481.3	1878.7	**3.90**
2004	421.2	1837.0	**4.36**
2005	250.5	1864.1	**7.44**
2006	302.2	1951.0	**6.46**
2007	211	1951.0	**9.25**
2008	206.2	1585.0	**7.69**
2009	235	1585.0	**6.74**
2010	89.4	1512.6	**16.92**
2011	95.6	1482.0	**15.50**
2012	68.8	1499.5	**21.79**
2013	76.9	1629.0	**21.18**
2014	61.6	1629.0	**26.44**
2015	156.3	4228.4	**27.05**
2016	131.7	2472.9	**18.78**
2017	54	1678.4	**31.08**
2018	11.4	817.2	**71.68**
2019	59.3	823.2	**13.88**
2020	70.7	1580.1	**22.35**
2021	21.149	20.7	0.98

Table 6.1.3.3. New catch numbers-at-age matrix after the SOP correction.

	1989	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
11	0.334	0.150	0.259	0.158	0.087	0.144	0.100	0.106	0.086	0.099	0.088
12	75.216	33.718	58.317	35.550	19.622	32.363	22.434	23.826	19.357	22.192	19.894
13	299.180	134.120	231.970	141.410	78.049	128.730	89.235	94.773	76.994	88.274	79.131
14	297.180	133.220	103.290	140.460	77.526	127.860	88.637	94.137	76.478	87.682	78.601
15	158.530	71.069	55.102	74.930	41.357	68.212	47.285	50.219	40.798	25.999	41.931
16	93.182	41.772	32.387	44.042	24.309	40.093	27.793	29.517	23.980	15.281	24.646
17	52.982	23.751	18.415	25.042	14.638	22.796	15.803	16.783	13.635	8.689	14.013
18	40.289	18.061	14.004	19.042	11.131	17.335	12.017	12.763	10.368	6.607	10.656
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
11	0.137	0.049	0.033	0.037	0.023	0.013	0.016	0.011	0.011	0.013	0.005
12	30.802	10.930	7.352	8.291	5.144	3.015	3.691	2.577	2.518	2.870	1.144
13	122.520	43.476	29.243	22.861	20.460	11.991	14.680	10.250	10.016	11.416	4.551
14	121.700	43.185	29.047	22.708	20.323	11.911	14.581	10.181	9.949	11.339	4.226
15	64.923	23.037	15.496	12.114	10.842	6.354	7.779	5.431	5.308	6.049	2.255
16	38.160	13.541	9.108	7.120	6.373	3.967	4.572	3.192	3.120	3.555	1.325
17	21.697	7.699	5.179	4.049	3.623	2.255	2.600	1.815	1.774	2.022	0.753
18	27.023	5.855	3.938	3.079	2.755	1.715	1.977	1.380	1.349	1.537	0.573
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
11	0.005	0.004	0.004	0.003	0.033	0.248	0.005	0.001	0.003	0.001	0.010
12	1.168	0.830	0.939	0.752	1.054	1.759	0.999	0.122	0.640	0.615	0.389
13	4.644	3.303	3.736	2.992	6.930	7.308	4.029	0.568	2.946	1.844	0.875
14	4.613	3.281	3.711	2.972	8.538	7.413	4.006	0.564	2.946	2.459	0.010
15	2.461	1.750	1.979	1.586	4.505	3.318	0.727	0.280	1.408	2.335	0.648
16	1.446	1.029	1.163	0.932	2.723	1.870	0.431	0.173	0.898	1.598	0.777
17	0.822	0.643	0.662	0.530	0.999	1.071	0.245	0.099	0.513	1.228	0.486
18	0.625	0.489	0.503	0.403	0.561	0.808	0.185	0.073	0.260	0.737	0.227

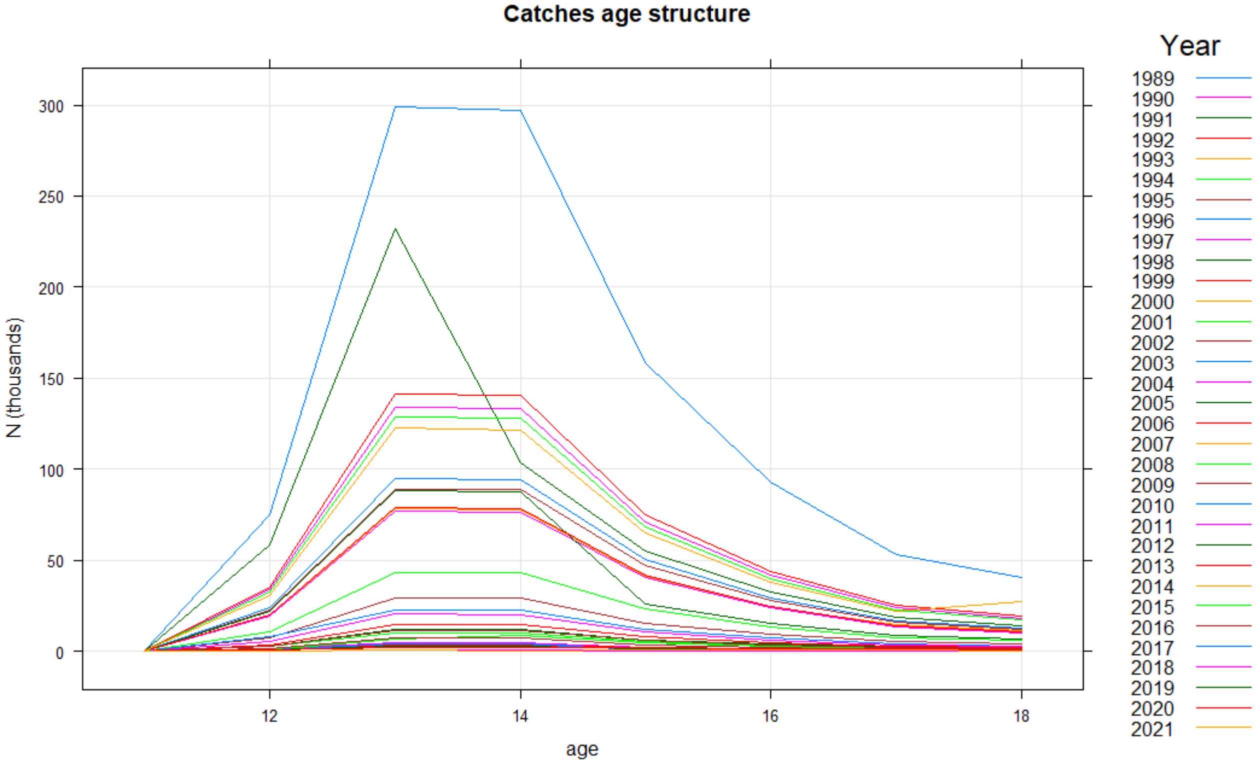


Figure 6.1.3.1 Catch at age distribution across the whole time series.

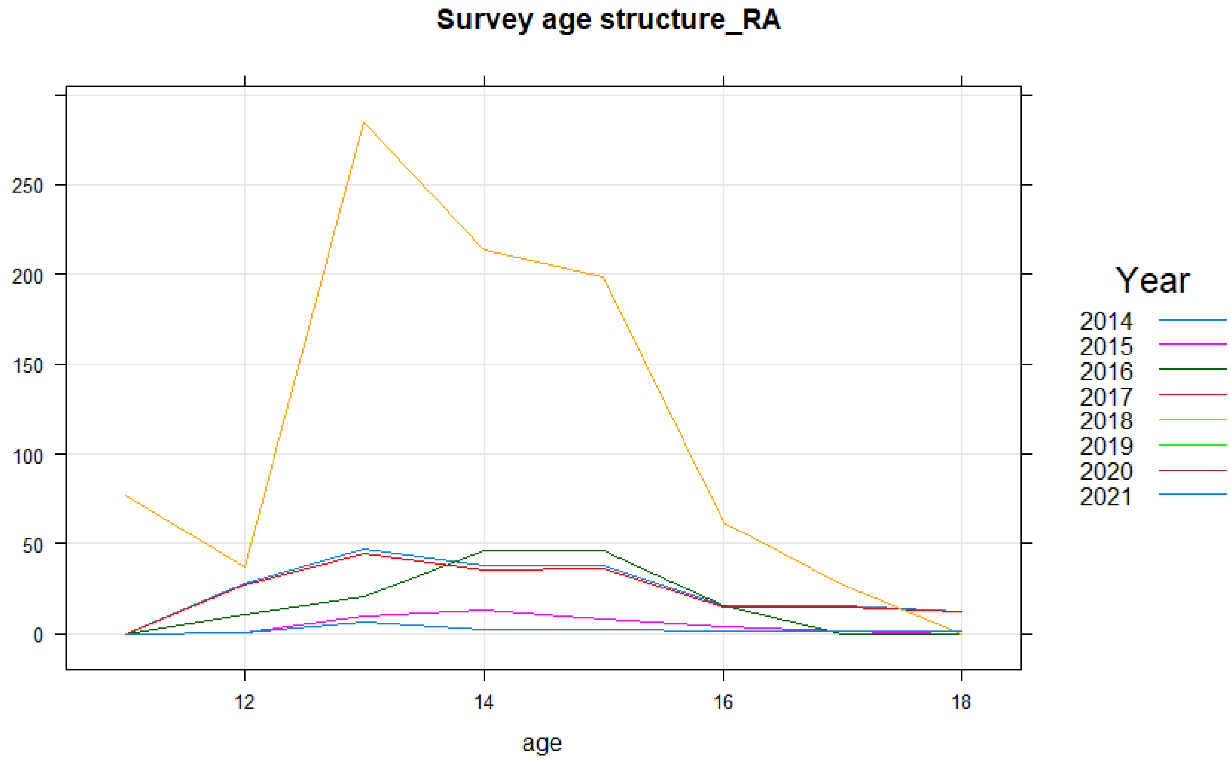


Figure 6.1.3.2 Abundance index at age distribution across the whole time series for the Romanian autumn survey.

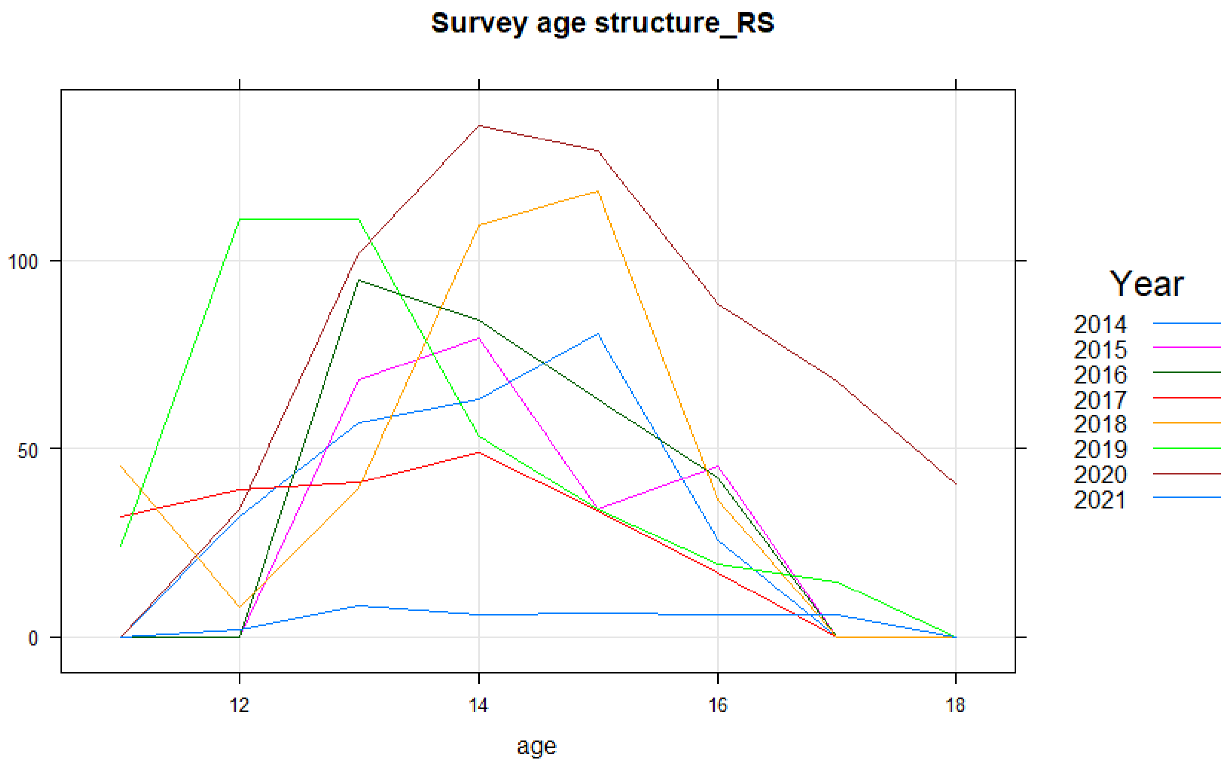


Figure 6.1.3.3 Abundance index at age distribution across the whole time series for the Romanian spring survey.

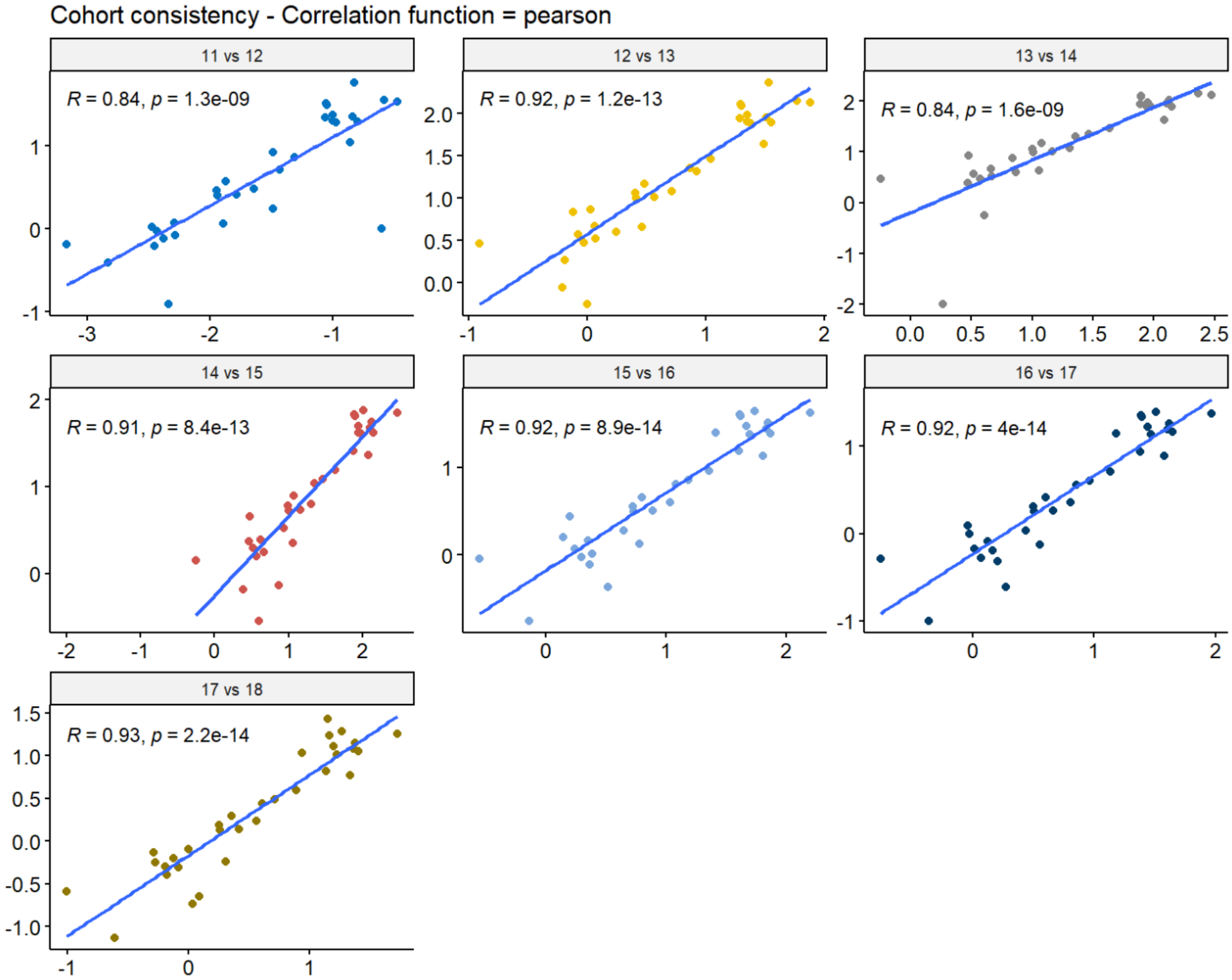


Figure 6.1.3.4 Cohorts consistency estimated for catch at age data.

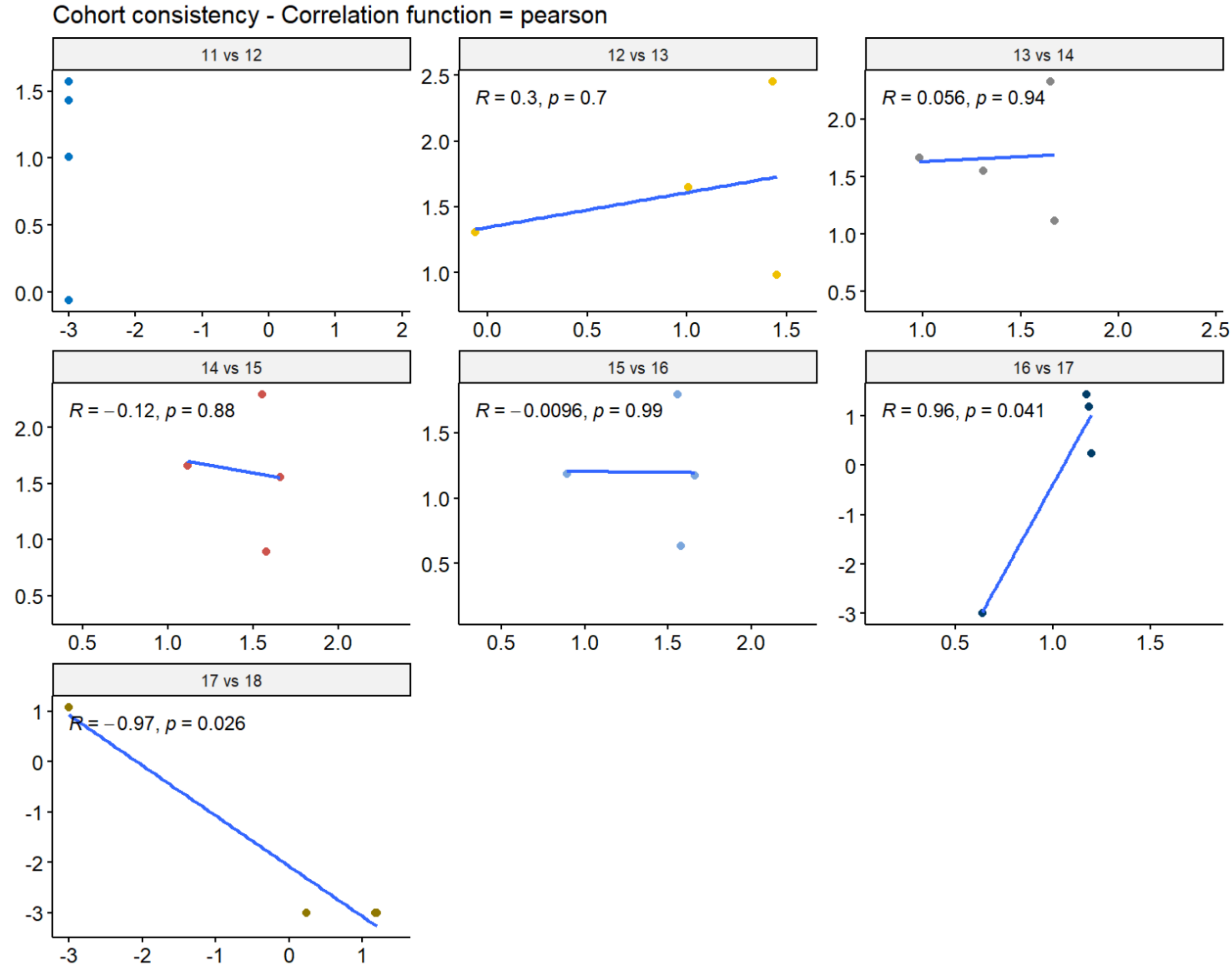


Figure 6.1.3.5 Cohorts consistency estimated for abundance index at age data Romanian autumn survey.

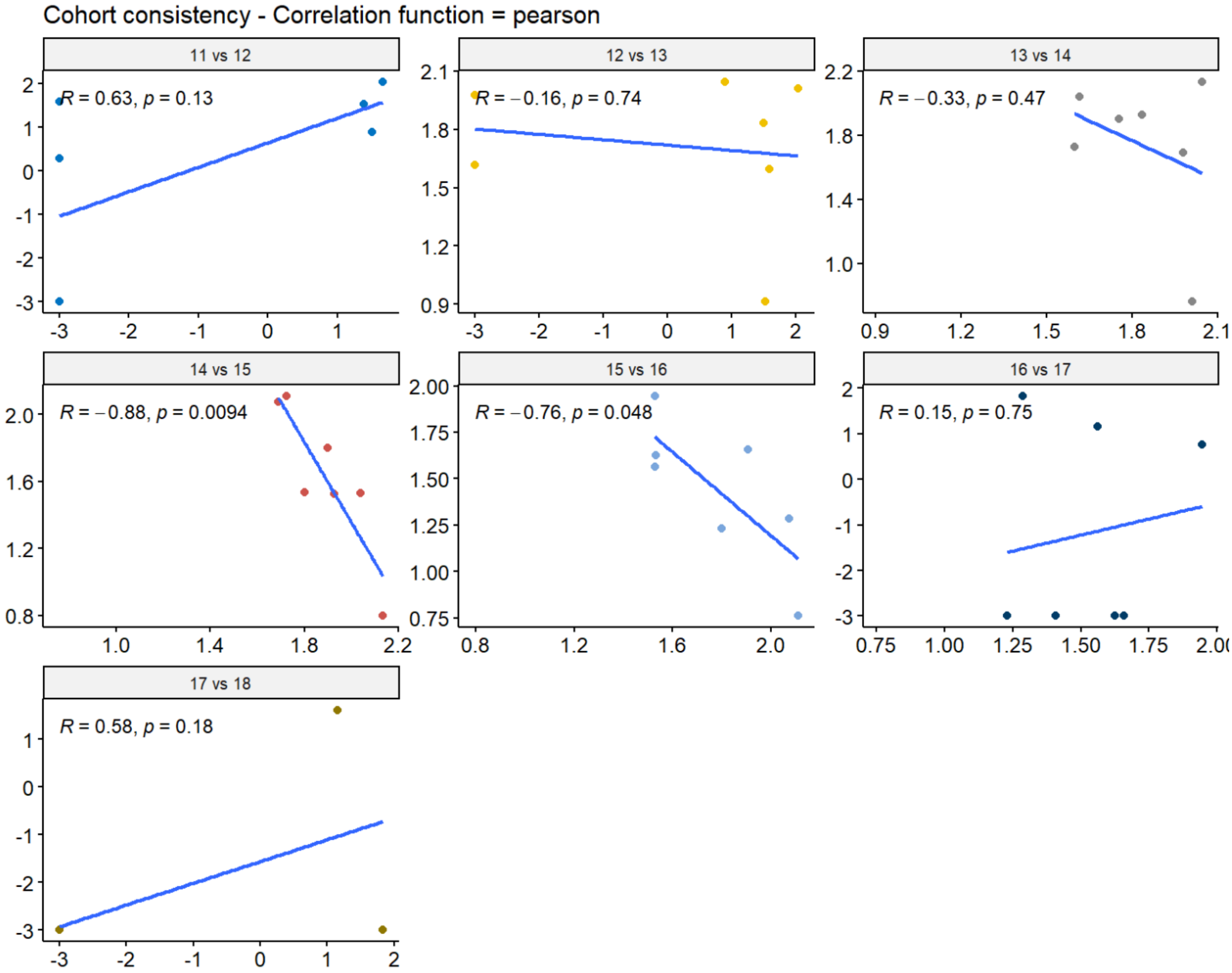


Figure 6.1.3.6 Cohorts consistency estimated for abundance index at age data Romanian spring survey.

6.1.4 Results

The following a4a sub-models were fitted through the available data:

```
fmodel: ~s(replace(age, age > 16, 16), k = 3) + s(year, k = 15)
srmodel: ~factor(year)
n1model: ~s(age, k = 3)
qmodel:
  ra: ~factor(replace(age, age > 16, 16))
  rs: ~factor(replace(age, age > 16, 16))
vmodel:
  catch: ~s(age, k = 3)
  ra:   ~1
  rs:   ~1
```

Using the command fitSumm it was possible to evaluate the number of parameters estimated by the a4a model, compared to the number of available observation. This can be used to check whether the model is over-parameterized (rule of thumb of a 25% ratio between observations and parameters). In this case, we have 68 parameters estimated by the model against 329 observation, thus the model is not over-parameterized.

fitSumm(fit)

number of parameters 68

nlogl 4.100844e+02

maxgrad 4.053110e-07

number of observations 329

gcv 2.906475e-01

convergence 0.000000e+00

accrate NA

nlogl_comp1 1.594670e+02

nlogl_comp2 1.004620e+02

nlogl_comp3 1.501550e+02

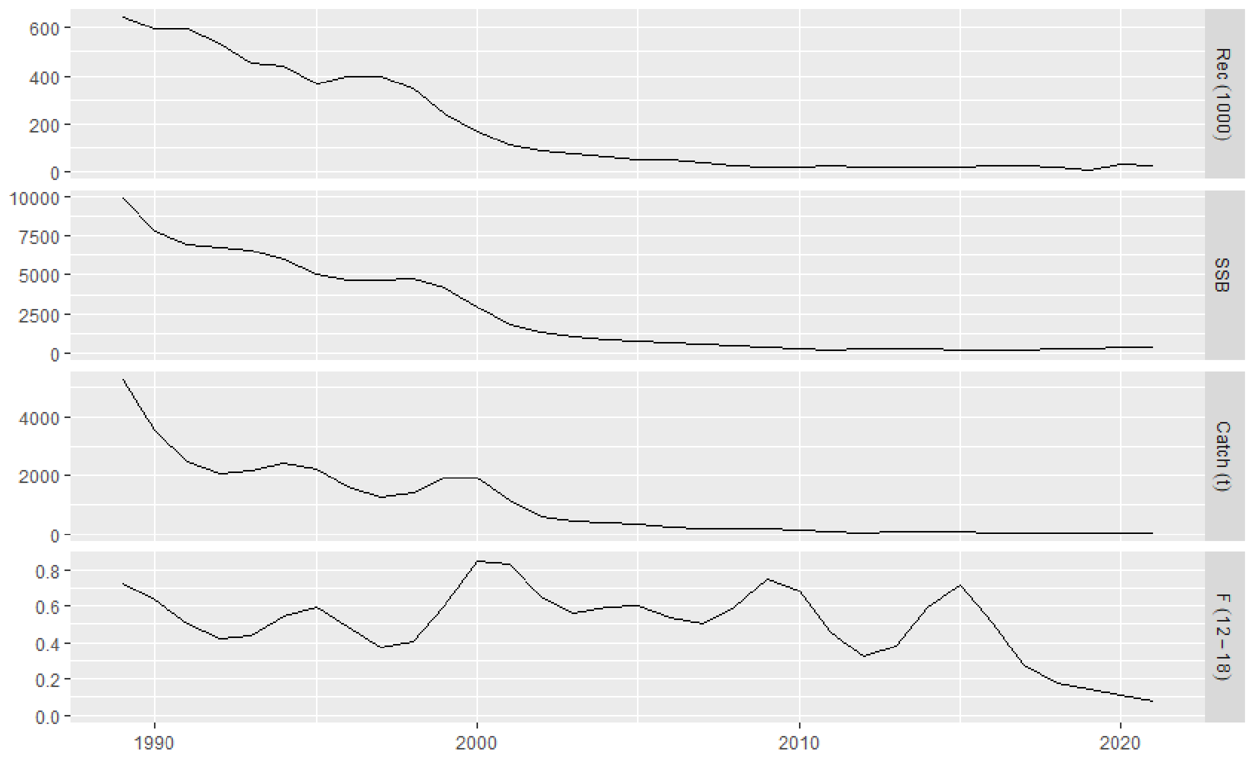


Figure 6.4.1.1 Summary of stock assessment results.

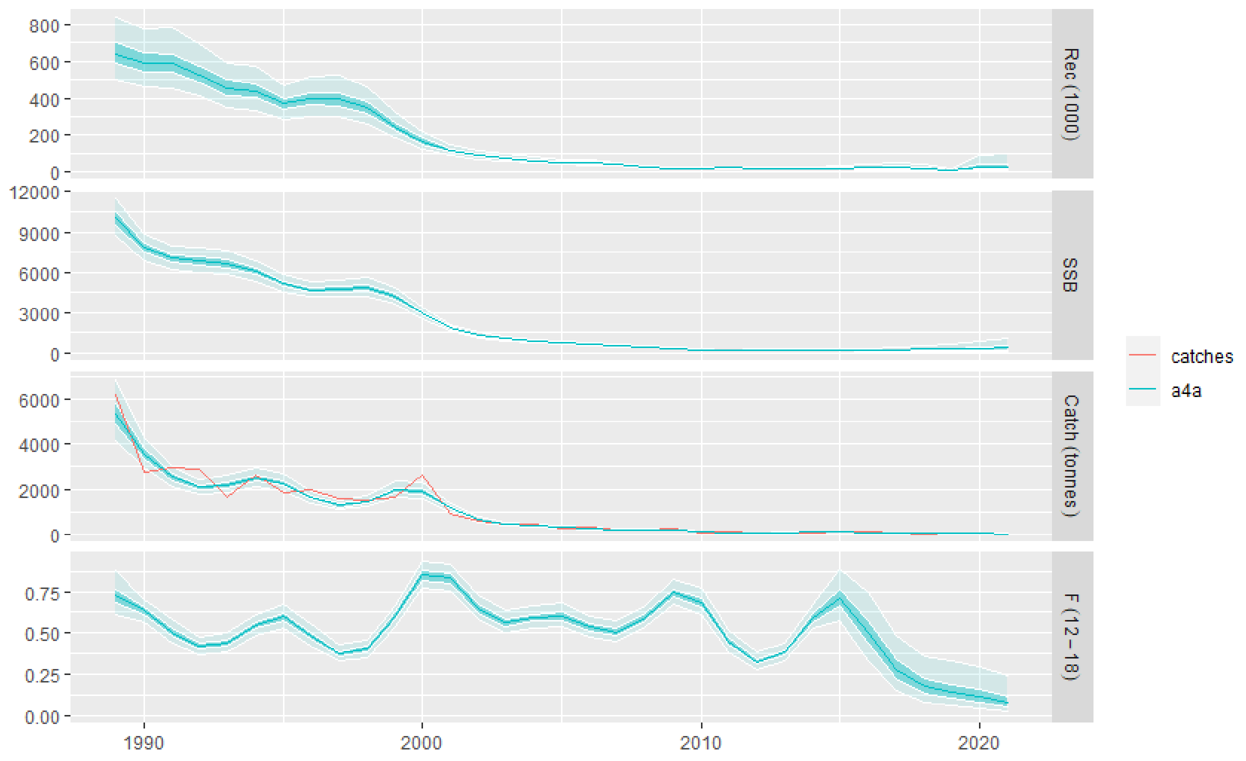


Figure 6.4.1.2 Summary of stock assessment results with uncertainty estimated through boostrap simulations. The original catches are also shown (SCAA models are re-estimating the catches, and it is important to check consistenct).

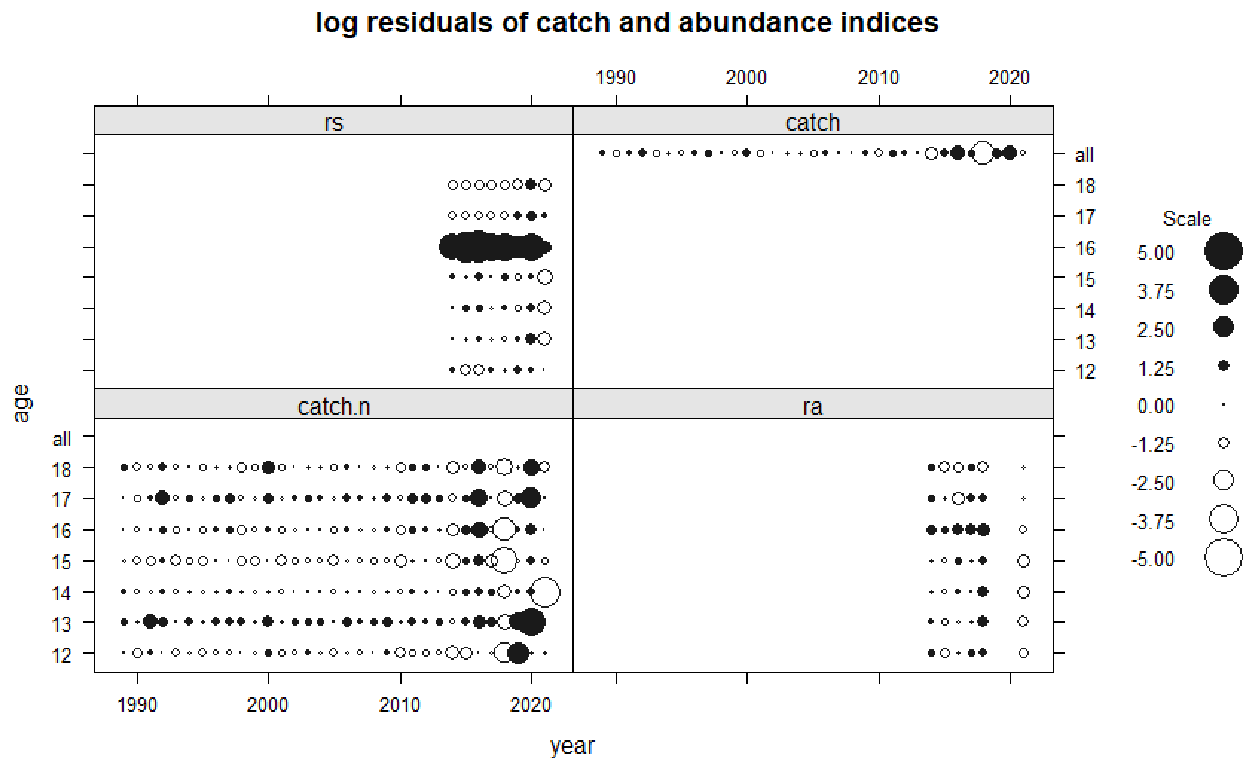


Fig. 6.4.1.3 Residuals of the best model run.

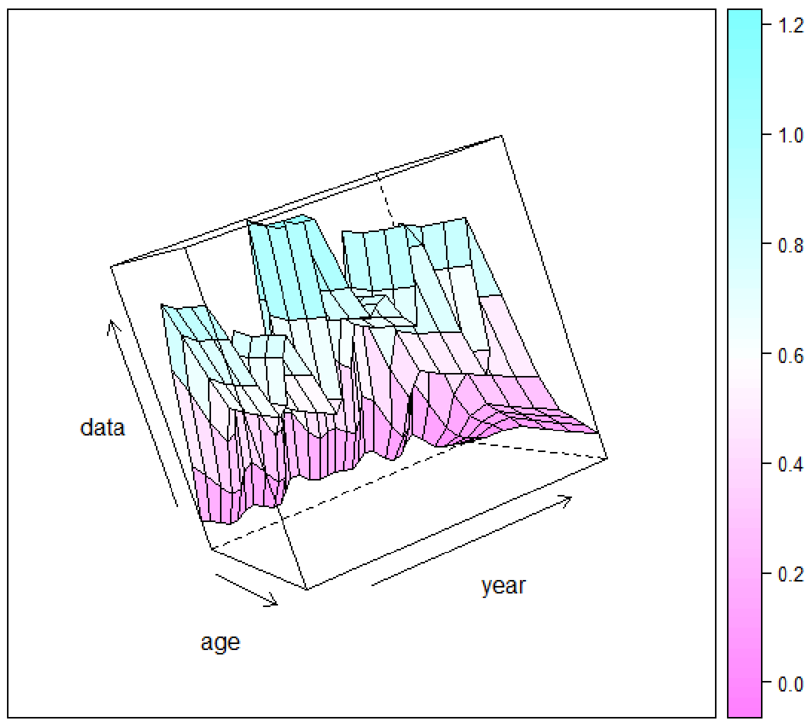


Fig. 6.4.1.4 Estimated fishing mortality at age and by year.

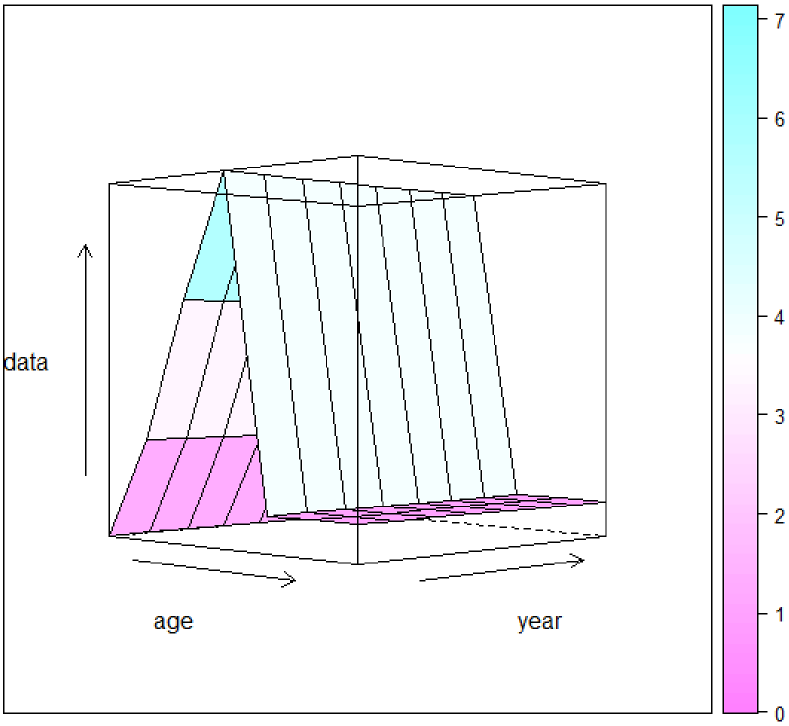


Fig. 6.4.1.4 Catchability at age for the Romanian autumn survey.

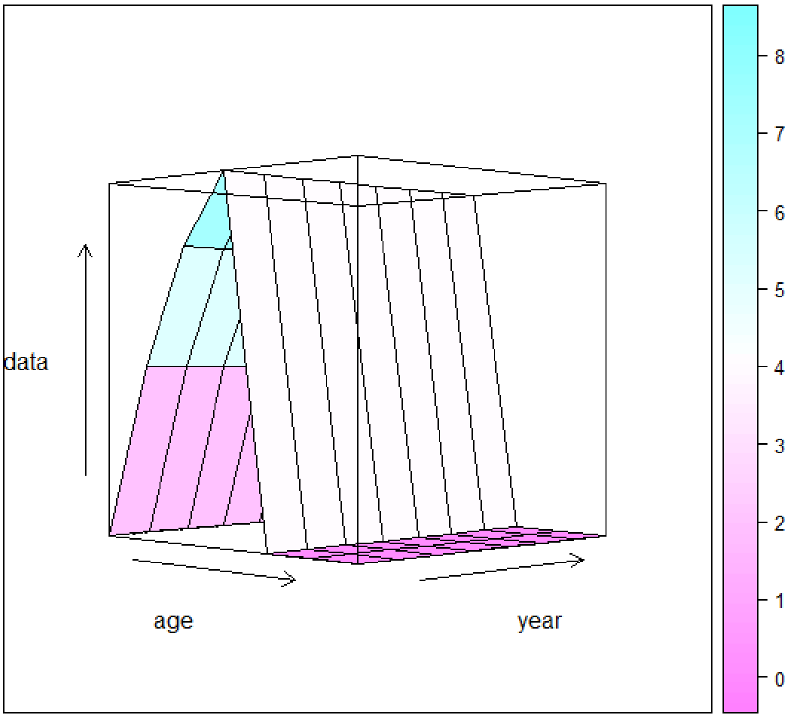


Fig. 6.4.1.5 Catchability at age for the Romanian spring survey.

6.1.5 Robustness analysis

6.1.6 Retrospective analysis, comparison between model runs, sensitivity analysis, etc.

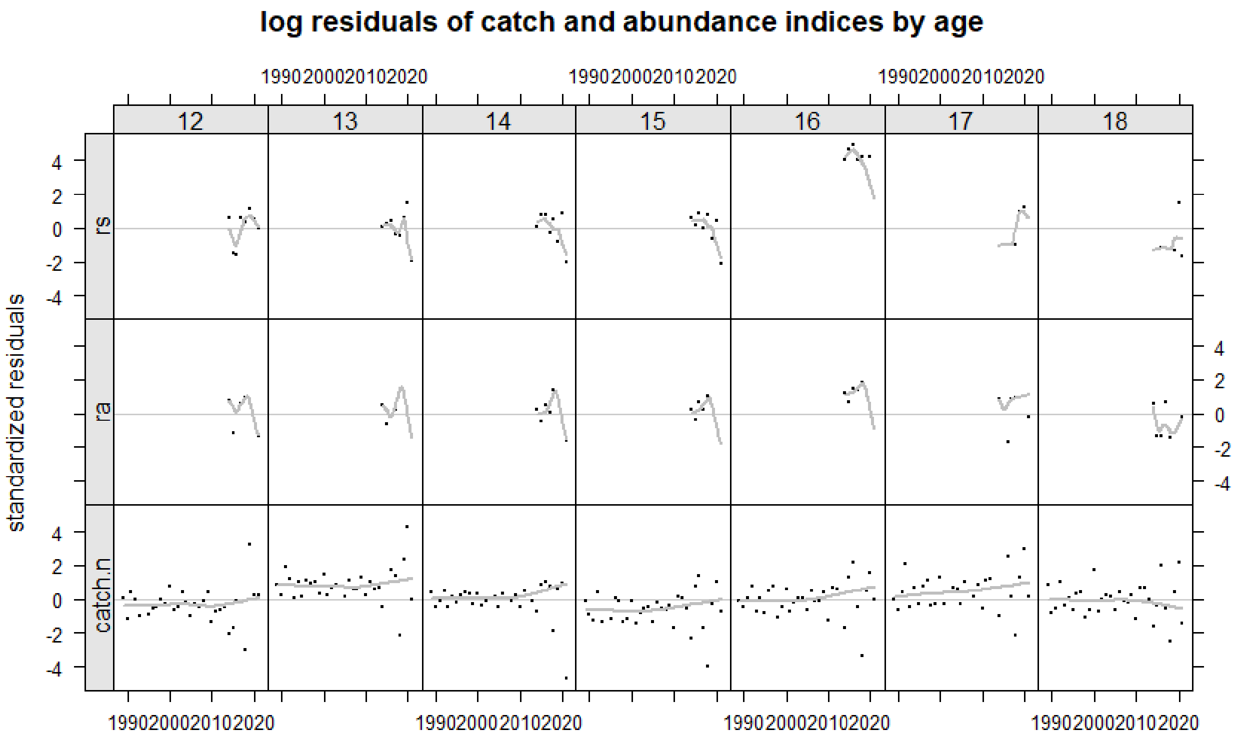


Figure 6.1.6.1 Log residuals of the model.

The fitting of catch data does not show any major problem, although the fitting is worsening in the last part of the time series. The fitting of the survey data is very poor.

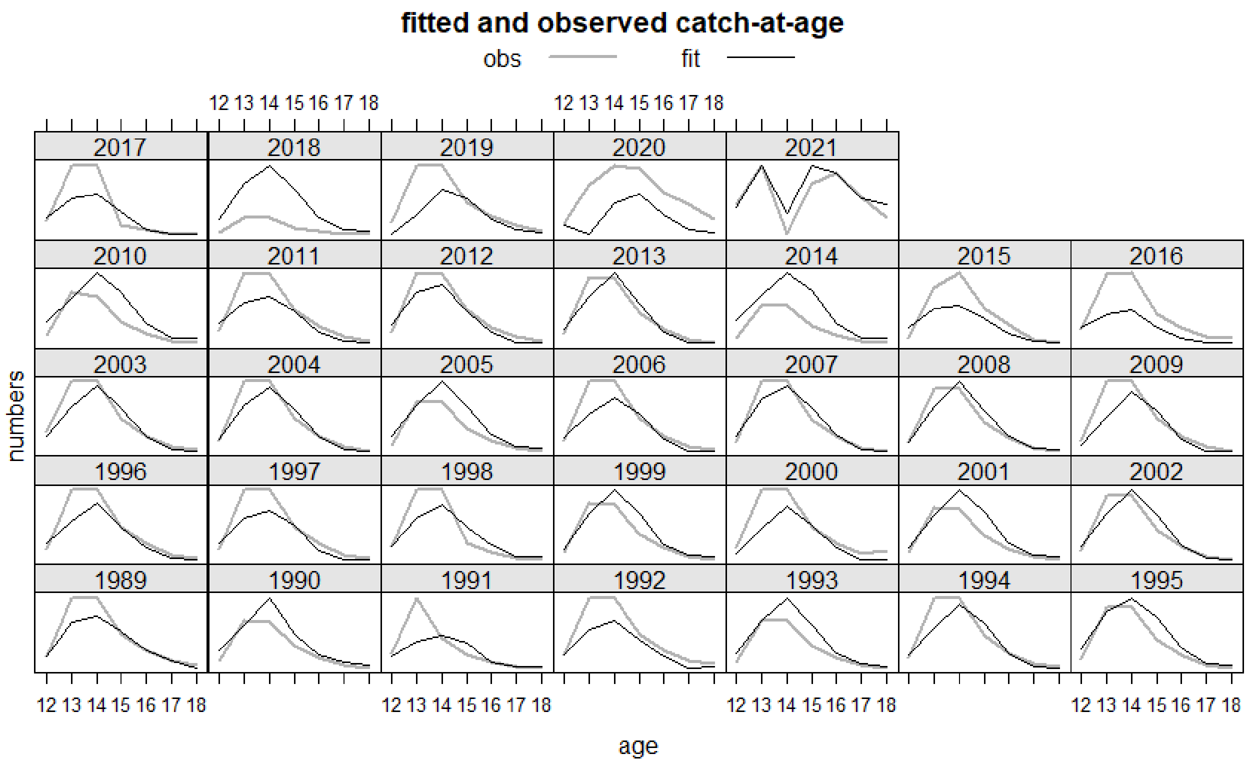


Figure 6.1.6.2 Fitting of catches.

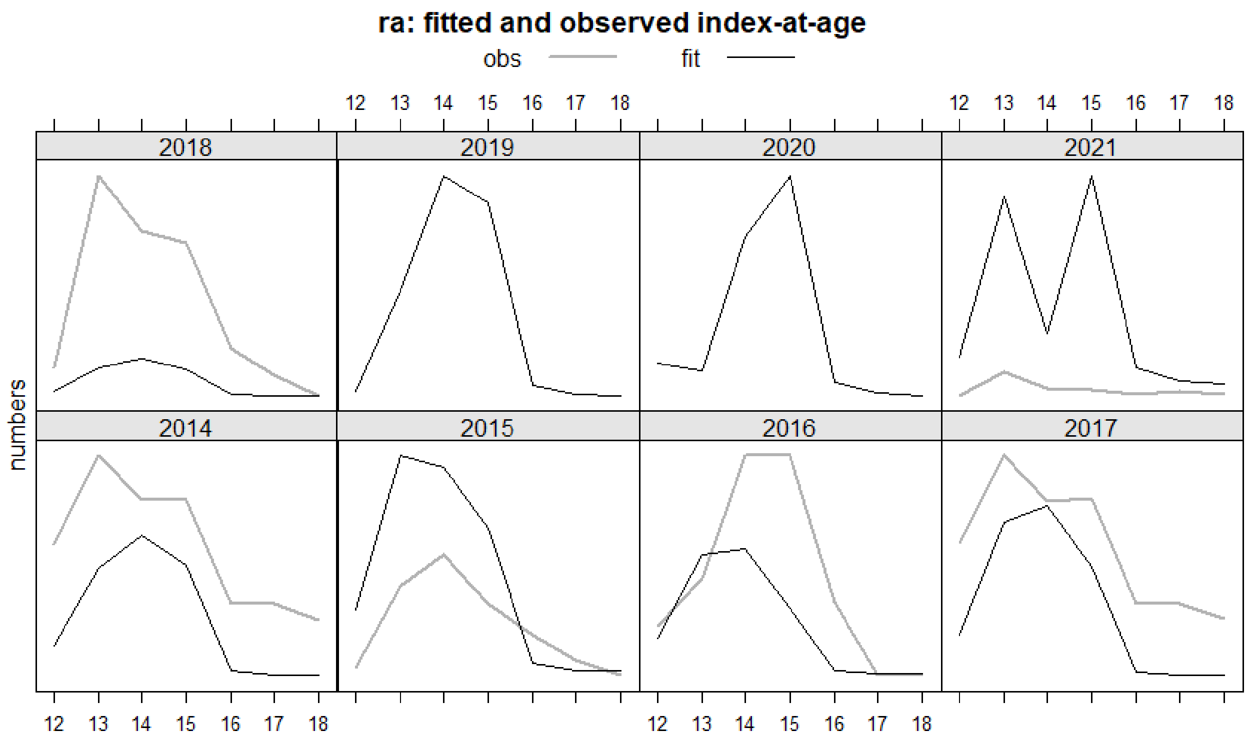


Figure 6.1.6.3 Fitting of the Romania autumn survey.

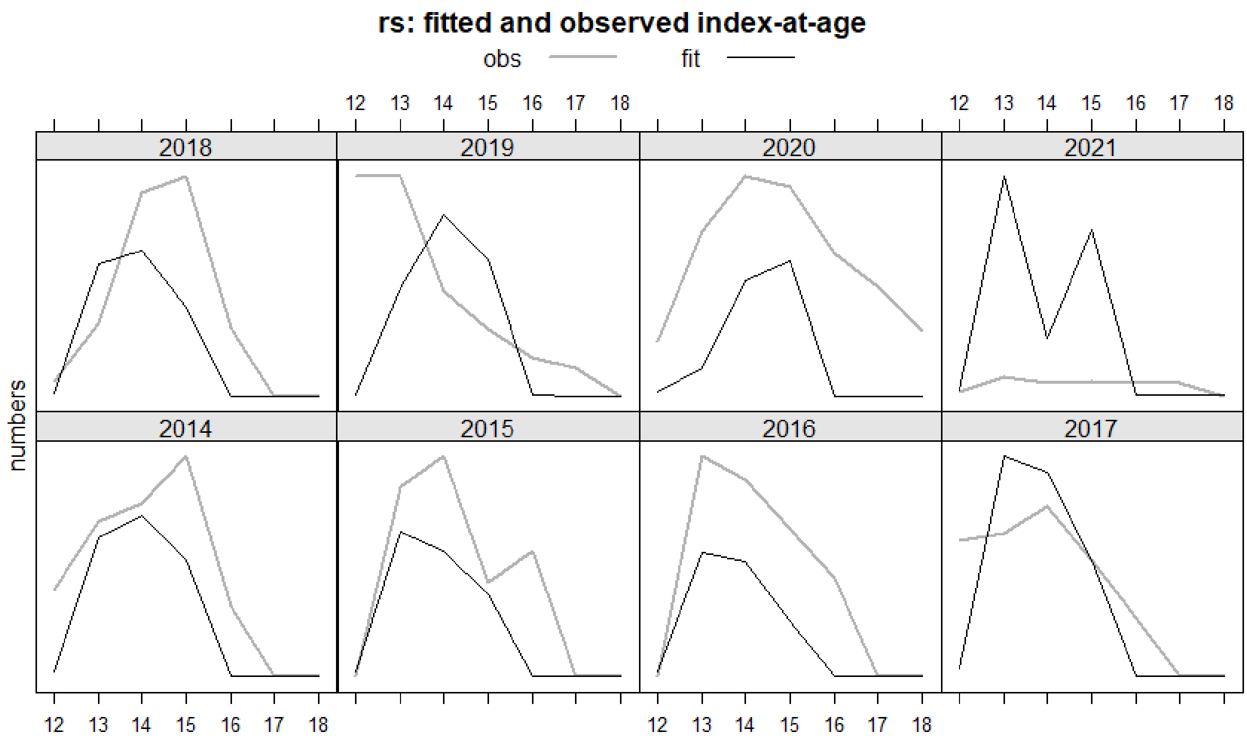


Figure 6.1.6.4 Fitting of the Romania spring survey.

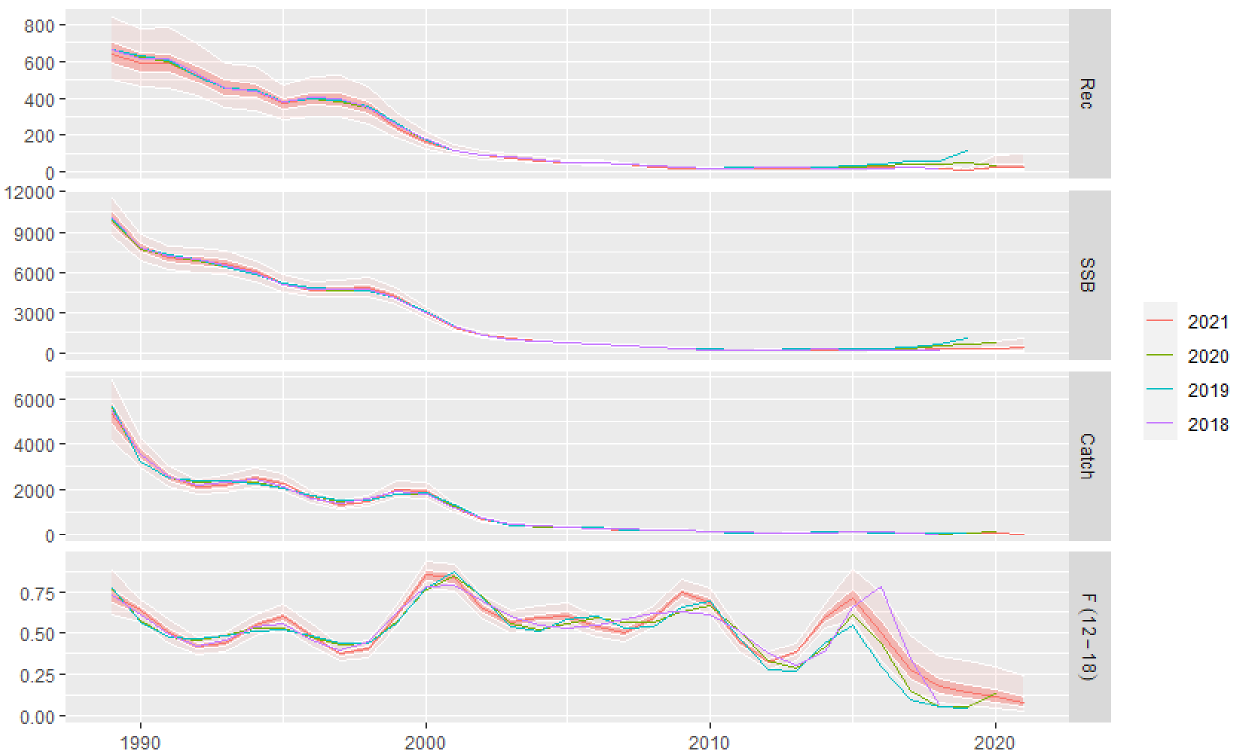


Figure 6.1.6.5 Retrospective analysis of the best model run (uncertainty is also shown).

The Mohn's rho test is showing that the values are acceptable for F (-0.05, included in the acceptable range -0.2 – 0.2). The Mohn's rho test is not acceptable for SSB and recruitment, indicating the presence of retrospective pattern (3.23 and 14.11, respectively).

The variance contribution of the model components shows that the model is mostly driven by catch data, while the contribution of tuning information (surveys) is scarce.

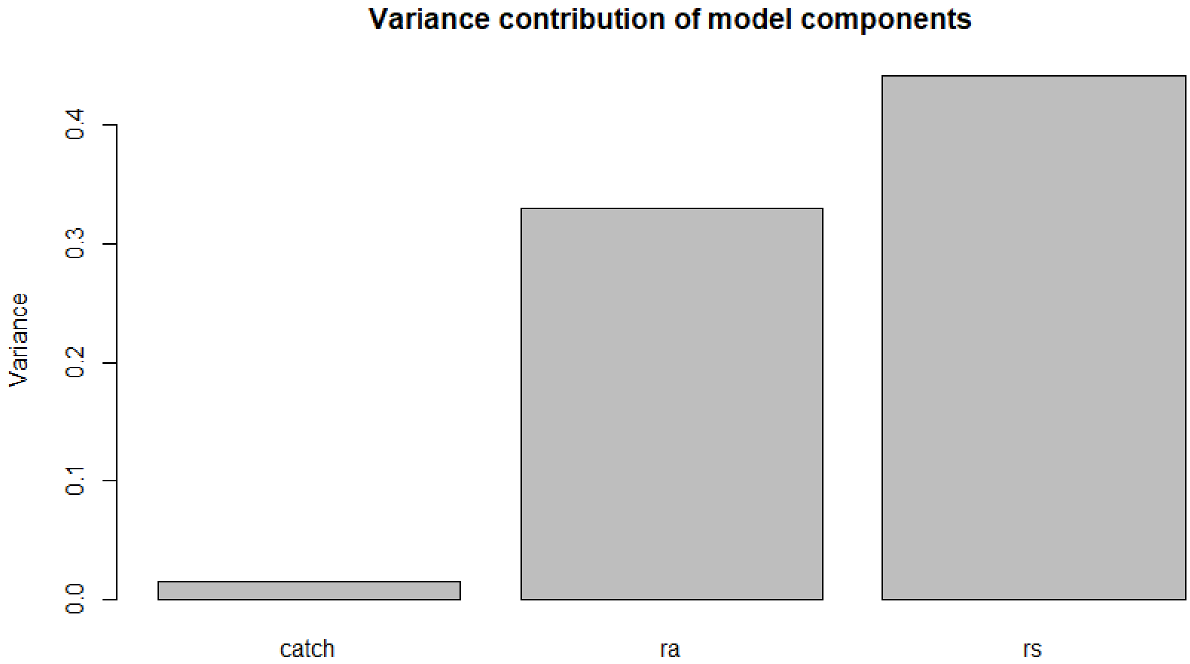


Figure 6.1.6.6 Variance contribution of model components: catch numbers-at-age, Autumn and Spring surveys.

6.1.7 Attempts with SPiCT

Several attempts using a surplus production model in continuous time (SPiCT) were made, using a time series of catches (tonnes) from 1989 to 2021. As tuning information, the biomass index from the two Bulgarian surveys (Autumn and Spring) was used. The SPiCT script is available on the GFCM sharepoint.

The data are summarized in Figure 6.1.7.1.

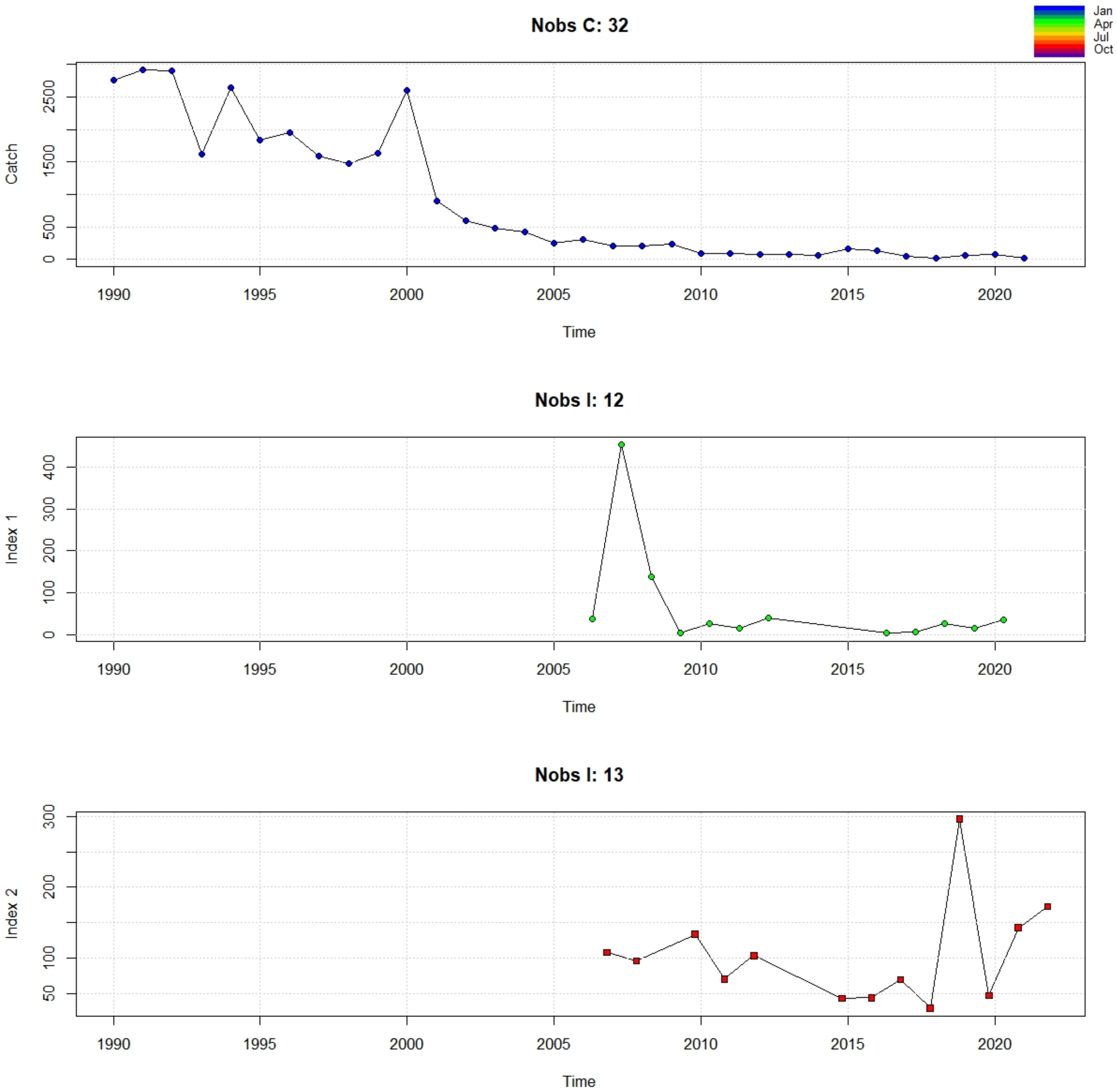


Figure 6.1.7.1 Input data for the SPiCT model.

The correlation between the catch data and the two sources of tuning information was rather poor (Figs. 6.1.7.2-6.1.7.3).

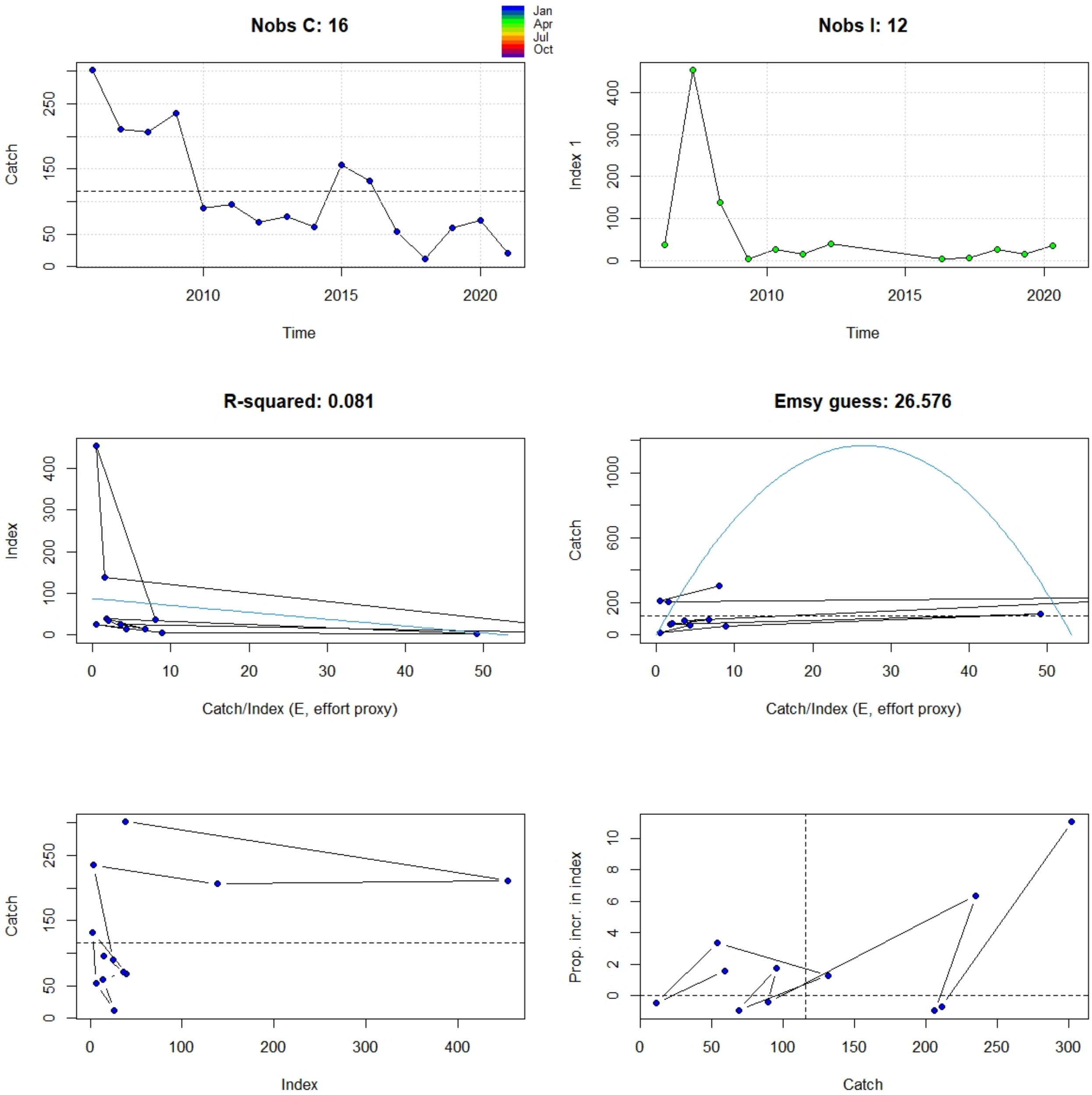


Figure 6.1.7.2 Correlation plots between the catch data and the Autumn survey.

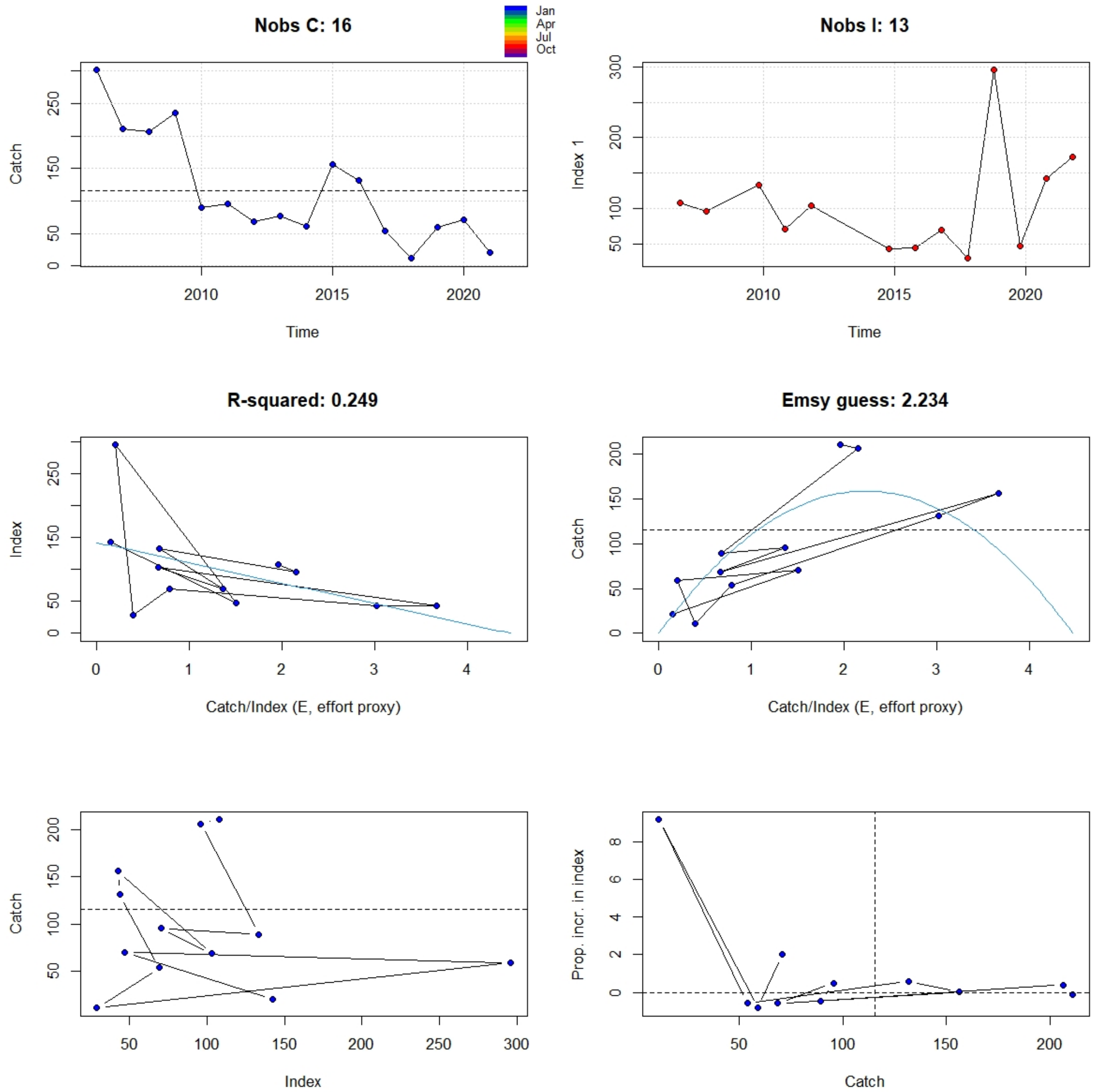


Figure 6.1.7.3 Correlation plots between the catch data and the Spring survey.

A default SPiCT model was run. Even though it did converge, the results, fitting and diagnostics showed major issues.

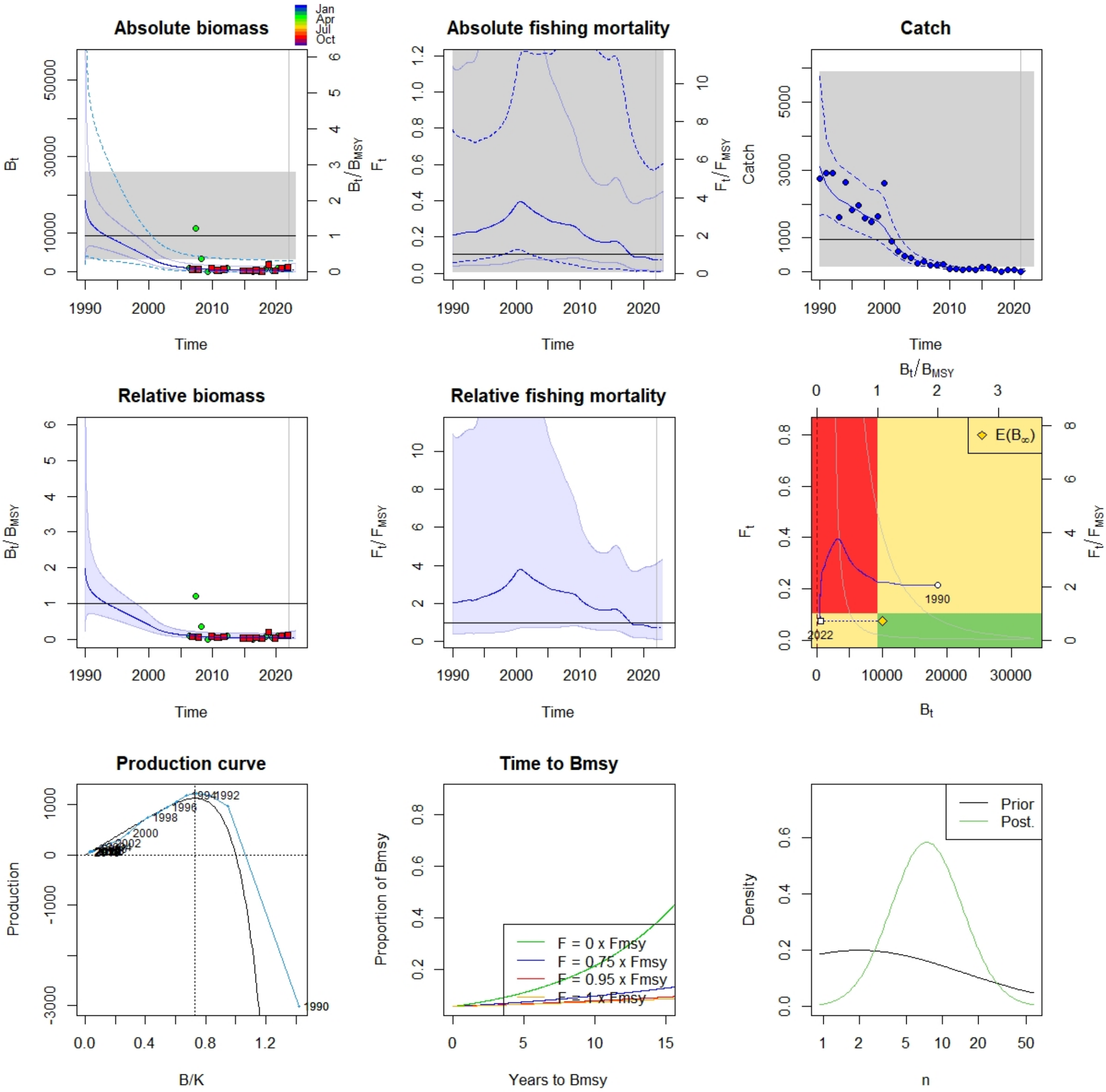


Figure 6.1.7.4 Fitting of the model and general results of the default SPiCT model.

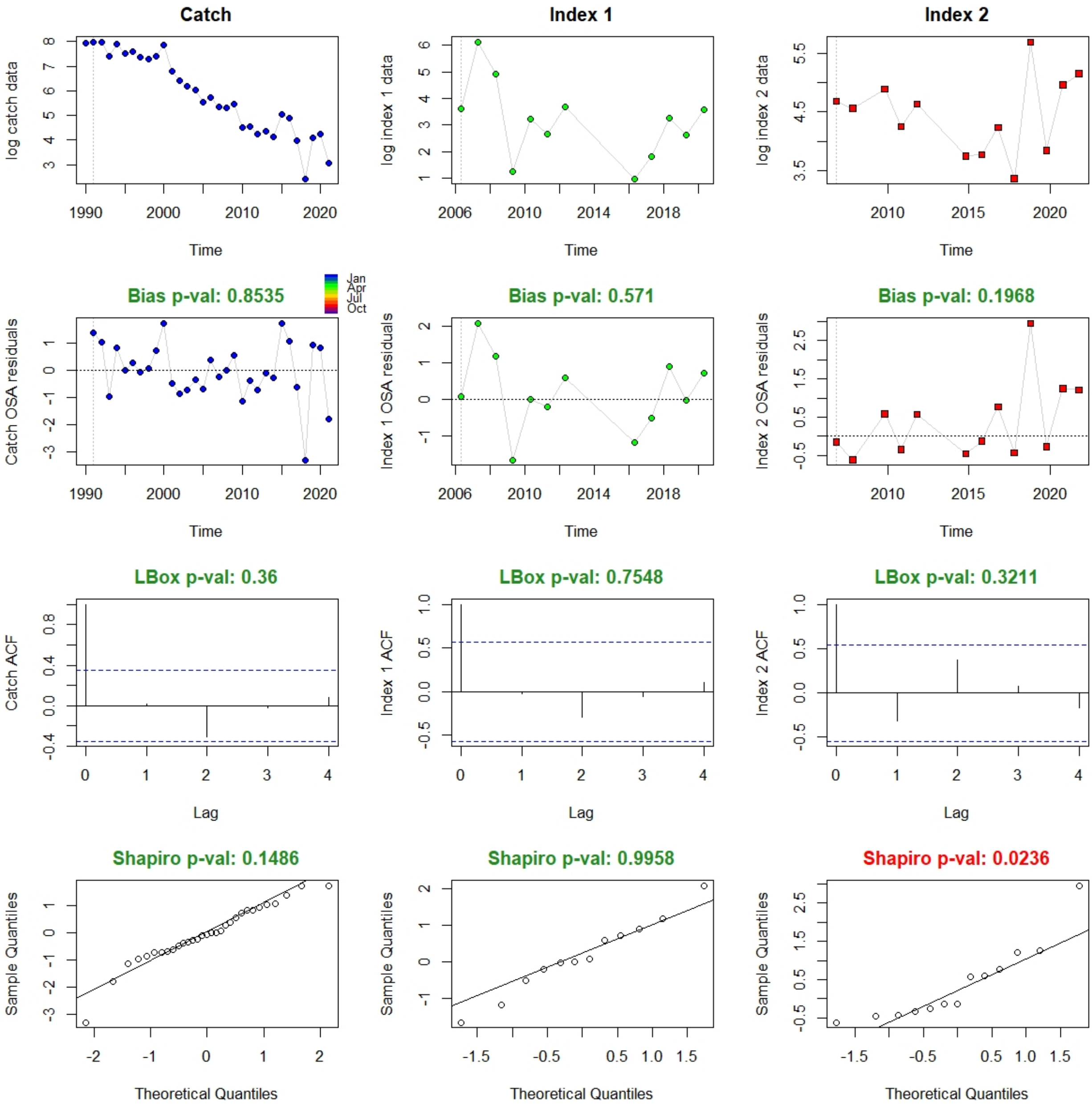


Figure 6.1.7.5 Diagnostics of the default SPiCT model.

Additional models were run in the attempt of reducing the uncertainty and solve the issues in the model diagnostics (e.g., non-normality of survey residuals).

A Schaefer model for production curve was used:

```
inp$phases$logn <- -1
inp$ini$logn <- log(2)
```

A prior for r was estimated using the FishLife package:

```
library(FishLife )
stk.fishlife<-Plot_taxa(Search_species(Genus="Squalus", Species="acanthias")$match_taxonomy, mfrow=c(2,3) )
```

```
#intrinsic growth rate
lnr <- stk.fishlife[[1]]$Mean_pred["ln_r"]
sd_lnr <- sqrt(stk.fishlife[[1]]$Cov_pred["ln_r", "ln_r"])
curve(dlnorm(x, lnr, sd_lnr), from = 0, to = 1)
inp$priors$logr <- c(lnr, sd_lnr, 1)
```

The robust estimation option was used with the aim of reducing the influence of extreme observations (e.g., surveys):

```
inp$robflagI <- 1
```

Finally, three scenarios were run to consider the initial status of the stock at the beginning of the time series. A prior for the parameter logbkfrac (biomass at the beginning of the time series compared to the virgin biomass) was set to 0.8, 0.5 and 0.2 (respectively, biomass at the beginning of the time series equal to the 80%, 50% and 20% of the virgin time series).

According to the expert knowledge, the stock of piked dogfish was already overexploited in 1989, therefore, the results of the scenario logbkfrac = 0.2 are shown here.

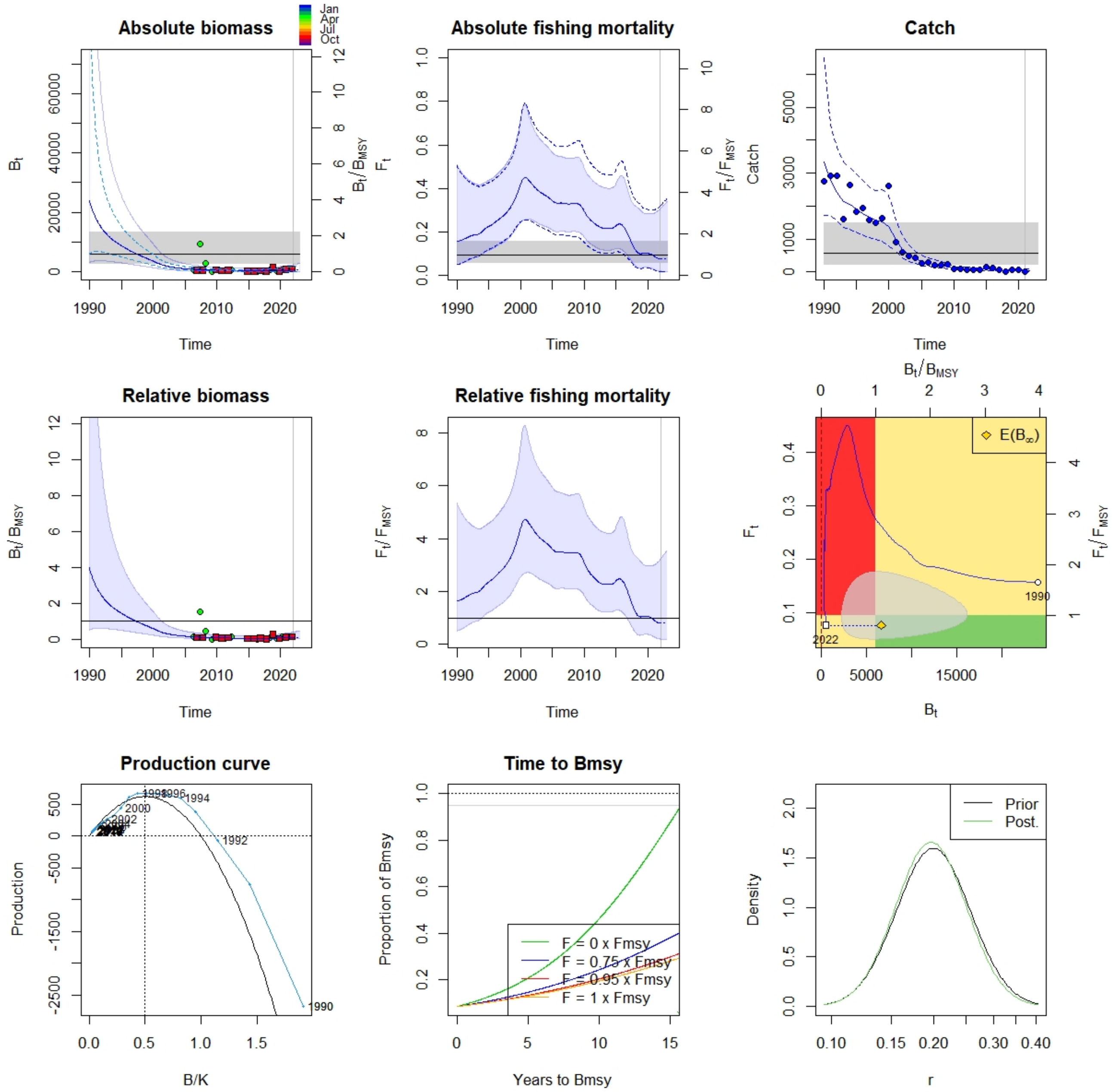


Figure 6.1.7.6 Fitting of the model and general results of the SPiCT model set with a prior of logbkfrac = 0.2.

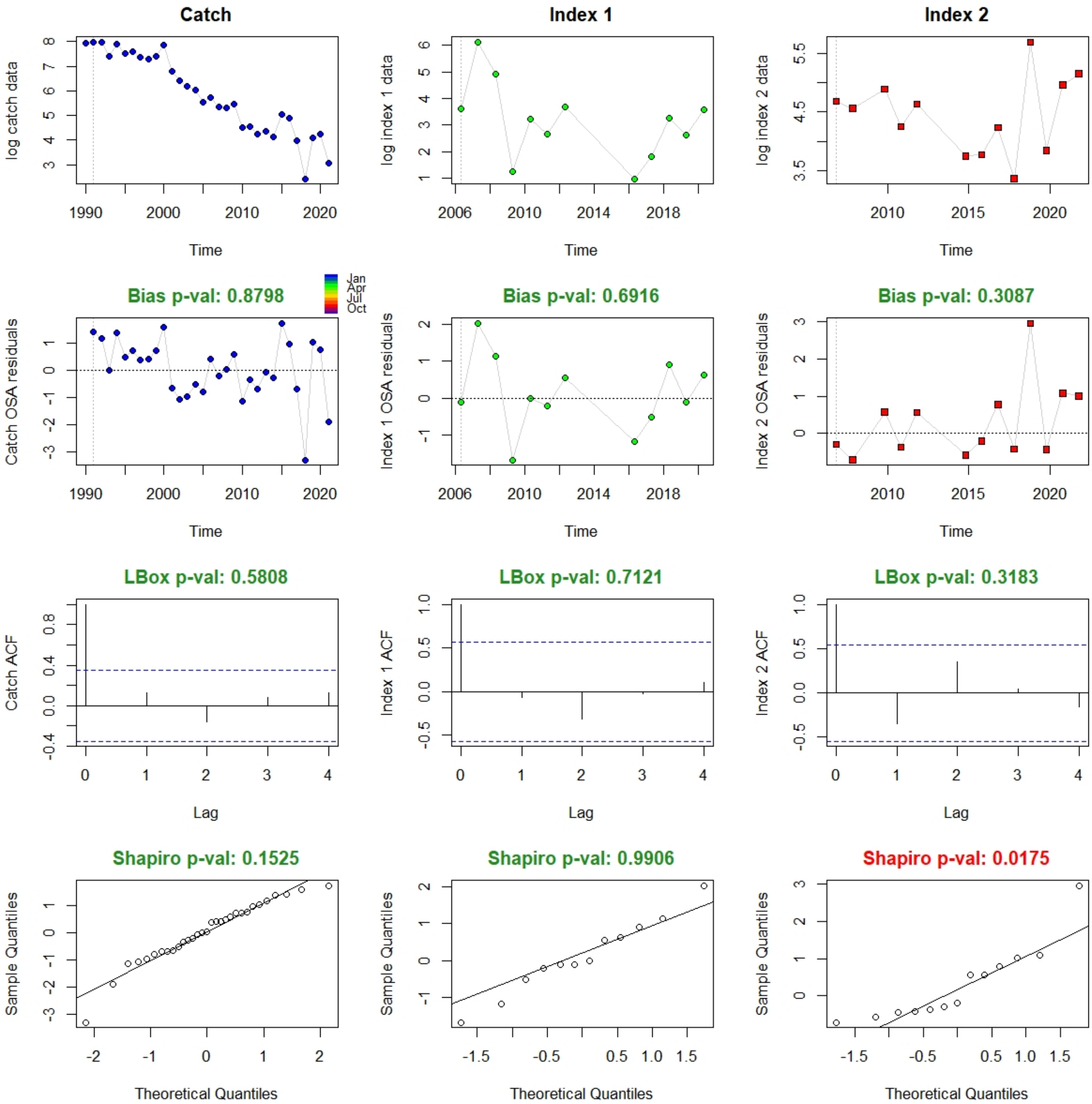


Figure 6.1.7.7 Diagnostics of the SPiCT model set with a prior of logbkfrac = 0.2.

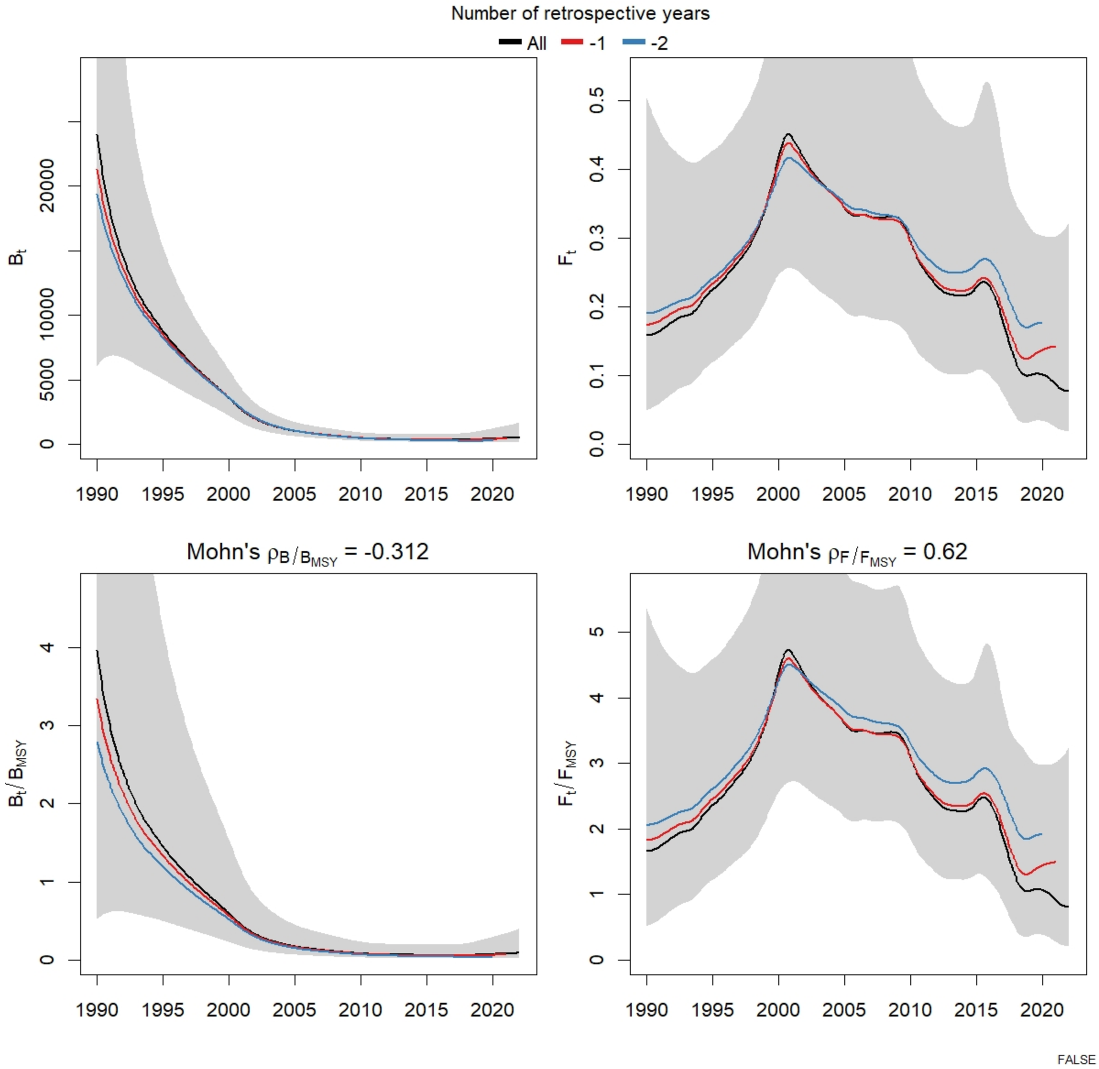


Figure 6.1.7.8 Retrospective analysis of the SPiCT model set with a prior of logbkfrac = 0.2.

6.1.8 Assessment quality

The unavailability of reliable catch-at-age data hampered the possibility of running an age-based model able to provide robust and sound results. Many of the experts suggested that data collection should be revised and data should be collected on dedicated surveys and for all the size classes instead only for the commercial sizes in order to improve data robustness and make the assessment better informed.

As concerns the attempts made with surplus production model (SPiCT), the lack of sufficiently longed time series of catches, and robust tuning information hampered to obtain reliable results. Longer time series of catches, possibly extending back to the 1970s, should be investigated, together with the availability of adequate tuning information (e.g., CPUEs, survey, etc.).

Significant problems were encountered in the preparation of the input data for the piked dogfish assessment with issues related to the creation of catch-at-age matrices. This triggered an in-depth reflection on the information available for this species and the improvements needed to ensure future advice for this stock. Identified issues included i) understanding of biological parameters (e.g., growth), ii) harmonization of data collection for biological data, with particular focus on discards to gather information on juveniles and sub-adults, iii) optimization and harmonization of surveys, iv) harmonization of ageing through a workshop, and v) quantification of bycatch, vi) extension of the time series of historical catch data to help better fitting of surplus production models. Nevertheless, work continued after the meeting to compile a final and complete data set including all data required to run stock assessments.

7 Stock predictions

Not carried out

7.1 Short term predictions

7.2 Medium term predictions

7.3 Long term predictions

8 Draft scientific advice

Precautionary advice was provided). The population was considered depleted and and a long term recovery plan should be established.

Based on	Indicator	Analytic al reference point (name and value)	Current value from the analysis (name and value)	Empirical reference value (name and value)	Trend (time period)	Stock Status
Fishing mortality	Fishing mortality					
	Fishing effort					
	Catch					
Stock abundance	Biomass					
	SSB					
Recruitment						
Final Diagnosis		The stock is considered as depleted. In the absence of a validated quantitative assessment, advice is provided on a precautionary basis.				

8.1 Explanation of codes

Trend categories

1) N - No trend
2) I - Increasing
3) D – Decreasing
4) C - Cyclic

Stock Status

Based on Fishing mortality related indicators

1) **N - Not known or uncertain** – Not much information is available to make a judgment;
2) **U - undeveloped or new fishery** - Believed to have a significant potential for expansion in total production;
3) **S - Sustainable exploitation**- fishing mortality or effort below an agreed fishing mortality or effort based Reference Point;
4) **IO –In Overfishing status**– fishing mortality or effort above the value of the agreed fishing mortality or effort based Reference Point. An agreed range of overfishing levels is provided;

Range of Overfishing levels based on fishery reference points

In order to assess the level of overfishing status when $F_{0.1}$ from a Y/R model is used as LRP, the following operational approach is proposed:

- If $Fc^*/F_{0.1}$ is below or equal to 1.33 the stock is in **(O_L): Low overfishing**
- If the $Fc/F_{0.1}$ is between 1.33 and 1.66 the stock is in **(O_I): Intermediate overfishing**
- If the $Fc/F_{0.1}$ is equal or above to 1.66 the stock is in **(O_H): High overfishing**

*Fc is current level of F

5) **C- Collapsed**- no or very few catches;

Based on Stock related indicators

1) **N - Not known or uncertain:** Not much information is available to make a judgment
2) **S - Sustainably exploited:** Standing stock above an agreed biomass based Reference Point;
3) **O - Overexploited**: Standing stock below the value of the agreed biomass based Reference Point. An agreed range of overexploited status is provided;

Empirical Reference framework for the relative level of stock biomass index

- **Relative low biomass:** Values lower than or equal to 33rd percentile of biomass index in the time series **(O_L)**
- **Relative intermediate biomass:** Values falling within this limit and 66th percentile **(O_I)**
- **Relative high biomass:** Values higher than the 66th percentile **(O_H)**

4) **D – Depleted**: Standing stock is at lowest historical levels, irrespective of the amount of fishing effort exerted;
5) **R –Recovering:** Biomass are increasing after having been depleted from a previous period;

Agreed definitions as per SAC Glossary

Overfished (or overexploited) *- A stock is considered to be overfished when its abundance is below an agreed biomass based reference target point, like B0.1 or BMSY. To apply this denomination, it should be assumed that the current state of the stock (in biomass) arises from the application of excessive fishing pressure in previous years. This classification is independent of the current level of fishing mortality.*

Stock subjected to overfishing (or overexploitation) *- A stock is subjected to overfishing if the fishing mortality applied to it exceeds the one it can sustainably stand, for a longer period. In other words, the current fishing mortality exceeds the fishing mortality that, if applied during a long period, under stable conditions, would lead the stock abundance to the reference point of the target abundance (either in terms of biomass or numbers)*