INSTITUTE OF OCEANOLOGY

BULGARIAN ACADEMY OF SCIENCES

STATE AND POPULATION DYNAMICS OF TURBOT STOCK (SCOPHTHALMUS MAXIMUS L.) OFF BULGARIAN BLACK SEA COAST IN 2006 - 2012

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Biology

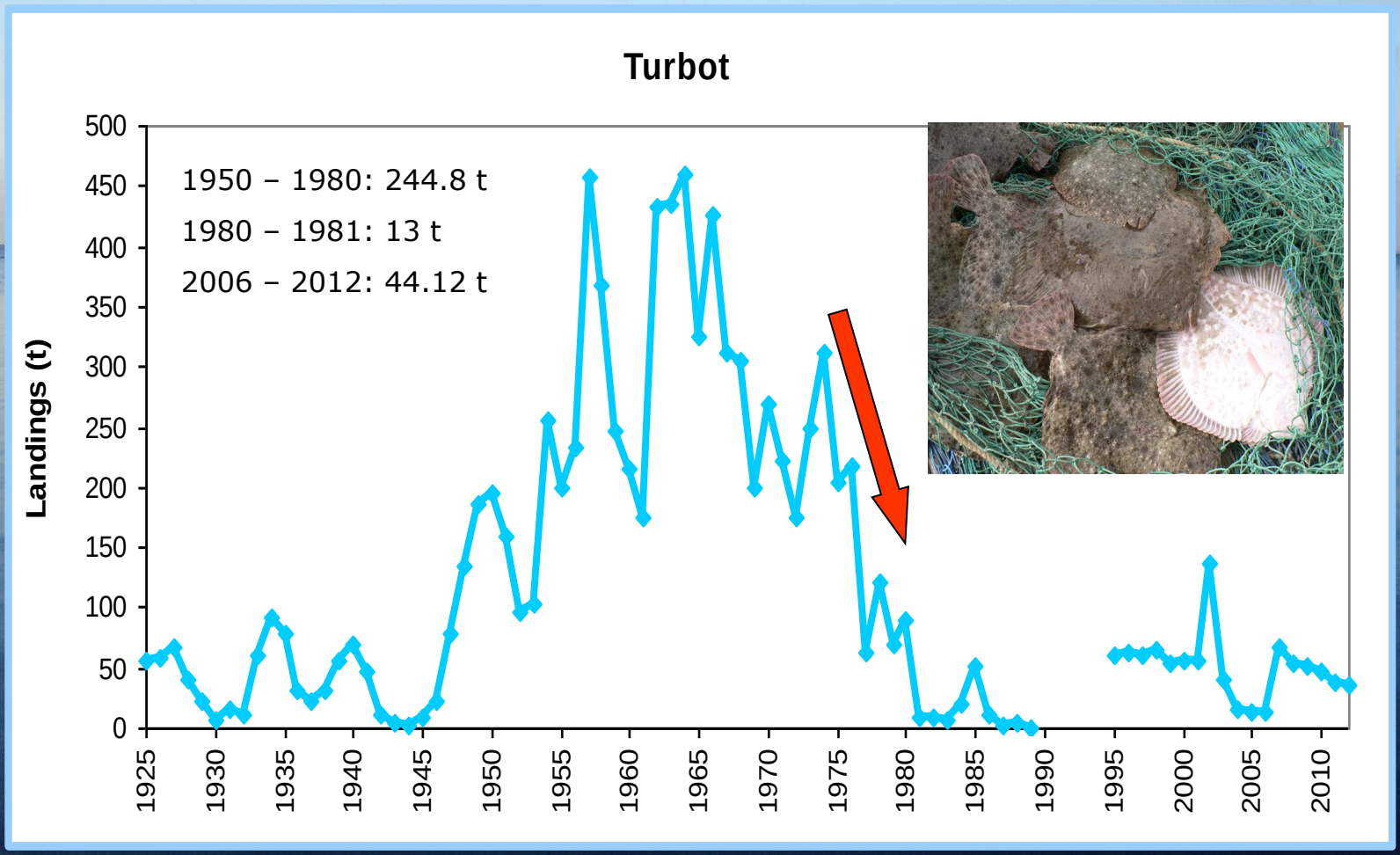
Turbot (*Sc. maximus*) occurs over the whole Black Sea continental shelf grouped in local shoals reaching depths of 100 - 120 m in the north-western area. The species inhabits sedimentary bottoms – sands and silty sands, mussel beds, as well as mixed seabed of sand and boulders.

The turbot has a life span of 10 - 12 years in the Bulgarian area (Karapetkova, Zivkov 2006) and reaches up to 87 cm in length and up to 15 kg in weight (Karapetkova, Zivkov 2006). *Sc.maximus* is not a highly migratory species but relocates seasonally towards the coast and offshore related to reproduction, feeding and wintering.

Fishery

Turbot is the one of the most important demersal fish species in the Black Sea with high market demand and prices. Main fishing gear for Bulgaria are gillnets. The turbot is often caught as a by-catch of sprat fishery and long lines fishery. Higher turbot catches are registered in spring and autumn periods: March – April and October – November.

Fishery


Turbot
Landings (t)
1950 – 1980: 244.8 t
1980 – 1981: 13 t
2006 – 2012: 44.12 t
500
450
400
350
300
250
200
150
100
50
0
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010

Fishing effort

Country	Species	Metier		CPUE			
		Gear	Gear	2008	2009	2010	2011
Bulgaria	TUR	GNS	LOA > 0 < 6	30.4	32.5	21.86	20.22
			LOA => 6<12	58.32	53.91	34.5	43.29
			LOA => 12<18	125.26	71.62	65.48	46.49
			LOA => 18<24	83.05	95.86	102.95	34.47
			LOA => 24<40	-	-	250	110.69
		OTM	LOA => 12<18	139.17	145.1	9.68	-
			LOA => 18<24	45	137.83	--	-
			LOA => 24<40	251.67	95	84.38	-

Fisheries management

- Technical tools

Fishing gear - bottom set gillnets

Mesh size - The minimum legal mesh size for bottom-set nets used in turbot fisheries is 200 mm.

Minimum allowable total length at landing – 45 cm

- Management tools

Seasonal closure - Prohibition of fishing activity during reproduction period of turbot is in force from 15 April to 15 June in European Community waters of the Black Sea.

Bottom trawling ban – in force since 1984

License system and individual quotas for turbot fishery

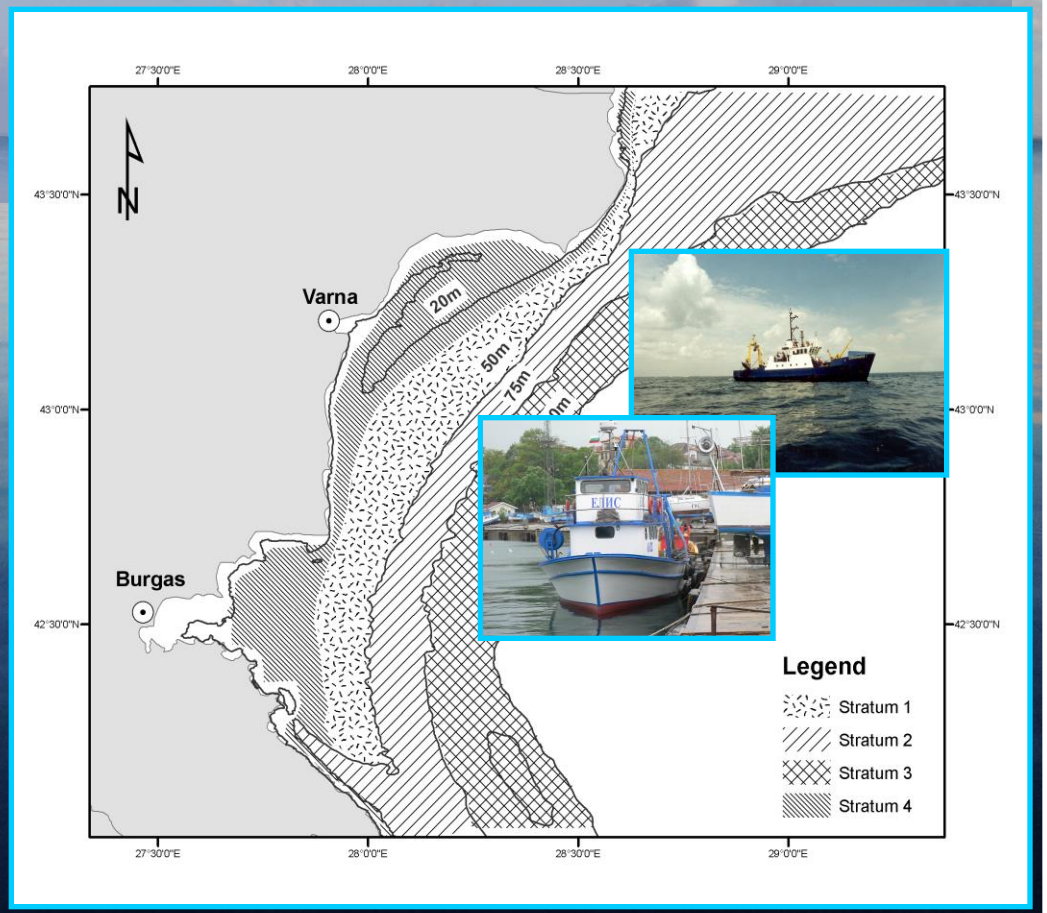
Turbot quotas – introduced since 2004 in national waters and after 2008 in community waters, quota allocations of turbot in Member States are in force regarding to Council Regulations (EC, 2008 - 2013)

Year	TAC (Bulgaria)
2008	45 t
2009	50 t
2010	48 t
2011	43.2 t
2012	43.2 t
2013	43.2 t

Stock state

- **Scientific surveys** - assessment of turbot stock biomass and population parameters
- **Period** - 2006 – 2012
- **Method** - swept area

Different indices and indicators were derived from survey data, collected during 12 demersal trawl surveys and more than 400 hauls. Estimated indicators were applied for assessment of turbot stock state and meet some of the requirements of Marine Strategy Framework Directive (D3).



Marine Strategy Framework Directive

Descriptor 1

"Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions."

Descriptor 3

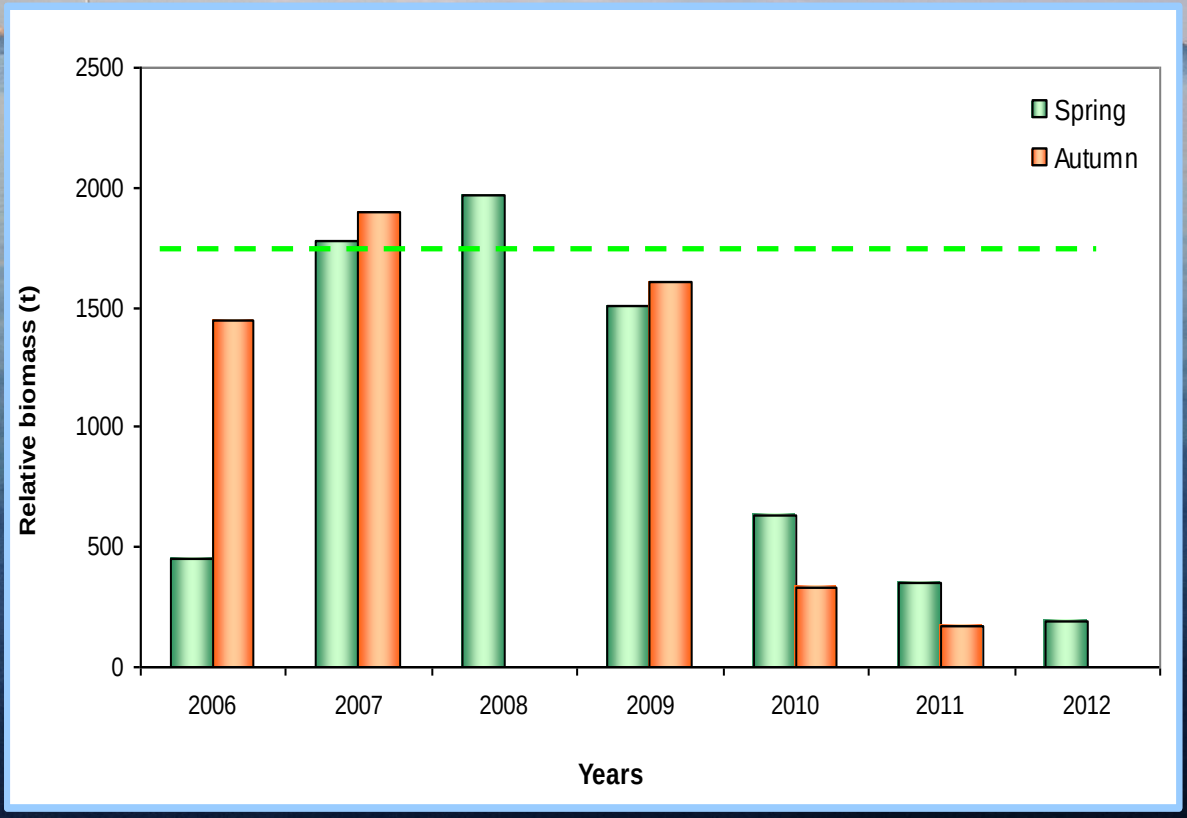
"Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock."

Indicators

1.1.1 Distributional range
1.1.2 Distributional pattern whin range, where appropriate
1.2.1 Population abundance and/or biomass, as appropriate
1.3.1 Population demographic characteristics (e.g. Body size or age class structure, sex ratio, fecundity rantes, survival/mortality rates)
3.1.1 Fishing mortality
3.1.2 Ratio between catch and biomass index
3.2.1 Spawning stock biomass (SSB)
3.2.2 Biomass indices
3.3.1 Proportion of fish larger than the mean size of first sexual maturation
3.3.2 Mean maximum length across all species found in research vessel surveys
3.3.3 95% percentile of the fish length distribution observed in research vessel surveys
3.3.4 Size at first sexual maturation, which may reflect the extent of undesirable genetic effects of exploitation

Indicators

Relative biomass index



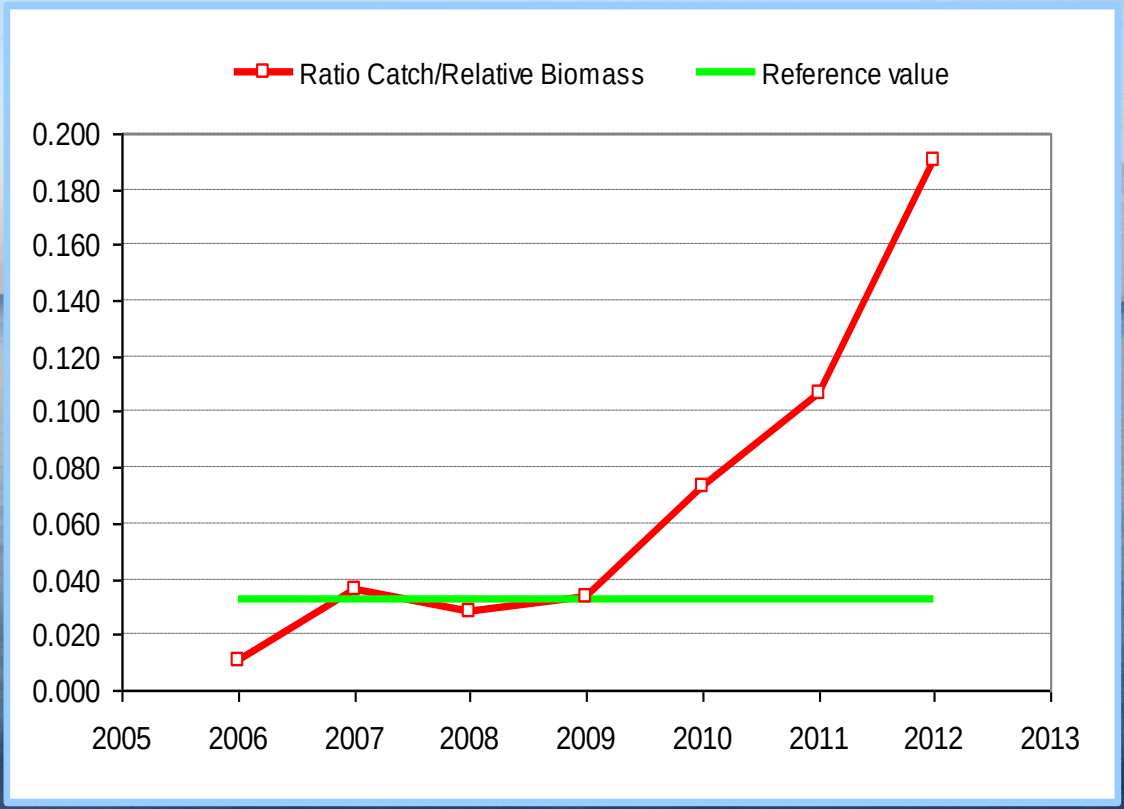
2006 - 2012

Range: 192 – 1966 t

Average: 1140 t

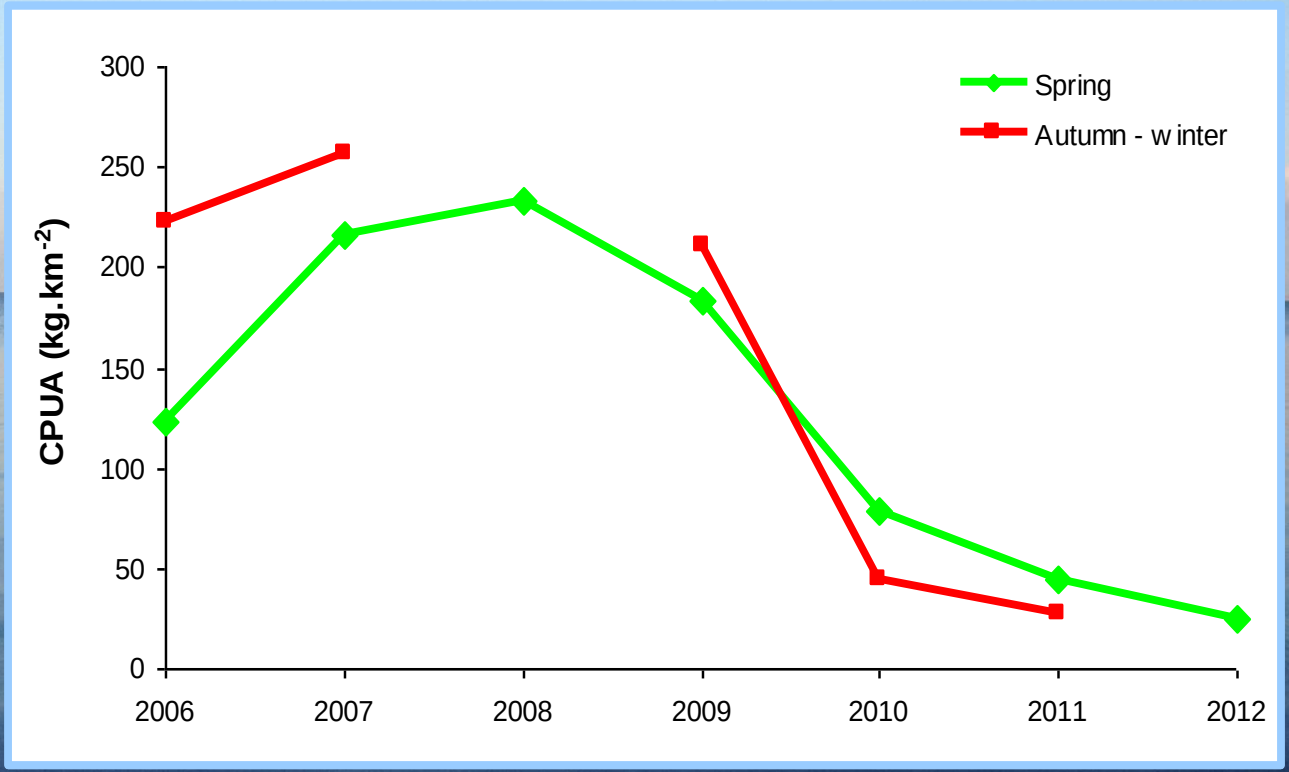
Reference point – 1700 t

Ratio between catch and biomass index

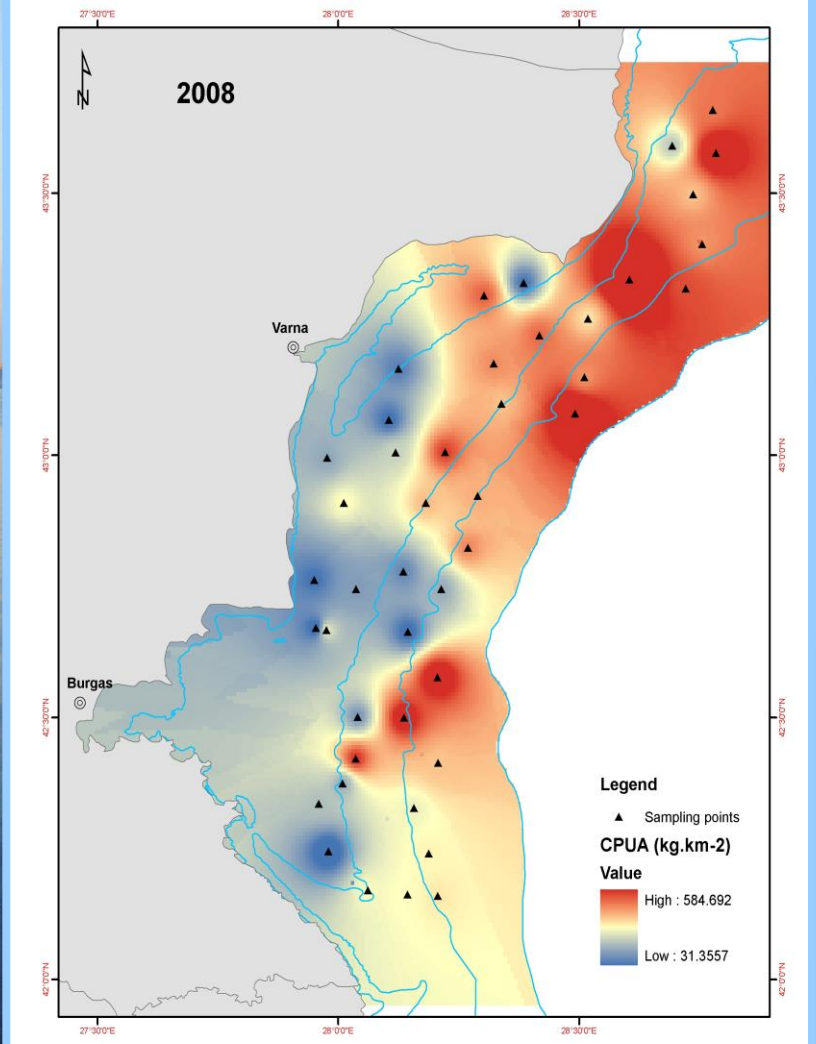


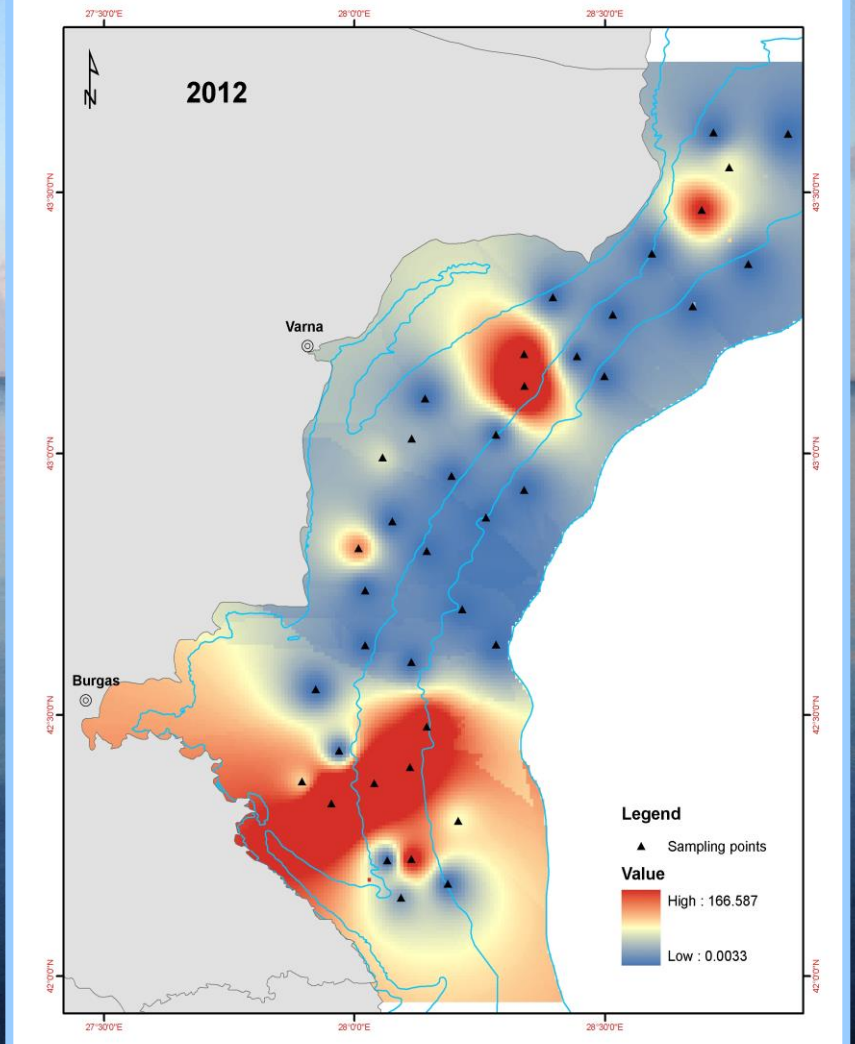
At national level, for achieving GES (MSFD), decreasing trend of ratio between catch and turbot biomass index is proposed with limit reference value of 0.033. For the determination of reference value, recent data for the period 2006 – 2011 are used.

Catch per unit area

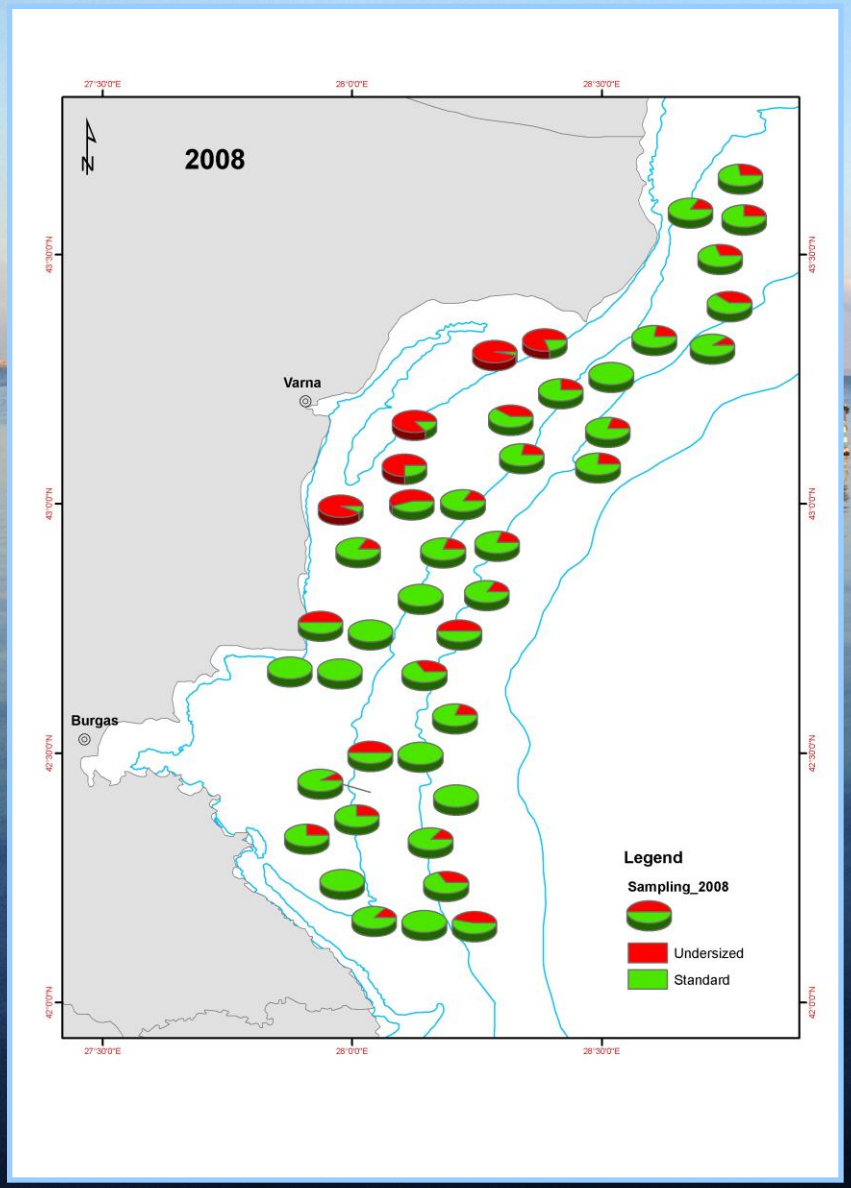


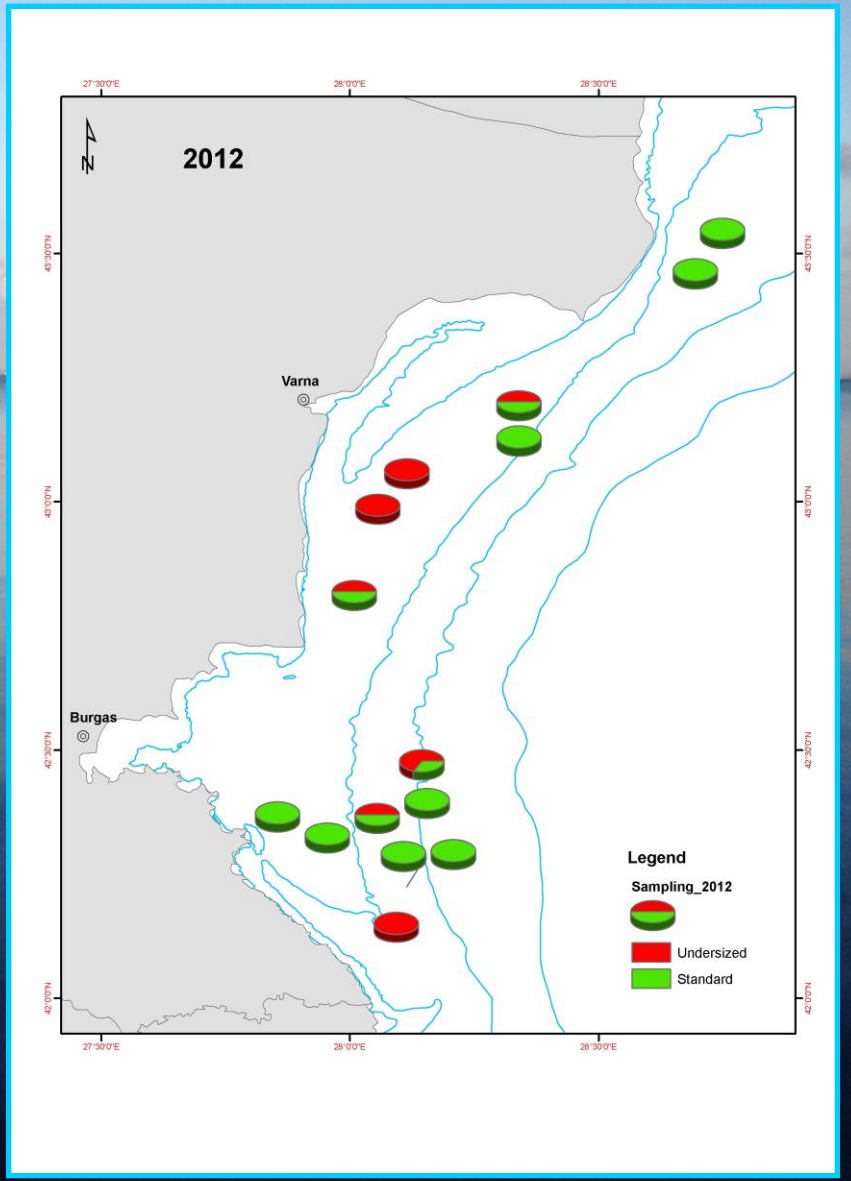
Decreasing trend of catches per unit area are observed since 2008. The average values ranged between 25.15 and 256.91 kg.km^{-2}. The average value for the period 2006 – 2012 is 138.93 kg.km^{-2}.


2008
Varna
Burgas
Legend
Sampling points
CPUA (kg.km-2)
Value
High : 584.692
Low : 31.3557


2012
Varna
Burgas
Legend
Sampling points
Value
High : 166.587
Low : 0.0033

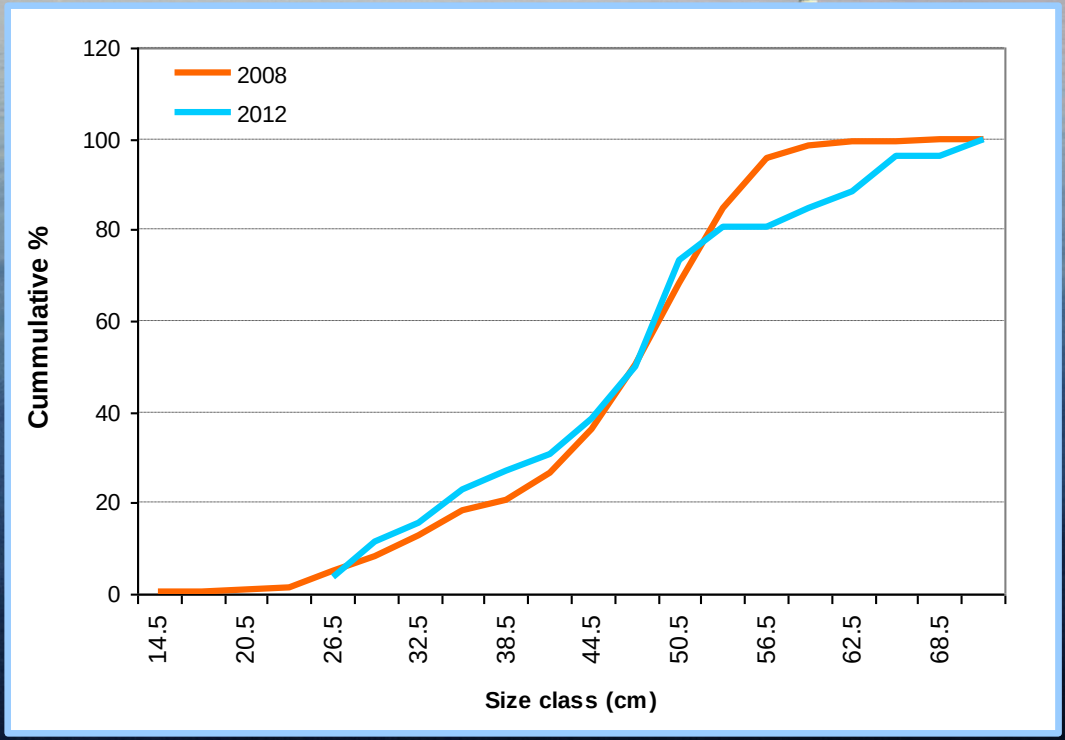
Population demographic characteristics

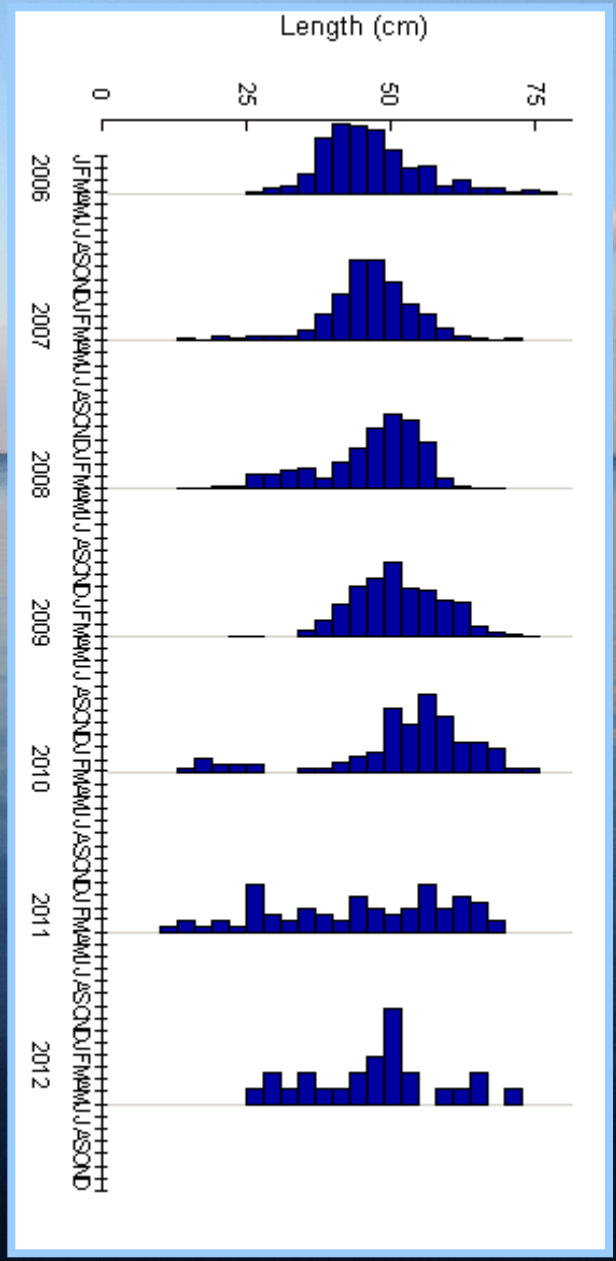




Size structure

Negative changes of turbot size structure are observed since 2008, with decreasing share of larger size classes with lengths between 48 and 55 cm, which mainly compose the spawning stock.





For characteristics of the demographic structure of turbot population, the average total length (Lmean) of the individuals in the catch, is used as indicator. Reference value is applied for the determination of basic condition, estimated for the period, for which is accepted that the population was in good condition.

Stock will have the necessary proportion of adult fish, if the mean length in the catch is in the range:

Lopt +/- 10%, т.е 0.9 Lopt < Lmean < 1.1 Lopt

(Froese and Sampang, 2012)

For the estimation of Lopt, the following equation was applied:

$\log Lopt = 1.0421 * \log L_{\infty} - 0.2742$ (Froese and Binohlan, 2000)

Parameters in VBGF – according to Ivanov, Karapetkova (1979) for the period 1956 – 1975.

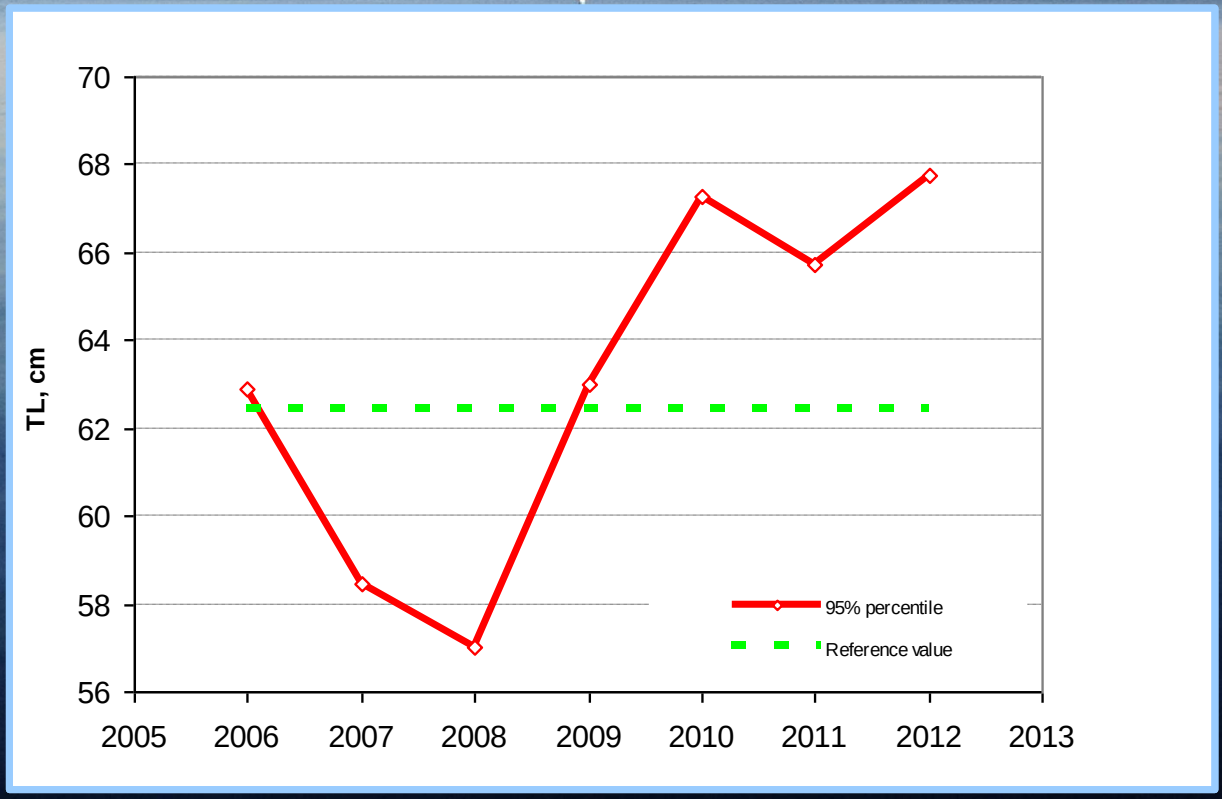
Size structure

State	*Sc. maximus* (L_{opt}=56.0 см)	
	Good	Not good
Mean value	56	<56
Range	$50.2 \leq L_{mean} \leq 61.6$	$L_{mean} < 50.2$

Year	*Sc.maximus*			
	L_{mean},cm	мин	макс	CI (95%)
2006	44.81	26	76.5	1.691
2007	46.19	26.5	74	0.700
2008	46.28	15	71	0.920
2009	50.92	24	74	0.756
2010	52.44	15	73	2.105
2011	44.34	10	68	3.722
2012	47.10	26	70	1.690
Mean	47.44			

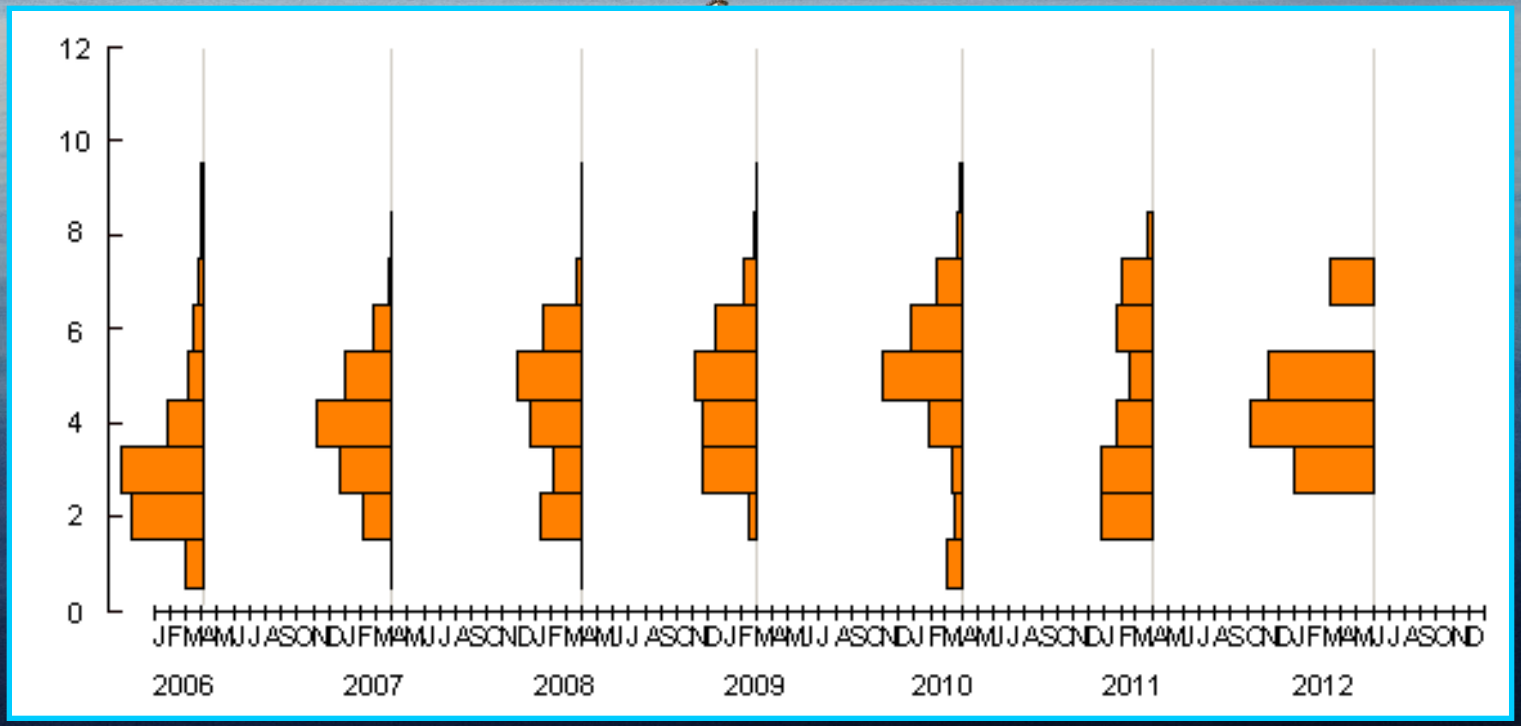
95% percentile of the observed size structure during the surveys

For determination of the basic conditions and reference value, data for the period 2006 – 2011 are used. Keeping of stable trend of 95 % percentile over the reference value of 62 cm is proposed.

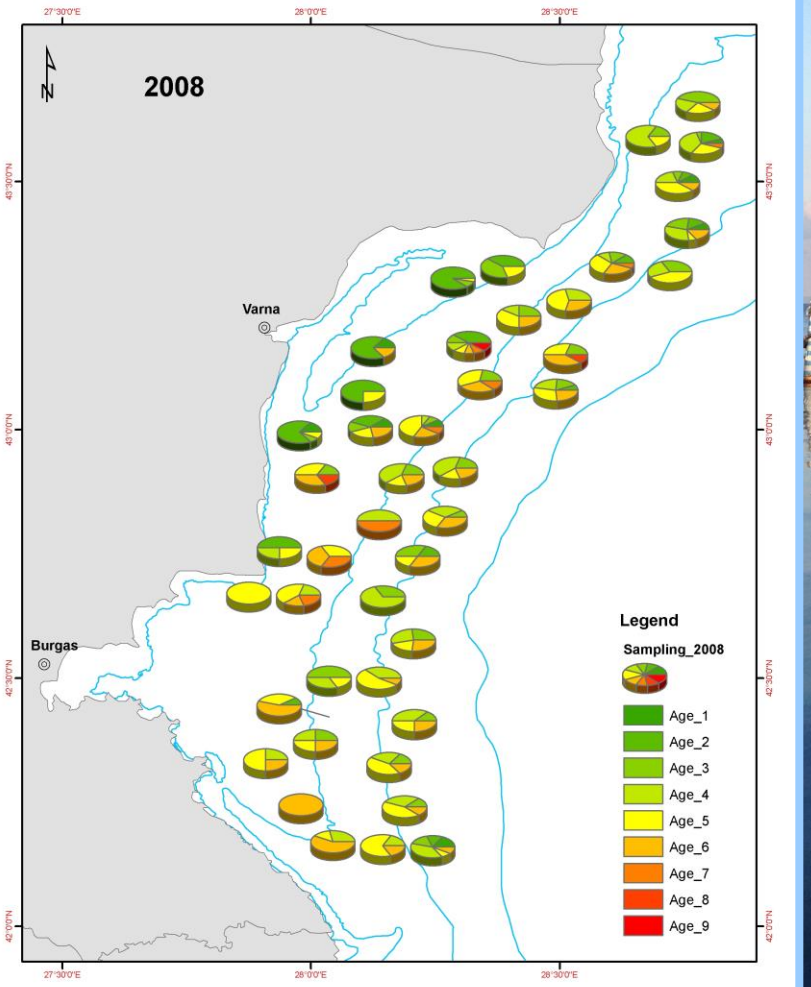


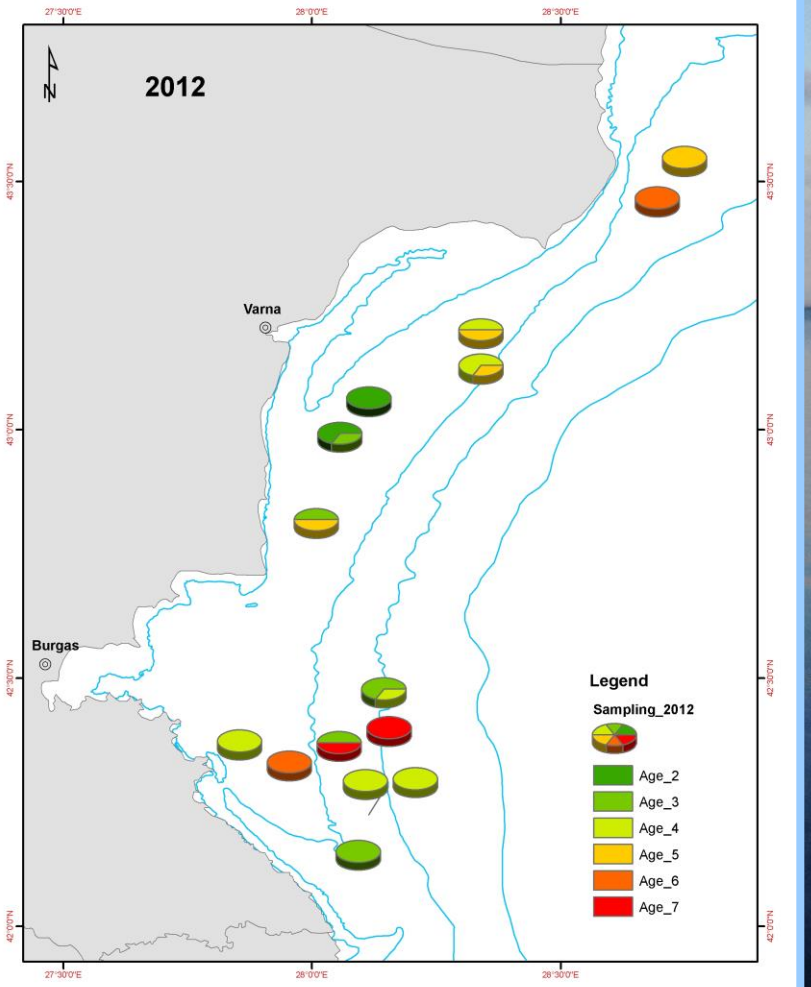
Age structure

Negative alterations are also observed in turbot age structure, especially during the last years – 2011 – 2012, when the abundance of older age groups is highly reduced.



Age structure





Conclusions

- The decreasing trend in the estimated relative biomass of turbot since 2008 is observed in the Bulgarian Black Sea area. The level of relative biomass is very low in 2011 and 2012.

For the recovery of turbot population in front of the Bulgarian Black Sea coast, except EU introduced quotas, implementation of additional, more effective measures are necessary.

- Additional reduction of fishing pressure on turbot is necessary especially during the period before spawning season in order to ensure species successful reproduction, necessary for the recovery of turbot stock.

- The negative trends in turbot size and age structure in front of the Bulgarian Black Sea coast since 2009 are observed, showing that the population is not in good condition.

- Research surveys at sea for monitoring of turbot stock are the main tool for fishery independent data gathering, which are essential for stock assessment and management purposes and should be carried out

Thank you!