Stock Annex: Roundnose grenadier (*Coryphaenoides rupestris*) in divisions 10.b and 12.c, and in subdivisions 12.a.1, 14.b.1, and 5.a.1 (Oceanic Northeast Atlantic and northern Reykjanes Ridge)

Stock specific documentation of standard assessment procedures used by ICES.

Stock: Roundnose grenadier

Working Group: Working Group on Biology and Assessment of Deep-sea Fisheries Resources (WGDEEP)

Created:

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A. General

A.1. Stock definition

See annex "Roundnose grenadier in 5.b, 6, 7 and 12.b".

A.2. Fishery

The fishery on the northern Mid-Atlantic Ridge (MAR) started in 1973, when dense aggregations of roundnose grenadier were discovered by USSR exploratory trawlers. Roundnose grenadier aggregations may have occurred on 70 seamounts between 46 and 62°N but only 30 of them were commercially important and subsequently exploited. The fishery is mainly conducted using pelagic trawls although on some seamounts it is possible to use bottom gear.

The largest annual catch of roundnose grenadier (almost 30,000 t) on the MAR was taken by the Soviet Union in 1975, fluctuating in subsequent years between 2800 to 22,800 t. The fishery for grenadier declined after the dissolution of the Soviet Union in 1992. In the last 15 years, there has been a sporadic fishery by vessels from Russia (annual catch estimated at 200–3200 t), Poland (500–6700 t), Latvia (700–4300 t) and Lithuania (data on catch are not available). In 2010 Spain started new target fishery of grenadiers (*M. berglax* and *C. rupestris*), but landings have been variable and at a considerably lower level. Preliminary catch data for 2017 and 2018 indicates that Spanish catch of roundnose grenadier was insignificant in 2017 and 2018, accounting for 84 t and 27 t, respectively, mostly from ICES Subarea 12. Roundnose grenadier has also been taken as bycatch in the Faroese orange roughy fishery, and Spanish blue ling and roughhead grenadier fishery.

A.3. Ecosystem aspects

The depth in most of divisions 10.b, 12.c and sub-divisions 5.a1, 12.a1, 14.b1 is > 4000 m and abyssal realm is not exploited by fisheries. The roughtest area is the Northern part of the MAR, located between Iceland and the Azores. Numerous seamounts of variable heights occur all long this ridge along with isolated seamounts in other areas such as Altair and Antialtair. The physical structure of seamounts often amplify water

currents and create unique hard substrata environments that are densely populated by filter-feeding epifauna such as sponges, bivalves, brittle stars, sea lilies and a variety of corals such as the reef-building cold-water coral *Lophelia pertusa*. This benthic habitat supports elevated levels of biomass in the form of fish aggregations, such as orange roughy and alfonsinos, and a number of seamounts have been targeted by commercial fleets. Such habitats are, however, highly susceptible to damage by mobile bottom fishing gear and the fish stocks can be rapidly depleted due to the life-history traits of the species, which are slow growing and longer-living than non-seamount species.

The MAR is isolated from the continental margins, except for the relatively continuous shallower connections via the Greenland and Scotland ridges, and some seamount chains, e.g. the New England seamounts. Along with much of the general biology, the status of communities inhabiting the MAR is unclear. Recent genetic analysis has shown roundnose grenadier population substructure along the central and eastern North Atlantic Ocean (White et al. 2010; Knutsen et al. 2012), suggesting limited connectivity across ocean basins. Geochemical analysis of roundnose grenadier otoliths revealed distinct population units along the NE Atlantic Ocean (Longmore et al., 2010, 2011). Depth-dependent genetic structure was also recently demonstrated (Gaither et al. 2018) identifying genetically based ontogenetic depth segregation whereby juvenile populations inhabiting shallow waters exhibit mixing, but adults segregate by depth forming genetically distinct populations.

B. Data

B.1. Commercial catch

Landings time-series data per ICES Subareas are available for whole fishery period. Landings by ICES division are available by countries. Landings data by ICES statistical rectangle are not available. Information on landings have been variable and at a considerably lower level down to insignificant in 2017 and 2018. Landings from the 1970s to the 1990s were reported to be mostly from pelagic trawling. In the 2000s there has been pelagic trawling in Division 14 and bottom trawling in Division 12.

Catch in Subarea 12 are allocated to MAR (Divisions 12.a,c) and western Hatton Bank (12.b).

There were no discards of roundnose grenadier on Russian trawlers where smallest fish and waste were used for fish meal processing. Recent information on discard rates is very limited. Discard rates of roundnose grenadier in other fisheries have declined and this can be attributed to the decline of the deep-water fishery overall. An assessment of discards was conducted in 2014, when the discards on Spanish target fishery estimated by scientific observers was at level of 386 t. No discards have been reported from 2015–2018.

Table 1. Working group estimates of catch of roundnose grenadier from Subdivision 5.a.1.

Year	USSR/ Russia	Total
1973	820	820
1974	12 561	12 561

Table 2. Working group estimates of catch of roundnose grenadier from Subarea 10.b.

Year	USSR/ Russia	Faroes1	Total
1976	170		170
1993		249	249

1994			
1995			
1996		3	3
1997		1	1
1998		1	1
1999		3	3
2000			
2001			
2002			
2003			
2004		1	1
2005	799		799
2006			
2007			
2008			
2009			
2010	73		73
2011			
2012			
2013			
2014			
2015			
2016			
2017			
2018	0	0	0

Table 3. Working group estimates of catch of roundnose grenadier from Subareas 12.a.1 and 12.c.

Year	USSR/ Russia	Poland2	Latvia2	Faroes2	Spain	Lithuanian	Total
1973	226						226
1974	5874						5874
1975	29894						29894
1976	4545						4545
1977	9347						9347
1978	12310						12310
1979	6145						6145
1980	17 419						17419
1981	2954						2954
1982	12472						12472

Year	USSR/ Russia	Poland2	Latvia2	Faroes2	Spain	Lithuanian	Total
1983	10300						10300
1984	6637						6637
1985	5793						5793
1986	22842						22842
1987	10893						10893
1988	10606						10606
1989	9495						9495
1990	2838						2838
1991	3214		4296				7510
1992	295		1684				1979
1993	473		2176	263			2912
1994			675	457			1132
1995				359			359
1996	208			136			344
1997	705	5867		138			6710
1998	812	6769		19			7600
1999	576	546		29			1151
2000	2325						2325
2001	1714			2			1716
2002	737						737
2003	510						510
2004	436			8			444
2005	600						600
2006				1			1
2007				2			2
2008	13						13
2009	5						5
2010							
2011							
2012					864	4	868
2013					118		118
2014				4			4
2015					329		329
2016					289		289
2017[3]					16		16
2018[3]					27		27

[1] revised catch data

[2] official ICES data

[3] preliminary data.

*** Subareas 12.a.1 only**

B.2. Biological data

Size frequency data (total length distribution) for roundnose grenadier are available for Russian catches for 1972-1990 (Shibanov 1997). Age estimates were available from Russia for 1974-1990 (Shibanov 1997). Other studies have attempted to estimate the age of roundnose grenadier, but accurate results remains scarce (Draganik et al. 1998; Swan and Gordon 2001). Available data is suggestive of spatial differences along the North Atlantic.

According to retrospective Russian data maturation of roundnose grenadier starts when fish are at least 50 cm long Total length. Mean length-at-maturity of males and females being 76 and 79 cm (TL) respectively (Savvatimsky 1992). Some individuals mature at the age 6, though somefish may remain immature until the age 20 (Savvatimsky 1969; Shibanov 1985). Data from 2010 indicated that gonads of roundnose grenadier were mostly at the stage of maturation. The total proportion of females at pre-spawning and spawning states constituted 25%, which is comparable with the results observed in May–June 2003 (21%). In the both cases a small number of juvenile specimens were observed in catches (2.3% and 3.4%respectively). No new data on maturity has been collected in recent years.

No specific information is available from the Mid-Atlantic Ridge but natural mortality of 0.1 has been used for roundnose grenadier in 5.b, 6, 7 and 12.b since 2002. This is based on catch curves from pre exploitation surveys.

The ecology of the species is well studied in continental margins of the North Atlantic, but not on the mid-Atlantic Ridge. The feeding ecology was studied in summer 2004 under the scope of the MAR-ECO project. The diet of roundnose grenadier was mainly comprised by cephalopods, pelagic shrimps and fish. Pelagic and benthopelagic copepods were the most numerous prey, but not in weight. There were ontogenetic changes in food preferences, with cephalopods the most important prey of the small grenadiers, while shrimps and fish became increasingly important with increasing size (Bergstad et al 2010).

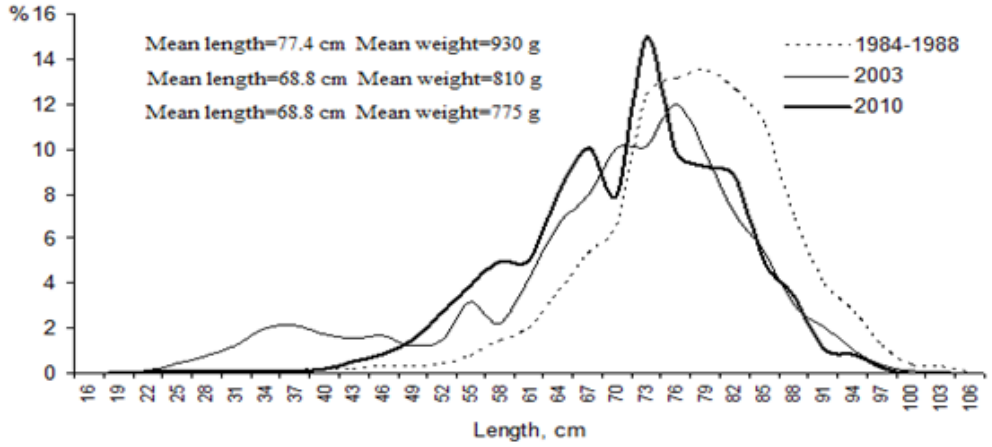

Figure 1. Total length composition of roundnose grenadier on the MAR in 1984–1988 (47–51°N), in 2003 (47–51°N) and in 2010 (47–50°N).

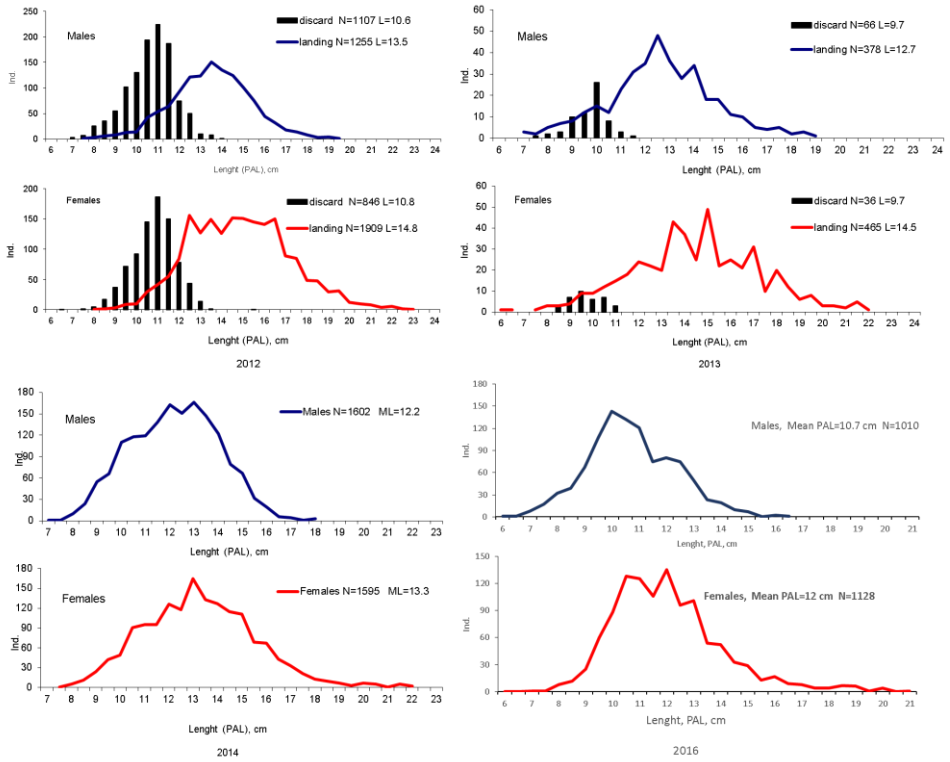

Figure 2. Length composition (PAL) of landings and discards of roundnose grenadier on Spanish commercial trawl fishery.

B.3. Surveys

There have been number of investigations from the Soviet Union on the northern MAR in the 1972-1990 including trawl acoustic surveys and underwater observations (Shibanov et al 2002). According to surveys data and analytical assessments in the 1970-1980s a stock size was estimated as 400,000-800,000 t (Baidalinov, 1986; Pavlov et al., 1991; Shibanov, 1997). In the 1990s no researches of roundnose grenadier were conducted in the area.

In recent years the MAR-ECO project reported some biological data (length, age maturity) for roundnose grenadier on the northern MAR.

Data on biology and distribution of juvenile roundnose grenadier was also collected in May–July 2003, 2005, 2007, 2011, 2013 during the international trawl-acoustic survey (ITAS) of redfish *Sebastes mentella* in the Irminger and Labrador Seas, as well as during investigations under the Russian national programme of investigations on the West Iceland and East Greenland slopes. Russian, Icelandic and German research vessels participated in ITAS. In 2015 the survey also was conducted but the information on the distribution of juvenile roundnose grenadier was not available to the ICES WGDEEP. Trawl stations were carried out by pelagic trawl (78,7/416) with vertical opening of 43 m and Gloria 896 pelagic trawl with vertical opening of 46 m. In 2003 for the first time, data suggesting a wide distribution of young fish in the high seas pelagic are obtained (Vinnicchenko and Khlivnoy, 2008). Investigation results are evidence of the long passive migrations of this species at early life stages. Outside the island slopes, juvenile roundnose grenadier was recorded in most parts of the surveyed area between 52°54'–63°41'N, 26°00'–51°06'W above 1200–3200 m depth (Figure 9.4.4). Juveniles were caught in pelagic layer at depths of 120–840. Maximum catches (up to ten individuals per one

trawling hour) were registered over the MAR in the layer 500–700 m. Pre-anal length of specimens varied from 2 to 7 cm, age varied from 0+ to 3 years.

Acoustic surveys on the MAR where conducted in 2003 by the Russian R/V *Atlantida* in the area between 47° and 58°N. According to results of this survey the biomass of the pelagic component of the grenadier only amounted to about 130,000 t (Gerber et al., 2004). It was concluded that the depths of aggregations and the number of small immature fish may have increased as compared to 1970-1980s. Last conclusion was related primarily to northern part of surveyed area (50-58°N). Another trawl acoustic survey was carried out by Russian RV "Atlantida" in October 2010 in the southern part of fishing area (44–50°N) (Shnar *et al* 2011), where 17 seamounts were surveyed (Figure 9.4.8). The typical echo-indications of grenadier were obtained over 13 seamounts located to the north of 46°N. Similar to 2003, considerable increase of the grenadier distribution depths (mainly 1200–1350 m, sometimes up to 1500 m) was observed (Figure 9.4.9) as compared to 1970s–1980s, when it was mainly from 600 to 1200 m (Chuksin and Sirotin, 1975). The biomass of the pelagic component of the grenadier on the 13 seamounts amounted to about 59 400 t. In 2003 the biomass was estimated 35 100 t on the nine seamounts of this area. The biomass values were higher in 2010 than in 2003 at the most seamounts (Table 9.4.8). The average biomass per one seamount increased from 3900 t in 2003 to 4600 t in 2010.

Table 4. Biomass estimations (tonnes) of roundnose grenadier based on Russian acoustic surveys on the MAR in 2003 and 2010.

Seamount number	2003	2010
462	Not surveyed	2188
473-A	1662	10 259
473-B	7016	6417
476-A	3159	4357
485-A	971	6350
485-B	Not surveyed	2097
491-B	3228	2203
493-A	Limited data	1828
494-A	18 086*	12 274
494-B		8227
495	977	1350
495-B	Not surveyed	241
496-A	Limited data	1573
TOTAL	35 099	59 364

*** total for two seamounts.**

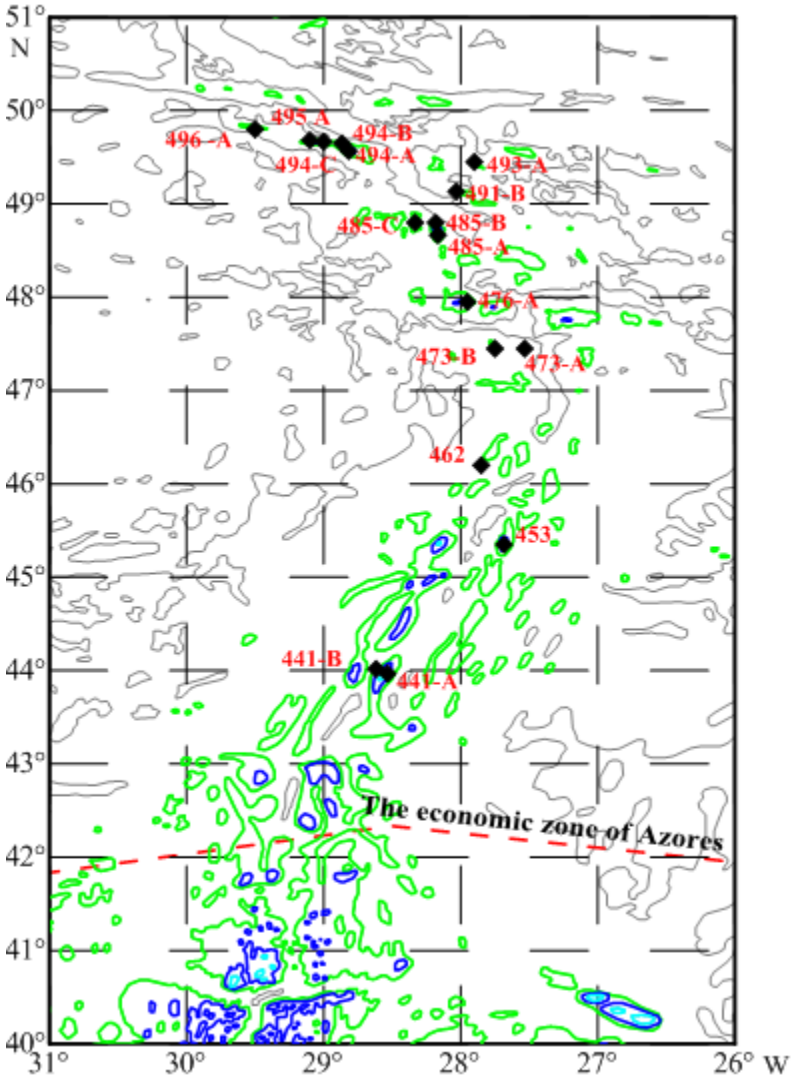

Figure 3. Location of seamounts surveyed at RV "Atlantida" on the MAR in October 2010.

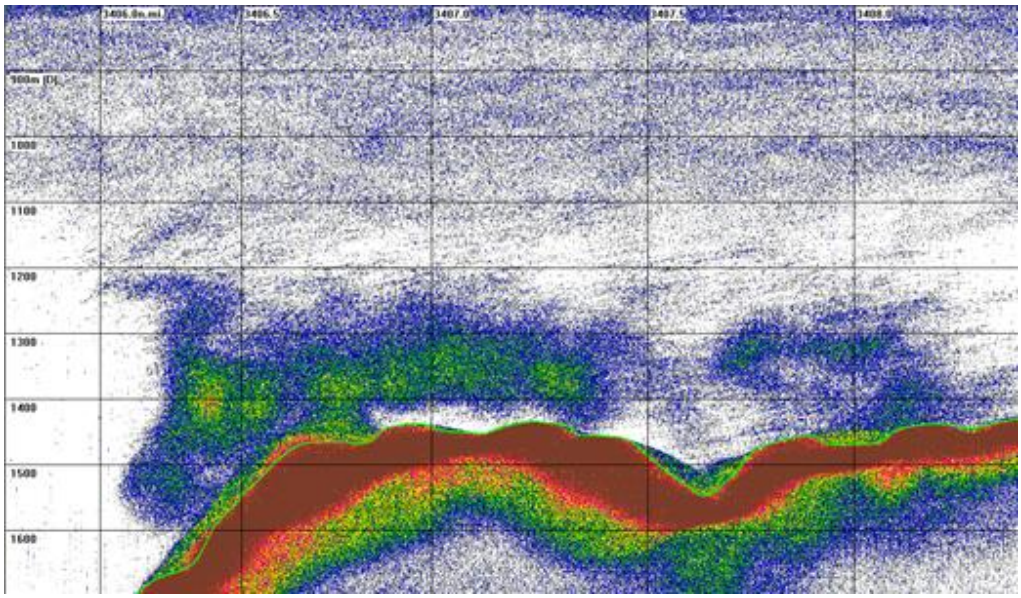

Figure 4. Echo-records of roundnose grenadier at the MAR seamount 494-A in October 2010.

B.4. Commercial cpue

Nominal catch per fishing day are available from the Soviet/Russian official data from 1974 to 2010. There are gaps in the series due to the lack of catch statistics for 1973 and 1982 as well as absence or reduced of target fishery in 1994-1995 and 2006-2010. From 2010, CPUE estimated for the Spanish vessels remains relatively stable, but in low numbers. These data must be treated with caution, since catch rates might be sensitive to a number of factors (distribution of pelagic schools, experience of vessel crew, environmental conditions, etc.) that could not be taken in account.

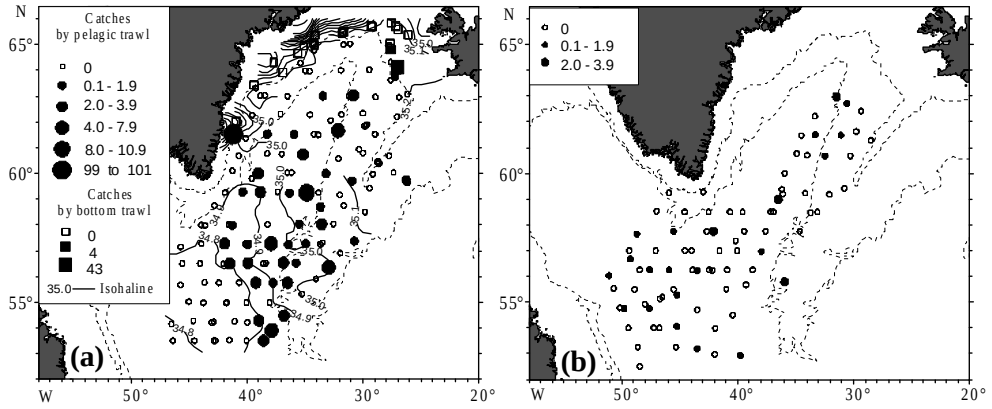

Figure 5. Catches of young roundnose grenadier (indiv./1 trawling hour) and water salinity at 50 m depth in the North Atlantic in May–July 2003 (a) and in June–July 2005 (b) (Vinnicchenko V., Khlivnoy V. 2008).

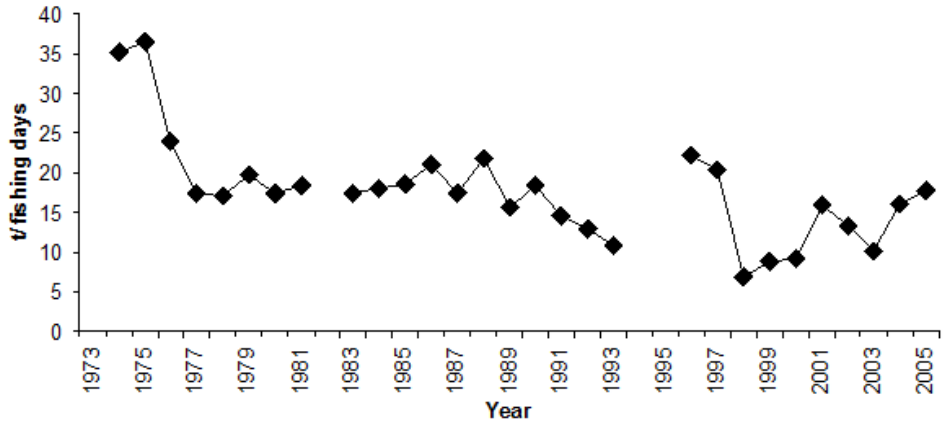

Figure 6. USSR/Russian cpue of roundnose grenadier on the MAR in 1973–2005.

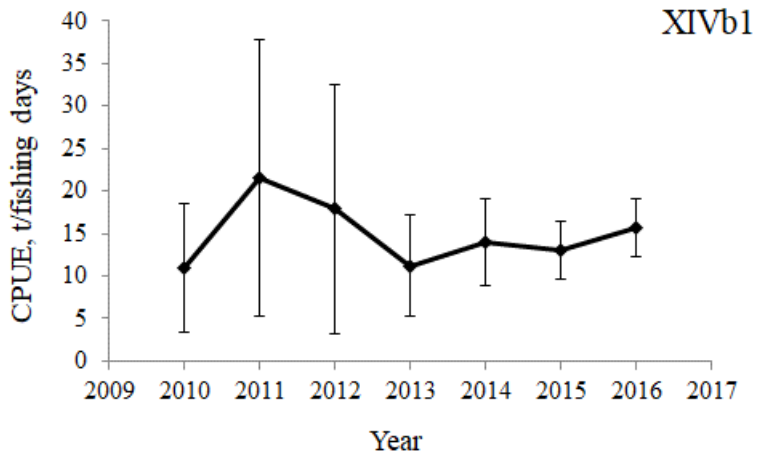

Figure 7. Spanish cpue of roundnose grenadier on the MAR in Subdivision 14.b.1 in 2010–2016.

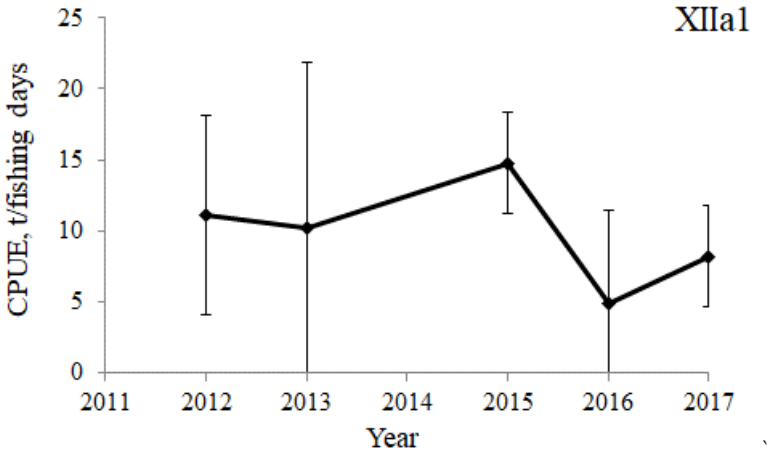

Figure 8. Spanish cpue of roundnose grenadier on the MAR in Subdivision 12.a.1 in 2012–2013 and 2015–2017.

Table 5. USSR/Russian fishing effort and cpue on the roundnose grenadier fishery on the MAR.

Year	ICES Subarea and Division	Number of fishing days	Catch per fishing day,t
1974	12.a.1+12.c, 5.a.1		35.2
1975	12.a.1+12.c		36.6
1976	12.a.1+12.c, 14.b.1, 10.b		24.0
1977	12.a.1+12.c		17.3
1978	12.a.1+12.c		17.0
1979	12.a.1+12.c		19.6
1980	12.a.1+12.c		17.3
1981	12.a.1+12.c		18.4
1982	12.a.1+12.c		
1983	12.a.1+12.c		17.3
1984	12.a.1+12.c		18
1985	12.a.1+12.c		18.5
1986	12.a.1+12.c		21
1987	12.a.1+12.c		17.3
1988	12.a.1+12.c		21.8
1989	12.a.1+12.c		15.6
1990	12.a.1+12.c		18.4
1991	12.a.1+12.c		14.5
1992	12.a.1+12.c		12.9
1993	12.a.1+12.c, 10.b		10.7
1994	12.a.1+12.c, 14.b.1, 10.b		
1995	12.a.1+12.c, 14.b.1, 10.b		
1996	12.a.1+12.c, 10.b		22.2
1997	12.a.1+12.c, 14.b.1, 10.b		20.3
1998	12.a.1+12.c, 10.b		6.8
1999	12.a.1+12.c, 10.b		8.8
2000	12.a.1+12.c, 14.b.1		9.1
2001	12.a.1+12.c		15.8
	14.b.1		
2002	12.a.1+12.c		13.2
	14.b.1		
2003	12.a.1+12.c	51	10.1
2004	12.a.1+12.c	25	16.1
2005	12.a.1+12.c	42	17.7
	10.b	37	
2006	12.a.1+12.c, 14.b.1, 10.b		
2007	12.a.1+12.c, 14.b.1, 10.b		
2008	12.c	7	
2009	12.c	1	

Table 6. Spanish fishing effort on roundnose grenadier fishery on the MAR, between 2010-2018.

Year	ICES Subarea and Division	Number of fishing days	Effort, kwd	Number of fishing boats
2010	14.b	19		3
2011	14.b	98		4
2012	12.a.1	60		7
	14.b	140		7
2013	12.a.1	18		3
	14.b	147		6
2014	14.b	150		3
2015	12.a.1	10	25400	1
	14.b.1	68	54693	3
2016	12.a.1	2	2419	2
	14.b.1	56	85051	3
2017	12.a.1	2	2419	1
	14.b.1	5	26394	2
2018	12.a.1	6	5601[1]	2
	14.b.1	0	0[1]	0

[1] **preliminary statistics.**

B.5. Other relevant data

No additional data.

C. Assessment: data and method

D. Short-term projection

Available data is inadequate to provide estimates.

E. Medium-term projections

Available data is inadequate to provide estimates.

F. Long-term projections

Available data is inadequate to provide estimates.

H. Other issues

Due to the particular environmental conditions and roundnose grenadier occurring in dense schools, unlike in other areas where it is rather a dispersed species, it remains challenging to assess the biomass without extensive acoustic surveys. Species abundance and response to fisheries remains unknown. However, long-term fisheries independent data suggests that roundnose grenadier remains the most abundant among grenadiers in along MAR and that low recruitment might affect population structure (Berstad et al. 2008; Bergstad 2013).

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