










Redfish (*Sebastes mentella* and *Sebastes fasciatus*)**Advice June 2019 for 2020-2021****in Division 3M****Recommendation for 2020 and 2021**

SC advises that catches should not exceed the $F_{0.1}$ level given the recent very low productivity of the stock. This corresponds to a TAC of 4 319 tonnes in 2020 and 4 624 tonnes in 2021.

Management objectives

No explicit management plan or management objectives have been defined by the Commission. Convention General Principles are applied.

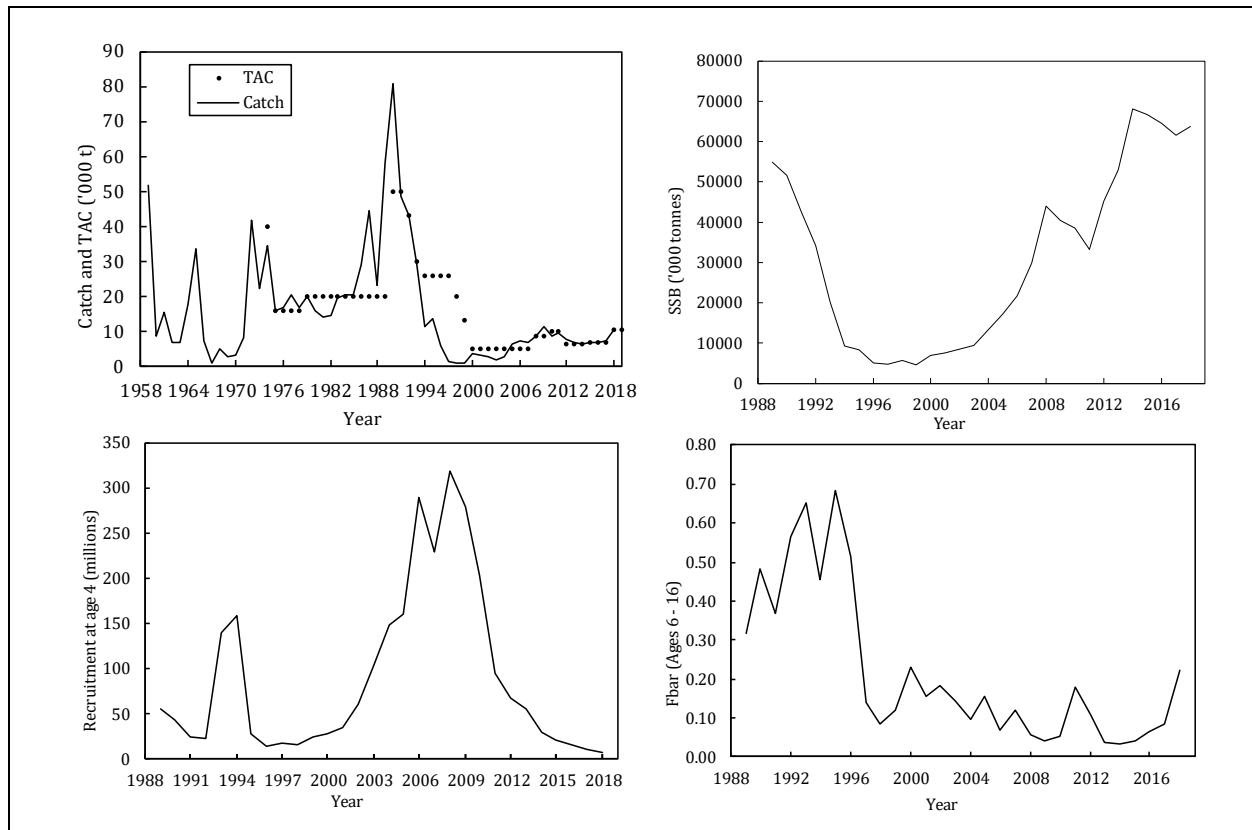
<i>Convention General Principles</i>	<i>Status</i>	<i>Comment/consideration</i>		
Restore to or maintain at B_{msy}		B_{msy} unknown. Stock above historical average level		OK
Eliminate overfishing		F_{msy} unknown. Catch at a low level over past 25 years		Intermediate
Apply Precautionary Approach		Candidate Yield per recruit reference points available and used, but need to be confirmed		Not accomplished
Minimise harmful impacts on living marine resources and ecosystems		VME closures in effect, no specific measures, low bycatch reported		Unknown
Preserve marine biodiversity		Cannot be evaluated		

Management unit

Catches of redfish in Div. 3M include three species of the genus *Sebastes*; *S. mentella*, *S. norvegicus* (= *S. marinus*) and *S. fasciatus*. For management purposes, they are considered as one stock. The assessment and advice are based on data for only two species (*S. mentella* & *S. fasciatus*), labeled as beaked redfish. The TAC advice is adjusted to reflect all three species on the Flemish Cap, based upon the relative species distribution in recent surveys.

Stock status

The stock is declining after a marked recovery that started in 2002-2003. High levels of biomass were maintained until 2014, supported by low fishing mortalities and individual growth of survivors, but could not be sustained. The decline in abundance is more pronounced, with no perspective to stop in the short term since year classes at recruitment continue to be extremely weak.



Reference points

No reference points have been adopted.

Assessment

Input data comes from the EU Flemish Cap bottom trawl survey and the fishery. A quantitative model (XSA) introduced in 2003 was used. Increased natural mortality was assumed from 2006 to 2010, but natural mortality was low (more typical of redfish) in other years. In order to include an independent approach to natural mortality in the 2017 sensitivity M framework, natural mortality was then estimated by a number of published models. There is no evidence that natural mortality has increased recently from the level of 0.1 adopted in the 2017 assessment, and therefore, the 2019 XSA assessment was run with average M in 2017 and 2018 kept at 0.10.

The next full assessment of this stock will be in 2021.

Projections

Short term (2020-2022) stochastic projections were carried out for female spawning stock biomass (SSB) and catch, under the most recent level of natural mortality and considering three options for fishing mortality ($F_{statusquo}$, $F_{0.1}$ and F_{max}). Projections were initialized at the beginning of 2020 assuming $F_{statusquo}$ during 2019. Assumed recruitment for 2019 to 2021 is the geometric mean of the most recent recruitments (age 4 XSA, 2015-2017).

Results for the three projection scenarios show biomass declines of 25% (for $F_{0.1}$), 34% (F_{max}) and 36% ($F_{statusquo}$) between 2019 and 2022. In all three scenarios, the biomass remains at a high level relative to historical values but has a low probability of being above 2019 levels.

Fstatusquo₂₀₁₈=0.220

	SSB Median and 80% CI	Yield	Median	TAC
2019 _{deterministi}	67553	12536		
2020	55768 (50610 - 62034)		9682	9925
2021	49656 (44935 - 54955)		9262	9495
2022	43021 (39130 - 47816)			

Fmax=0.188

	SSB Median and 80% CI	Yield	Median	TAC
2019 _{deterministi}	67553	12536		
2020	55768 (50610 - 62034)		8379	8590
2021	50617 (45816 - 56012)		8241	8448
2022	44764 (40713 - 49757)			

F0.1=0.091

	SSB Median and 80% CI	Yield	Median	TAC
2019 _{deterministi}	67553	12536		
2020	55768 (50610 - 62034)		4213	4319
2021	53703 (48634 - 59372)		4510	4624
2022	50573 (46050 - 56165)			

average beaked redfish proportion in the 2017-2018 3M redfish catch

0.98

	Fstatus quo	F0.1	Fmax
P(SSB ₂₀₂₀ >SSB ₂₀₁₉)	<10%	<10%	<10%
P(SSB ₂₀₂₁ >SSB ₂₀₁₉)	<10%	<10%	<10%
P(SSB ₂₀₂₂ >SSB ₂₀₁₉)	<10%	<10%	<10%

Human impact

Mainly fishery related mortality. Other sources (e.g. pollution, shipping, oil-industry) are undocumented.

Biology and Environmental Interactions

Since 2004 a rapid increase was observed on survey biomass both of golden (*Sebastes norvegicus*) and Acadian (*Sebastes fasciatus*) redfish stocks. Due to their shallower depth distributions these two redfish species overlap with cod to an extent greater than deep sea redfish (*Sebastes mentella*). Since 2006, the cod stock started to recover, while those two redfish stocks declined sharply. Redfish is an important component in the diet of cod, especially in those years when successful recruitment events were observed in redfish stocks.

Fishery

Redfish is caught in directed bottom trawl fisheries at intermediate depths (300-700m), but also as bycatch in fisheries directed for cod and Greenland halibut. The fishery in NAFO Div. 3M is regulated by minimum mesh size and quota.

Recent catch estimates and TACs ('000 t) are as follows:

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
TAC	10.0	10.0	6.5	6.5	6.5	6.7	7.0	7.0	10.5	10.5
STATLANT 21	8.2	9.7	5.4	6.8	6.4	6.9	6.6	7.1	10.5	
STACFIS Total catch ^{1,2}	8.5	11.1	6.2	7.8	7.4	6.9	6.6	7.1	10.5	
STACFIS Catch ^{2,3}	5.4	9.0	6.3	5.2	4.6	5.2	6.2	6.9	10.3	

¹ Estimated redfish catch of all three redfish species.

² On 2011-2014 STACFIS catch estimates based on the average 2006-2010 bias.

³ STACFIS beaked redfish catch

Effects of the fishery on the ecosystem

General impacts of fishing gears on the ecosystem should be considered. A large area of Div. 3M has been closed to protect sponge, seapens and coral.

Sources of information: SCR Doc. 19/016; SCR Doc. 19/014REV, 017,021; SCS Doc. 19/06, 09, 10,11