Cod in Division 3M Advice June 2021 for 2022

Recommendation for 2022

Scientific Council notes that the strong year-classes of 2009 to 2011 are dominant in the current SSB. Subsequent recruitments are much lower; therefore, substantial declines in stock size are occurring and expected to continue in the very near future under any fishing scenario.

Yield of less than or equal to 5 000 tonnes in 2022 results in a very low probability (≤10%) of SSB being below B_{lim} in 2023 and a very low probability of exceeding F_{lim}. However, given the present low level of the SSB and projected decline of total biomass under any fishing scenario, in order to promote growth in SSB, SC advises catches of no more than 3 000 tonnes in 2022.

Management objectives

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

Convention objectives	*Status*	*Comment/consideration*
Restore to or maintain at B_{msy}	🟡	Stock above B_{lim} in 2021. B_{msy} is unknown
Eliminate overfishing	🟢	$F<F_{lim}$ in 2020
Apply Precautionary Approach	🟢	F_{lim} and B_{lim} defined
Minimise harmful impacts on living marine resources and ecosystems	🟡	VME closures in effect, no specific measures
Preserve marine biodiversity	⚪	Cannot be evaluated

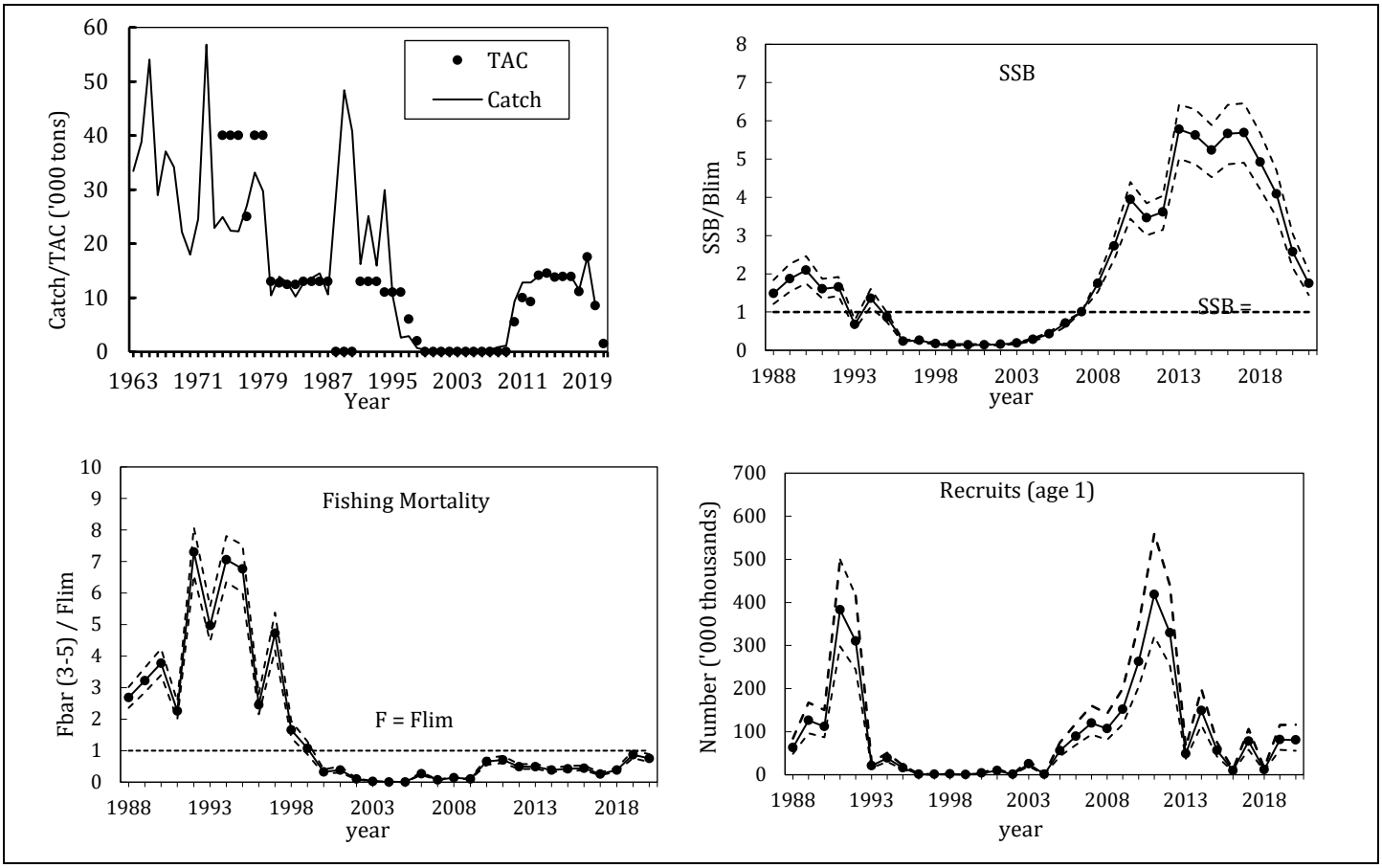
🟢 OK
🟡 Intermediate
🔴 Not accomplished
⚪ Unknown

Management unit

The cod stock in Flemish Cap (NAFO Div. 3M) is considered to be a separate population.

Stock status

SSB has been declining rapidly since 2017 but is still estimated to be above B_{lim} (median 15 408 t). This decline is expected to continue in the next couple of years due to poor recruitment between 2015 and 2018. Fishing mortality has remained below F_{lim} (median 0.196) since the fishery reopened in 2010. However, in 2019 and 2020 it increased substantially and is now close to F_{lim}.



Reference points

$B_{lim} = SSB_{2007}$:	Median = 15 408 tonnes of spawning biomass (Scientific Council, 2021).
$F_{lim} = F_{30\%SPR}$:	Median = 0.196 (Scientific Council, 2021).

Projections

Although advice is given only for 2022, projection results are shown to 2024 to illustrate the medium-term implications. F_{bar} is the mean of the F at ages 3-5 and used as the indicator of overall fishing mortality; F_{sq} is the status quo F, calculated as the mean of the last three years F_{bar} (2018-2020).

Table 1.

	B		SSB		Yield
	Median and 80% CI				
F_{bar} = Fsq (median = 0.131)					
2021	45787	(40635 - 51559)	27058	(23458 - 31446)	1500
2022	42969	(37884 - 48389)	24420	(21335 - 27970)	6525
2023	34733	(29703 - 40345)	18598	(15605 - 21773)	5291
2024	29999	(24718 - 36318)	19822	(16344 - 23723)	
F_{bar} = 0					
2021	45787	(40635 - 51559)	27058	(23458 - 31446)	1500
2022	42969	(37884 - 48389)	24420	(21335 - 27970)	0
2023	41143	(36076 - 46765)	24071	(21037 - 27322)	0
2024	42102	(36620 - 48376)	30514	(27027 - 34628)	
F_{bar} = 3/4F_{lim} (median = 0.147)					
2021	45787	(40635 - 51559)	27058	(23458 - 31446)	1500
2022	42969	(37884 - 48389)	24420	(21335 - 27970)	7160
2023	34111	(29091 - 39726)	18092	(15086 - 21246)	5694
2024	28966	(23642 - 35277)	18923	(15516 - 22770)	
F_{bar} = 1/2F_{lim} (median = 0.098)					
2021	45787	(40635 - 51559)	27058	(23458 - 31446)	1500
2022	42969	(37884 - 48389)	24420	(21335 - 27970)	5000
2023	36238	(31192 - 41834)	19854	(16887 - 23067)	4254
2024	32578	(27213 - 38900)	22092	(18612 - 25996)	
Catch = 1500 tons					
2021	45787	(40635 - 51559)	27058	(23458 - 31446)	1500
2022	42969	(37884 - 48389)	24420	(21335 - 27970)	1500
2023	39661	(34603 - 45288)	22807	(19826 - 26087)	1500
2024	38994	(33591 - 45246)	27691	(24211 - 31752)	
Catch = 1875 tons					
2021	45787	(40635 - 51559)	27058	(23458 - 31446)	1500
2022	42969	(37884 - 48389)	24420	(21335 - 27970)	1875
2023	39291	(34238 - 44913)	22482	(19454 - 25735)	1875
2024	38216	(32795 - 44488)	27028	(23511 - 31085)	
Catch = 2250 tons					
2021	45787	(40635 - 51559)	27058	(23458 - 31446)	1500
2022	42969	(37884 - 48389)	24420	(21335 - 27970)	2250
2023	38923	(33871 - 44544)	22151	(19150 - 25412)	2250
2024	37438	(32028 - 43736)	26354	(22862 - 30373)	
Catch = 3000 tons					
2021	45787	(40635 - 51559)	27058	(23458 - 31446)	1500
2022	42969	(37884 - 48389)	24420	(21335 - 27970)	3000
2023	38196	(33139 - 43808)	21520	(18528 - 24739)	3000
2024	35865	(30453 - 42155)	24986	(21477 - 28888)	

Table 2.

	Yield			P(SSB < B_{lim})				P(F_{bar} > F_{lim})			
	2021	2022	2023	2021	2022	2023	2024	2021	2022	2023	P(SSB_{24} > SSB_{21})
$F_{bar} = F_{sq} = 0.131$	1500	6525	5291	<1%	<1%	13%	8%	<1%	<1%	<1%	1%
$F_{bar} = 0$	1500	0	0	<1%	<1%	<1%	<1%	<1%	<1%	<1%	90%
$F_{bar} = 3/4F_{lim} = 0.147$	1500	7160	5694	<1%	<1%	17%	13%	<1%	1%	2%	<1%
$F_{bar} = 1/2F_{lim} = 0.098$	1500	5000	4254	<1%	<1%	5%	1%	<1%	<1%	<1%	4%
Catch = 1500 tons	1500	1500	1500	<1%	<1%	1%	<1%	<1%	<1%	<1%	58%
Catch = 1875 tons	1500	1875	1875	<1%	<1%	1%	<1%	<1%	<1%	<1%	48%
Catch = 2250 tons	1500	2250	2250	<1%	<1%	1%	<1%	<1%	<1%	<1%	36%
Catch = 3000 tons	1500	3000	3000	<1%	<1%	2%	<1%	<1%	<1%	<1%	20%

The results indicate that under all scenarios with F_{bar}>0, total biomass during the projected years will decrease, whereas the SSB is projected to increase slightly in 2024 (Table 1). The probability of SSB being below B_{lim} in 2023 is high (≥13%) in the scenarios with $F_{bar}=F_{sq}$ and $F_{bar}=3/4F_{lim}$, while being very low (≤10%) in the rest of the cases (Table 2). The probability of SSB in 2024 being above that in 2021 ranges between <1% and 90%, depending on the scenario.

Under all scenarios, the probability of F_{bar} exceeding F_{lim} is less than or equal to 2% in 2022 and 2023.

SC notes that projected values of risk, in particular more than one year ahead (Table 2), will be inherently more uncertain than the projected median stock sizes (Table 1). The risks are typically derived from the tails of a probability distribution which are less precisely estimated compared to the median (centre) of the same distribution.

Assessment

A Bayesian SCAA model, introduced at the 2018 benchmark, was used as the basis for the assessment of this stock with data from 1988 to 2020.

The next full assessment for this stock will be in 2022.

Human impact

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

Biological and environmental interactions

Redfish, shrimp and smaller cod are important prey items for cod. Recent studies indicate strong trophic interactions between these species in the Flemish Cap.

Fishery

Cod is caught in directed trawl and longline fisheries and as bycatch in the directed redfish fishery by trawlers. The fishery is regulated by quota. New technical regulations were introduced in 2021, in particular a closure of the directed fishery in the first quarter as well as sorting grids to protect juveniles.

Recent catch estimates and TACs ('000 tonnes) are as follows:

,000 tons	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
TAC	5.5	10.0	9.3	14.1	14.5	13.8	13.9	13.9	11.1	17.5	8.5	1.5
STATLANT 21	5.2	10.0	9.1	13.5	14.4	12.8	13.8	13.9	10.5	13.0	8.5	
STACFIS	9.3	12.8	12.8	14.0	14.3	13.8	14.0	13.9	11.5	17.5	8.5	

Effects of the fishery on the ecosystem

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

Special comment

The stock continues to decline and is expected to be at very low levels during the next few years.

Sources of information

SCS Doc. 21/05, 21/10, 21/13 and SCR Doc. 21/05, 21/17.