Cod in Division 3M Advice June 2018 for 2019

Recommendation for 2019

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 expected over the medium term under any option.

For 2019, SC recommends a catch of no more than 20 796 t (yield at ¾ F_{lim}).

Catches above ¾ F_{lim} increase the risk of being below B_{lim} in the medium term.

Management objectives

A management strategy evaluation process has been initiated for this stock by Commission and Scientific Council but is not yet been finalized. At this moment general convention objectives (NAFO/GC Doc 08/3) are applied.

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

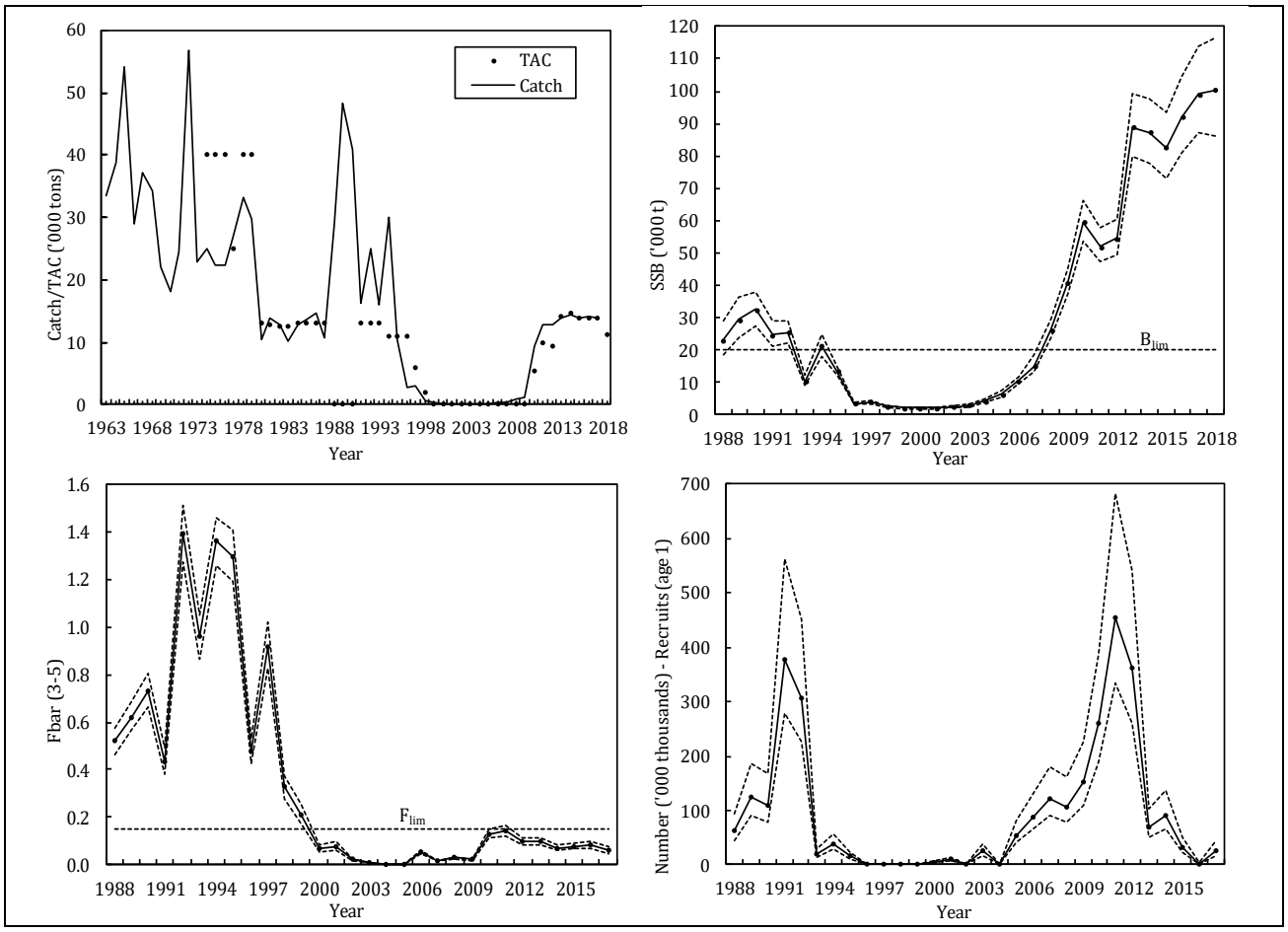
🟢 OK
🟡 Intermediate
🔴 Not accomplished
⚪ Unknown

Management unit

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

Stock status

Current SSB is estimated to be well above B_{lim}. However, since 2015 recruitment has been very low. F increased in 2010 with the re-opening of the fishery although it has remained below F_{lim} (0.153) since 2000.



Reference points

B_{lim}: 20 000 t of spawning biomass (Scientific Council, 2018).

$F_{lim} = F_{30\%SPR}$: 0.153 (Scientific Council, 2018)

Projections

	B		SSB		Yield
	Median and 90% CI				
$F_{bar}=F_{lim}$ (median=0.15)					
2018	108705	(94014 - 125180)	100343	(86263- 116383)	11145
2019	95351	(80800 - 111466)	90123	(76337 - 106201)	26502
2020	51428	(40481 - 64418)	47805	(37198 - 60396)	14260
2021	29467	(20160 - 40273)	26392	(17815 - 36684)	
$F_{bar}=3/4F_{lim}$ (median=0.12)					
2018	108705	(94014 - 125180)	100343	(86263- 116383)	11145
2019	95351	(80800 - 111466)	90123	(76337 - 106201)	20796
2020	56533	(45623 - 69596)	52867	(42341 - 65526)	12359
2021	35407	(26166 - 46024)	32204	(23660 - 42420)	
$F_{bar}=F_{2015-2017}$ (median=0.07)					
2018	108705	(94014 - 125180)	100343	(86263- 116383)	11145
2019	95351	(80800 - 111466)	90123	(76337 - 106201)	13863
2020	62796	(51855 - 75854)	59056	(48509 - 71796)	9191
2021	43374	(34048 - 54034)	39963	(31485 - 50314)	

	Yield			$P(B < B_{lim})$				$P(F > F_{lim})$			
	2018	2019	2020	2018	2019	2020	2021	2018	2019	2020	$P(B_{21} > B_{18})$
$F_{lim} = 0.15$	11145	26502	14260	<1%	<1%	<1%	13%	<1%	50%	50%	<1%
$3/4F_{lim} = 0.12$	11145	20796	12359	<1%	<1%	<1%	1%	<1%	1%	5%	<1%
$F_{2015-2017} = 0.07$	11145	13863	9191	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%

Although advice is given only for 2019, projection results are shown to 2021 to illustrate the medium term implications.

The results indicate that under all scenarios total biomass and SSB during the projected years will decrease sharply. The probability of SSB being below B_{lim} in 2020 is very low (<1%) in all cases. For both $F_{2015-2017}$ and ¾ F_{lim}, the probability of SSB being below B_{lim} in 2021 is very low (≤1%). However, the probability of being below B_{lim} is 13% if $F = F_{lim}$. The probability of SSB in 2020 or 2021 being above that in 2018 is <1%

Under 3/4 F_{lim} and $F_{2015-2017}$, the probability of F exceeding F_{lim} is less than or equal to 5%.

Under all scenarios, the projected Yield increases in 2019, but decreases again for 2020.

Assessment
A new Bayesian SCAA model was used as the basis for the assessment of this stock for the first time. This model was approved during the 2018 3M cod benchmark. As a result of poor reliability of catch data prior to 1988, the assessment was conducted from 1988 to 2017.

The results of the Bayesian SCAA model have changed the perception of recent stock size compared to previous assessments. The level of M is higher than that in previous assessments; this may result in higher changes in stock abundance estimates from year to year and also in projections. Higher stock abundance is derived from the Bayesian SCAA, especially since 2010, which implies a higher level of SSB and a lower level of F. Recruitment is estimated at very low levels over the last years, which implies that the SSB is projected to decrease in the near future.

Timing of the next full assessment of this stock will be subject to the timelines of the ongoing MSE process.

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.

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

,000 tons	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
TAC	ndf	5.5	10.0	9.3	14.1	14.5	13.8	13.9	13.9	11.1
STATLANT 21	1.2	5.2	10.0	9.1	13.5	14.4	12.8	13.8	13.9	
STACFIS	1.2	9.3	12.8	12.8	14.0	14.3	13.8	14.0	13.9	

ndf – no directed fishing

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, seapens and coral.

Sources of information
SCS Doc. 18/05, 18/07, 18/08, 18/09, 18/13, 18/14, 18/18; SCR Doc. 95/73, 18/08, 18/38; and NAFO/GC Doc 08/3.