Yellowtail flounder in Divisions 3LNO Advice June 2021 for 2022 - 2024

Recommendation for 2022 to 2024
Scientific Council advises that fishing mortality up to 85% F_{msy}, corresponding to catches of 22 100 t, 20 800 t, and 19 900 t in 2022 to 2024 respectively, have risk of no more than 30% of exceeding F_{lim}, and are projected to maintain the stock above B_{msy}.

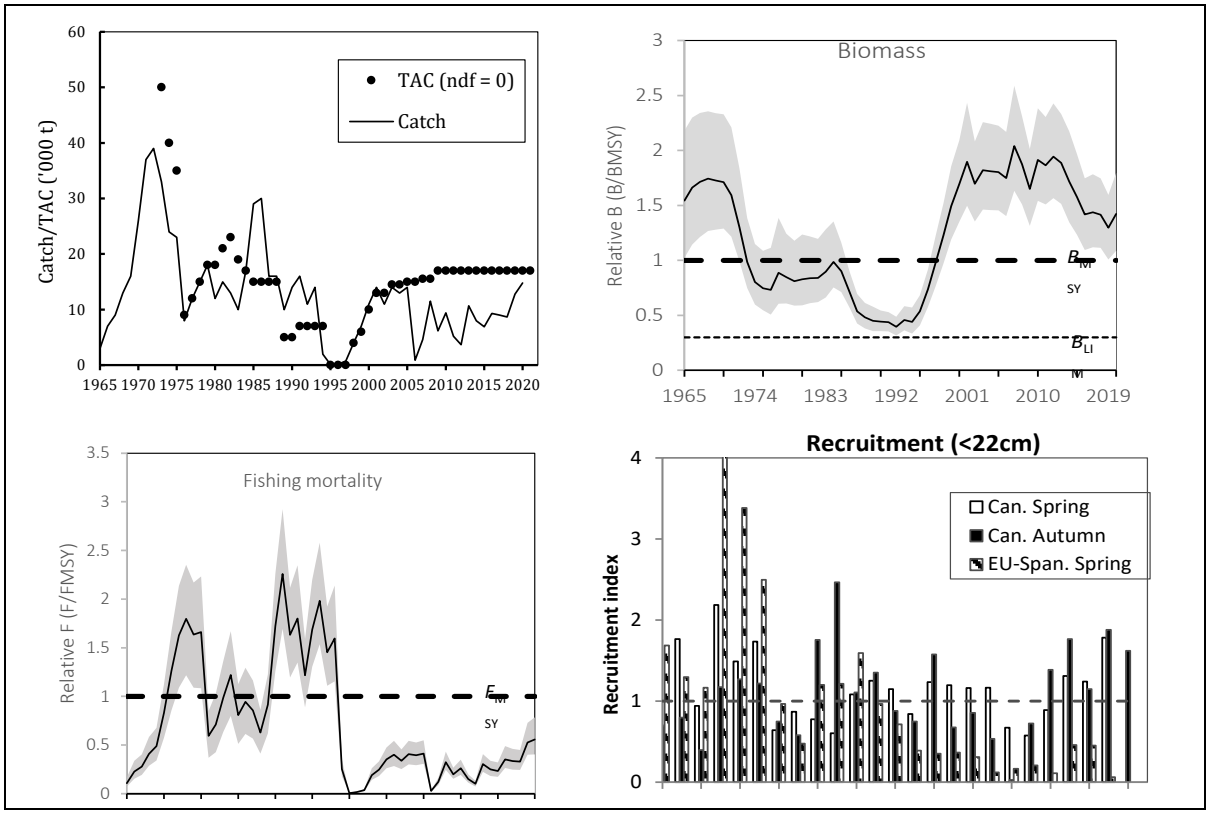
Management objectives
No explicit management plan or management objectives are defined by the Commission. Convention General Principles are applied.

Convention objectives	*Status*	*Comment/consideration*
Restore to or maintain at B_{msy}	🟢	B> B_{msy}
Eliminate overfishing	🟢	$F < F_{lim}$
Apply Precautionary Approach	🟢	Stock in safe zone of PA framework
Minimise harmful impacts on living marine resources and ecosystems	🟡	Bycatch regulations in place for moratorium stocks, general VME closures in effect
Preserve marine biodiversity	⚪	Cannot be evaluated

🟢 OK
🟡 Intermediate
🔴 Not accomplished
⚪ Unknown

Management unit
The management unit is NAFO Divisions 3LNO. The stock is mainly concentrated on the southern Grand Bank and is recruited from the Southeast Shoal area nursery ground.

Stock status
The stock biomass increased from 1994 to 2001, after which it remained stable until 2014. Biomass subsequently declined from ~2 times B_{msy} and is currently 1.4 times B_{msy} (B_{msy} = 89 790 tons). There is very low risk of the stock being below B_{msy} or F being above F_{msy}. Recent recruitment appears to be higher than average.



Reference points

B_{lim} is 30% B_{msy} and F_{lim} is F_{msy} (STACFIS 2004 p 133).

Projections

Medium-term projections were carried forward to the year 2025 with catch in 2021 assumed to be the TAC=17 000 t. Constant fishing mortality was applied from 2022-2025 at several levels of F (F=0, $F_{status\ quo}$, 2/3 F_{msy}, 85% F_{msy} and F_{msy}).

F_{msy} was estimated to be 0.21. Fishing at F_{msy} would first lead to a considerable yield in 2022, but yields are then projected to decline in the medium term with catch at 2/3 F_{msy}, 85% F_{msy} and F_{msy}. At the end of the projection period, the risk of biomass being below B_{lim} is less than 1% in all cases.

For the $F_{\text{status quo}}$ projections, probability that $F > F_{lim}=F_{msy}$ in 2022-2025 was less than 0.04 in the medium term. At 2/3 F_{msy}, the probability that F > F_{lim} was between 0.08 and 0.11 in the medium term. Projected at the level of 85% F_{lim}, the probability that F > F_{lim} ranges between 0.27 and 0.30 and for F_{msy} projections, this probability increased to 0.50. For biomass projections, in all scenarios for 2022-2025, the probability of biomass being below B_{lim} was less than 0.01. The probability that biomass in 2025 is greater than B_{2021} is 0.48, 0.41, 0.32 and 0.26 for projections of $F_{status\ quo}$, 2/3 F_{msy}, 85% F_{msy}, and F_{msy} respectively.

Projections with $Catch_{2021}$= TAC=17 000 t		
Year	Yield ('000t) median	Projected Relative Biomass(B/B_{msy}) median (90% CL)
F=0		
2022	0.00	1.39 (0.92, 1.97)
2023	0.00	1.56 (1.03, 2.18)
2024	0.00	1.69 (1.13, 2.32)
2025		1.78 (1.22, 2.41)
$F_{status\ quo}$ = 0.112		
2022	13.99	1.39 (0.92, 1.97)
2023	14.06	1.4 (0.91, 2)
2024	14.12	1.41 (0.89, 2.01)
2025		1.42 (0.88, 2.02)
2/3 F_{MSY} = 0.139		
2022	17.36	1.39 (0.92, 1.97)
2023	16.98	1.37 (0.87, 1.96)
2024	16.73	1.35 (0.83, 1.94)
2025		1.33 (0.8, 1.94)
85% F_{MSY} =0.177		
2022	22.11	1.39 (0.92, 1.97)
2023	20.77	1.31 (0.83, 1.9)
2024	19.92	1.26 (0.75, 1.85)
2025		1.22 (0.69, 1.83)
F_{MSY} =0.21		
2022	26.05	1.39 (0.92, 1.97)
2023	23.70	1.27 (0.79, 1.85)
2024	22.20	1.19 (0.68, 1.78)
2025		1.13 (0.59, 1.75)

	Yield ('000t)			$P(F>F_{lim})$				$P(B<B_{lim})$				$P(B<B_{MSY})$				
$Catch_{2021}$=17 000t	2022	2023	2024	2022	2023	2024	2025	2022	2023	2024	2025	2022	2023	2024	2025	$P(B_{2025}>B_{2021})$
F=0	0.00	0.00	0.00	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	9%	4%	2%	1%	82%
$F_{status\ quo}$ = 0.112	13.99	14.06	14.12	2%	3%	3%	4%	<1%	<1%	<1%	<1%	9%	9%	10%	10%	48%
2/3 F_{MSY} = 0.139	17.36	16.98	16.73	8%	9%	10%	11%	<1%	<1%	<1%	<1%	9%	11%	13%	15%	41%
85% F_{MSY} =0.177	22.11	20.77	19.92	27%	28%	29%	30%	<1%	<1%	<1%	<1%	9%	14%	20%	24%	32%
F_{MSY}=0.209	26.05	23.70	22.20	50%	50%	50%	50%	<1%	<1%	<1%	<1%	9%	18%	27%	34%	26%

Assessment

A Schaefer surplus production model in a Bayesian framework was used for the assessment of this stock. The results were comparable to the previous assessment. Input data comes from research surveys and the fishery. Next assessment: 2024.

Human impact
Mainly fishery related mortality has been documented. Other sources (e.g., pollution, shipping, oil-industry) are undocumented.

Biology and Environmental interactions
As stock size increased from the low level in the mid-90s, the stock expanded northward and continues to occupy this wider distribution. This expansion of the stock coincided with warmer temperatures.

Despite the increase in stock size observed since the mid-90s, the average length at which 50% of fish are mature has been lower for both males and females in the recent period. There also seems to have been a slight downward trend in weight at length since 1996. The cause of these changes is unknown.

The Grand Bank (3LNO) Ecosystem Production Unit (EPU) is currently experiencing low productivity conditions and biomass has declined across multiple trophic levels and stocks since 2014.

Fishery
Yellowtail flounder is caught in a directed trawl fishery and as bycatch in other trawl fisheries. The fishery is regulated by quota and minimum size restrictions. Catches in several years were low due to industry-related factors, but in recent years catches have increased and in 2019 and 2020 were 75% and 87% of the TAC respectively. American plaice and cod are taken as bycatch in the yellowtail fishery. There is a 15% bycatch restriction on American plaice and a 4% limit on cod.

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

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
TAC	17	17	17	17	17	17	17	17	17	17
STATLANT 21	3.1	10.7	8.0	6.7	8.3	9.2	8.6	12.3	14.0	
STACFIS	3.1	10.7	8.0	6.9	9.3	9.2	8.7	12.8	14.8	

Effects of the fishery on the ecosystem
Fishing intensity on yellowtail flounder has impacts on Div. 3NO cod and Div. 3LNO American plaice through bycatch. General impacts of fishing gears on the ecosystem should also be considered. Areas within Divs. 3LNO have been closed to protect sponge and coral.

Special comments
Management of yellowtail flounder should take into consideration impacts on other stocks. Bycatch in the yellowtail flounder fishery may be impeding recovery of Div. 3NO cod and American plaice in Div. 3LNO, which have both been below B_{lim} for many years and are currently experiencing reduced productivity conditions. Measures to reduce bycatch of American plaice in the yellowtail flounder fishery in particular, which currently has a 15% limit, could reduce the impact of fishing on the recovery of that stock. Such measures could include maintaining or reducing the yellowtail flounder TAC, reducing the bycatch limit, or seasonal closures in areas of high bycatch, in order to protect stocks in the collapsed zone.

Sources of information
SCR 20/09, 04, 21/18, 19; SCS 21/05, 06, 09, 13; NAFO/GC Doc 08/3 NAFO/FC 04/18