

Turbot (*Scophthalmus maximus*) in Subarea 4 (North Sea)

ICES advice on fishing opportunities

In the context of the EU multiannual plan for demersal fisheries in the North Sea, in which this stock is considered bycatch, the EC has requested that ICES provide advice based on the precautionary approach. ICES advises that catches of up to 4538 tonnes are considered to be precautionary.

ICES advises that turbot should be managed using a single-species TAC covering an area appropriate to the relevant stock distribution (ICES Subarea 4).

Stock development over time

Recruitment (R) is variable without a trend. Fishing mortality (F) has decreased since the mid-1990s, and has been just below F_{MSY} since 2012. The spawning-stock biomass (SSB) has increased since 2005 and has been above $MSY B_{trigger}$ since 2013.

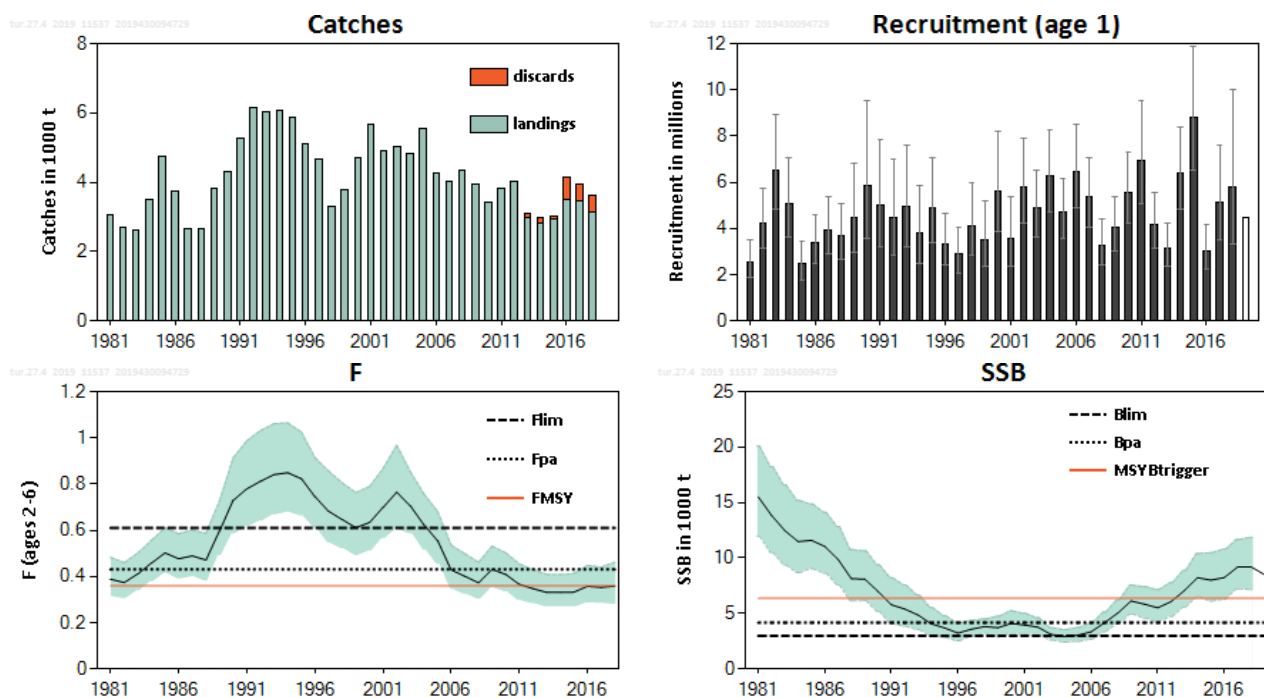


Figure 1 Turbot in Subarea 4. Summary of the stock assessment (weights in thousand tonnes). Catches only represent landings up to 2012. Shaded areas represent 95% confidence intervals. Assumed recruitment is unshaded.

Stock and exploitation status

ICES assesses that fishing pressure on the stock is below F_{MSY} , F_{pa} , and F_{lim} ; spawning stock size is above $MSY B_{trigger}$, B_{pa} , and B_{lim} .

Table 1 Turbot in Subarea 4. State of the stock and fishery relative to reference points.

	Fishing pressure			Stock size				
	2016	2017	2018	2017	2018	2019		
Maximum sustainable yield	F_{MSY}	✓	✓	✓	Below			
Precautionary approach	F_{pa}, F_{lim}	✓	✓	✓	Harvested sustainably			
Management plan	F_{MGT}	—	—	—				
				$MSY B_{trigger}$	✓	✓	✓	Above trigger
				B_{pa}, B_{lim}	✓	✓	✓	Full reproductive capacity
				B_{MGT}	—	—	—	

Catch options

Table 2 Turbot in Subarea 4. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
F (wanted catch, ages 2–6) (2019)	0.36	F_{sq} = average of F (wanted catch, ages 2–6) (2016–2018).
SSB (2020)	8 559	Short-term forecast; in tonnes.
$R_{age\ 1}$ (2019, 2020)	4 492	Geometric mean (GM, 1981–2018); in thousands.
Wanted catch (2019)	3 147	Short-term forecast, assuming an F at <i>status quo</i> (F_{sq}); in tonnes.

Table 3 Turbot in Subarea 4. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch * (2020)	Wanted catch ** (2020)	Unwanted catch ** (2020)	F (wanted catches, ages 2–6) (2020)	SSB (2021)	% SSB change ***	% Advice change ^
ICES advice basis							
Precautionary approach: F_{pa}	4538	3902	635	0.47	7753	-9.4	-8.4
Other scenarios							
MSY approach: F_{MSY}	3649	3138	511	0.36	8575	0.185	-26
$F_{MSY\ upper} = 0.48$	4614	3968	646	0.48	7683	-10.2	-6.8
$F_{MSY\ lower} = 0.25$	2664	2291	373	0.25	9495	10.9	-46
$F = 0$	0	0	0	0	12019	40	-100
F_{pa}	4538	3902	635	0.47	7753	-9.4	-8.4
F_{lim}	5545	4768	777	0.61	6830	-20	12
F_{sq}	3617	3111	507	0.36	8605	0.53	-27
$SSB(2021) = B_{lim}$	9945	8552	1393	1.58	2974	-65	101
$SSB(2021) = B_{pa}$	8542	7346	1196	1.18	4163	-51	73
$SSB(2021) = MSY\ B_{trigger}$	6071	5220	850	0.69	6353	-26	23
Roll-over advice	4952	4258	694	0.53	7372	-13.9	0

* (Wanted catch) / (1 – average discard rate); average discard rate 2016–2018 = 14.0%.

** “Wanted” and “unwanted” catch are used to describe fish that would be landed and discarded in the absence of the EU landing obligation, based on average discard rate estimates for 2016–2018 (14.0%); unwanted catch = (wanted catch) × (average discard rate) / (1 – average discard rate).

*** SSB 2021 relative to SSB 2020.

^ Total catch in 2020 relative to advice value for 2018 and 2019 (4952 tonnes).

The decrease in advice (-8.4%) is due to a changed perception of the stock following an interbenchmark, during which the advice basis for turbot in 27.4 changed from category 3 to category 1 (ICES, 2018a, 2018b).

Basis of the advice

Table 4 Turbot in Subarea 4. The basis of the advice.

Advice basis	Precautionary approach.
Management plan	The EU Multiannual Plan for the North Sea (EU, 2018) takes bycatch of this species into account.
	The EC has requested that ICES provide advice based on the precautionary approach.

Quality of the assessment

Turbot in Subarea 4 was interbenchmarked in 2017 and 2018 (ICES, 2018a, 2018b), changing the perception of stock status and trends compared with previous advice.

The age composition of the Dutch landings is available for most of the years, being derived almost entirely from the Dutch beam trawl fishery. This creates uncertainty in the assessment, because a large proportion (~33%) of the catch comes from other gears. Danish age-structured data are available from 2014, suggesting a higher average age of turbot in the Danish landings compared to the Dutch beam trawl fishery.

The two age-structured index time-series of fisheries-independent surveys (BTS-ISIS and SNS) used in the assessment show a poor internal consistency, especially for older ages, leading to a poor tracking of cohorts over time. A fisheries-independent survey, having both adequate catchability of large flatfish and covering the entire distribution area of the stock, is needed to improve the assessment. To address this issue in future assessments, a Dutch science–industry partnership initiated a new fisheries-independent beam trawl survey for turbot and brill in 2019.

An age-aggregated landing per unit of effort index has been available since 1995 and is derived from landings and effort data for the Dutch beam trawl fleet. This index has the most weight in estimating the final biomass and strongly influences the trend in the assessment. Measures taken by the Dutch Producers Organization in response to quota limitation may have biased this index.

Discards are not included in the current assessment but are used to provide advice.

Issues relevant for the advice

The basis for the advice this year is the precautionary approach, as requested by the European Commission.

The precautionary advice for this stock is based on a constant fishing mortality that has a low probability of bringing SSB below B_{lim} in the long term ($F_{P.05} = 0.47$; see ICES, 2018c). This would imply an increase in F compared to current levels, and is also well above F_{MSY} (0.36)..

ICES was requested to evaluate the role of TAC in the fisheries management of turbot and brill in the North Sea (ICES, 2018d). ICES concluded that fisheries on turbot and brill should be managed using single-species TACs that cover an area appropriate to the relevant stock distribution (for turbot this is ICES Subarea 4). Additionally, management of these stocks under a combined species TAC may hinder effective management of the exploitation rates of the individual species and could lead to the overexploitation of either species.

Since 1 January 2019, turbot in Subarea 4 is under the EU landing obligation, without exemptions. Discarding for this stock has historically been very limited; however, there are now indications that in the past years discarding has increased, partly as a result of Producer Organization (PO) measures (including a minimum landing size) which aim to prevent early exhaustion of the landing quota. Furthermore, the estimated discard rates have remained high in 2017 and 2018 compared to earlier years, in spite of PO measures being relaxed from 2017 onwards.

Currently, the catches consist predominantly of immature fish, which is having a negative impact on the potential yield from the stock. As turbot is a fast-growing species, reduction in the exploitation on younger ages would lead to an increase in maximum sustainable yield.

Reference points

Table 5 Turbot in Subarea 4. Reference points, values, and their technical basis. All weights are in tonnes.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	6353	Fifth percentile of the SSB at MSY.	ICES (2018b)
	F_{MSY}	0.36	EQsim analysis based on the recruitment period 1981–2017.	ICES (2018b)
Precautionary approach	B_{lim}	2974	B_{lim} was set to B_{loss} .	ICES (2018b)
	B_{pa}	4163	$B_{lim} \times \exp(1.645 \times 0.2) \approx 1.4 \times B_{lim}$.	ICES (2018b)
	F_{lim}	0.61	EQsim analysis based on the recruitment period 1981–2017.	ICES (2018b)
	F_{pa}	0.47	$F_{P.05}$ without ICES advice rule.	ICES (2019)
Management plan	SSB _{mgt}	Not defined		
	F_{mgt}	Not defined		

Basis of the assessment

Table 6 Turbot in Subarea 4. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2018c).
Assessment type	Age-based analytical assessment (SAM; ICES, 2018b) that uses landings in the model and in the forecast.
Input data	Commercial landings raised to international landings, two survey indices (SNS, BTS-Isis), one standardized commercial biomass index (NL_BT2). Assumed constant annual maturity ogive (over years) and natural mortality (over ages and years).
Discards and bycatch	Discard data are not included in the assessment, but are used to provide catch advice. The discard rate was 14% (average of 2016–2018). 69% of the landings include discard information in 2018, and 4% of the discards were sampled for age.
Indicators	None.
Other information	An interbenchmark procedure was conducted for this stock in July 2018, changing the perception of the stock and upgrading the stock to a category 1 assessment (ICES, 2018b).
Working group	Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK)

Information from stakeholders

The Dutch demersal fishing industry provided information on national producer organization (PO) measures that are meant to prevent early exhaustion of the combined TAC for turbot and brill. These measures included the introduction in 2013 of a minimum landing size for turbot and brill of 27 cm; this was increased in 2016, first to 30 cm and then to 32 cm. Furthermore, the measures include an overall cap on landings per trip. Information on the market categories in the landings suggest that the smaller market categories are increasingly absent from the landings (2016 and 2017), while these smaller market categories were landed by flag vessels that were not under the Dutch PO measures. However, following the increase in catch advice in 2018–2019, PO measures were relaxed.

History of the advice, catch, and management

Table 7 Turbot in Subarea 4. ICES advice and official landings. All weights are in tonnes.

Year	ICES advice	Catch corresp. to advice	Agreed TAC* in 4 and 2.a turbot & brill	Official landings in 4 and 2.a turbot & brill	Official landings in 4 turbot	ICES estimated landings turbot	ICES estimated discards	ICES total
2000		-	9000	5534	4026			
2001		-	9000	5674	4101			
2002		-	6750	5052	3750			
2003		-	5738	4721	3375			
2004		-	4877	4568	3319			
2005		-	4550	4355	3195			
2006		-	4323	4152	2977			
2007		-	4323	4750	3510			
2008		-	5263	4011	3007			
2009		-	5263	4253	3091			
2010		-	5263	4192	2692			
2011		-	4642	4304	2807			
2012	No increase in catches	-	4642	4426	2914			
2013	No new advice, same as for 2012	-	4642	4474	3084	2982	97	3079
2014	Apply F_{MSY} proxy for data-limited stocks	< 2978	4642	4128	2871	2834	158	2992
2015	ICES DLS approach (max. –20%)	< 2406	4642	4677	2978	2922	112	3034
2016	Precautionary approach (decrease catches by 20%)	< 1995	4488	4953	3421	3493	666	4159
2017	Precautionary approach	< 4952	5924	5106	3641	3441	496	3937

Year	ICES advice	Catch corresp. to advice	Agreed TAC* in 4 and 2.a turbot & brill	Official landings in 4 and 2.a turbot & brill	Official landings in 4 turbot	ICES estimated landings turbot	ICES estimated discards	ICES total
2018	Precautionary approach	< 4952	7102	4337**, ^	3168**, ^	3140	486	3626
2019	Precautionary approach	< 4952	8122					
2020	Precautionary approach	< 4538						

* EU combined TAC for turbot and brill in EU waters of Division 2.a and Subarea 4.

** Preliminary.

^ Including below minimum size (BMS) landings.

History of the catch and landings

Table 8 Turbot in Subarea 4. Catch distribution by fleet in 2018 as estimated by ICES.

Catch (2018)	Landings			Discards
3626 tonnes	Beam trawls 67%	Bottom trawls 25%	Other gears 8%	486 tonnes
	3140 tonnes			

Table 9 Turbot in Subarea 4. History of commercial landings; the official estimated values by country. All weights are in tonnes.

Year	Netherlands	UK	Denmark	Belgium	France	Germany	Norway	Other**	Total
1975	3349	503	387	159	21	169	0	1	4589
1976	3253	632	588	147	38	157	0	2	4816
1977	2973	683	474	146	38	173	0	1	4486
1978	3196	752	693	170	51	174	0	1	5036
1979	3999	838	1164	187	22	152	0	3	6365
1980	3241	559	1360	163	17	146	0	1	5486
1981	3073	404	1044	142	6	87	0	1	4756
1982	3029	335	880	153	14	43	0	1	4454
1983	3163	277	893	174	24	44	0	1	4576
1984	3800*	282	886	242	40	46	0	1	5297
1985	4600*	312	983	222	37	34	0	1	6188
1986	3810*	287	997	134	5	32	0	1	5264
1987	2760*	345	988	130	21	28	0	1	4272
1988	2660	328	858	129	24	42	0	1	4042
1989	3666	333	637	176	30	85	0	1	4927
1990	3732	437	1046	292	52	185	0	7	5751
1991	3780	688	1233	350	64	186	30	9	6340
1992	3495	902	907	317	81	163	66	3	5934
1993	2939	1013	818	355	123	252	47	1	5547
1994	2724	882	862	330	141	263	42	1	5244
1995	2476	703	761	315	108	276	33	1	4672
1996	1776	687	618	210	160	157	36	1	3644
1997	1854	619	479	169	1	215	45	1	3382
1998	1695	582	392	198	22	164	33	1	3087
1999	1808	488	411	224	0	224	32	1	3187
2000	2280	549	469	302	21	349	55	1	4026
2001	2226	642	506	333	17	297	79	1	4101
2002	1898	551	677	244	15	280	85	1	3750
2003	1893	431	486	193	18	289	65	1	3375
2004	1762	463	518	207	15	278	75	1	3319
2005	1903	347	429	159	18	274	65	1	3195
2006	1828	381	338	146	22	221	40	1	2977
2007	2263	485	310	173	33	203	43	1	3510
2008	1744	371	457	182	22	199	33	1	3007
2009	1698	422	548	172	24	197	30	1	3091

Year	Netherlands	UK	Denmark	Belgium	France	Germany	Norway	Other**	Total
2010	1469	385	466	118	37	191	26	1	2692
2011	1540	396	548	122	29	144	28	1	2807
2012	1739	362	482	145	30	120	36	1	2914
2013	1765	374	498	159	40	219	29	1	3084
2014	1540	389	452	175	42	197	38	1	2834
2015	1739	336	392	215	46	236	10	4	2978
2016	1854	404	505	339	38	273	8	1	3421
2017	2118	397	486	336	40	252	13	1	3641
2018 [^]	1855 ^{^^}	367	331	268 ^{^^}	27	304	15	1	3168

* No official landings are available for the Netherlands between 1984 and 1987. Values are inserted from the IBPNew report (ICES, 2012).

** "Other" includes Sweden and, in early years, Ireland and the Faroe Islands.

[^] Preliminary.

^{^^} Including BMS landings.

Summary of the assessment

Table 10 Turbot in Subarea 4. Assessment summary. Weights are in tonnes. High and low values indicate the 95% confidence intervals.

Year	Recruitment			SSB			Landings	Discards	F (per year)		
	Age 1	High	Low	SSB	High	Low			Ages 2-6	High	Low
	thousands			tonnes							
1981	2558	3531	1854	15508	20091	11971	3074		0.39	0.48	0.31
1982	4233	5721	3133	13841	18228	10509	2705		0.37	0.46	0.30
1983	6540	8914	4799	12461	16567	9372	2619		0.41	0.50	0.34
1984	5053	7041	3626	11478	15188	8675	3514		0.46	0.56	0.38
1985	2457	3421	1765	11592	14858	9043	4749		0.50	0.61	0.41
1986	3385	4572	2507	11040	14115	8635	3730		0.48	0.58	0.39
1987	3950	5349	2917	9862	12835	7578	2670		0.49	0.60	0.40
1988	3678	5046	2681	8126	10745	6145	2659		0.47	0.59	0.38
1989	4476	6821	2937	8101	10640	6167	3825		0.60	0.73	0.49
1990	5841	9504	3590	6982	9385	5194	4282		0.73	0.91	0.58
1991	5020	7868	3203	5785	8218	4073	5279		0.78	0.99	0.61
1992	4467	7011	2846	5400	7571	3852	6149		0.81	1.03	0.64
1993	4951	7606	3222	4858	6665	3541	6027		0.84	1.06	0.67
1994	3809	5822	2491	4064	5526	2988	6081		0.85	1.06	0.68
1995	4894	7078	3384	3687	4780	2844	5867		0.82	1.03	0.66
1996	3339	4622	2412	3238	4142	2531	5118		0.75	0.91	0.61
1997	2873	4033	2047	3573	4369	2922	4667		0.68	0.86	0.54
1998	4123	5959	2853	3814	4502	3230	3305		0.65	0.80	0.52
1999	3487	5163	2355	3711	4751	2898	3764		0.61	0.76	0.49
2000	5632	8215	3861	4100	5229	3215	4696		0.63	0.79	0.51
2001	3581	5376	2386	3954	5004	3125	5654		0.70	0.87	0.56
2002	5781	7922	4219	3770	4604	3087	4922		0.76	0.97	0.60
2003	4877	6525	3646	3111	3711	2608	5029		0.71	0.85	0.58
2004	6255	8275	4728	2931	3545	2424	4827		0.62	0.76	0.51
2005	4702	6166	3585	3040	3723	2483	5560		0.56	0.68	0.45
2006	6434	8503	4868	3342	4165	2681	4267		0.43	0.54	0.34
2007	5350	7038	4067	4150	5124	3361	4026		0.40	0.50	0.32
2008	3251	4384	2411	5021	6210	4060	4350		0.37	0.46	0.30
2009	4018	5381	3000	6125	7546	4971	3944		0.43	0.53	0.35
2010	5556	7268	4248	5839	7419	4595	3424		0.41	0.50	0.33
2011	6933	9507	5056	5513	7143	4255	3806		0.37	0.45	0.29
2012	4148	5534	3110	6060	7770	4726	4020		0.35	0.43	0.28
2013	3166	4208	2382	7043	8883	5584	2982	97	0.33	0.41	0.27
2014	6363	8366	4839	8224	10395	6507	2834	159	0.33	0.41	0.27
2015	8792	11868	6514	8008	10476	6121	2925	112	0.33	0.41	0.27
2016	3048	4189	2218	8233	10793	6281	3493	666	0.36	0.45	0.29

Year	Recruitment			SSB			Landings	Discards	F (per year)		
	Age 1	High	Low	SSB	High	Low			Ages 2–6	High	Low
	thousands			tonnes			tonnes				
2017	5140	7607	3473	9184	11670	7227	3441	496	0.35	0.44	0.28
2018	5763	10010	3318	9210	11850	7158	3140	486	0.36	0.46	0.28
2019	4492			8523							

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Recommended citation: ICES. 2019. Turbot (*Scophthalmus maximus*) in Subarea 4 (North Sea). In Report of the ICES Advisory Committee, 2019. ICES Advice 2019, tur.27.4, <https://doi.org/10.17895/ices.advice.4876>