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

ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2023 should be no more than 2432 tonnes.

Management of turbot and brill under a combined species TAC prevents effective control of the single-species exploitation rates and could lead to the overexploitation of either species. ICES advises that management should be implemented at the species level.

Stock development over time

Fishing pressure on the stock is below F_{MSY} and spawning-stock size is above MSY $B_{trigger}$, B_{pa}, and B_{lim}.

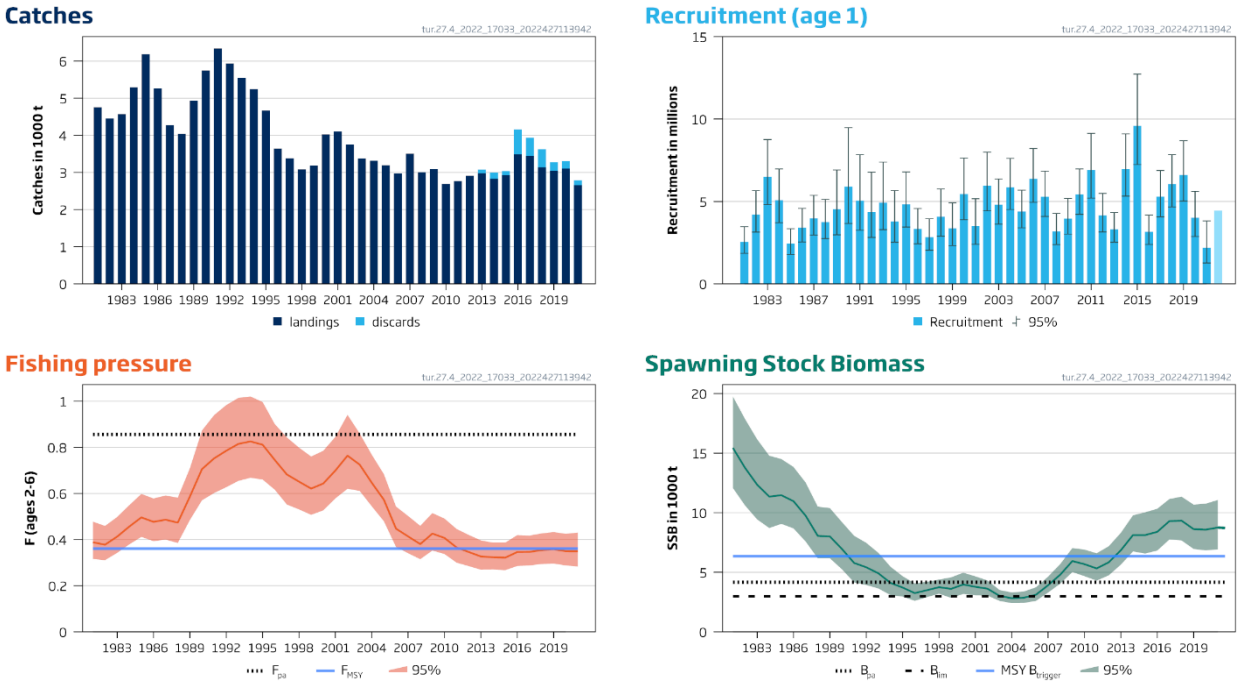

Figure 1 Turbot in Subarea 4. Summary of the stock assessment. Discards are only available since 2013. The assumed recruitment value for 2022 is shaded in a lighter colour.

Catch scenarios

Table 1 Turbot in Subarea 4. Values in the forecast and for the interim year.

Variable	Value	Notes
$F_{age\ 2–6}$ (2022)	0.35	Average exploitation pattern (2019–2021), scaled to $F_{ages\ 2–6}$ 2021
SSB (2023)	7726	Short-term forecast; in tonnes
$R_{age\ 1}$ (2022, 2023)	4447	Geometric mean of recruitment (GM, 1981–2021); thousands
Projected landings (2022)	2440	Short-term forecast; in tonnes

Table 2 Turbot in Subarea 4. Annual catch scenarios. All weights are in tonnes.

Basis	Total catch* (2023)	Projected landings (2023)	Projected discards (2023) **	F (projected landings, ages 2–6) (2023)	SSB (2024)	% SSB change^	% advice change^^
ICES advice basis							
MSY approach: F_{MSY}	2432	2289	143	0.361	7103	−8.1	−33
Other scenarios							
$F_{MSY\ upper}$	3095	2913	182	0.482	6480	−16	−14
$F_{MSY\ lower}$	1774	1670	105	0.252	7725	0	-51
F = 0	0	0	0	0	9422	22	−100
F_{pa}	4778	4497	281	0.856	4926	−36	32
$F = F_{2022}$	2364	2225	139	0.35	7167	−7.2	−34
SSB (2024) = B_{lim}	6977	6566	411	1.60	2974	-62	93
SSB (2024) = B_{pa}	5624	5292	331	1.10	4163	−46	56
SSB (2024) = MSY $B_{trigger}$	3232	3041	190	0.51	6353	−18	−11
Rollover advice	3609	3396	213	0.58	6002	−22	0

* (Projected landings)/(1–average discard rate); average discard rate by weight 2019–2021 = 5.9%.
** Including BMS landings, assuming average discard rate by weight 2019–2021 = 5.9%.
^ SSB 2024 relative to SSB 2023.
^^ Total catch in 2023 relative to the advice value for 2022 (3609 tonnes).

The change in advice (−33%) is mainly due to the downward revision of recruitment assumed last year and a decrease in incoming recruitment.

Basis of the advice

Table 3 Turbot in Subarea 4. The basis of the advice.

Advice basis	MSY approach
Management plan	The EU Multiannual Plan for the North Sea (EU, 2018) takes bycatch of this species into account.

Quality of the assessment

The age composition of the Dutch landings is available for most of the years and is derived almost entirely from the Dutch beam trawl fishery. This creates uncertainty in the assessment, because a fourth of the Dutch landings comes from other gears which are not as comprehensively sampled. Comprehensive Danish age-structured data are available since 2014.

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.

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.

Discard estimates are available but uncertain due to the limited availability of age-length information. Discards are not included in the current assessment but are used to provide advice.

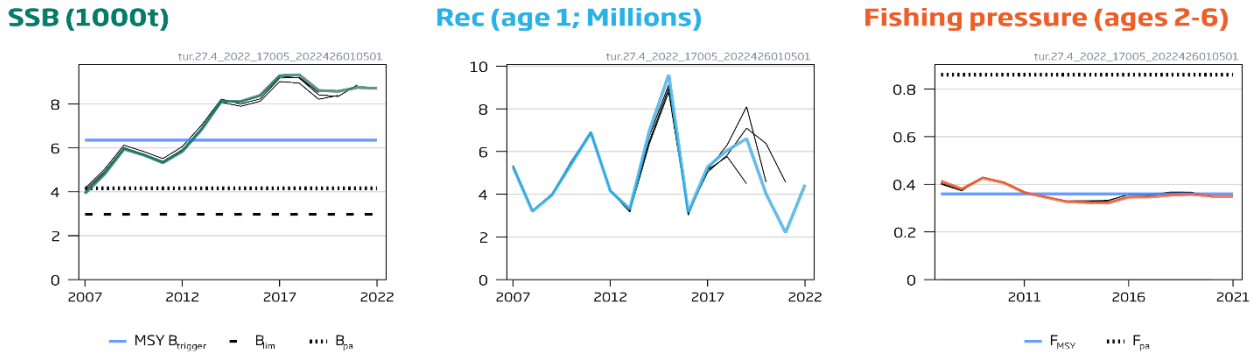

Figure 2 Turbot in Subarea 4. Historical assessment results (final-year recruitment included for each line, corresponding to the forecast recruitment in the interim year).

Issues relevant for the advice

In 2018, ICES (2018a) advised 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.

Reference points

Table 4 Turbot in Subarea 4. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	6353	Fifth percentile of the SSB at MSY; in tonnes	ICES (2018b)
	F_{MSY}	0.361	EQsim analysis based on the recruitment period 1981–2017	ICES (2018b)
Precautionary approach	B_{lim}	2974	B_{lim} was set to $B_{loss;}$ in tonnes	ICES (2018b)
	B_{pa}	4163	$B_{lim} \times \exp(1.645 \times \sigma) \approx 1.4 \times B_{lim}$, $\sigma = 0.20$; in tonnes.	ICES (2018b)
	F_{lim}		F_{lim} (0.606) is no longer considered appropriate given the estimate of F_{pa}	ICES (2018b, 2022a)
	F_{pa}	0.856	The F that provides a 95% probability for SSB to be above B_{lim} ($F_{P.05}$ with advice rule [AR]); in tonnes	ICES (2018b, 2022a)
Management plan	SSB_{mgt}	Not defined		
	F_{mgt}	Not defined		

Basis of the assessment

Table 5 Turbot in Subarea 4. Basis of the assessment and advice.

ICES stock data category	1 (ICES, 2022a)
Assessment type	Age-based analytical assessment (SAM; ICES, 2022b) that uses landings in the model and in the forecast
Input data	Commercial landings raised to international landings, two survey indices (SNS [B3499], BTS-Isis [B2453]), 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 5.9% (average of 2019–2021). Sixty-one percent of the catches include discard information in 2021, and 0% 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)

History of the advice, catch, and management

Table 6 Turbot in Subarea 4. ICES advice, ICES estimates of landings and discards, and official landings. All weights are in tonnes.

Year	ICES advice	Catch corresp. to advice	Agreed TAC* in Subarea 4 and Division 2.a (turbot and brill)	Official landings in Subarea 4 and Division 2.a (turbot and brill)	Official landings in Subarea 4 (turbot)	ICES landings in Subarea 4 (turbot)	ICES discards in Subarea 4 (turbot)	ICES catch in Subarea 4 (turbot)
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	4157	2977			
2007		-	4323	4754	3510			
2008		-	5263	4015	3007			
2009		-	5263	4258	3091			
2010		-	5263	4201	2692			
2011		-	4642	4312	2807			
2012	No increase in catches	-	4642	4529	2914			
2013	No new advice, same as for 2012	-	4642	4480	3084	2982	97	3079
2014	Apply F_{MSY} proxy for data-limited stocks (DLS)	≤ 2978	4642	4132	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
2018	Precautionary approach	≤ 4952	7102	4422	3228	3140	486	3626
2019	Precautionary approach	≤ 4952	8122	4514	3119	3045	230 ^	3275 ^
2020	Precautionary approach	≤ 4538	6498	4370**	3180**	3104	199 ^	3303 ^
2021	MSY approach	≤ 3948	5848	3750**	2809**	2659	129 ^	2788 ^
2022	MSY approach	≤ 3609	5487					
2023	MSY approach	≤ 2432						

* A combined TAC for turbot and brill in EU waters of Subarea 4 and Division 2.a. up to 2020 and in United Kingdom and European Union waters of 4; United Kingdom waters of 2.a thereafter.
** Preliminary.
^ Includes estimated BMS landings.

History of the catch and landings

Table 7 Turbot in Subarea 4. Catch distribution by fleet in 2021 as estimated by ICES.

Catch	Landings			Discards
2788 tonnes	Beam trawls 66%	Bottom trawls 25%	Other gears 9%	129 tonnes
	2659 tonnes			

Table 8 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**	BMS landings	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
2010	1469	385	466	118	37	191	26	1		2692
2011	1540	396	548	122	29	144	28	1		2807
2012	1740	362	482	145	30	120	36	1		2914
2013	1763	374	498	159	40	219	29	1		3084
2014	1593	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	0	3641
2018	1914	368	331	267	27	306	15	1	2.10	3230
2019	1901	362	273	228	14	326	13	1	3.00	3121
2020^	2089	352	257	161	5	297	18	1	0.64	3180
2021^	1676	324	326	245	3	221	13	1	0.94	2809

* 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.

Summary of the assessment

Table 9 Turbot in Subarea 4. Assessment summary. Weights are in tonnes, recruitment in thousands. High and low values indicate 95% confidence intervals.

Year	Recruitment (Age 1)			Spawning Stock Biomass			Landings	Discards^	Fishing pressure (landings, Ages 2–6)		
	R	High	Low	SSB	High	Low			F	High	Low
1981	2538	3473	1855	15 445	19 756	12 074	4755		0.39	0.48	0.32
1982	4215	5658	3141	13 770	17 869	10 610	4453		0.38	0.46	0.31
1983	6493	8764	4810	12 353	16 165	9440	4575		0.41	0.50	0.34
1984	5084	6971	3708	11 351	14 783	8715	5297		0.46	0.55	0.38
1985	2440	3347	1780	11 467	14 505	9065	6188		0.50	0.60	0.41
1986	3407	4576	2537	10 964	13 840	8686	5263		0.48	0.58	0.39
1987	3986	5374	2957	9750	12 536	7583	4271		0.49	0.59	0.40
1988	3753	5123	2749	8058	10 512	6176	4041		0.47	0.58	0.39
1989	4535	6912	2976	8008	10 385	6175	4927		0.59	0.71	0.48
1990	5894	9479	3664	6951	9209	5247	5750		0.71	0.87	0.57
1991	5050	7839	3253	5784	8064	4148	6340		0.75	0.94	0.60
1992	4369	6776	2817	5420	7470	3933	5933		0.79	0.98	0.63
1993	4931	7390	3290	4914	6632	3641	5546		0.81	1.01	0.65
1994	3784	5668	2526	4108	5469	3085	5244		0.83	1.02	0.67
1995	4839	6791	3447	3718	4673	2958	4671		0.81	1.00	0.66
1996	3333	4568	2432	3252	4066	2602	3644		0.75	0.90	0.62
1997	2838	3951	2038	3497	4199	2912	3382		0.68	0.84	0.55
1998	4081	5759	2892	3748	4389	3200	3086		0.65	0.80	0.53
1999	3376	4920	2316	3610	4574	2850	3187		0.62	0.76	0.51
2000	5453	7633	3895	3974	4968	3180	4025		0.64	0.79	0.53
2001	3520	5165	2398	3780	4659	3066	4100		0.70	0.85	0.58
2002	5950	7996	4427	3623	4314	3042	3749		0.76	0.94	0.62
2003	4802	6364	3623	3017	3507	2596	3374		0.73	0.86	0.61
2004	5861	7614	4512	2825	3310	2410	3317		0.65	0.77	0.54
2005	4394	5683	3397	2867	3388	2426	3195		0.57	0.68	0.48
2006	6375	8216	4947	3120	3740	2602	2976		0.45	0.54	0.37
2007	5289	6843	4089	3917	4643	3305	3509		0.41	0.50	0.34
2008	3191	4276	2381	4798	5694	4043	3005		0.38	0.46	0.32
2009	3957	5188	3018	5943	7037	5019	3089		0.43	0.52	0.35
2010	5419	6971	4213	5679	6901	4673	2692		0.41	0.49	0.34
2011	6895	9134	5205	5325	6596	4299	2771		0.37	0.45	0.30
2012	4155	5490	3145	5839	7188	4743	2914		0.35	0.42	0.29
2013	3309	4337	2525	6850	8317	5642	2982	97	0.33	0.40	0.27
2014	6959	9101	5321	8126	9781	6751	2834	159	0.32	0.39	0.27
2015	9598	12 726	7238	8122	10 035	6573	2922	112	0.32	0.39	0.27
2016	3159	4175	2390	8396	10 332	6823	3493	666	0.35	0.42	0.29
2017	5291	6882	4068	9294	11 147	7748	3441	496	0.35	0.42	0.29
2018	6051	7845	4667	9333	11 350	7674	3140	486	0.35	0.43	0.29
2019	6605	8689	5021	8620	10 680	6957	3046	230	0.36	0.43	0.30
2020	4014	5604	2875	8577	10 758	6838	3104	199	0.35	0.43	0.29
2021	2197	3819	1264	8756	11 067	6927	2659	129	0.35	0.43	0.28
2022	4447*		1855	8715							

* Geometric mean (1981–2021).

^ Discards are not used in the model.

Sources and references

EU. 2018. Regulation (EU) 2018/973 of the European Parliament and of the Council of 4 July 2018 establishing a multiannual plan for demersal stocks in the North Sea and the fisheries exploiting those stocks, specifying details of the implementation of the landing obligation in the North Sea and repealing Council Regulations (EC) No 676/2007 and (EC) No 1342/2008. Official Journal of the European Union, L. 179. 13 pp. http://data.europa.eu/eli/reg/2018/973/oj.

ICES. 2012. Report of the Inter-Benchmark Protocol on New Species (Turbot and Sea bass; IBPNew 2012), 1–5 October 2012, Copenhagen, Denmark. ICES CM 2012/ACOM:45. 239 pp. https://doi.org/10.17895/ices.pub.5346.

ICES. 2018a. EU request for ICES to provide advice on a revision of the contribution of TACs to fisheries management and stock conservation. *In* Report of the ICES Advisory Committee, 2018. ICES Advice 2018, sr.2018.15. 35 pp. https://doi.org/10.17895/ices.pub.4531.

ICES. 2018b. Report of the InterBenchmark Protocol for turbot in the North Sea 2018 (IBPTurbot), 30–31 July 2018, IJmuiden, the Netherlands. ICES CM 2018/ACOM:50. 74 pp. https://doi.org/10.17895/ices.pub.19290554.

ICES. 2022a. Advice on fishing opportunities. *In* Report of the ICES Advisory Committee, 2022. ICES Advice 2022, section 1.1.1. https://doi.org/10.17895/ices.advice.19928060.

ICES. 2022b. Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK). ICES Scientific Reports. 4:43. http://doi.org/10.17895/ices.pub.19786285. *In prep*.

Download the stock assessment data and figures.

Recommended citation: ICES. 2022. Turbot (*Scophthalmus maximus*) in Subarea 4 (North Sea). *In* Report of the ICES Advisory Committee, 2022. ICES Advice 2022, tur.27.4. https://doi.org/10.17895/ices.advice.19453871.