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

ICES advice on fishing opportunities

ICES advises that when the MSY approach is applied, catches in 2022 should be no more than 3609 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}; spawning-stock size is above MSY $B_{trigger}$, B_{pa}, and B_{lim}.

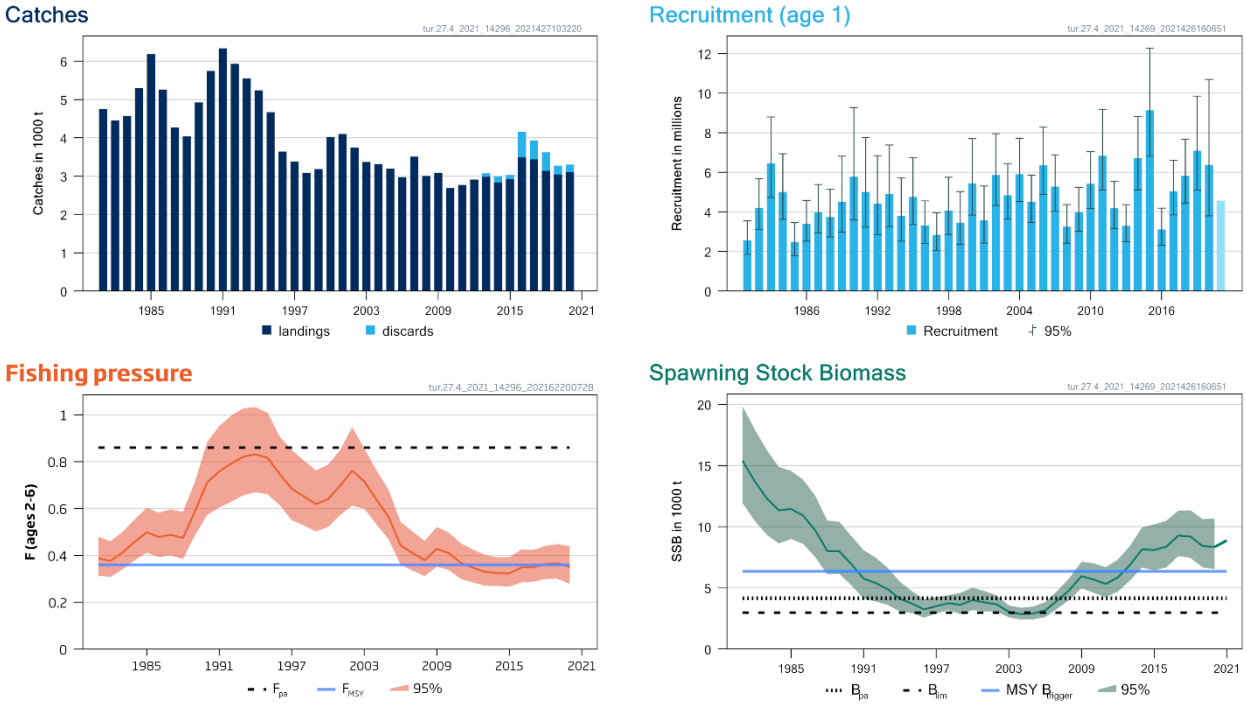

Figure 1 Turbot in Subarea 4. Summary of the stock assessment (weights in thousand tonnes). Discards are only available from 2013. The assumed recruitment value for 2021 is shaded in a lighter colour.

Catch scenarios

Table 1 Turbot in Subarea 4. Values in the forecast and for the interim year.. All weights are in tonnes, recruitment in thousands.

Variable	Value	Notes
$F_{age\ 2\text{-}6}$ (2021)	0.36	F_{sq} = average of $F_{ages\ 2–6}$ (2018–2020)
SSB (2022)	9336	Short-term forecast (STF)
$R_{age\ 1}$ (2021, 2022)	4566	Geometric mean (1981–2020)
Projected landings (2021)	3328	STF

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

Basis	Total catch* (2022)	Projected landings** (2022)	Projected discards (2022) ***	F (projected landings, ages 2–6) (2022)	SSB (2023)	% SSB change^	% advice change^^
ICES advice basis							
MSY approach: F_{MSY}	3609	3291	318	0.361	9012	−3.5	−8.6
Other scenarios							
$F_{MSY\ upper}$	4564	4162	402	0.482	8095	−13.3	15.6
$F_{MSY\ lower}$	2634	2401	232	0.252	9957	6.6	−33
F = 0	0	0	0	0	12545	34	−100
F_{pa}	6984	6368	616	0.856	5821	−38	77
F_{sq}	3609	3291	318	0.360	9012	−3.5	−8.6
SSB (2023) = B_{lim}	10180	9282	897	1.70	2974	-68	158
SSB (2023) = B_{pa}	8812	8035	777	1.27	4163	−55	123
SSB (2023) = MSY $B_{trigger}$	6410	5845	565	0.76	6353	−32	62
Rollover advice	3948	3600	348	0.40	8686	−7	0

* (Projected landings)/(1–average discard rate); average discard rate by weight 2018–2020 = 8.8%.
** Marketable landings.
*** Including BMS landings, assuming average discard rate by weight 2018–2020 = 8.8%.
^ SSB 2023 relative to SSB 2022.
^^ Total catch in 2022 relative to the advice value for 2021 (3948 tonnes).

The change in advice (−8.6%) is mainly due to the downward revision of the 2018 year class.

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, 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. Comprehensive 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.

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 in recent years. Furthermore, the current assessment uses the selectivity estimated for the total catch to build an exploitable biomass estimate used to fit the Dutch LPUE data; this may not be entirely representative given differences in age composition from fleets not included in the Dutch LPUE.

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.

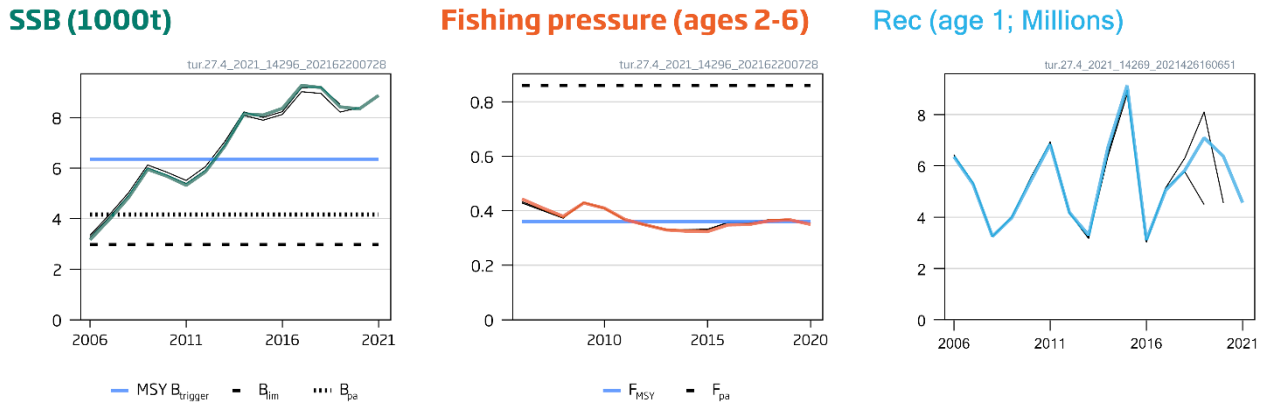

Figure 2 Turbot in Subarea 4. Historical assessment results (final-year recruitment included for each line, corresponding to the forecast recruitment in the interim year).

Issues relevant for the advice

ICES was requested to evaluate the role of TAC in the fisheries management of turbot and brill in the North Sea (ICES, 2018a). 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.

Reference points

Table 4 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}	0.361	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}		F_{lim} (0.606) is no longer considered appropriate given the estimate of F_{pa}	ICES (2018b, 2021)
	F_{pa}	0.856	The F that provides a 95% probability for SSB to be above B_{lim} (F_{P05} with advice rule [AR])	ICES (2018b, 2021)
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, 2021a)
Assessment type	Age-based analytical assessment (SAM; ICES, 2021b) 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 8.8% (average of 2018–2020). Sixty-eight percent of the catches include discard information in 2020, 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	4481**	3095 **	3045	230 ^	3275 ^
2020	Precautionary approach	< 4538	6498	4370**	3180**	3104	199 ^	3303 ^
2021	MSY approach	< 3948	5848					
2022	MSY approach	< 3609						

* EU combined TAC for turbot and brill in EU waters of Division 2.a and Subarea 4.
** Preliminary.
^ Includes estimated BMS landings.

History of the catch and landings

Table 7 Turbot in Subarea 4. Catch distribution by fleet in 2020 as estimated by ICES.

Catch (2020)	Landings			Discards
3303 tonnes	Beam trawls 66%	Bottom trawls 28%	Other gears 6%	199 tonnes
	3104 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	2.1	3230
2019^	1878	359	273	228	14	326	13	1	3.0	3095
2020^	2089	352	257	161	5	297	18	1	0.64	3180

* 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			SSB			Landings	Discards^	F (landings)		
	Age 1	High	Low	SSB	High	Low			Ages 2–6	High	Low
1981	2559	3539	1851	15393	19842	11941	4755		0.39	0.48	0.31
1982	4206	5684	3112	13728	17969	10488	4453		0.38	0.46	0.31
1983	6447	8793	4726	12331	16278	9341	4575		0.41	0.50	0.34
1984	5010	6933	3621	11333	14878	8632	5297		0.46	0.55	0.38
1985	2487	3455	1791	11448	14568	8996	6188		0.50	0.60	0.41
1986	3396	4585	2515	10915	13852	8600	5263		0.48	0.58	0.39
1987	3973	5380	2934	9716	12550	7522	4271		0.49	0.60	0.40
1988	3748	5137	2735	8014	10506	6113	4041		0.47	0.59	0.38
1989	4502	6821	2971	7989	10402	6136	4927		0.59	0.72	0.49
1990	5778	9269	3602	6934	9226	5211	5750		0.71	0.88	0.57
1991	5009	7759	3233	5769	8089	4115	6340		0.76	0.95	0.60
1992	4413	6836	2849	5394	7474	3893	5933		0.79	1.00	0.63
1993	4899	7378	3253	4891	6639	3603	5546		0.82	1.03	0.66
1994	3794	5718	2518	4106	5506	3062	5244		0.83	1.03	0.67
1995	4754	6729	3359	3724	4724	2935	4671		0.82	1.01	0.66
1996	3310	4555	2405	3240	4080	2573	3644		0.75	0.91	0.61
1997	2840	3954	2040	3504	4231	2901	3382		0.68	0.85	0.55
1998	4051	5745	2856	3749	4401	3193	3086		0.65	0.80	0.53
1999	3442	5031	2356	3619	4599	2848	3187		0.62	0.76	0.50
2000	5434	7695	3837	3999	5024	3184	4025		0.64	0.79	0.52
2001	3587	5307	2424	3817	4739	3075	4100		0.70	0.85	0.57
2002	5862	7945	4325	3656	4389	3046	3749		0.76	0.95	0.61
2003	4837	6435	3636	3042	3569	2593	3374		0.72	0.86	0.60
2004	5906	7722	4516	2851	3377	2407	3317		0.64	0.76	0.53
2005	4506	5857	3466	2905	3473	2430	3195		0.57	0.68	0.47
2006	6356	8277	4880	3162	3837	2606	2976		0.44	0.54	0.36
2007	5278	6878	4050	3961	4753	3301	3509		0.41	0.50	0.34
2008	3253	4374	2420	4830	5803	4019	3005		0.38	0.46	0.31
2009	3970	5240	3009	5954	7141	4963	3089		0.43	0.52	0.35
2010	5425	7039	4181	5681	7007	4606	2692		0.41	0.50	0.34
2011	6838	9183	5092	5322	6694	4231	2771		0.37	0.45	0.30
2012	4182	5554	3149	5854	7306	4691	2914		0.35	0.43	0.28
2013	3300	4361	2498	6863	8432	5586	2982	97	0.33	0.40	0.27
2014	6714	8814	5114	8141	9948	6663	2834	159	0.33	0.39	0.27
2015	9135	12266	6802	8101	10187	6442	2922	112	0.32	0.39	0.27
2016	3115	4188	2316	8362	10485	6670	3493	666	0.35	0.43	0.28
2017	5044	6615	3847	9272	11317	7596	3441	496	0.35	0.42	0.29
2018	5830	7664	4435	9187	11338	7444	3140	486	0.36	0.44	0.30
2019	7094	9846	5112	8420	10619	6677	3046	230	0.37	0.45	0.30
2020	6374	10693	3800	8343	10662	6529	3104	199	0.35	0.44	0.28
2021	4566*			8878							

* Geometric mean (1981–2020).

^ Discards are not used in the model.

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Download the stock assessment data and figures.

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