

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

### ICES stock advice

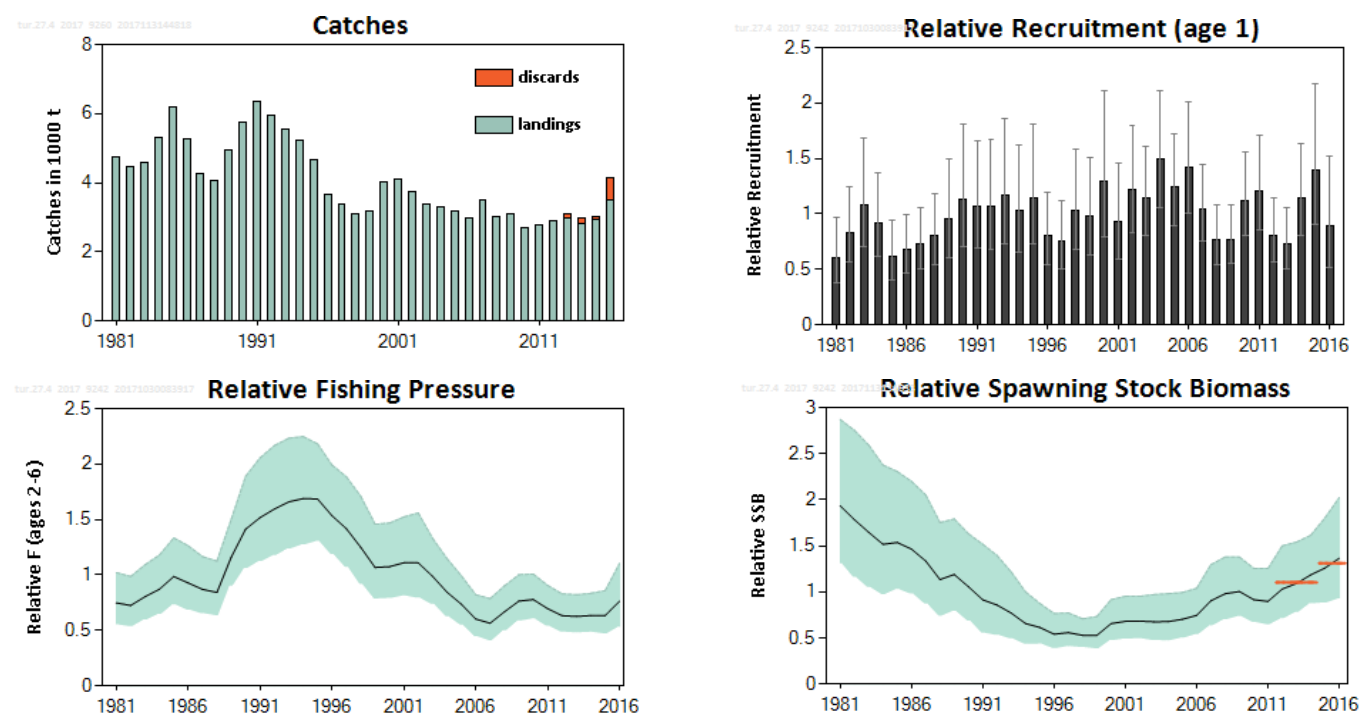
**Please note: This advice was updated in December 2017 (ICES, 2017c).**

ICES advises that when the precautionary approach is applied, catches should be no more than 4952 tonnes in each of the years 2018 and 2019. If discard rates do not change from 2016, this implies landings of no more than 4159 tonnes.

Management of turbot and brill under a combined species TAC prevents effective control of the exploitation rates of the individual species and could lead to the overexploitation of either species.

### Stock development over time

Recruitment is variable without a trend. Fishing mortality (F) is estimated to have decreased since the mid-1990s and has been stable for the past ten years. SSB has increased since the late 1990s.

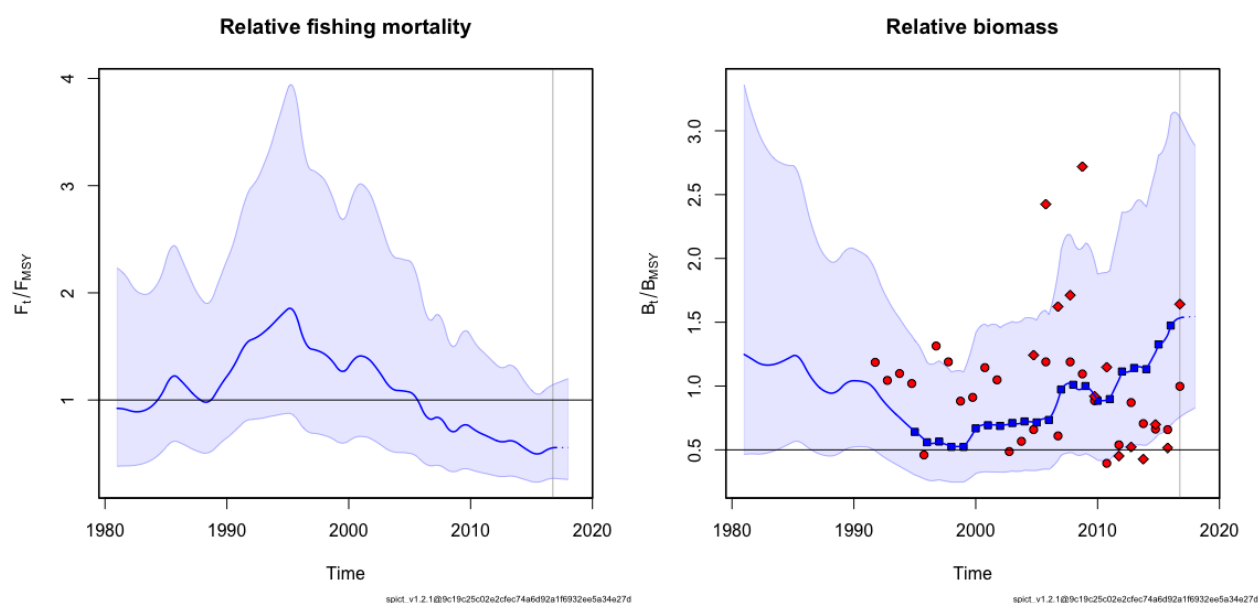


**Figure 1** Turbot in Subarea 4. Summary of the stock assessment (weights in thousand tonnes). Catches only represent landings up to 2012. Shaded areas represent 95% confidence intervals.

### Stock and exploitation status

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

		Fishing pressure				Stock size			
		2014	2015	2016		2014	2015	2016	
Maximum sustainable yield	$F_{MSY}$ proxy	✓	✓	✓ Below		$MSY_{B_{trigger}}$ proxy	✓	✓	✓ Above trigger
Precautionary approach	$F_{pa}, F_{lim}$	✓	✓	✓ Below possible reference points		$B_{pa}, B_{lim}$	✓	✓	✓ Above possible reference points
Management plan	$F_{MGT}$	—	—	— Not applicable		$B_{MGT}$	—	—	— Not applicable



**Figure 2** Turbot in Subarea 4. State of the stock and fishery relative to reference points. This is a SPiCT analysis, showing fishing mortality relative to  $F_{MSY}$  and exploitable biomass relative to  $B_{MSY}$ . The symbols in the relative biomass plot indicate observed biomass indices (red dots = BTS Isis survey index, red diamonds = SNS survey index and blue squares = NL BT2 LPUE index), while the shaded areas in both plots indicate 95% confidence intervals. The horizontal lines indicate levels relative to the  $F_{MSY}$  and  $MSY B_{trigger}$  proxies.

## Catch options

ICES framework for category 3 stocks was applied (ICES, 2012a). An SSB index from an age based assessment indicative of trends was applied as the indicator of stock development. The advice is based on a comparison of the two latest index values (2015–2016) with the three preceding values (2012–2014), multiplied by the recent catch (catch in 2016). The recent catch (2016) was used because the perception of the stock has changed following an interbenchmark process (ICES, 2017a). The index is estimated to have increased by 19%.

The Surplus Production in Continuous Time (SPiCT; Pedersen and Berg, 2017) analysis suggests the fishing mortality is below, and the stock size above, proxies of the  $MSY$  reference points (Figure 2); therefore, no additional precautionary buffer was applied. The discard rate is 16% of the total catch.

**Table 2** Turbot in Subarea 4. The basis for the catch options.\*

Index A (2016–2015)		1.312
Index B (2014–2012)		1.102
Index ratio (A/B)		1.191
Uncertainty cap	Not applied	-
Catch in 2016		4159 tonnes
Discard rate in 2016		0.16
Precautionary buffer	Not applied	-
Catch advice**		4952 tonnes
Landings corresponding to the catch advice***		4159 tonnes

\* The figures in the table are rounded. Calculations were done with unrounded inputs and computed values may not match exactly when calculated using the rounded figures in the table.

\*\* [Catch for 2016] × [index ratio].

\*\*\* [Catch for 2016] × [index ratio] × [1 – discard rate].

## Basis of the advice

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

Advice basis	Precautionary approach
Management plan	ICES is not aware of an agreed precautionary management plan for turbot in this area.

## Quality of the assessment

Turbot in Subarea 4 was interbenchmarked in 2017 (ICES, 2017a), which changed the perception of stock status and trends compared with previous advice. A complete time-series of age composition for the catch data is not available. The age composition of the Dutch landings is available for most of the years. These data are derived almost entirely from the Dutch beam trawl fishery. This creates uncertainty in the assessment since a large proportion of the catch comes from other gears. Danish age-structured data are available from 2014. These data suggest a higher average age of turbot in the landings compared to the Dutch beam trawl fishery. The age-structured fisheries-independent indices used in the trends-based assessment are of poor quality at older ages. A fisheries-independent index covering the entire distribution area of the stock would improve the assessment. The commercial index used has been available since 1995 and is derived from landings and effort data for the Dutch beam trawl fleet. The long-term trend in this age-aggregated fisheries-dependent index has the most weight in estimating the final biomass trend in the assessment. This commercial index is corrected for the increasing use of pulse trawls in the Dutch fishery, and for changes in the spatial distribution of the fishery. Other effects that may have influenced this index (such as changes in the EU minimum landing size regulations or the increasing discard rates as a result of Producer Organization (PO) measures in response to an increasingly limiting quota) have not been examined.

There is a substantial retrospective bias in the estimate of  $F$  for which a reason could not be identified. The negligible retrospective bias in the SSB estimate makes it possible to provide consistent Category 3 catch advice.

## Issues relevant for the advice

A combined species EU TAC for turbot together with brill is set for EU waters of Division 2.a and Subarea 4 (EU, 2013). The areas in the EU TAC do not correspond to the stock areas for either of these stocks. Additionally, management of these stocks under a combined species TAC prevents effective control of the exploitation rates of the individual species and could lead to the overexploitation of either species.

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. No official minimum landing size has been set, but Belgian and Dutch producer organizations have adopted voluntary minimum landing sizes, although this still leads to a large proportion of immature fish being caught. Discarding for this stock has historically been very limited. However, there are now indications of increased discarding as a result of PO measures that aim to prevent early exhaustion of the quota.

## 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 $B_{\text{trigger proxy}}$	$\frac{B}{B_{\text{MSY}}} = 0.5$ *	Relative value from the SPiCT model. $B_{\text{MSY}}$ is estimated directly from the SPiCT assessment model and changes when the assessment is updated.	ICES (2017a)
	$F_{\text{MSY proxy}}$	$\frac{F}{F_{\text{MSY}}} = 1$ *	Relative value from the SPiCT model. $F_{\text{MSY}}$ is estimated directly from the SPiCT assessment model and changes when the assessment is updated.	ICES (2017a)
Precautionary approach	$B_{\text{lim}}$	Not defined		
	$B_{\text{pa}}$	Not defined		
	$F_{\text{lim}}$	Not defined		
	$F_{\text{pa}}$	Not defined		
Management plan	$\text{SSB}_{\text{mgt}}$	Not defined		
	$F_{\text{mgt}}$	Not defined		

\* No reference points are defined for this stock in terms of absolute values. The SPiCT-estimated values of the ratios  $F/F_{\text{MSY}}$  and  $B/B_{\text{MSY}}$  are used to estimate stock status relative to the proxy MSY reference points.

## Basis of the assessment

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

ICES stock data category	3 ( <a href="#">ICES, 2016</a> )
Assessment type	Age-based assessment indicative of trends (SAM; ICES, 2017b)
Input data	Commercial landings (Dutch age data from 1981 to present, Danish age data from 2014 to 2016, raised in InterCatch) 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	Data not included in the assessment, but are used to provide catch advice. 85% of the landings include discard information in 2016.
Indicators	None
Other information	An interbenchmark procedure was conducted for this stock in June–October 2017 (ICES, 2017a).
Working group	Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak ( <a href="#">WGNSSK</a> )

## Information from stakeholders

The Dutch demersal fishing industry provided information on national PO measures that are meant to prevent early exhaustion of the quota. These measures included the introduction of a minimum landings size of 27 cm in 2013 that was increased in 2016 to 30 cm first, and then to 32 cm. As well, 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, while these market categories are landed by flag vessels that are not under the Dutch PO measures.

## History of the advice, catch, and management

**Table 6** Turbot in Subarea 4. ICES advice and official landings. All weights are in tonnes.

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC* in 4 and 2.a turbot & brill	Official landings in 4 and 2.a turbot & brill	Official landings 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	4673	2978	2922	112	3034
2016	Precautionary approach (decrease catches by 20%)	< 1995	4488	4673**	3147**	3493	666	4159
2017	Precautionary approach (same advised catch value as given for 2016)	< 1995	4937					
2018		< 4952						
2019		< 4952						

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

\*\* Preliminary.

## History of the catch and landings

**Table 7** Turbot in Subarea 4. Catch distribution by fleet in 2016 as estimated by ICES.

Catch (2016)	Landings			Discards
4159 tonnes	Beam trawls 70.17%	Bottom trawls 21%	Other gears 8.83%	666 tonnes
	3493 tonnes			

**Table 8** Turbot in Subarea 4. History of commercial landings; the official estimated values are presented by area for each country participating in the fishery. All weights are in tonnes.

Year	Netherlands	UK	Denmark	Belgium	France	Germany	Norway	Other**	Subarea 4 totals
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	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	NA	8	0	3147

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

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

## Summary of the assessment

**Table 9** Turbot in Subarea 4 Assessment summary. Weights are in tonnes.

Year	Recruitment (Age 1) Relative	High	Low	SSB Relative	High	Low	Total landings*	Discards**	F Ages 2–6 Relative	High	Low
1981	0.602	0.963	0.376	1.934	2.870	1.303	4755		0.748	1.021	0.549
1982	0.834	1.240	0.561	1.783	2.752	1.155	4453		0.725	0.985	0.532
1983	1.086	1.686	0.700	1.647	2.592	1.046	4575		0.805	1.091	0.593
1984	0.914	1.366	0.612	1.516	2.376	0.967	5297		0.871	1.180	0.644
1985	0.614	0.938	0.402	1.536	2.305	1.023	6188		0.987	1.335	0.729
1986	0.679	0.998	0.462	1.464	2.199	0.974	5263		0.928	1.263	0.682
1987	0.731	1.060	0.504	1.334	2.051	0.868	4271		0.871	1.165	0.648
1988	0.800	1.177	0.544	1.134	1.751	0.734	4041		0.843	1.125	0.631
1989	0.952	1.495	0.607	1.188	1.790	0.788	4927		1.163	1.502	0.898
1990	1.130	1.806	0.708	1.055	1.630	0.682	5750		1.413	1.890	1.057
1991	1.069	1.652	0.692	0.913	1.516	0.550	6340***		1.517	2.055	1.119
1992	1.068	1.666	0.685	0.857	1.395	0.527	5934***		1.596	2.168	1.174
1993	1.168	1.862	0.733	0.770	1.215	0.488	5547***		1.659	2.233	1.233
1994	1.025	1.623	0.648	0.656	0.999	0.431	5244***		1.689	2.248	1.269
1995	1.144	1.807	0.724	0.614	0.874	0.431	4672***		1.685	2.183	1.301
1996	0.801	1.197	0.535	0.541	0.765	0.382	3644***		1.534	1.992	1.182
1997	0.751	1.119	0.505	0.558	0.771	0.404	3382***		1.418	1.886	1.066
1998	1.037	1.588	0.676	0.528	0.707	0.394	3086		1.250	1.710	0.913
1999	0.976	1.511	0.630	0.528	0.732	0.380	3187***		1.068	1.458	0.782
2000	1.289	2.111	0.786	0.656	0.915	0.470	4026***		1.074	1.468	0.786
2001	0.928	1.452	0.593	0.680	0.951	0.486	4101***		1.110	1.524	0.809
2002	1.221	1.796	0.830	0.683	0.951	0.490	3750***		1.110	1.560	0.790
2003	1.140	1.608	0.808	0.675	0.970	0.470	3374		0.987	1.331	0.733
2004	1.492	2.106	1.057	0.677	0.980	0.468	3317		0.845	1.149	0.623
2005	1.239	1.718	0.894	0.702	0.993	0.497	3195		0.737	0.994	0.547
2006	1.423	2.007	1.009	0.745	1.038	0.534	2976		0.602	0.822	0.443
2007	1.044	1.445	0.755	0.903	1.295	0.630	3509		0.566	0.786	0.405
2008	0.766	1.076	0.545	0.980	1.378	0.697	3005		0.667	0.903	0.496
2009	0.772	1.080	0.552	1.004	1.378	0.731	3089		0.765	1.002	0.583
2010	1.115	1.556	0.800	0.915	1.255	0.667	2692		0.778	1.009	0.602
2011	1.207	1.713	0.850	0.896	1.252	0.642	2771		0.697	0.907	0.536
2012	0.811	1.150	0.572	1.030	1.499	0.708	2914		0.634	0.831	0.483
2013	0.731	1.050	0.508	1.092	1.539	0.774	2982	97	0.625	0.820	0.477
2014	1.149	1.631	0.810	1.184	1.614	0.869	2834	158	0.634	0.835	0.483
2015	1.401	2.172	0.903	1.259	1.803	0.879	2922	112	0.634	0.858	0.468
2016	0.890	1.525	0.519	1.365	2.023	0.921	3493	666	0.763	1.104	0.528

\* The landings presented are the sum of product values from landings- and weights-at-age used in the assessment model and do not match exactly the ICES estimates presented in previous tables.

\*\* Discards are not used in the assessment model.

\*\*\* These landings values are taken from Table 8. Because of missing age data they are treated as missing in the assessment.

## Sources and references

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