

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

### ICES advice on fishing opportunities

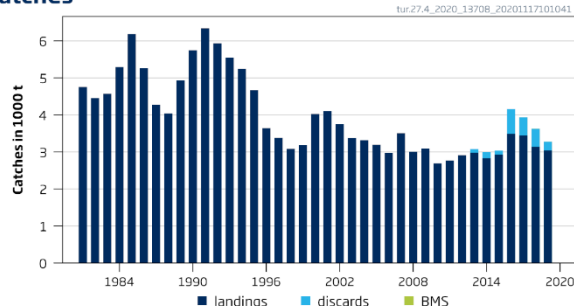
ICES advises that when the MSY approach is applied, catches in 2021 should be no more than 3948 tonnes.

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.

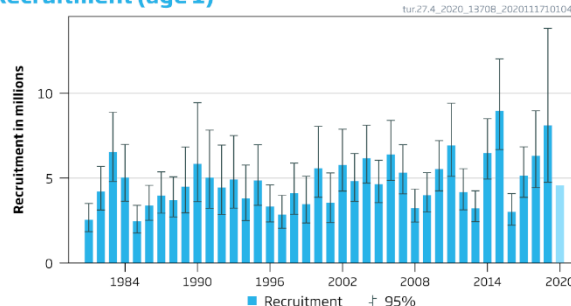
*Note: This advice sheet is abbreviated due to the COVID-19 disruption. The previous advice issued for 2020 is attached as Annex 1.*

### Stock development over time

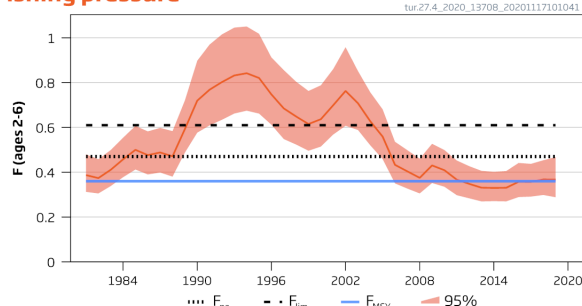
#### Catches



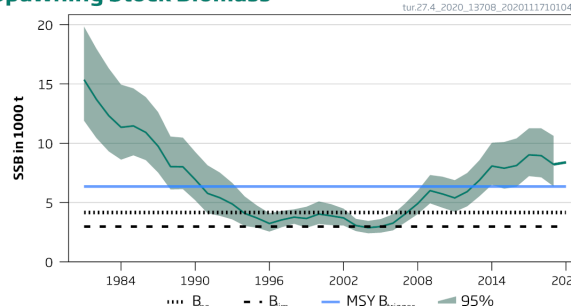
#### Recruitment (age 1)



#### Fishing pressure



#### Spawning Stock Biomass



**Figure 1<sup>†</sup>** Turbot in Subarea 4. Summary of the stock assessment (weights in thousand tonnes). Discards are only available from 2013. Shaded areas represent 95% confidence intervals. Assumed recruitment is unshaded. Landings below minimum conservation reference size (BMS) are those officially reported.

### Stock and exploitation status

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

		Fishing pressure			Stock size		
		2017	2018	2019	2018	2019	2020
Maximum sustainable yield	$F_{MSY}$	✓	✗	✗	MSY	✓	✓
				Above	$B_{trigger}$	✓	✓
Precautionary approach	$F_{pa}, F_{lim}$	✓	✓	✓			
				Harvested sustainably	$B_{pa}, B_{lim}$	✓	✓
Management plan	$F_{MGT}$	—	—	—			
					$B_{MGT}$	—	—

<sup>†</sup> Version 2: Line for  $F_{pa}$  corrected.

## Catch scenarios

**Table 2** Turbot in Subarea 4. Assumptions made for the interim year and in the forecast. All weights are in tonnes, recruitment in thousands.

Variable	Value	Notes
F (2020)	0.36	$F_{sq}$ = average of $F_{ages\ 2-6}$ (2017–2019)
SSB (2021)	9161	Short-term forecast (STF)
$R_{age\ 1}$ (2020, 2021)	4563	Geometric mean (1981–2019)
Projected landings (2020)	3402	STF, assuming an F at <i>status quo</i> ( $F_{sq}$ )

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

Basis	Total catch * (2021)	Projected landings ** (2021)	Projected discards *** (2021)	F (projected landings, ages 2–6) (2021)	SSB (2022)	% SSB change ^	% advice change ^^
ICES advice basis							
MSY approach: $F_{MSY}$	3948	3514	435	0.36	9449	3.1	–13
Other scenarios							
$F_{MSY\ upper}$	4984	4435	549	0.48	8449	–7.8	9.8
$F_{MSY\ lower}$	2887	2569	318	0.25	10484	14.4	–36
$F = 0$	0	0	0	0	13337	46	–100
$F_{pa}$	4902	4363	540	0.47	8528	–6.9	8
$F_{lim}$	5980	5322	658	0.61	7498	–18.2	32
$F_{sq}$	3985	3547	439	0.36	9414	2.8	–12.2
$SSB(2022) = B_{lim}$	10948	9742	1205	1.69	2974	–68	141
$SSB(2022) = B_{pa}$	9587	8531	1055	1.28	4163	–55	111
$SSB(2022) = MSY\ B_{trigger}$	7194	6402	792	0.79	6353	–31	59
Rollover advice	4537	4038	499	0.43	8879	–3.1	0

\* (Projected landings) / (1 – average discard rate); average discard rate by weight 2017–2019 = 11.0%.

\*\* Marketable landings.

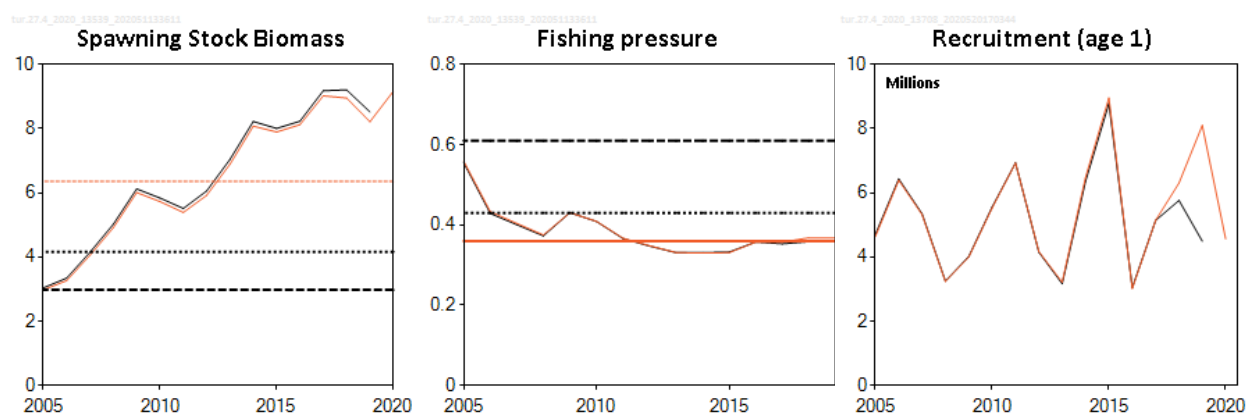
\*\*\* Including BMS landings, assuming average discard rate by weight 2017–2019 = 11.0%.

^ SSB 2022 relative to SSB 2021.

^^ Total catch in 2021 relative to the advice value for 2020 (4538 tonnes).

The change in advice (–13%) is due to a change in the basis for the advice, from the precautionary approach for 2020 to the MSY approach for 2021.

## Quality of the assessment



**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).

## History of the advice, catch, and management

**Table 4** 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	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
2018	Precautionary approach	< 4952	7102	4334 **	3166 **	3140	486	3626
2019	Precautionary approach	< 4952	8122	4476 **	3100 **	3045	230 ^	3275 ^
2020	Precautionary approach	< 4538	6498					
2021	MSY approach	< 3948						

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

\*\* Preliminary.

^ Including below minimum size (BMS) landings.

## Summary of the assessment

**Table 5** 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 <sup>^</sup>	Official BMS landings <sup>^</sup>	F (landings)		
	Age 1	High	Low	SSB	High	Low				Ages 2–6	High	Low
1981	2543	3504	1846	15371	19850	11903	4755			0.39	0.48	0.31
1982	4217	5690	3125	13709	17990	10447	4453			0.37	0.46	0.31
1983	6528	8877	4800	12330	16327	9312	4575			0.41	0.50	0.34
1984	5040	6987	3635	11346	14946	8614	5297			0.46	0.55	0.38
1985	2453	3401	1769	11463	14631	8980	6188			0.50	0.61	0.41
1986	3390	4572	2514	10916	13898	8574	5263			0.48	0.58	0.39
1987	3968	5366	2935	9747	12630	7522	4271			0.49	0.60	0.40
1988	3709	5077	2710	8032	10571	6102	4041			0.47	0.58	0.38
1989	4495	6832	2957	8015	10479	6131	4927			0.59	0.72	0.49
1990	5842	9441	3615	6935	9274	5187	5750			0.72	0.90	0.58
1991	5023	7828	3223	5774	8146	4093	6340			0.77	0.97	0.61
1992	4452	6946	2853	5403	7529	3877	5933			0.80	1.02	0.63
1993	4921	7503	3228	4877	6655	3575	5546			0.83	1.05	0.66
1994	3797	5771	2498	4088	5522	3026	5244			0.84	1.05	0.67
1995	4864	6965	3397	3696	4753	2875	4671			0.82	1.02	0.66
1996	3333	4596	2417	3234	4106	2547	3644			0.75	0.91	0.61
1997	2852	3982	2042	3541	4301	2915	3382			0.68	0.86	0.55
1998	4104	5883	2863	3769	4430	3207	3086			0.65	0.80	0.52
1999	3469	5109	2355	3658	4651	2876	3187			0.62	0.76	0.50
2000	5583	8049	3872	4032	5102	3187	4025			0.64	0.79	0.51
2001	3555	5304	2383	3881	4867	3094	4100			0.70	0.86	0.57
2002	5773	7878	4230	3707	4492	3060	3749			0.76	0.96	0.61
2003	4835	6449	3624	3065	3629	2589	3374			0.71	0.85	0.59
2004	6179	8115	4705	2882	3454	2405	3317			0.63	0.76	0.52
2005	4638	6052	3555	2978	3609	2456	3195			0.56	0.68	0.46
2006	6391	8395	4866	3263	4014	2652	2976			0.43	0.54	0.35
2007	5324	6969	4068	4057	4950	3324	3509			0.40	0.50	0.33
2008	3239	4349	2412	4914	6005	4021	3005			0.38	0.46	0.31
2009	3998	5326	3001	6009	7324	4930	3089			0.43	0.53	0.35
2010	5532	7207	4246	5727	7187	4564	2692			0.41	0.50	0.34
2011	6929	9408	5103	5391	6892	4216	2771			0.37	0.45	0.30
2012	4170	5550	3133	5921	7497	4677	2914			0.35	0.43	0.28
2013	3216	4254	2432	6894	8584	5536	2982	97		0.33	0.41	0.27
2014	6481	8496	4944	8080	10049	6497	2834	159		0.33	0.40	0.27
2015	8960	12020	6679	7896	10113	6165	2925	112		0.33	0.41	0.27
2016	3016	4086	2227	8125	10417	6338	3493	666		0.36	0.44	0.29
2017	5142	6837	3867	9023	11265	7227	3441	496		0.36	0.44	0.29
2018	6308	8962	4441	8957	11262	7123	3140	484*	2	0.37	0.45	0.30
2019	8102	13821	4750	8218	10622	6357	3045	227*	3	0.37	0.47	0.29
2020	4563**			8393***								

\* Since 2018, discards minus BMS landings from EU fleets officially reported in logbooks.

\*\* Geometric mean (1981–2019).

\*\*\* From the short-term forecast.

<sup>^</sup> Discards and BMS landings are not used in the model.

## Sources and references

ICES. 2020. Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK). ICES Scientific Reports, 2:61. <http://doi.org/10.17895/ices.pub.6092>.

*Recommended citation:* ICES. 2020. Turbot (*Scophthalmus maximus*) in Subarea 4 (North Sea). In Report of the ICES Advisory Committee, 2020. ICES Advice 2020, tur.27.4. <https://doi.org/10.17895/ices.advice.5914>.

# Annex 1

ICES Advice on fishing opportunities, catch, and effort  
Greater North Sea ecoregion  
Published 28 June 2019

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

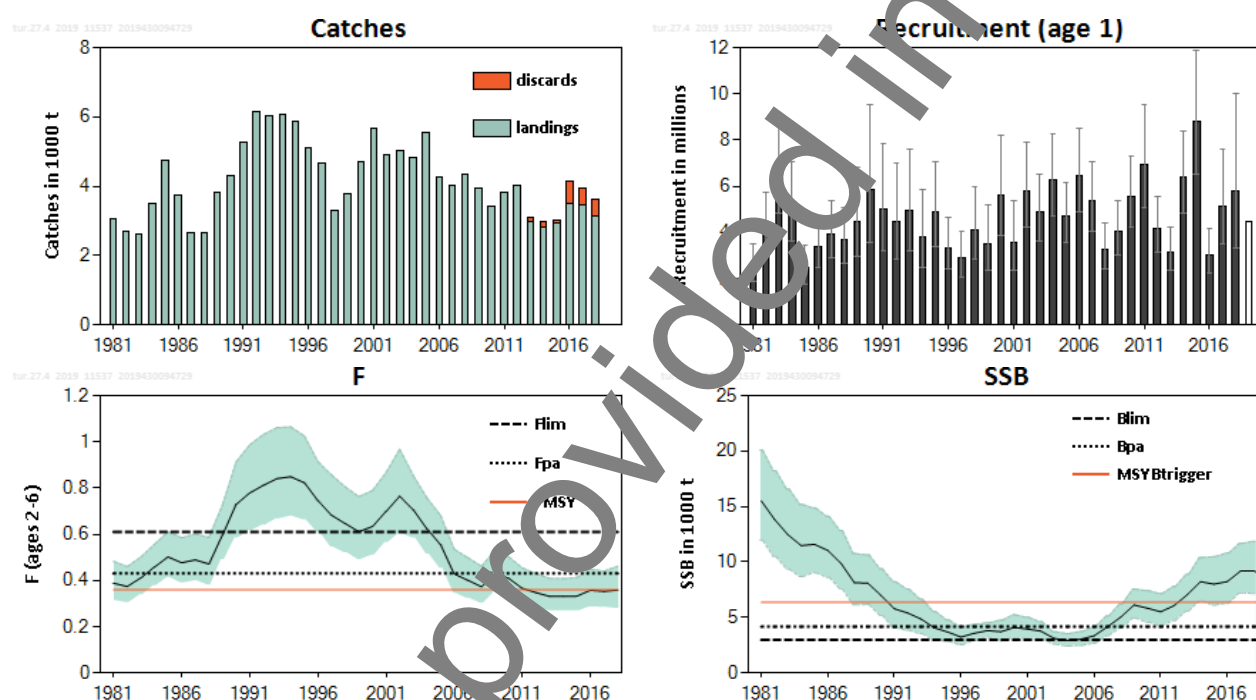
### ICES advice on fishing opportunities

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	MSY	✓	✓	✓ Above trigger
Precautionary approach	$F_{pa}, F_{lim}$	✓	✓	✓ Harvested sustainably	$B_{pa}, B_{lim}$	✓	✓	✓ Full reproductive capacity
Management plan	$F_{MGT}$	—	—	—	$B_{MGT}$	—	—	—

## 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	575	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	851	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)
	$B_{PE}$	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	$B_{mgt}$	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 the forecast.
Input data	Commercial landings raised to international landings, two survey indices (SNS, BTS-Is), one standardized commercial biomass index (NL_BT2). Assumed constant annual maturity (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 2016 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 (WGNESSK)

## 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 Emsy 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	2	169	0	1	4589
1976	3253	632	588	147	28	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	16	17	146	0	1	5486
1981	3073	404	1044	42	6	87	0	1	4756
1982	3029	335	880	15	14	43	0	1	4454
1983	3163	277	893	17	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	98	130	21	28	0	1	4272
1988	2660	328	88	129	24	42	0	1	4042
1989	3666	333	63	176	30	85	0	1	4927
1990	3732	437	46	292	52	185	0	7	5751
1991	3780	688	125	350	64	186	30	9	6340
1992	3495	902	907	317	81	163	66	3	5934
1993	2939	715	818	355	123	252	47	1	5547
1994	2724	86	862	330	141	263	42	1	5244
1995	2476	73	761	315	108	276	33	1	4672
1996	1775	637	618	210	160	157	36	1	3644
1997	1554	619	479	169	1	215	45	1	3382
1998	169	582	392	198	22	164	33	1	3087
1999	1208	488	411	224	0	224	32	1	3187
2000	2280	549	469	302	21	349	55	1	4026
2001	2236	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	1	2978
2016	1854	404	505	339	38	273	8	1	3421
2017	2118	397	486	336	40	252	13	1	3641
2018 <sup>^</sup>	1855 <sup>^^</sup>	367	331	268 <sup>^^</sup>	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.

<sup>^</sup> Preliminary.

<sup>^^</sup> 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					tonnes		
1981	2558	3531	1854	15508	20091	11911	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	9772	2619		0.41	0.50	0.34
1984	5053	7041	3626	11478	15118	8675	3514		0.46	0.56	0.38
1985	2457	3421	1765	11592	14853	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	12831	7578	2670		0.49	0.60	0.40
1988	3678	5046	2681	8126	10715	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	9185	5194	4282		0.73	0.91	0.58
1991	5020	7868	3203	7783	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	4458	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	3314	3587	4780	2844	5867		0.82	1.03	0.66
1996	3339	4622	2112	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	6535	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	6160	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	5311	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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