

Spurdog (*Squalus acanthias*) in the Northeast Atlantic

ICES advice on fishing opportunities

ICES advises that when the precautionary approach is applied, there should be no targeted fisheries on this stock in 2019 and 2020. Landing of bycatch should be part of a management plan, including close monitoring of the stock and fisheries.

Based on medium-term projections, annual catches at the recent assumed level (2468 tonnes) would allow the stock to increase at a rate close to that estimated with zero catches; therefore ICES considers that bycatch should not exceed that level.

Stock development over time

The total biomass and recruitment have declined substantially since the 1960s to the lowest level observed, but appear to have stabilized over the last decade. The harvest rate has declined substantially and is estimated to be well below the MSY level (HR_{MSY}).

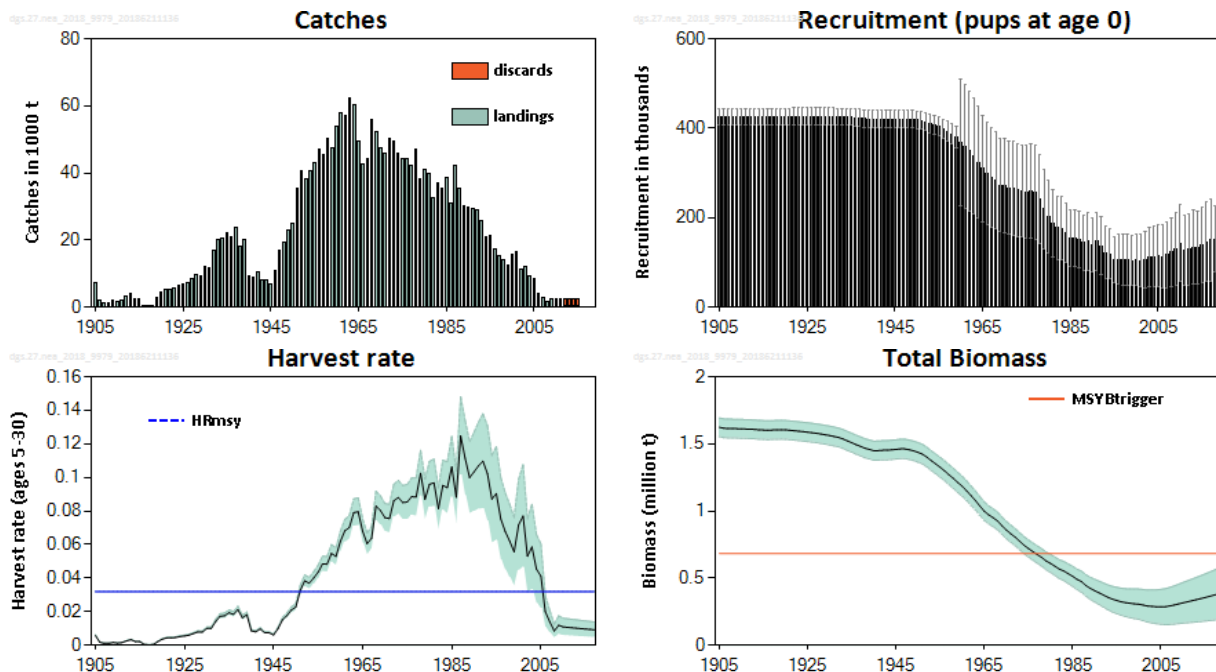


Figure 1 Spurdog in the Northeast Atlantic. Summary of the stock assessment. Long-term trends in catches (including assumed discards since 2010), mean harvest rate (average ages 5–30), recruitment (number of pups), and total biomass. Shaded areas in the bottom panels reflect estimates of precision (± 2 standard deviation) and horizontal lines indicate the associated MSY reference points. The final-year recruitment estimate is provisional, taken from the estimated stock–recruit relationship.

Stock and exploitation status

ICES assesses that fishing pressure on the stock is below HR_{MSY} , and total biomass is below $MSY B_{trigger}$. No other reference points for fishing pressure and stock size have been defined for this stock.

Table 1 Spurdog in the Northeast Atlantic. State of the stock and fishery relative to reference points.

		Fishing pressure			Stock size					
		2015	2016	2017	2016	2017	2018			
Maximum sustainable yield	HR_{MSY}	✓	✓	✓	Below	$MSY B_{trigger}$	✗	✗	✗	Below trigger
Precautionary approach	HR_{pa}, HR_{lim}	✓	✓	✓	Below possible reference points	B_{pa}, B_{lim}	?	?	?	Undefined
Management plan	HR_{MGT}	—	—	—	Not applicable	B_{MGT}	—	—	—	Not applicable

Catch scenarios

This stock is defined as category 1; however, the ICES MSY approach cannot be utilized to generate advice because B_{lim} remains undefined. ICES advice for this stock is therefore based upon the precautionary approach.

Recent landings have averaged around 320 tonnes (2013–2017) and have occurred whilst the stock was under the moratorium. Discards over this period cannot be quantified and all catches (landings and discards) are considered to be bycatches. The survey index shows an increasing trend in total biomass over the same period (ICES, 2018).

The current stock assessment assumes that total catches (2468 tonnes, average of 2007–2009) have not changed after the introduction of the moratorium. The difference between the reported landings and the assumed constant catches of 2468 tonnes is therefore considered to represent discarding.

Assuming that catches continue to remain at the level of 2468 tonnes, projections indicate that the stock would continue to increase and recover at a rate close to that estimated with zero catches.

ICES advises that when the precautionary approach is applied, there should be no targeted fisheries on this stock in 2019 and 2020. Landing of bycatches should be part of a management plan, including close monitoring of the stock and fisheries.

Table 2 Spurdog in the Northeast Atlantic. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
Harvest rate (2018)	0.0090	The harvest rate (ages 5–10) associated with a total catch of 2468 tonnes (average catch in 2007–2009)
B_{tot} (2019)	390 358 tonnes	Total biomass
Recruitment (2018)	152 138 pups	Modelled stock–recruit relationship, based on the number of pregnant females in the population (number)
Catch (2018)	2468 tonnes	Average catch in 2007–2009

Table 3 Spurdog in the Northeast Atlantic. Annual catch scenarios. All weights are in tonnes.

Basis	Catch		Harvest rate		B _{tot}		% B _{tot} change rel. to 2019		% Advice change	
	2019	2020	2019	2020	2020	2021	2020*	2021*	2019**	2020**
ICES advice basis										
Average catch 2007–2009 = 2468	2468	2468	0.0088	0.0086	399460	408819	2.3%	4.7%	0%	0%
Zero catch	0	0	0	0	401948	413786	3.0%	6.0%	-100%	-100%
Other scenarios										
Harvest rate = HR _{MSY} × B _{tot} (2019 or 2020) / MSY B _{trigger}	5210	5364	0.0185	0.0188	396696	403145	1.62%	3.3%	111%	117%
TAC 2009 = 1422	1422	1422	0.0051	0.0049	400515	410924	2.6%	5.3%	-42%	-42%
Harvest rate = HR _{MSY} (0.032)	9120	9119	0.032	0.032	392753	395429	0.61%	1.30%	270%	269%

*Total biomass for 2020 or 2021 relative to the total biomass for 2019.

** Catch for 2019 or 2020 relative to advice value for 2017 and 2018 (2 468 t).

There is no change in advice because the advice basis is unchanged compared to advice for 2017 and 2018.

Basis of the advice

Table 4 Spurdog in the Northeast Atlantic. The basis of the advice.

Advice basis	Precautionary approach (with MSY reference points and medium-term projections)
Management plan	ICES is not aware of any agreed precautionary management plan for spurdog in this area.

Quality of the assessment

Because of the number of assumptions made within the assessment model, uncertainty is likely to be underestimated. Assumptions about total dead catch of Northeast Atlantic spurdog have been used based on historical catch estimates, together with UK length–frequency distributions. However, there are still concerns over the quality of the data as a consequence of (a) uncertainty in the historical level of catches because of misreporting and generic landings categories, (b) lack of commercial length–frequency information for countries other than the UK, (c) lack of data on dead discards, and (d) the survey data examined do not cover the entire stock area. Reliable catch data since 2010 are not available. Future assessments require updated and validated growth parameters and better estimates of natural mortality.

The updated assessment has resulted in an upward revision of stock size compared to previous assessment.

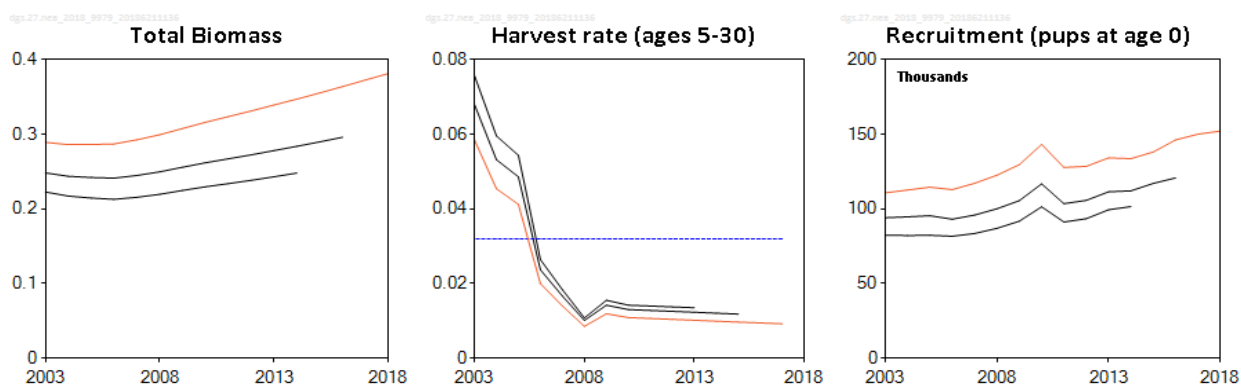


Figure 2 Spurdog in the Northeast Atlantic. Historical assessment results (final-year recruitment estimates are provisional, taken from the estimated stock–recruit relationship).

Issues relevant for the advice

Spurdog is a long-lived, slow-growing, and late-maturing species and is therefore particularly vulnerable to fishing mortality. The stock was subject to high harvest rates for more than four decades, and fisheries were not managed during this time. Management measures have only been restrictive for the entire stock area since 2009 and harvest rates have been below the MSY level since 2005. Spurdog is showing some signs of increase from the historical lows in the mid-2000s, but this period is very short in comparison to the longer-term historical decline. Recovery will be slow (e.g. over 20 years to reach current MSY B_{trigger}) and not biologically feasible under short-term management time frames (Table 11).

The TAC was reduced by 90% in 2010, and set to zero from 2011 onwards. There have been no targeted fisheries in EU or Norwegian waters since 2011. Spurdog remains a bycatch in the mixed demersal and gillnet fisheries, and an unquantified amount of discarding now takes place in these fisheries. The proportion of dead spurdog when taken aboard is low in longline fisheries, but higher in trawl and gillnet fisheries. Levels of discard survival are unknown but likely variable. In the absence of reliable catch data since 2010, ICES assumes the average landings for 2007–2009 to be a representative level of dead catch for 2010 onwards.

In 2009, a maximum landing length (100 cm) was introduced in EU waters, which is thought to have deterred many of the fisheries targeting mature female spurdog. Norway has a minimum landing size of 70 cm (first introduced in 1964), and from 2011 no directed fishery has been permitted in Norway.

Restrictions on landings of spurdog are thought to have contributed to the increased retention of smooth-hounds, which are also a small shark species.

Reference points

Table 5 Spurdog in the Northeast Atlantic. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	HR _{MSY} (MSY harvest rate)	0.032	Catch as a proportion of the total biomass, assuming average selection over the ages 5–30, reflecting a non-target selection pattern	ICES (2018)
	MSY B_{trigger}	683 340 t	MSY $B_{\text{trigger}} = B_{\text{FMSY}}/1.4$ (in terms of total biomass), representing a proxy for the 5 th percentile of the distribution of B_{FMSY} *	ICES (2018)
Precautionary approach	B_{lim}	Not defined		
	B_{pa}	Not defined		
	F_{lim}	Not defined		
	F_{pa}	Not defined		
Management plan	SSB _{MGT}	NA		
	F_{MGT}	NA		

*The basis for MSY B_{trigger} has changed compared to the previous advice, following ICES (2017).

Basis of the assessment

Table 6 Spurdog in the Northeast Atlantic. Basis of assessment and advice.

ICES stock data category	1 (ICES, 2016)
Assessment type	Age-length and sex-structured model (De Oliveira <i>et al.</i> , 2013)
Input data	GLM standardized Scottish survey index, Scottish survey length–frequency data (ScoGFS-WIBTS-Q1, ScoGFS-WIBTS-Q4, Sco-IBTS-Q1, Sco-IBTS-Q3), total landings, UK (E & W) and UK (Scotland) landings length frequencies
Discards and bycatch	Discarding is known to take place, but dead discards have not been quantified. It is assumed that EU catches have been discarded since 2010. The annual discards in the period 2010-2017 in the assessment are assumed as the difference between the assumed catches (average of 2007-2009 catches (2468 t)) and reported landings.
Indicators	None
Other information	A benchmark assessment was carried out in 2011 (ICES, 2010).
Working group	Working Group on Elasmobranch Fishes (WGEF)

Information from stakeholders

Reports suggest that the zero TAC since 2011 has increased regulatory discards of spurdog in mixed fisheries.

There are anecdotal reports across the stock area from fishers of localized increased occurrence of spurdog. This is supported by scientific observations on commercial fishing vessels and sampled catches from the Norwegian commercial gillnet fleet over the last decade.

History of the advice, catch, and management

Table 7 Spurdog in the Northeast Atlantic. History of ICES advice, the agreed TAC, and ICES estimates of Landings. Weights in tonnes.

Year	ICES advice	Catch corresp. to advice	Agreed TAC	ICES landings^^
1999	None		8900*	12385
2000	None		8900*	15891
2001	None		8900*	16693
2002	None		7100*	11170
2003	None		5600*	12247
2004	None		4500*	9366
2005	None		1100*	8426
2006	F = 0	0	1100*	4109
2007		0	3700**	2929
2008	F = 0	0	2600***	1836
2009	No fishery	0	1422	2640
2010	No new advice, same as for 2009	0	1422^	1249
2011	F = 0	0	0	580
2012	F = 0	0	0	261
2013	F = 0	0	0	333
2014	No new advice, same as for 2013	0	0	383
2015	No target fishery, minimize bycatch	0	0	237
2016	No new advice, same as for 2015	0	0^^^	382
2017	PA approach (and no target fishery and medium-term projections.	≤ 2468	0^^^	273
2018	PA approach (and no target fishery and medium-term projections.	≤ 2468	0^^^	
2019	PA approach (and no target fishery and medium-term projections.	≤ 2468		
2020	PA approach (and no target fishery and medium-term projections.	≤ 2468		

* TAC for ICES Subarea 4 and Division 2.a (EC).

** Combined TAC for ICES Subarea 4 and Division 2.a (EC) and for ICES Division 3.a, and subareas 1, 5, 6, 7, 8, 12, and 14 (EU and international waters).

*** Combined TAC for ICES Subarea 4 and Division 2.a (EC) and for ICES subareas 1, 5, 6, 7, 8, 12, and 14 (EU and international waters).

^ Landing of bycatch permitted up to 10% of the 2009 quota.

^^ Landings for the total stock area, subareas 1–9.

^^^ A bycatch quota of 270 t was made available to those countries taking part in a pilot spurdog avoidance programme.

History of the catch and landings

The quantity of spurdog caught in the NEAFC area is uncertain.

Table 8 Spurdog in the Northeast Atlantic. Catch distribution by fleet in 2017 as estimated by ICES.

Total catch (2017)	Landings				Discards
	gillnets	bottom trawls	lines	others	
Unknown	74%	8%	13%	5%	Unquantified*
273 t					

* Discards are not quantified but in the assessment, discards are assumed to be the difference between the assumed catches (average of 2007–2009 catches (2468 t)) and the reported landings. This amounts to 2119 t for 2017.

Table 9 Spurdog in the Northeast Atlantic. History of ICES landings for each country participating in the fishery. Weights in tonnes.

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Belgium	1097	1085	1110	1072	1139	920	1048	979	657	750	582	393	447	335	396	391
Denmark	1404	1418	1282	1533	1217	1628	1008	1395	1495	1086	1364	1246	799	486	212	146
Faroe Islands	0	22	0	0	0	0	0	0	0	6	2	3	25	137	203	310
France	17514	19067	12430	12641	8356	8867	7022	11174	7872	5993	4570	4370	4908	4831	3329	1978
Germany	43	42	39	25	8	22	41	48	27	24	26	6	55	8	21	100
Iceland	36	22	14	25	5	9	7	5	4	17	15	53	185	108	97	166
Ireland	108	476	1268	4658	6930	8791	5012	8706	5612	3063	1543	1036	1150	2167	3624	3056
Netherlands	217	268	183	315	0	0	0	0	0	0	0	0	0	0	0	0
Norway	5925	3941	3992	4659	4279	3487	2986	3614	4139	5329	8104	9633	7113	6945	4546	3940
Poland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Portugal	2	0	0	0	0	0	1	5	3	2	128	188	250	323	190	256
Russia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spain	0	0	8	653	0	0	0	0	0	0	0	0	0	0	0	0
Sweden	399	308	398	300	256	360	471	702	733	613	390	333	230	188	95	104
UK (E&W)	9229	9342	8024	6794	8046	7841	7047	7684	6952	5371	5414	3770	4207	3494	3462	2354
UK (Sc)	4994	3970	3654	4371	4957	6749	6267	8043	8075	8024	7768	8531	9677	6614	4676	8517
Total	40968	39961	32402	37046	35193	38674	30910	42355	35569	30278	29906	29562	29046	25636	20851	21318

Table 9 (cont.) Spurdog in the Northeast Atlantic. History of ICES landings for each country participating in the fishery^{*,**^}. Weights in tonnes.

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Belgium	430	443	382	354	400	410	23	11	13	20	17	0	0	7	1	0	0	0	0	0	0	0
Denmark	142	196	126	131	146	156	256	232	219	151	122	76	77	83	11	26	31	20	10	28	24	na
Faroe Islands	51	218	362	486	368	613	340	224	295	225	271	241	144	462	179	104	0	0	-	-	-	-
France	1607	1555	1286	998	4342	4304	2569	1705	1062	2426	715	453	366	577	348	131	42	13	19	2	1	3
Germany	38	21	31	54	194	304	121	98	138	144	6	0	0	1	1	1	1	0	1	0	2	-
Iceland	156	106	80	57	107	199	276	200	142	71	75	36	52	95	58	51	44	6	19	8	8	4
Ireland	2305	2214	1164	904	905	1227	1214	1416	1076	940	614	558	163	214	26	11	2	27	18	2	34	1
Netherlands	0	0	0	0	28	39	27	10	25	41	34	28	26	5	7	2	28	3	0	1	1	1
Norway	2748	1567	1293	1461	1643	1424	1091	1119	1054	1010	790	616	711	543	541	246	108	251	313	217	270	222
Poland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-
Portugal	120	100	46	21	2	3	4	4	9	6	10	9	4	2	2	3	2	2	1	2	1	1
Russia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-
Spain	0	0	28	95	372	363	306	135	17	71	106	16	15	32	6	4	0	4	1	4	10	5
Sweden	154	196	140	114	123	238	0	275	244	170	148	95	9	80	5	0	0	0	0	0	0.1	0.1
UK (E&W)	2670	3066	4480	4461	3654	4516	2823	3109	1729	1887	434	386	91	194	8	0	2	1	0	0	30	37
UK (Sc)	6873	5665	4501	3248	3606	2897	2120	3708	3342	1263	766	415	178	345	56	1	1	6	0	0	-	-
Total	17294	15347	13919	12384	15890	16693	11170	12246	9365	8425	4108	2929	1836	2640	1249	580	261	333	383	265	382	273

* Catch data used in the assessment: before 2010, landings are assumed to represent catches; since 2010, when the TAC was first reduced by 90% (2010) and then set to zero (2011 onwards), landings are no longer considered to be representative of catches because of unquantified amounts of discarding.

** Landings are considered unrepresentative of catches since 2010.

^ Average landings in 2007–2009 are assumed to represent the catch since 2010.

Summary of the assessment

Table 10 Spurdog in the Northeast Atlantic. Summary table of estimates from the spurdog assessment: recruitment (number of pups), total biomass (tonnes), harvest rate (assuming average selection over the ages 5–30), and the working group estimates of landings and catch (tonnes) used in the assessment. Estimates of precision (\pm standard deviation).

Year	Recruitment (pups at age 0)			Total biomass			Landings*	Discards*	Harvest rate		
	Number	High	Low	Tonnes	High	Low	tonnes	tonnes	Ages 5–30	High	Low
1905	425677	443952	407402	1623340	1693032	1553648	7248		0.0058	0.0063	0.0053
1906	425864	444151	407577	1616270	1685964	1546576	2200		0.00176	0.00192	0.00161
1907	425915	444205	407625	1614470	1684168	1544772	1428		0.00115	0.00125	0.00104
1908	425946	444238	407654	1613540	1683244	1543836	1409		0.00113	0.00123	0.00103
1909	425975	444269	407681	1612720	1682428	1543012	2022		0.00163	0.00177	0.00148
1910	426013	444310	407716	1611380	1681094	1541666	1563		0.00126	0.00137	0.00114
1911	426039	444338	407740	1610600	1680318	1540882	1957		0.00158	0.00172	0.00143
1912	426069	444371	407767	1609510	1679234	1539786	3199		0.0026	0.0028	0.0023
1913	426118	444426	407810	1607300	1677032	1537568	4050		0.0033	0.0036	0.0030
1914	426174	444489	407859	1604400	1674140	1534660	2641		0.0021	0.0023	0.00194
1915	426202	444522	407882	1603070	1672820	1533320	2602		0.0021	0.0023	0.00192
1916	426227	444550	407904	1601890	1671648	1532132	534		0.00043	0.00047	0.00039
1917	426221	444543	407899	1602840	1672608	1533072	339		0.00027	0.00030	0.00025
1918	426211	444530	407892	1603990	1673766	1534214	451		0.00037	0.00040	0.00033
1919	426200	444517	407883	1605010	1674794	1535226	2659		0.0022	0.0023	0.00196
1920	426219	444540	407898	1603850	1673642	1534058	4396		0.0036	0.0039	0.0032
1921	426257	444585	407929	1601070	1670872	1531268	5321		0.0043	0.0047	0.0039
1922	426300	444639	407961	1597540	1667354	1527726	5401		0.0044	0.0048	0.0040
1923	426334	444684	407984	1594130	1663956	1524304	5655		0.0046	0.0050	0.0042
1924	426362	444724	408000	1590680	1660522	1520838	6355		0.0052	0.0057	0.0047
1925	426383	444759	408007	1586760	1656618	1516902	6719		0.0055	0.0060	0.0050
1926	426393	444786	408000	1582730	1652608	1512852	7277		0.0060	0.0065	0.0054
1927	426389	444801	407977	1578410	1648308	1508512	8395		0.0069	0.0075	0.0063
1928	426366	444802	407930	1573280	1643202	1503358	9522		0.0079	0.0086	0.0072
1929	426313	444778	407848	1567380	1637330	1497430	9320		0.0078	0.0085	0.0071
1930	426239	444734	407744	1562040	1632020	1492060	11914		0.0099	0.0108	0.0090
1931	426101	444639	407563	1554510	1624524	1484496	11838		0.0099	0.0108	0.0090
1932	425929	444511	407347	1547500	1617554	1477446	16726		0.0141	0.0154	0.0128
1933	425591	444244	406938	1536150	1606252	1466048	20244		0.0172	0.0188	0.0157
1934	425045	443795	406295	1521980	1592138	1451822	20378		0.0175	0.0191	0.0159
1935	424372	443227	405517	1508450	1578674	1438226	22266		0.0194	0.021	0.0176
1936	423487	442468	404506	1493820	1564122	1423518	20925		0.0184	0.020	0.0167
1937	422565	441669	403461	1481320	1551712	1410928	23930		0.021	0.023	0.0193
1938	421347	440602	402092	1466580	1537076	1396084	18196		0.0163	0.0178	0.0149
1939	420476	439842	401110	1458280	1528892	1387668	20119		0.0182	0.0199	0.0165
1940	419442	438933	399951	1448620	1519360	1377880	9428		0.0086	0.0094	0.0078

Year	Recruitment (pups at age 0)			Total biomass			Landings*	Discards*	Harvest rate		
	Number	High	Low	Tonnes	High	Low			tonnes	tonnes	Ages 5–30
1941	419338	438861	399815	1450050	1520928	1379172	8740		0.0080	0.0087	0.0072
1942	419366	438905	399827	1452270	1523290	1381250	10625		0.0096	0.0105	0.0088
1943	419305	438868	399742	1452650	1523822	1381478	8181		0.0074	0.0081	0.0068
1944	419512	439069	399955	1455490	1526820	1384160	8151		0.0074	0.0080	0.0067
1945	419767	439312	400222	1458300	1529792	1386808	6776		0.0061	0.0067	0.0056
1946	420160	439676	400644	1462370	1534028	1390712	10895		0.0098	0.0107	0.0089
1947	420238	439758	400718	1462250	1534078	1390422	16893		0.0152	0.0166	0.0138
1948	419837	439417	400257	1456210	1528214	1384206	19491		0.0176	0.0192	0.0160
1949	419189	438860	399518	1447850	1520040	1375660	23010		0.021	0.023	0.0190
1950	418171	437978	398364	1436370	1508754	1363986	24750		0.023	0.025	0.021
1951	416894	436871	396917	1423660	1496248	1351072	35301		0.033	0.036	0.030
1952	414375	434653	394097	1401080	1473892	1328268	40550		0.038	0.042	0.035
1953	410915	431589	390241	1374230	1447290	1301170	38206		0.037	0.040	0.034
1954	407376	428448	386304	1350740	1424076	1277404	40570		0.040	0.044	0.036
1955	403193	424717	381669	1325850	1399492	1252208	43127		0.043	0.048	0.039
1956	398299	420329	376269	1299360	1373348	1225372	46951		0.048	0.053	0.044
1957	392429	415031	369827	1270000	1344378	1195622	45570		0.048	0.053	0.044
1958	386511	409669	363353	1242940	1317760	1168120	50394		0.055	0.060	0.049
1959	379387	403173	355601	1211870	1287192	1136548	47394		0.053	0.058	0.048
1960	367532	508934	226130	1184260	1258432	1110088	53997		0.062	0.068	0.056
1961	358842	496986	220698	1150640	1223684	1077596	57721		0.068	0.075	0.061
1962	348270	482388	214152	1113810	1185718	1041902	57256		0.070	0.077	0.063
1963	336847	466557	207137	1077860	1148594	1007126	62288		0.079	0.087	0.071
1964	323247	447697	198797	1037100	1106644	967556	60146		0.080	0.088	0.071
1965	309582	428722	190442	998587	1066975	930199	49336		0.068	0.075	0.061
1966	298869	413749	183989	970845	1038165	903525	42713		0.060	0.067	0.054
1967	290625	402179	179071	949393	1015759	883027	44116		0.064	0.071	0.057
1968	282844	391336	174352	925997	991535	860459	56043		0.083	0.092	0.074
1969	272394	377026	167762	890074	954942	825206	52074		0.080	0.089	0.072
1970	270528	375492	165564	858171	922503	793839	47557		0.076	0.084	0.068
1971	266222	369956	162488	830615	894541	766689	45653		0.075	0.084	0.067
1972	265278	369442	161114	804978	868614	741342	50416		0.086	0.096	0.076
1973	261751	365335	158167	774573	838065	711081	49412		0.088	0.098	0.078
1974	258704	361900	155508	745381	808857	681905	45684		0.085	0.095	0.075
1975	257389	361407	153371	720314	783928	656700	44119		0.085	0.096	0.075
1976	259022	365080	152964	697426	761334	633518	44064		0.089	0.100	0.077
1977	255705	361143	150267	674978	739340	610616	42252		0.088	0.100	0.077
1978	241156	339780	142532	654074	719098	589050	47235		0.102	0.116	0.089
1979	219339	308677	130001	627509	693423	561595	38201		0.087	0.099	0.075
1980	202625	284391	120859	609481	676441	542521	40968		0.096	0.110	0.082
1981	186839	261879	111799	587959	656121	519797	39962		0.097	0.111	0.083

Year	Recruitment (pups at age 0)			Total biomass			Landings*	Discards*	Harvest rate		
	Number	High	Low	Tonnes	High	Low	tonnes	tonnes	Ages 5–30	High	Low
1982	176935	248189	105681	566822	636336	497308	32402		0.081	0.094	0.069
1983	175460	246590	104330	552782	623782	481782	37046		0.095	0.110	0.080
1984	165147	232037	98257	532885	605489	460281	35194		0.094	0.109	0.078
1985	155023	217893	92153	513628	587916	439340	38674		0.106	0.124	0.088
1986	153482	216816	90148	490234	566344	414124	30910		0.088	0.104	0.072
1987	150583	213373	87793	473895	551911	395879	42356		0.125	0.148	0.101
1988	144398	206236	82560	445362	525422	365302	35569		0.111	0.134	0.089
1989	146803	211143	82463	423601	505883	341319	30279		0.100	0.121	0.078
1990	138411	199383	77439	406453	490975	321931	29906		0.103	0.127	0.080
1991	146485	211911	81059	390089	477109	303069	29563		0.107	0.133	0.081
1992	137034	200974	73094	373544	463162	283926	29046		0.110	0.138	0.081
1993	122168	179844	64492	356717	448943	264491	25637		0.102	0.131	0.074
1994	118461	174701	62221	343187	438177	248197	20851		0.087	0.113	0.061
1995	105962	158004	53920	333689	431383	235995	21318		0.090	0.118	0.062
1996	106847	162335	51359	323652	424238	223066	17295		0.075	0.100	0.051
1997	107086	164198	49974	317346	420940	213752	15348		0.068	0.091	0.045
1998	106083	163475	48691	312486	419126	205846	13919		0.062	0.084	0.040
1999	104271	161293	47249	308481	418165	198797	12385		0.056	0.076	0.035
2000	104904	162258	47550	305589	418351	192827	15891		0.072	0.099	0.045
2001	104265	163917	44613	298820	414726	182914	16693		0.077	0.108	0.046
2002	105999	168267	43731	291183	410375	171991	11170		0.053	0.075	0.031
2003	110748	176842	44654	289246	411892	166600	12247		0.059	0.084	0.033
2004	112643	181235	44051	286266	412514	160018	9366		0.045	0.066	0.025
2005	114572	185102	44042	286268	416252	156284	8426		0.041	0.060	0.022
2006	112924	183348	42500	287127	420927	153327	4109		0.0200	0.029	0.0105
2007	117170	190476	43864	292562	430374	154750	2929		0.0140	0.021	0.0073
2008	122576	199074	46078	299457	441507	157407	1836		0.0085	0.0125	0.0045
2009	129610	209924	49296	307801	454337	161265	2640		0.0119	0.0175	0.0063
2010	143201	229297	57105	316111	467625	164597	1249**	1219***	0.0109	0.0161	0.0057
2011	127799	206577	49021	323654	479730	167578	580**	1888***	0.0107	0.0158	0.0056
2012	128511	207151	49871	331270	492000	170540	261**	2207***	0.0104	0.0154	0.0054
2013	134192	216734	51650	339268	504848	173688	333**	2135***	0.0102	0.0151	0.0052
2014	133675	215391	51959	347248	517696	176800	383**	2085***	0.0099	0.0148	0.0050
2015	138188	223192	53184	355467	530879	180055	237	2231***	0.0097	0.0145	0.0049
2016	146238	235876	56600	364039	544579	183499	349	2119***	0.0094	0.0142	0.0047
2017	150114	242482	57746	372728	558434	187022	273	2195***	0.0092	0.0139	0.0046
2018	152138^	224908^	79368^	381466	572272	190660					

*Catch data used in the assessment: before 2010, landings are assumed to represent catch; since 2010, when the TAC was first reduced by 90% (2010) and then set to zero (2011 onwards), landings are no longer considered to be representative of catch because of unquantified amounts of discarding. **Landings considered unrepresentative of catch since 2010. ***Discards are the difference between assumed catch (average landings 2007–2009 = 2468 t are assumed to represent catches since 2010) and landings. ^Provisional values taken from the estimated stock–recruit relationship.

Table 11 Spurdog in the Northeast Atlantic. Extension of short-term forecasts to the medium- to longer-term (3, 5, 10, and 30 years beyond 2018). Estimates of total biomass relative to the total biomass in 2018 for different future catch options, assuming that the catch in 2018 is 2468 tonnes (see Table 3 for 2019 and 2020). Point estimates are shown in the upper third of the table, with corresponding lower and upper values (reflecting ± 2 standard deviations) given in the middle and bottom third of the table.

	Medium-term projections				
	MSY approach	Zero	TAC 2009	Ave. catch 2007–2009	MSY harvest rate
Average catch*	7962	0	1422	2468	10102
Point estimates					
+ 3 years	1.06	1.08	1.08	1.07	1.04
+ 5 years	1.09	1.15	1.13	1.12	1.05
+ 10 years	1.18	1.32	1.29	1.26	1.10
+ 30 years	1.51	2.16	2.05	1.96	1.30
Point estimates -2 standard deviations					
+ 3 years	1.03	1.06	1.05	1.05	1.01
+ 5 years	1.04	1.11	1.10	1.09	1.01
+ 10 years	1.08	1.25	1.22	1.19	1.03
+ 30 years	1.20	1.90	1.83	1.76	1.13
Point estimates +2 standard deviations					
+ 3 years	1.08	1.11	1.10	1.10	1.06
+ 5 years	1.14	1.19	1.17	1.16	1.09
+ 10 years	1.28	1.39	1.36	1.33	1.17
+ 30 years	1.82	2.43	2.27	2.16	1.47

* "Average catch" is the average for the projection period 2019–2047.

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