ICES Advice on fishing opportunities, catch, and effort
Ecoregions in the Northeast Atlantic and adjacent seas
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Spurdog (*Squalus acanthias*) in subareas 1–10, 12, and 14 (the Northeast Atlantic and adjacent waters)

ICES advice on fishing opportunities

ICES advises that when the precautionary approach is applied, there should be no targeted fisheries on this stock in 2021 and 2022.

Note: This advice sheet is abbreviated due to the COVID-19 disruption. The previous advice issued for 2019 and 2020 is attached as Annex 1.

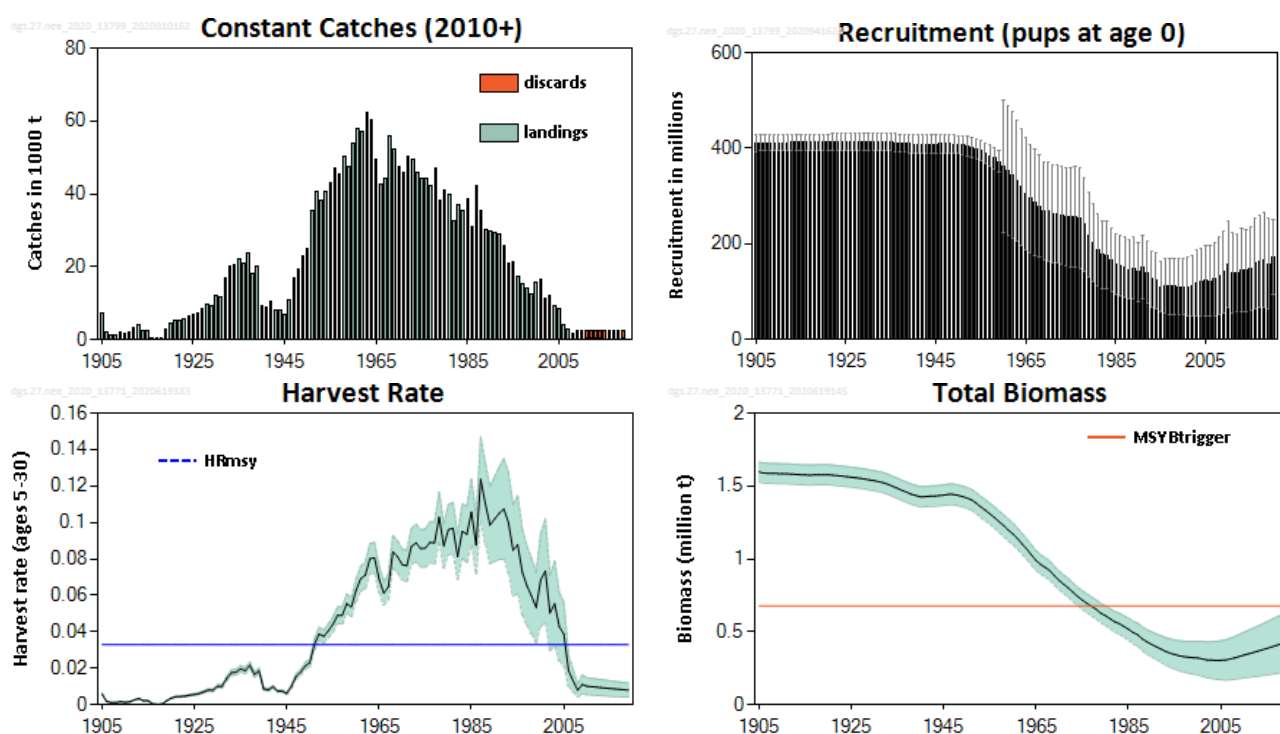### Stock development over time

Figure 1   Spurdog in subareas 1–10, 12, and 14. 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–recruitment relationship.

Stock and exploitation status

Table 1   Spurdog in subareas 1–10, 12, and 14. State of the stock and the fishery relative to reference points.

		Fishing pressure					Stock size		
		2017	2018	2019			2018	2019	2020
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	F_{MGT}	—	—	— Not applicable		B_{MGT}	—	—	— Not applicable

Catch scenarios

Table 2   Spurdog in subareas 1–10, 12, and 14. Assumptions made for the interim year and in the forecast.

Variable	Value	Notes
Harvest rate (2020)	0.0078	The harvest rate (ages 5–10) associated with a total catch of 2468 tonnes (average catch in 2007–2009)
B_{tot} (2021)	447720	Total biomass; in tonnes
Recruitment (2020)	171756	Modelled stock–recruitment relationship, based on the number of pregnant females in the population (number of pups in thousands)
Catch (2020)	2468	Average catch in 2007–2009; in tonnes

Table 3   Spurdog in subareas 1–10, 12, and 14. Annual catch scenarios. All weights are in tonnes.

Basis	Catch		Harvest rate		B_{tot}		% B_{tot} change rel. to 2021		% advice change	
	2021	2022	2021	2022	2022	2023	2022 *	2023 *	2021 **	2022 **
ICES advice basis										
Zero catch	0	0	0	0	461188	474888	3.0	6.1	−100	−100
Other scenarios										
Average catch 2007–2009 = 2468	2468	2468	0.0076	0.0075	458701	469925	2.5	5.0	0	0
Harvest rate = HR_{MSY} × B_{tot} (2021 or 2022) / MSY $B_{trigger}$	7264	7430	0.022	0.023	453868	460111	1.37	2.8	194	201
TAC 2009 = 1422	1422	1422	0.0044	0.0043	459755	472029	2.7	5.4	−42	−42
Harvest rate = HR_{MSY} (0.033)	10985	10963	0.034 ***	0.034	450117	452813	0.54	1.14	345	344
SSB_{2022} = MSY $B_{trigger}$ ^										

* Total biomass for 2022 or 2023 relative to the total biomass for 2021.

** Catch for 2020 or 2021 relative to the advice value for 2019 and 2020 (2468 tonnes).

*** The harvest rate shown is a weighted average (weighted by population number-at-age) for ages 5–30; therefore, there is a slight difference between the resultant harvest rate for ages 5–30 and HR_{MSY} because of the slightly different age structure compared to equilibrium conditions.

^The MSY $B_{trigger}$ option was left blank because MSY $B_{trigger}$ cannot be achieved in 2022, even with zero catch.
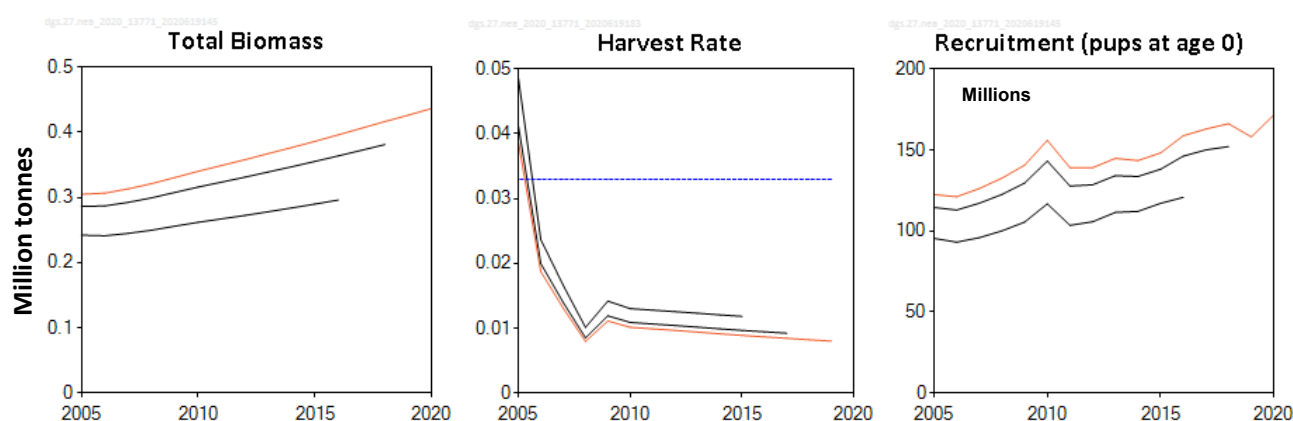
Quality of the assessment

Figure 2   Spurdog in subareas 1–10, 12, and 14. Historical assessment results (final-year recruitment estimates are provisional, taken from the estimated stock–recruitment relationship). The blue dotted line is HR_{MSY} = 0.033.

Issues relevant for the advice

Based on medium-term projections (30 years), annual catches at the recent assumed level (2468 tonnes) would allow the stock to increase at a rate that is similar (8% lower) to that estimated with zero catches; therefore, ICES considers that bycatch should not exceed the recent assumed level of total catches of 2468 tonnes.

Reference points

Table 4   Spurdog in subareas 1–10, 12, and 14. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	HR_{MSY} (MSY harvest rate)	0.033	Catch as a proportion of the total biomass, assuming average selection over the ages 5–30, reflecting a non-target selection pattern	ICES (2020)
	MSY $B_{trigger}$	677068 tonnes	MSY $B_{trigger}$ = B_{MSY}/1.4 (in terms of total biomass), representing a proxy for the 5th percentile of the distribution of B_{MSY}	ICES (2020)
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		

NA = not available.

History of the advice, catch, and management

Table 5   Spurdog in subareas 1–10, 12, and 14. History of ICES advice, the agreed TAC, and ICES estimates of landings. Weights are 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	263
2016	No new advice, same as for 2015	0	0 ^^^	373
2017	PA approach (and no target fishery and medium-term projections)	≤ 2468 §	0 ^^^	296

Year	ICES advice	Catch corresp. to advice	Agreed TAC	ICES landings ^^
2018	PA approach (and no target fishery and medium-term projections)	≤ 2468 §	0 ^^^	363
2019	PA approach (and no target fishery and medium-term projections)	≤ 2468 §	0 ^^^	454
2020	PA approach (and no target fishery and medium-term projections)	≤ 2468 §	0 ^^^	
2021	PA approach (no targeted fisheries)	0		
2022	PA approach (no targeted fisheries)	0		

* 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, as well as 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 tonnes was made available to those countries taking part in a pilot spurdog avoidance programme.

§ Assumed annual catch.

Summary of the assessment

Table 6   Spurdog in subareas 1–10, 12, and 14. 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 (±2 standard deviation).

Year	Recruitment (pups at age 0)			Total biomass			Landings*	Discards *	Harvest rate		
	Millions	High	Low	Tonnes	High	Low	Tonnes	Tonnes	Ages 5–30	High	Low
1905	411	428	393	1595770	1664076	1527464	7248		0.0059	0.0064	0.0054
1906	411	429	393	1588700	1657008	1520392	2200		0.00179	0.00196	0.00163
1907	411	429	394	1586910	1655222	1518598	1428		0.00117	0.00127	0.00106
1908	411	429	394	1586010	1654328	1517692	1409		0.00115	0.00126	0.00105
1909	411	429	394	1585210	1653534	1516886	2022		0.00165	0.00180	0.00151
1910	411	429	394	1583890	1652220	1515560	1563		0.00128	0.00140	0.00116
1911	411	429	394	1583140	1651476	1514804	1957		0.00160	0.00175	0.00146
1912	411	429	394	1582090	1650434	1513746	3199		0.0026	0.0029	0.0024
1913	412	429	394	1579920	1648272	1511568	4050		0.0033	0.0036	0.0030
1914	412	429	394	1577080	1645440	1508720	2641		0.0022	0.0024	0.00198
1915	412	429	394	1575800	1644172	1507428	2602		0.0021	0.0023	0.00195
1916	412	429	394	1574690	1643072	1506308	534		0.00044	0.00048	0.00040
1917	412	429	394	1575710	1644104	1507316	339		0.00028	0.00030	0.00025
1918	412	429	394	1576930	1645334	1508526	451		0.00037	0.00040	0.00034
1919	412	429	394	1578020	1646432	1509608	2659		0.0022	0.0024	0.00199
1920	412	429	394	1576950	1645372	1508528	4396		0.0036	0.0039	0.0033
1921	412	430	394	1574250	1642684	1505816	5321		0.0044	0.0048	0.0040
1922	412	430	394	1570800	1639246	1502354	5401		0.0045	0.0049	0.0041
1923	412	430	394	1567480	1635942	1499018	5655		0.0047	0.0051	0.0043
1924	412	430	394	1564130	1632608	1495652	6355		0.0053	0.0058	0.0048
1925	412	430	395	1560310	1628808	1491812	6719		0.0056	0.0061	0.0051
1926	412	430	395	1556390	1624910	1487870	7277		0.0061	0.0066	0.0055
1927	412	430	395	1552190	1620734	1483646	8395		0.0070	0.0077	0.0064
1928	413	430	395	1547190	1615760	1478620	9522		0.0080	0.0087	0.0073
1929	413	430	395	1541420	1610020	1472820	9320		0.0079	0.0086	0.0072
1930	413	431	395	1536230	1604866	1467594	11914		0.0101	0.0110	0.0092
1931	413	431	395	1528870	1597544	1460196	11838		0.0101	0.0110	0.0092
1932	413	431	395	1522050	1590770	1453330	16726		0.0144	0.0157	0.0131
1933	413	431	395	1510900	1579672	1442128	20244		0.0175	0.0191	0.0159
1934	412	430	394	1496970	1565806	1428134	20378		0.0178	0.0194	0.0162
1935	412	430	394	1483690	1552600	1414780	22266		0.0197	0.021	0.0179
1936	411	430	393	1469350	1538348	1400352	20925		0.0187	0.020	0.0170
1937	411	429	392	1457160	1526260	1388060	23930		0.022	0.024	0.0197
1938	410	428	391	1442760	1511976	1373544	18196		0.0166	0.0181	0.0151

Year	Recruitment (pups at age 0)			Total biomass			Landings*	Discards *	Harvest rate		
	Millions	High	Low	Tonnes	High	Low	Tonnes	Tonnes	Ages 5–30	High	Low
1939	409	428	390	1434840	1504186	1365494	20119		0.0185	0.020	0.0168
1940	408	427	389	1425580	1495068	1356092	9428		0.0087	0.0095	0.0079
1941	408	427	389	1427420	1497062	1357778	8740		0.0081	0.0088	0.0074
1942	408	427	389	1430070	1499872	1360268	10625		0.0098	0.0107	0.0089
1943	408	427	389	1430890	1500862	1360918	8181		0.0075	0.0082	0.0069
1944	408	427	389	1434180	1504328	1364032	8151		0.0075	0.0082	0.0068
1945	408	427	389	1437440	1507768	1367112	6776		0.0062	0.0068	0.0057
1946	409	428	390	1441960	1512472	1371448	10895		0.0100	0.0108	0.0091
1947	409	428	390	1442270	1512970	1371570	16893		0.0154	0.0168	0.0140
1948	409	428	390	1436660	1507554	1365766	19491		0.0179	0.0195	0.0163
1949	408	427	389	1428730	1499826	1357634	23010		0.021	0.023	0.0193
1950	407	426	388	1417670	1488976	1346364	24750		0.023	0.025	0.021
1951	406	426	387	1405370	1476898	1333842	35301		0.033	0.036	0.030
1952	404	424	384	1383230	1454998	1311462	40550		0.039	0.042	0.035
1953	401	421	381	1356810	1428846	1284774	38206		0.037	0.041	0.034
1954	398	418	377	1333780	1406112	1261448	40570		0.041	0.044	0.037
1955	394	415	373	1309360	1382020	1236700	43127		0.044	0.048	0.040
1956	390	411	368	1283370	1356398	1210342	46951		0.049	0.054	0.044
1957	384	406	362	1254530	1327976	1181084	45570		0.049	0.054	0.044
1958	379	401	356	1228030	1301950	1154110	50394		0.055	0.061	0.050
1959	372	395	349	1197550	1272008	1123092	47394		0.054	0.059	0.048
1960	361	501	222	1170610	1243972	1097248	53997		0.063	0.069	0.057
1961	353	489	217	1137680	1209960	1065400	57721		0.069	0.076	0.062
1962	343	475	211	1101580	1172764	1030396	57256		0.071	0.078	0.064
1963	332	459	204	1066370	1136422	996318	62288		0.080	0.088	0.072
1964	318	441	196	1026380	1095288	957472	60146		0.081	0.089	0.072
1965	305	422	188	988655	1056455	920855	49336		0.069	0.076	0.062
1966	295	408	181	961705	1028487	894923	42713		0.061	0.068	0.055
1967	287	397	176	941045	1006923	875167	44116		0.065	0.071	0.058
1968	279	386	172	918435	983535	853335	56043		0.084	0.093	0.075
1969	269	372	165	883291	947769	818813	52074		0.081	0.090	0.072
1970	267	371	163	852149	916139	788159	47557		0.077	0.085	0.068
1971	263	366	161	825341	888973	761709	45653		0.076	0.085	0.068
1972	262	365	159	800439	863831	737047	50416		0.087	0.097	0.077
1973	259	362	157	770761	834057	707465	49412		0.089	0.099	0.078
1974	256	359	154	742290	805622	678958	45684		0.086	0.096	0.075
1975	255	359	152	717939	781461	654417	44119		0.086	0.096	0.075
1976	257	363	152	695762	759634	631890	44064		0.089	0.100	0.078
1977	254	359	149	674032	738418	609646	42252		0.089	0.100	0.077
1978	240	338	142	653852	718964	588740	47235		0.103	0.117	0.089
1979	218	307	129	628008	694082	561934	38201		0.087	0.099	0.075
1980	202	284	120	610689	677885	543493	40968		0.096	0.110	0.082
1981	186	261	112	589858	658338	521378	39962		0.097	0.111	0.083
1982	177	248	106	569390	639310	499470	32402		0.081	0.094	0.069
1983	176	247	104	556001	627501	484501	37046		0.095	0.110	0.080
1984	166	233	99	536749	609947	463551	35194		0.094	0.109	0.078
1985	156	219	93	518118	593102	443134	38674		0.106	0.124	0.088
1986	154	218	91	495329	572237	418421	30910		0.088	0.103	0.072
1987	152	215	89	479593	558511	400675	42356		0.124	0.147	0.101
1988	146	209	84	451678	532748	370608	35569		0.110	0.132	0.088
1989	149	214	84	430545	513951	347139	30279		0.099	0.120	0.078
1990	141	204	79	414059	499825	328293	29906		0.102	0.125	0.079
1991	150	217	83	398381	486767	309995	29563		0.105	0.130	0.080
1992	140	205	75	382497	473599	291395	29046		0.107	0.135	0.080
1993	125	184	67	366360	460200	272520	25637		0.100	0.128	0.072
1994	123	180	65	353561	450309	256813	20851		0.085	0.110	0.060
1995	110	164	56	344800	444410	245190	21318		0.088	0.115	0.061
1996	111	168	54	335472	438124	232820	17295		0.073	0.096	0.049

Year	Recruitment (pups at age 0)			Total biomass			Landings*	Discards *	Harvest rate		
	Millions	High	Low	Tonnes	High	Low	Tonnes	Tonnes	Ages 5–30	High	Low
1997	111	170	53	329881	435699	224063	15348		0.065	0.087	0.043
1998	111	170	51	325745	434777	216713	13919		0.060	0.080	0.039
1999	109	168	50	322461	434711	210211	12385		0.053	0.073	0.034
2000	110	170	51	320323	435845	204801	15891		0.069	0.094	0.043
2001	109	171	48	314278	433130	195426	16693		0.073	0.102	0.045
2002	112	176	47	307387	429723	185051	11170		0.050	0.071	0.030
2003	117	186	49	306239	432239	180239	12247		0.055	0.079	0.032
2004	120	191	48	304086	433908	174264	9366		0.043	0.062	0.024
2005	122	196	49	304972	438766	171178	8426		0.039	0.056	0.021
2006	121	195	48	306748	444604	168892	4109		0.0187	0.027	0.0102
2007	126	203	49	313169	455299	171039	2929		0.0131	0.0191	0.0071
2008	133	213	52	321145	467793	174497	1836		0.0079	0.0116	0.0043
2009	141	225	56	330671	482107	179235	2640		0.0111	0.0162	0.0060
2010	156	247	65	340320	497076	183564	1249 **	1219 ***	0.0101	0.0148	0.0055
2011	139	223	56	349172	510840	187504	580 **	1888 ***	0.0099	0.0145	0.0053
2012	139	222	57	358102	524758	191446	261 **	2207 ***	0.0097	0.0141	0.0052
2013	145	231	58	367455	539295	195615	333 **	2135 ***	0.0094	0.0138	0.0050
2014	143	228	59	376770	553790	199750	383 **	2085 ***	0.0091	0.0135	0.0048
2015	148	237	60	386343	568641	204045	263 **	2205***	0.0089	0.0131	0.0046
2016	159	253	64	396400	584192	208608	373 **	2095***	0.0087	0.0128	0.0045
2017	163	260	66	406569	599885	213253	296 **	2172 ***	0.0084	0.0125	0.0044
2018	166	266	66	416836	615682	217990	363 **	2105 ***	0.0082	0.0122	0.0042
2019	158	253	64	426532	630632	222432	454 **	2014 ***	0.0080	0.0119	0.0041
2020	172 ^	250 ^	94 ^	436999	646599	227399					

* 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 tonnes are assumed to represent catches since 2010) and landings.

^ Provisional values taken from the estimated stock–recruitment relationship.

Table 7 Spurdog in subareas 1–10, 12, and 14. Extension of short-term forecasts to the medium- to longer-term (3, 5, 10, and 30 years beyond 2020). Estimates of total biomass relative to the total biomass in 2020 for different future catch scenarios, assuming that the catch in 2020 is 2468 tonnes (see Table 3 for the 2021 and 2022 catches for the different catch scenarios). 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	Average catch 2007–2009	MSY harvest rate
Average catch *	10327	0	1422	2468	12011
Point estimates					
+ 3 years	1.05	1.09	1.08	1.08	1.04
+ 5 years	1.08	1.15	1.14	1.13	1.05
+ 10 years	1.16	1.32	1.29	1.27	1.09
+ 30 years	1.42	2.15	2.05	1.98	1.28
Point estimates −2 standard deviations					
+ 3 years	1.02	1.06	1.06	1.05	1.01
+ 5 years	1.03	1.11	1.10	1.09	1.01
+ 10 years	1.05	1.25	1.22	1.20	1.02
+ 30 years	1.11	1.86	1.81	1.76	1.10
Point estimates +2 standard deviations					
+ 3 years	1.08	1.11	1.10	1.10	1.06
+ 5 years	1.13	1.19	1.17	1.16	1.09
+ 10 years	1.26	1.40	1.36	1.34	1.17
+ 30 years	1.74	2.43	2.29	2.19	1.45

* "Average catch" is the average for the projection period 2021–2049.

Sources and references

ICES. 2020. Working Group on Elasmobranch Fishes (WGEF). ICES Scientific Reports, 2:77. http://doi.org/10.17895/ices.pub.7470.

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Annex 1

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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 of 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$_{MSY}$).
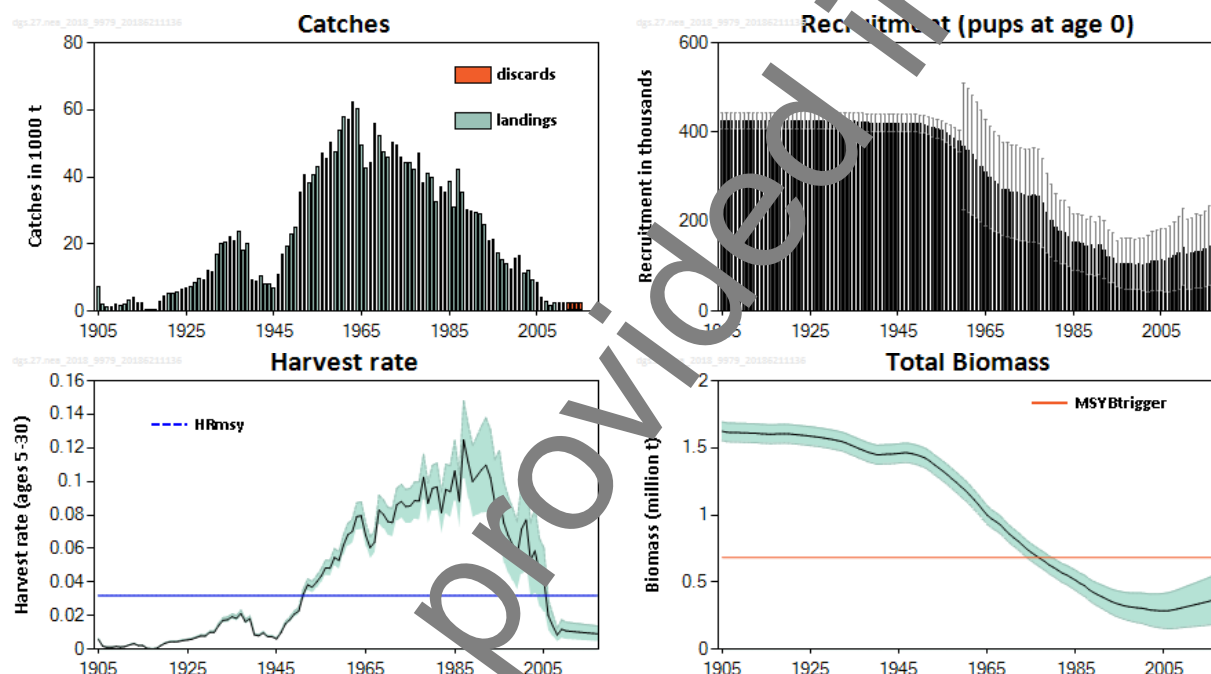

Figure 1   Spurdog in the Northeast Atlantic. Summary of the stock assessment. Long-term trends in catches (including assumed discards since 2010), mean harvest rate (average ages 5–30), recruitment (number of pups), and total biomass. Shaded areas in the bottom panels reflect estimates of precision (±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	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 considerd 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)	0.0096	The harvest rate (ages 5–10) associated with a total catch of 2468 tonnes (average catch in 2007–2009)
B_{tot} (2019)	399 353 tonnes	Total biomass
Recruitment (2018)	151 138 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.%	-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.%	111%	117%
TAC 2009 = 1422	1422	1422	0.0051	0.0049	400515	410924	.6%	5.3%	-42%	-42%
Harvest rate = HR_{MSY} (0.032)	9120	9119	0.032	0.032	392753	395429	0.1%	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.

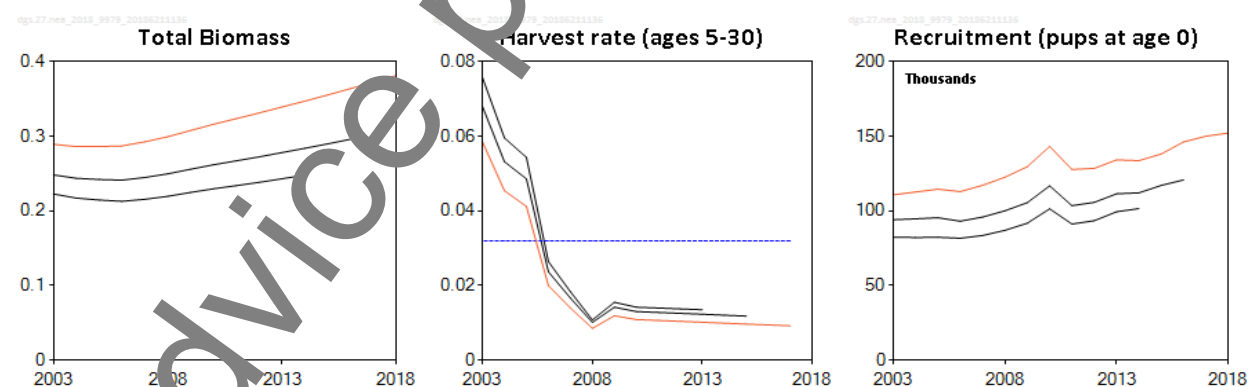The updated assessment has resulted in an upward revision of stock size compared to previous assessment.

Figure   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 $B_{trigger}$ = B_{FMSY}/1.4 (in terms of total biomass), representing a proxy for the 5th 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 *et al*., 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 occurence 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	2000***	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	532	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	7995	5570	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	703	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	7043	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	93	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	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	10	16	15	32	6	4	0	4	1	4	10	5
Sweden	154	196	140	114	123	238	0	275	244	170	14	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	43	386	91	194	8	0	2	1	0	0	30	37
UK (Sc)	6873	5665	4501	3248	3606	2897	2120	3708	3342	126	766	415	178	345	56	1	1	6	0	0	-	-
Total	17294	15347	13919	12384	15890	16693	11170	12246	9365	8435	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 (±2 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	7218		0.0058	0.0063	0.0053
1906	425864	444151	407577	1616270	1685964	1546576	2210		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	1573320	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	403446	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	High	Low
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	8161		0.0074	0.0081	0.0068
1944	419512	439069	399955	1455490	1526820	1384160	8111		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	16867		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	1328258	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	890014	954942	825206	52074		0.080	0.089	0.072
1970	270528	375492	165564	859171	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	30010		0.088	0.104	0.072
1987	150583	213373	87793	473895	551911	395879	42336		0.125	0.148	0.101
1988	144398	206236	82560	445362	525422	365302	35550		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	264421	25637		0.102	0.131	0.074
1994	118461	174701	62221	343187	438177	248497	20851		0.087	0.113	0.061
1995	105962	158004	53920	333689	431383	235505	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	213712	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	413514	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	322054	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	333268	504848	173688	333**	2135***	0.0102	0.0151	0.0052
2014	133675	215391	51959	341248	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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