9.3.17 Spurdog (*Squalus acanthias*) in the Northeast Atlantic

ICES stock advice

ICES advises that when the precautionary approach is applied, there should be no targeted fisheries on this stock in 2017 and 2018. 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. Any possible provision for the landing of bycatch should be part of a management plan, including close monitoring of the stock and fisheries.

Stock development over time

The spawning 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.

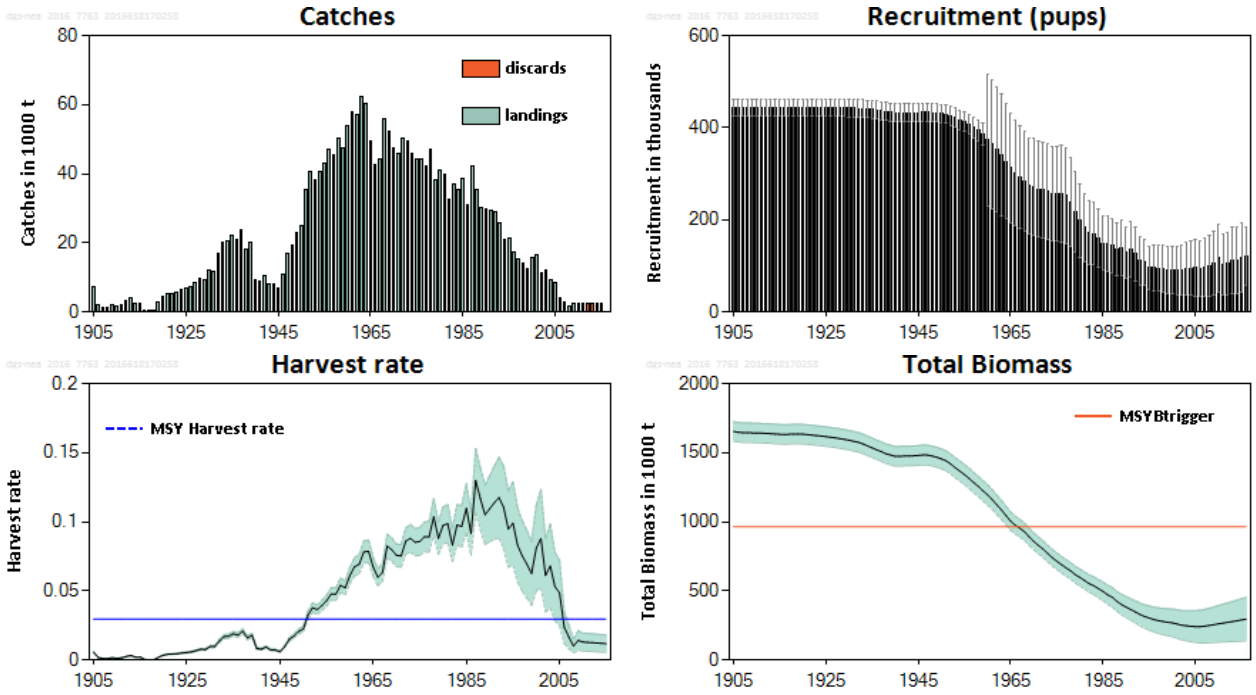

Figure 9.3.17.1 Spurdog in the Northeast Atlantic. Summary of the stock assessment (weights in thousand tonnes). Long-term trends in catches, mean harvest rate (average ages 5–30), recruitment (number of pups), and total biomass. Shaded areas in the bottom panels reflect estimates of precision (±2 standard deviation) and horizontal lines indicate the associated MSY levels. The final-year recruitment estimate is provisional, taken from the estimated stock–recruit relationship.

Stock and exploitation status

Table 9.3.17.1 Spurdog in the Northeast Atlantic. State of the stock and fishery relative to reference points.

		Fishing pressure					Stock size				
		2013	2014	2015			2014	2015	2016	
Maximum sustainable yield	F_{MSY}	✓	✓	✓	Appropriate	MSY $B_{trigger}$	✗	✗	✗	Below trigger
Precautionary approach	F_{pa}, F_{lim}	?	?	?	Undefined	B_{pa}, B_{lim}	?	?	?	Undefined
Management plan	F_{MGT}	-	-	-	Not applicable	SSB_{MGT}	-	-	-	Not applicable

Catch options

ICES advises that when the precautionary approach is applied, there should be no targeted fisheries on this stock in 2017 and 2018. Based on medium-term projections, the recent assumed annual catches (2468 t) would allow the stock to recover at a rate close to that estimated with zero catches. Any possible provision for the landing of bycatch should be part of a management plan, including close monitoring of the stock and fisheries. Discarding is known to take place, but ICES cannot quantify the corresponding catches. This is expected to lead to a total biomass of 308 788 tonnes in 2018 and 315 358 tonnes in 2019.

Table 9.3.17.2 Spurdog in the Northeast Atlantic. The basis for the catch options.

Variable	Value	Source	Notes
Harvest rate (2016)	0.012	ICES (2016a)	The harvest rate associated with a total catch of 2468 t (average catch in 2007–2009).
B_{tot} (2017)	302376 t	ICES (2016a)	Total biomass.
Recruitment (2016)	120800	ICES (2016a)	Modelled stock–recruit relationship, based on the number of pregnant females in the population (numbers).
Catch (2016)	2468 t	ICES (2016a)	Average catch in 2007–2009.

Table 9.3.17.3 Spurdog in the Northeast Atlantic. The catch options. Weights in tonnes.

Rationale	Catch		Basis	Harvest rate		B_{tot}		% landings change rel. to 2016		% B_{tot} change rel. to 2017	
	2017	2018		2017	2018	2018	2019	2017	2018	2018	2019
Average catch 2007–2009	2468	2468	Average (2007–2009) = 2384	0.011	0.011	308788	315358	0	0	2.1	4.3
Zero catch	0	0	Zero catch	0.000	0.000	311279	320333	−100	−100	2.9	5.9
MSY harvest rate × B_{tot} (2017 or 2018)/MSY $B_{trigger}$	2050	2148	MSY harvest rate × B_{tot} (2017 or 2018)/MSY $B_{trigger}$	0.009	0.010	309211	316103	−17	−13	2.3	4.5
Last non-zero TAC	1422	1422	TAC 2009 = 1422	0.007	0.006	309844	317467	−42	−42	2.5	5.0
MSY harvest rate	6538	6571	MSY harvest rate = 0.030	0.030	0.030	304680	307119	165	166	0.8	1.6

Basis of the advice

Table 9.3.17.4 Spurdog in the Northeast Atlantic. The basis of the advice.

Advice basis	Precautionary approach and medium-term projections.
Management plan	There is no management plan for this stock.

Quality of the assessment

Because of the number of assumptions made within the assessment model, uncertainty is likely to be underestimated. Estimates of total dead catch of Northeast Atlantic spurdog have been used, 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.

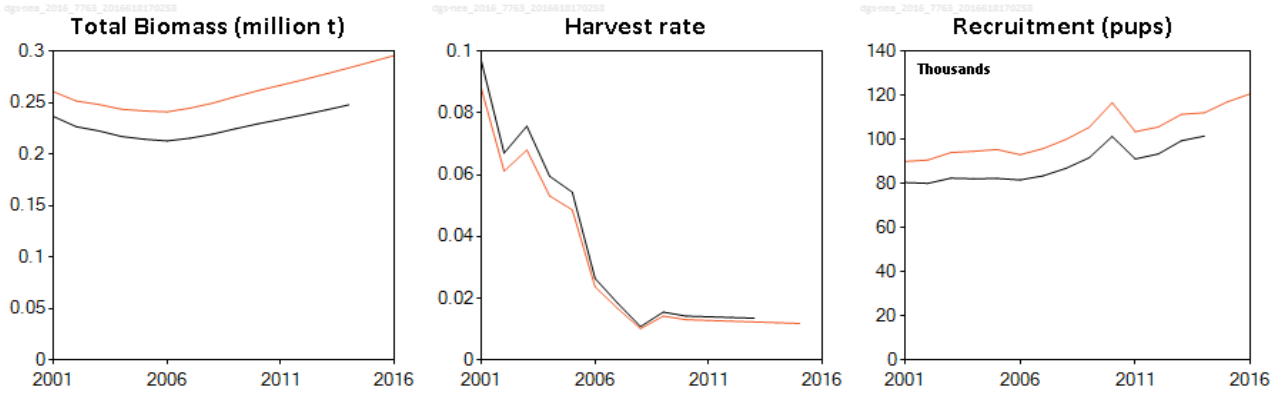

Figure 9.3.17.2 Spurdog in the Northeast Atlantic. Historical assessment results (final-year recruitment estimates are provisional, taken from the estimated stock–recruit relationship).

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 reduced below the MSY level in recent years. 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 30 years to reach current MSY $B_{trigger}$) and not biologically feasible under short-term management time frames (Table 9.3.17.11).

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. At-vessel mortality is low in longline fisheries, but higher in trawl and gillnet fisheries. Exact levels of discard survival are variable and unknown, being determined by many factors (e.g. catch method, soak time, quantity caught). 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 9.3.17.5 Spurdog in the Northeast Atlantic. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY harvest rate	0.030	Catch as a proportion of the total biomass, assuming average selection over the ages 5–30, reflecting a non-target selection pattern.	ICES (2016a)
	MSY $B_{trigger}$	964 563 t	MSY $B_{trigger}$ = B_{MSY} (in terms of total biomass).	ICES (2016a)
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		

Basis of the assessment

Table 9.3.17.6 Spurdog in the Northeast Atlantic. The basis of the assessment.

ICES stock data category	1 (ICES, 2016b).
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, and 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.
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.

Fishers have reported that catches of spurdog have recently increased. 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 9.3.17.7 Spurdog in the Northeast Atlantic. History of ICES advice, the agreed TAC, and ICES estimates of Landings. Weights in thousand tonnes.

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC	ICES landings^^
1999	None		8.9*	12.4
2000	None		8.9*	15.9
2001	None		8.9*	16.7
2002	None		7.1*	11.0
2003	None		5.6*	12.2
2004	None		4.5*	9.4
2005	None		1.1*	8.4
2006	F = 0	0	1.1*	4.1
2007		0	3.7**	2.9
2008	F = 0	0	2.6***	1.8
2009	No fishery	0	1.4	2.6
2010	No new advice, same as for 2009	0	0.142^	1.3
2011	F = 0	0	0	0.6
2012	F = 0	0	0	0.3
2013	F = 0	0	0	0.3
2014	No new advice, same as for 2013	0	0	0.4
2015	No target fishery, minimize bycatch	0	0	0.3
2016	No new advice, same as for 2015	0	0	
2017	PA approach (and no target fishery and medium-term projections.	≤ 2.468		
2018	PA approach (and no target fishery and medium-term projections.	≤ 2.468		

* 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 and subareas 3.a, 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.

History of catch and landings

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

Table 9.3.17.8 Spurdog in the Northeast Atlantic. Catch distribution by fleet in 2015 as estimated by ICES.

Total catch (2015)	Landings				Discards
Unknown	gillnets	bottom trawls	lines	others	Discarding is known to take place but cannot be quantified
	68%	16%	12%	4%	
	265 t				

Table 9.3.17.9 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	17 514	19 067	12 430	12 641	8356	8867	7022	11 174	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 9.3.17.9 (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
Belgium	430	443	382	354	400	410	23	11	13	20	17	0	0	7	1	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
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
Germany	38	21	31	54	194	304	121	98	138	144	6	0	0	1	1	1	1	0	1	0
Iceland	156	106	80	57	107	199	276	200	142	71	75	36	52	95	58	51	44	6	19	8
Ireland	2305	2214	1164	904	905	1227	1214	1416	1076	940	614	558	163	214	26	11	2	27	18	2
Netherlands	0	0	0	0	28	39	27	10	25	41	34	28	26	5	7	2	28	3	0	1
Norway	2748	1567	1293	1461	1643	1424	1091	1119	1054	1010	790	616	711	543	541	246	108	251	313	217
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
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
Sweden	154	196	140	114	123	238	0	275	244	170	148	95	9	80	5	0	0	0	0	0
UK (E&W)	2670	3066	4480	4461	3654	4516	2823	3109	1729	1887	434	386	91	194	8	0	2	1	0	0
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

Summary of the assessment

Table 9.3.17.10 Spurdog in the Northeast Atlantic. Summary table of estimates from the spurdog assessment: recruitment (number of pups in thousands), 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.

Year	Recruitment			Total biomass			Landings	Catch*	Harvest rate		
	thousands	High	Low	tonnes	High	Low	tonnes	tonnes	Ages 5–30	High	Low
1905	444	463	425	1653940	1723978	1583902	7248	7248	0.006	0.006	0.005
1906	444	463	425	1646860	1716900	1576820	2200	2200	0.002	0.002	0.002
1907	444	463	425	1645040	1715084	1574996	1428	1428	0.001	0.001	0.001
1908	444	463	425	1644090	1714138	1574042	1409	1409	0.001	0.001	0.001
1909	444	463	425	1643250	1713300	1573200	2022	2022	0.002	0.002	0.001
1910	444	463	425	1641870	1711924	1571816	1563	1563	0.001	0.001	0.001
1911	444	463	425	1641050	1711106	1570994	1957	1957	0.002	0.002	0.001
1912	444	463	425	1639910	1709970	1569850	3199	3199	0.003	0.003	0.002
1913	444	463	425	1637640	1707702	1567578	4050	4050	0.003	0.003	0.003
1914	444	462	425	1634670	1704736	1564604	2641	2641	0.002	0.002	0.002
1915	444	462	425	1633260	1703330	1563190	2602	2602	0.002	0.002	0.002
1916	444	462	425	1631990	1702066	1561914	534	534	0.000	0.000	0.000
1917	444	462	425	1632850	1702928	1562772	339	339	0.000	0.000	0.000
1918	444	462	425	1633900	1703982	1563818	451	451	0.000	0.000	0.000
1919	444	462	425	1634830	1704914	1564746	2659	2659	0.002	0.002	0.002
1920	444	462	425	1633570	1703656	1563484	4396	4396	0.003	0.004	0.003
1921	444	462	425	1630680	1700768	1560592	5321	5321	0.004	0.005	0.004
1922	444	462	425	1627030	1697122	1556938	5401	5401	0.004	0.005	0.004
1923	443	462	425	1623500	1693598	1553402	5655	5655	0.005	0.005	0.004
1924	443	462	425	1619920	1690026	1549814	6355	6355	0.005	0.006	0.005
1925	443	462	424	1615860	1685974	1545746	6719	6719	0.005	0.006	0.005
1926	443	462	424	1611680	1681804	1541556	7277	7277	0.006	0.006	0.005
1927	443	462	424	1607210	1677344	1537076	8395	8395	0.007	0.007	0.006
1928	443	462	424	1601910	1672058	1531762	9522	9522	0.008	0.008	0.007
1929	443	461	424	1595810	1665972	1525648	9320	9320	0.008	0.008	0.007
1930	442	461	423	1590260	1660438	1520082	11914	11914	0.010	0.011	0.009
1931	442	461	423	1582500	1652698	1512302	11838	11838	0.010	0.011	0.009
1932	442	461	423	1575250	1645470	1505030	16726	16726	0.014	0.015	0.013
1933	441	460	422	1563620	1633868	1493372	20244	20244	0.017	0.018	0.015
1934	440	459	421	1549130	1619412	1478848	20378	20378	0.017	0.019	0.016
1935	439	458	420	1535240	1605562	1464918	22266	22266	0.019	0.021	0.017
1936	438	457	418	1520220	1590590	1449850	20925	20925	0.018	0.020	0.016
1937	436	456	417	1507290	1577716	1436864	23930	23930	0.021	0.023	0.019
1938	435	454	415	1492070	1562562	1421578	18196	18196	0.016	0.018	0.015
1939	434	453	414	1483260	1553826	1412694	20119	20119	0.018	0.019	0.016
1940	432	452	413	1473060	1543708	1402412	9428	9428	0.008	0.009	0.008
1941	432	452	413	1473910	1544646	1403174	8740	8740	0.008	0.009	0.007
1942	432	452	413	1475530	1546356	1404704	10625	10625	0.009	0.010	0.009
1943	432	452	412	1475290	1546212	1404368	8181	8181	0.007	0.008	0.007
1944	432	452	413	1477510	1548532	1406488	8151	8151	0.007	0.008	0.007
1945	433	452	413	1479680	1550806	1408554	6776	6776	0.006	0.007	0.005
1946	433	453	413	1483130	1554364	1411896	10895	10895	0.010	0.011	0.009
1947	433	453	413	1482380	1553724	1411036	16893	16893	0.015	0.016	0.014
1948	433	452	413	1475730	1547194	1404266	19491	19491	0.017	0.019	0.016
1949	432	451	412	1466760	1538352	1395168	23010	23010	0.021	0.023	0.019
1950	430	450	410	1454680	1526408	1382952	24750	24750	0.022	0.024	0.020

Year	Recruitment			Total biomass			Landings	Catch*	Harvest rate		
	thousands	High	Low	tonnes	High	Low	tonnes	tonnes	Ages 5–30	High	Low
1951	429	449	409	1441360	1513238	1369482	35301	35301	0.032	0.035	0.029
1952	426	446	405	1418180	1490222	1346138	40550	40550	0.038	0.041	0.034
1953	421	442	401	1390690	1462918	1318462	38206	38206	0.036	0.040	0.033
1954	417	438	396	1366550	1438988	1294112	40570	40570	0.040	0.043	0.036
1955	412	434	391	1340970	1413644	1268296	43127	43127	0.043	0.047	0.039
1956	407	429	385	1313760	1386700	1240820	46951	46951	0.048	0.052	0.043
1957	400	422	378	1283630	1356874	1210386	45570	45570	0.048	0.052	0.043
1958	394	416	371	1255760	1329350	1182170	50394	50394	0.054	0.059	0.049
1959	386	409	363	1223820	1297804	1149836	47394	47394	0.052	0.057	0.047
1960	373	517	230	1195270	1267950	1122590	53997	53997	0.061	0.067	0.055
1961	364	504	224	1160660	1232066	1089254	57721	57721	0.067	0.074	0.061
1962	353	489	217	1122800	1192918	1052682	57256	57256	0.069	0.076	0.062
1963	341	472	210	1085790	1154576	1017004	62288	62288	0.078	0.086	0.070
1964	327	452	201	1043920	1111348	976492	60146	60146	0.079	0.087	0.071
1965	312	432	192	1004280	1070374	938186	49336	49336	0.067	0.074	0.060
1966	301	417	186	975392	1040236	910548	42713	42713	0.060	0.066	0.054
1967	293	405	181	952784	1016486	889082	44116	44116	0.063	0.070	0.057
1968	284	393	176	928222	990908	865536	56043	56043	0.082	0.091	0.074
1969	274	378	169	891128	952952	829304	52074	52074	0.080	0.088	0.071
1970	271	376	166	858063	919155	796971	47557	47557	0.076	0.084	0.068
1971	267	370	163	829351	889833	768869	45653	45653	0.075	0.083	0.067
1972	265	369	161	802562	862546	742578	50416	50416	0.086	0.096	0.077
1973	261	364	158	771003	830625	711381	49412	49412	0.088	0.098	0.078
1974	258	360	155	740658	800038	681278	45684	45684	0.085	0.095	0.075
1975	256	359	153	714433	773715	655151	44119	44119	0.086	0.096	0.076
1976	257	362	152	690372	749696	631048	44064	44064	0.089	0.100	0.078
1977	253	357	149	666731	726245	607217	42252	42252	0.089	0.100	0.078
1978	238	335	141	644621	704525	584717	47235	47235	0.104	0.117	0.090
1979	216	303	128	616846	677362	556330	38201	38201	0.088	0.100	0.076
1980	199	279	119	597621	658901	536341	40968	40968	0.097	0.111	0.084
1981	183	256	110	574916	637112	512720	39962	39962	0.099	0.112	0.085
1982	173	241	104	552616	615872	489360	32402	32402	0.083	0.095	0.071
1983	171	239	102	537422	601864	472980	37046	37046	0.098	0.112	0.083
1984	160	224	96	516383	582125	450641	35194	35194	0.097	0.112	0.081
1985	149	209	89	496009	563135	428883	38674	38674	0.110	0.128	0.092
1986	147	207	87	471512	540154	402870	30910	30910	0.091	0.107	0.076
1987	144	203	84	454068	524306	383830	42356	42356	0.130	0.153	0.107
1988	137	195	79	424407	496375	352439	35569	35569	0.117	0.139	0.094
1989	138	198	78	401474	475334	327614	30279	30279	0.105	0.127	0.084
1990	129	185	73	383145	458913	307377	29906	29906	0.109	0.133	0.085
1991	136	196	76	365541	443461	287621	29563	29563	0.114	0.140	0.087
1992	126	184	68	347695	427849	267541	29046	29046	0.117	0.147	0.088
1993	111	163	59	329566	411954	247178	25637	25637	0.110	0.140	0.081
1994	107	158	57	314727	399497	229957	20851	20851	0.095	0.122	0.067
1995	96	142	49	303953	391047	216859	21318	21318	0.099	0.129	0.069
1996	95	145	46	292581	382159	203003	17295	17295	0.083	0.110	0.056
1997	95	145	44	284899	377055	192743	15348	15348	0.075	0.101	0.050
1998	93	144	43	278661	373423	183899	13919	13919	0.069	0.094	0.045
1999	91	141	41	273278	370634	175922	12385	12385	0.063	0.086	0.040
2000	92	142	41	269029	369013	169045	15891	15891	0.081	0.112	0.050
2001	90	142	38	260869	363525	158213	16693	16693	0.088	0.123	0.052

Year	Recruitment			Total biomass			Landings	Catch*	Harvest rate		
	thousands	High	Low	tonnes	High	Low	tonnes	tonnes	Ages 5–30	High	Low
2002	91	145	36	251793	357243	146343	11170	11170	0.061	0.088	0.035
2003	94	152	36	248345	356735	139955	12247	12247	0.068	0.098	0.038
2004	95	154	35	243774	355224	132324	9366	9366	0.053	0.078	0.028
2005	95	157	34	242106	356728	127484	8426	8426	0.049	0.072	0.025
2006	93	154	33	241228	359076	123380	4109	4109	0.024	0.035	0.012
2007	96	159	33	244803	366033	123573	2929	2929	0.017	0.025	0.008
2008	100	165	35	249716	374510	124922	1836	1836	0.010	0.015	0.005
2009	106	174	37	255924	384474	127374	2640	2640	0.014	0.021	0.007
2010	117	190	43	261887	394623	129151	1249**	2468^	0.013	0.019	0.007
2011	104	170	37	267137	403653	130621	580**	2468^	0.013	0.019	0.006
2012	106	174	38	272494	412912	132076	261**	2468^	0.013	0.019	0.006
2013	111	183	40	278191	422707	133675	333**	2468^	0.012	0.019	0.006
2014	112	184	40	283923	432581	135265	383**	2468^	0.012	0.018	0.006
2015	117	193	41	289940	442870	137010	265**	2468^	0.012	0.018	0.006
2016	121	183	59	296104	453338	138870					

* 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.

Table 9.3.17.11 Spurdog in the Northeast Atlantic. Extension of short-term forecasts to the medium- to longer-term (3, 5, 10, and 30 years beyond 2016). Estimates of total biomass relative to the total biomass in 2016 for different future catch options, assuming that the catch in 2016 is 2468 tonnes (see Table 9.3.17.3 for 2017 and 2018). 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*	3800	0	1422	2468	7404
Point estimates					
+ 3 years	1.07	1.08	1.07	1.07	1.04
+ 5 years	1.12	1.14	1.13	1.11	1.06
+ 10 years	1.24	1.31	1.27	1.24	1.11
+ 30 years	1.77	2.18	2.02	1.90	1.33
Point estimates −2 standard deviations					
+ 3 years	1.04	1.06	1.05	1.04	1.01
+ 5 years	1.08	1.11	1.09	1.07	1.02
+ 10 years	1.16	1.24	1.20	1.16	1.04
+ 30 years	1.48	1.94	1.82	1.70	1.16
Point estimates +2 standard deviations					
+ 3 years	1.09	1.11	1.10	1.09	1.06
+ 5 years	1.15	1.18	1.16	1.15	1.09
+ 10 years	1.32	1.39	1.34	1.31	1.18
+ 30 years	2.06	2.42	2.22	2.11	1.51

*"Average catch" is the average for the projection period 2017–2045.

Sources and references

De Oliveira, J. A. A., Ellis, J. R., and Dobby, H. 2013. Incorporating density dependence in pup production in a stock assessment of NE Atlantic spurdog *Squalus acanthias*. ICES Journal of Marine Science, 70: 1341–1353.

ICES. 2010. Report of the Benchmark Workshop on Deep-water Species (WKDEEP), 17–24 February 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:38. 247 pp.

ICES. 2016a. Report of the Working Group on Elasmobranch Fishes (WGEF), 15–24 June 2016, Lisbon, Portugal. ICES CM 2016/ACOM:20. 684 pp.

ICES. 2016b. General context of ICES advice. *In* Report of the ICES Advisory Committee, 2016. ICES Advice 2016, Book 1, Section 1.2.