

Supplementary Material

Material and methods

In the following, a glossary of terms and the data used to support the analysis of the direct economic value of the North Sea cod stock is described.

Glossary of terms

Given the complexity of the fisheries objectives used by ICES when providing scientific recommendations for EU fish stocks under TAC regulation, we include a glossary of terms gathered from ICES (http://www.ices.dk/community/Documents/Advice/Acronyms_and_terminology.pdf) and [36] in order to better understand and interpret the data and results presented in the paper. Many of these are mentioned in the manuscript and also illustrated in Figure 1.

TAC: Total Allowable Catches annually allocated to each member State under the Common Fisheries Policy.

Overshooting: the level of compliance of fishing quotas (total removals/TAC).

F_{current}: Fishing mortality estimated for the current assessment year.

F_{management plan}: Fishing mortality reference point as defined in management plans. A management plan includes the decision-making processes (harvest control rules, tactical decision making) and the sanctions on implementation and the requirements for monitoring and reporting. Management plans may also exist in the form of rebuilding plans or recovery plans.

F_{pa}: Precautionary reference point for fishing mortality (mean over defined age range).

F_{lim}: Limit reference point for fishing mortality (mean over defined age range).

Supporting Tables

Table S1. Main variables for the North Sea cod stock in ICES areas IV, VIIId, IIIa (in thousand t).

Year	Reported TB	Estimated TB _{TAC}	Estimated TB _{SRs}	Estimated TB _{Catches}	Estimated TB _{Catches*}	TACs	SRs	Total removals
1987	568.6					206.9	133.5	248.2
1988	450.9					191.6	170.0	199.5
1989	413.3					159.5	157.0	169.0
1990	308.9					145.9	143.0	132.6
1991	284.0					138.7	116.3	120.2
1992	374.7					117.7	109.0	134.8
1993	341.4					118.5	121.0	149.3
1994	397.1					120.4	124.3	153.4
1995	432.7					144.0	139.2	185.9
1996	368.4					156.5	158.4	165.5
1997	450.4					138.3	150.6	166.3
1998	282.0					168.7	179.8	140.7
1999	213.2					157.7	146.9	100.9

Table S1. Cont.

Year	Reported TB	Estimated TB _{TAC}	Estimated TB _{SRs}	Estimated TB _{Catches}	Estimated TB _{Catches*}	TACs	SRs	Total removals
2000	246.9					96.2	92.8	101.9
2001	196.2					57.6	0.0	90.8
2002	205.6					57.9	0.0	88.5
2003	128.5					32.5	0.0	60.7
2004	117.9					31.4	0.0	47.6
2005	118.6					31.9	0.0	47.0
2006	122.2					27.6	0.0	41.6
2007	157.0					24.5	0.0	56.1
2008	155.4					27.1	0.0	54.1
2009	167.2					34.6	0.0	56.8
2010	187.9	187.9	187.9	187.9	187.9	79.0	75.3	84.4
2011		211.0	214.8	186.0	194.1	88.8	86.0	83.6
2012		236.2	244.6	184.1	200.2	99.4	98.0	82.7
2013		263.6	277.7	182.3	206.5	110.9	111.2	81.9
2014		293.2	313.8	180.5	212.7	123.4	125.7	81.1
2015		324.9	353.1	178.9	218.9	136.7	141.5	80.4
2016		358.5	395.4	177.2	225.1	150.8	158.4	79.6
2017		394.0	440.4	175.7	231.3	165.8	176.4	78.9
2018		431.0	487.7	174.1	237.5	181.3	195.4	78.3
2019		469.2	536.8	172.7	243.6	197.4	215.1	77.6
2020		508.3	587.2	171.3	249.6	213.8	235.3	77.0
2011		547.8	638.1	169.9	255.6	230.5	255.7	76.3
2022		587.4	688.9	168.6	261.6	247.1	276.0	75.7

Source: own elaboration from [44] and the surplus production model. Estimated values provided by the model are shown in italics. * Estimates including a 50% discards reduction.

Table S2. Fishing effort and overshooting of the North Sea cod stock in ICES areas IV, VIIId, IIIa.

Year	F _{current}	F _{lim}	F _{pa}	F _{Management Plan}	Overshooting
2002	0.92	0.86	0.65		1.56
2003	0.90	0.86	0.65		1.94
2004	0.85	0.86	0.65		1.52
2005	0.80	0.86	0.65		1.50
2006	0.72	0.86	0.65		1.35
2007	0.66	0.86	0.65		2.44
2008	0.63	0.86	0.65	0.40	2.12
2009	0.60	0.86	0.65	0.40	1.72
2010	0.58	0.86	0.65	0.40	2.08
2011	0.57	0.86	0.65	0.40	2.59
2012	0.57	0.86	0.65	0.40	2.60

Source: own elaboration from [44].