

WORKING GROUP ON ELASMOBRANCH FISHES (WGEF)

VOLUME 2 | ISSUE 77

ICES SCIENTIFIC REPORTS

RAPPORTS
SCIENTIFIQUES DU CIEM



International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

H.C. Andersens Boulevard 44-46
DK-1553 Copenhagen V
Denmark
Telephone (+45) 33 38 67 00
Telefax (+45) 33 93 42 15
www.ices.dk
info@ices.dk

The material in this report may be reused for non-commercial purposes using the recommended citation. ICES may only grant usage rights of information, data, images, graphs, etc. of which it has ownership. For other third-party material cited in this report, you must contact the original copyright holder for permission. For citation of datasets or use of data to be included in other databases, please refer to the latest ICES data policy on ICES website. All extracts must be acknowledged. For other reproduction requests please contact the General Secretary.

This document is the product of an expert group under the auspices of the International Council for the Exploration of the Sea and does not necessarily represent the view of the Council.

ISSN number: 2618-1371 | © 2020 International Council for the Exploration of the Sea

ICES Scientific Reports

Volume 2 | Issue 77

WORKING GROUP ON ELASMOBRANCH FISHES (WGEF)

Recommended format for purpose of citation:

ICES. 2020. Working Group on Elasmobranch Fishes (WGEF).
ICES Scientific Reports. 2:77. 789 pp. <http://doi.org/10.17895/ices.pub.7470>

Editors

Jurgen Batsleer • Pascal Lorance

Authors

Morgane Amelot • Thomas Barreau • Jurgen Batsleer • Loïc Baulier • Gérard Biais • Katinka Bleeker •
Guzmán Diez • Ivone Figueiredo • Klara Jakobsdottir • Graham Johnston • Armelle Jung •
Claudia Junge • Marlén Knutsen Myrlund • Wendel Lleal • Pascal Lorance • Catarina Maia •
Tanja Miethe • Teresa Moura • José de Olivera • Sophy Philips-McCully • Cristina Rodríguez-Cabello •
Mário Rui Pinho • Régis Santos • Barbara Serra Pereira • Matthias Schaber • Joana Silva •
James Thorburn • Noémi Van Bogaert • Wouter van Broekhoven • Paddy Walker

Contents

i	Executive summary	xvii
ii	Expert group information	xviii
1	Introduction.....	1
1.1	Terms of Reference.....	1
1.2	Participants	2
1.3	Background and history	3
1.4	Planning of the work of the group	5
1.5	ICES approach to F_{MSY}	8
1.6	Community plan of action for sharks	9
1.7	Conservation advice.....	9
1.8	Sentinel fisheries.....	10
1.9	Mixed fisheries regulations.....	11
1.10	Current ICES expert groups of relevance to the WGEF.....	11
1.11	Other meetings of relevance to WGEF	13
1.11.1	ICCAT	13
1.11.2	General Fisheries Commission for the Mediterranean (GFCM).....	13
1.12	Relevant biodiversity and conservation issues	14
1.12.1	OSPAR Convention.....	14
1.12.2	Convention on the Conservation of Migratory Species (CMS)	14
1.12.3	Convention on International Trade in Endangered Species (CITES)	15
1.12.4	Convention on the Conservation of European Wildlife and Natural Habitats (Bern convention)	15
1.13	ICES fisheries advice.....	19
1.14	Data availability.....	20
1.15	Methods and software.....	27
1.16	InterCatch	28
1.17	Transparent Assessment Framework (TAF)	28
1.18	References	29
2	Spurdog in the Northeast Atlantic.....	32
2.1	Stock distribution	32
2.2	The fishery	32
2.2.1	History of the fishery	32
2.2.2	The fishery in 2019.....	32
2.2.3	ICES advice applicable	33
2.2.4	Management applicable	33
2.3	Catch data	35
2.3.1	Landings	35
2.3.2	Discards.....	35
2.3.3	Discard survival	36
2.3.4	Quality of the catch data	36
2.4	Commercial catch composition	36
2.4.1	Length composition of landings	36
2.4.2	Length composition of discards	37
2.4.3	Sex ratio	37
2.4.4	Quality of data	37
2.5	Commercial catch-effort data.....	37
2.6	Fishery-independent information.....	38
2.6.1	Availability of survey data.....	38
2.6.2	Length-frequency distributions.....	39
2.6.3	CPUE.....	40

2.6.4	Statistical modelling.....	40
2.7	Life-history information	41
2.8	Exploratory assessments and previous analyses	42
2.8.1	Previous assessments	42
2.8.2	Simulation of effects of maximum landing length regulations.....	42
2.9	Stock assessment.....	42
2.9.1	Introduction	42
2.9.2	Summary of model runs.....	44
2.9.3	Results for base case run	44
2.9.4	Retrospective analysis	46
2.9.5	Sensitivity analyses	46
2.9.6	MSY $B_{trigger}$	47
2.9.7	Projections	47
2.9.8	Conclusion.....	47
2.10	Quality of assessments	48
2.10.1	Catch data	48
2.10.2	Survey data	48
2.10.3	Biological information.....	49
2.10.4	Assessment	49
2.10.5	ADG comments from 2018	49
2.11	Reference points	50
2.12	Conservation considerations	51
2.13	Management considerations	51
2.14	Additional recent information	52
2.14.1	Developing an abundance index for spurdog in Norwegian waters.....	52
2.14.2	Recent life-history information.....	52
2.15	References	53
3	Deep-water sharks; Leafscale gulper shark and Portuguese dogfish in the Northeast Atlantic (subareas 4–14).....	121
3.1	Stock distribution.....	121
3.2	Leafscale gulper shark.....	121
3.2.1	Portuguese dogfish	121
3.3	The fishery	122
3.3.1	History of the fishery	122
3.3.2	Species distribution and spatial overlap with fisheries.....	122
3.3.3	The fishery in 2019.....	123
3.3.4	ICES advice applicable.....	123
3.3.5	Management applicable	124
3.4	Catch data	126
3.4.1	Landings	126
3.4.2	Discards.....	126
3.4.3	Quality of the catch data	128
3.4.4	Discard survival	128
3.5	Commercial catch composition	129
3.5.1	Species composition	129
3.5.2	Length composition	129
3.5.3	Quality of catch and biological data.....	129
3.6	Commercial catch-effort data.....	129
3.7	Fishery-independent surveys.....	129
3.8	Life-history information	130
3.9	Exploratory assessments.....	130
3.9.1	Analyses of Scottish deep-water survey data	130
3.9.2	Analyses of AZTI survey.....	131

3.9.3	Analyses of on-board Portuguese data.....	131
3.10	Stock assessment	132
3.11	Quality of the assessments	132
3.11.1	Historical assessments	133
3.12	Reference points	133
3.13	Conservation considerations	133
3.14	Management considerations	133
3.15	References	134
4	Kitefin shark in the Northeast Atlantic (entire ICES Area)	154
4.1	Stock distribution	154
4.2	The fishery	154
4.2.1	History of the fishery	154
4.2.2	The fishery in 2019.....	154
4.2.3	ICES advice applicable	154
4.2.4	Management applicable	155
4.3	Catch data	156
4.3.1	Landings	156
4.3.2	Discards.....	156
4.3.3	Quality of catch data.....	156
4.4	Commercial catch composition	156
4.5	Commercial catch–effort data	157
4.6	Fishery-independent surveys.....	157
4.7	Life-history information	157
4.8	Exploratory assessment models	157
4.9	Stock assessment	158
4.10	Quality of assessments	158
4.11	Reference points	158
4.12	Conservation considerations	158
4.13	Management considerations	158
4.14	References	159
5	Other deep-water sharks and skates from the Northeast Atlantic (ICES subareas 4–14).....	165
5.1	Stock distributions	165
5.2	The fishery	165
5.2.1	History of the fishery	165
5.2.2	The fishery in 2019.....	166
5.2.3	ICES advice applicable	166
5.2.4	Management applicable	166
5.3	Catch data	168
5.3.1	Landings	168
	Gulper sharks <i>Centrophorus</i> spp. (excluding <i>C. squamosus</i>)	168
	Birdbeak dogfish <i>Dearnia calcea</i>	168
	Longnose velvet dogfish <i>Centroscymnus crepidater</i>	168
	Black dogfish <i>Centroscyllium fabricii</i>	168
	Lanternsharks <i>Etmopterus</i> spp.....	168
	Other species.....	169
5.3.2	Discards.....	169
5.3.3	Quality of the catch data	169
5.3.4	Discard survival	169
5.4	Commercial catch composition	169
5.5	Commercial catch and effort data	169
5.6	Fishery-independent surveys.....	169
5.6.1	ICES Subarea 6	169
5.6.2	ICES Subarea 7	170

5.6.3	ICES divisions 8.c and 9.a	170
5.6.4	ICES Subarea 10	170
5.7	Life-history information	170
5.8	Exploratory assessments analyses of relative abundance indices	171
5.8.1	Summary of trends by species	171
	Birdbeak dogfish <i>Deania calcea</i> and Arrowhead dogfish <i>Deania profundorum</i>	171
	Knifetooth dogfish <i>Scymnodon ringens</i>	171
	Velvet belly lanternshark <i>Etmopterus spinax</i>	171
	Bluntnose six-gill shark <i>Hexanchus griseus</i>	172
	Other deep-water elasmobranchs	172
5.9	Stock assessment	172
5.10	Quality of assessments	172
5.11	Reference points	172
5.12	Conservation considerations	172
5.13	Management considerations	172
5.14	References	172
6	Porbeagle in the Northeast Atlantic (subareas 1–14)	189
6.1	Stock distribution	189
6.2	The fishery	189
6.2.1	History of the fishery	189
6.2.2	The fishery in 2019	189
6.2.3	ICES advice applicable	190
6.2.4	Management applicable	190
6.3	Catch data	190
6.3.1	Landings	190
6.3.2	Discards	190
6.3.3	Quality of catch data	191
6.3.4	Discard survival	191
6.4	Commercial catch composition	191
6.4.1	Conversion factors	192
6.5	Commercial catch and effort data	192
6.6	Fishery-independent surveys	192
6.7	Life-history information	193
6.7.1	Movements and migrations	194
6.7.2	Reproductive biology	194
6.7.3	Genetic information	195
6.8	Exploratory assessment models	195
6.8.1	Previous studies	195
6.8.2	Population dynamics model	195
6.8.3	The SPICT model	196
6.9	Stock assessment	196
6.10	Quality of assessments	196
6.11	Reference points	196
6.12	Conservation considerations	197
6.13	Management considerations	197
6.14	References	198
7	Basking Shark in the Northeast Atlantic (ICES areas 1–14)	211
7.1	Stock distribution	211
7.2	The fishery	211
7.2.1	History of the fishery	211
7.2.2	The fishery in 2019	212
7.2.3	ICES advice applicable	212
7.2.4	Management applicable	212

7.3	Catch data	212
7.3.1	Landings	212
7.3.2	Discards.....	213
7.3.3	Quality of the catch data	214
7.3.4	Discard survival	214
7.4	Commercial catch composition	214
7.5	Commercial catch-effort data.....	214
7.6	Fishery-independent surveys.....	214
7.7	Life-history and other relevant information	215
7.8	Exploratory assessment models	216
7.9	Stock assessment	217
7.10	Quality of assessments	217
7.11	Reference points	217
7.12	Conservation considerations	217
7.13	Management considerations	217
7.14	References	217
8	Blue shark in the North Atlantic (North of 5°N)	232
8.1	Stock distribution	232
8.2	The fishery	232
8.2.1	History of the fishery	232
8.2.2	The fishery in 2019.....	233
8.2.3	Advice applicable	233
8.2.4	Management applicable	233
8.3	Catch data	233
8.3.1	Landings	233
8.3.2	Discards.....	234
8.3.3	Discard survival	235
8.3.4	Quality of catch data.....	235
8.4	Commercial catch composition	235
8.4.1	Conversion factors	236
8.5	Commercial catch and effort data	236
8.6	Fishery-independent surveys.....	236
8.7	Life-history information	236
8.8	Exploratory assessment models	238
8.8.1	Previous assessments	238
8.9	Stock assessment	239
8.10	Quality of assessments	240
8.11	Reference points	240
8.12	Conservation considerations	240
8.13	Management considerations	240
8.14	References	241
9	Shortfin mako in the North Atlantic (North of 5°N)	266
9.1	Stock distribution	266
9.2	The fishery	266
9.2.1	History of the fishery	266
9.2.2	The fishery in 2015.....	267
9.2.3	Advice applicable	267
9.2.4	Management applicable	267
9.3	Catch data	267
9.3.1	Landings	267
9.3.2	Discards.....	268
9.3.3	Quality of catch data.....	268
9.3.4	Discard survival	269

9.4	Commercial catch composition	269
9.4.1	Conversion factors	269
9.5	Commercial catch and effort data	269
9.6	Fishery-independent surveys.....	270
9.7	Life-history information	270
9.7.1	Habitat	270
9.7.2	Nursery grounds	271
9.7.3	Diet.....	271
9.7.4	Movements.....	271
9.8	Exploratory assessment models	271
9.9	Stock assessment.....	272
9.10	Quality of assessment.....	272
9.11	Reference points	272
9.12	Conservation considerations	273
9.13	Management considerations	273
9.14	References	273
10	Tope in the Northeast Atlantic	289
10.1	Stock distribution	289
10.2	The fishery	289
10.2.1	History of the fishery	289
10.2.2	The fishery in 2019.....	289
10.2.3	ICES Advice applicable	289
10.2.4	Management applicable	289
10.3	Catch data	290
10.3.1	Landings	290
10.3.2	Discards.....	290
10.3.3	Quality of catch data.....	291
10.3.4	Discard Survival.....	291
10.4	Commercial catch composition	291
10.5	Commercial catch and effort data	291
10.6	Fishery-independent information	291
10.6.1	Availability of survey data	291
10.6.2	Trends in survey abundance	292
10.6.3	Length distributions	293
10.6.3.1	Recreational length distributions.....	293
10.6.4	Tagging information.....	293
10.7	Life-history information	294
10.7.1	Parturition and nursery grounds.....	295
10.8	Exploratory assessment models	295
10.8.1	Data used	295
10.8.2	Methodology.....	296
10.8.2.1	Cormack-Jolly-Seber Model	296
10.8.2.2	Deriving population size: the Jolly-Seber approach.....	297
10.8.3	Computation details	297
10.8.4	Results.....	298
10.8.5	Discussion	298
10.9	Stock assessment.....	298
10.10	Quality of the assessment.....	298
10.11	Reference points	299
10.12	Conservation considerations	299
10.13	Management considerations	299
10.14	References	299
11	Thresher sharks in the Northeast Atlantic and Mediterranean Sea	320

11.1	Stock distribution	320
11.2	The fishery	320
11.2.1	History of the fishery	320
11.2.2	The fishery in 2019.....	320
11.2.3	ICES Advice applicable	320
11.2.4	Management applicable	321
11.3	Catch data	321
11.3.1	Landings	321
11.3.2	Discards.....	321
11.3.3	Quality of catch data.....	321
11.3.4	Discard survival	322
11.4	Commercial catch composition	322
11.5	Commercial catch and effort data	322
11.6	Fishery-independent surveys.....	322
11.7	Life-history information	322
11.7.1	Movements and migrations	322
11.7.2	Nursery grounds	323
11.7.3	Diet.....	323
11.8	Exploratory assessments.....	324
11.9	Stock assessment	324
11.10	Quality of assessments	324
11.11	Reference points	324
11.12	Conservation considerations	325
11.13	Management considerations	325
11.14	References	325
12	Other pelagic sharks in the Northeast Atlantic	332
12.1	Ecosystem description and stock boundaries.....	332
12.1.1	Taxonomic changes.....	332
12.2	The fishery	332
12.2.1	History of the fishery	332
12.2.2	The fishery in 2019.....	332
12.2.3	ICES advice applicable	332
12.2.4	Management applicable	333
12.3	Catch data	334
12.3.1	Landings	334
12.3.2	Discards.....	334
12.3.3	Quality of catch data.....	334
12.3.4	Discard survival	334
12.4	Commercial catch composition	334
12.5	Commercial catch and effort data	335
12.6	Fishery-independent data.....	335
12.7	Life-history information	335
12.8	Exploratory assessments.....	335
12.9	Stock assessment	335
12.10	Quality of the assessment.....	335
12.11	Reference points	336
12.12	Conservation considerations	336
12.13	Management considerations	336
12.14	References	337
13	Demersal elasmobranchs in the Barents Sea	351
13.1	Ecoregion and stock boundaries	351
13.2	The fishery	351
13.2.1	History of the fishery	351

13.2.2	The fishery in 2019.....	352
13.2.3	ICES advice applicable	352
13.2.4	Management applicable	352
13.3	Catch data	352
13.3.1	Landings	352
13.3.2	Discards.....	352
13.3.3	Quality of catch data.....	353
13.3.4	Discard survival	353
13.4	Commercial catch composition	353
13.5	Commercial catch and effort data	353
13.6	Fishery-independent surveys.....	354
13.6.1	Russian bottom trawl survey (RU-BTr-Q4).....	354
13.6.2	Norwegian coastal survey (NOcoast-Aco-Q4).....	354
13.6.3	Deep stations from multiple Norwegian surveys (NO-GH-Btr-Q3 and others).....	354
13.6.4	Joint Russian-Norwegian surveys (BS-NoRu-Q1 (BTr), Eco-NoRu-Q3 (Aco)/Eco-NoRu-Q3 (Btr))	354
13.6.5	Quality of survey data	355
13.7	Life-history information	355
13.8	Exploratory assessment models	356
13.9	Exploratory assessment models	356
13.10	Quality of assessments	356
13.11	Reference points	356
13.12	Conservation considerations	356
13.13	Management considerations	356
13.14	References	356
14	Demersal elasmobranchs in the Norwegian Sea	364
14.1	Ecoregion and stock boundaries	364
14.2	The fishery	364
14.2.1	History of the fishery	364
14.2.2	The fishery in 2019.....	364
14.2.3	ICES advice applicable	364
14.2.4	Management applicable	365
14.3	Catch data	365
14.3.1	Landings	365
14.3.2	Discard data	365
14.3.3	Quality of catch data.....	365
14.3.4	Discard survival	366
14.4	Commercial catch composition	366
14.4.1	Species and size composition	366
14.4.2	Quality of the data	366
14.5	Commercial catch and effort data	367
14.6	Fishery-independent surveys.....	367
14.6.1	Russian bottom trawl survey (RU-BTr-Q4).....	367
14.6.2	Norwegian coastal survey (NOcoast-Aco-4Q).....	367
14.6.3	Deep stations from multiple Norwegian surveys (NO-GH-Btr-Q3 and others).....	368
14.6.4	Joint Russian-Norwegian survey (BS-NoRu-Q1 (BTr), Eco-NoRu-Q3 (Aco)/Eco-NoRu-Q3 (Btr))	368
14.6.5	Quality of survey data.....	368
14.7	Life-history information	369
14.8	Exploratory assessment models	369
14.9	Stock assessment	369
14.10	Quality of assessments	369
14.11	Reference points	369

14.12	Conservation considerations	369
14.13	Management considerations	370
14.14	References	370
15	Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and eastern Channel	377
15.1	Ecoregion and stock boundaries	377
15.2	The fishery	377
15.2.1	History of the fishery	377
15.2.2	The fishery in 2019.....	378
15.2.3	ICES Advice applicable	378
15.2.3.1	State of the stocks	378
15.2.4	Management applicable	379
15.3	Catch data	382
15.3.1	Landings	382
15.3.2	Discard data	382
15.3.3	Quality of the catch data	382
15.3.4	Discard survival	383
15.4	Commercial landings composition.....	383
15.4.1	Species and size composition	383
15.4.2	Quality of data	384
15.5	Commercial catch-effort data.....	384
15.6	Fishery-independent surveys.....	384
15.6.1	International Bottom Trawl Survey North Sea Q1 (IBTS-Q1) and Q3 (IBTS-Q3)	385
15.6.2	Channel groundfish survey	385
15.6.3	Beam trawl surveys.....	385
15.6.4	Index calculations	386
15.6.5	Other surveys.....	387
15.7	Life-history information	387
15.7.1	Ecologically important habitats	388
15.8	Exploratory assessment models	388
15.8.1	GAM analyses of survey trends	388
15.8.2	Exploratory assessment of thornback ray in the Eastern English Channel	388
15.8.3	Data Limited stock assessment methods applied to North Sea and English Channel	389
15.8.4	Estimation of abundance and spatial analysis-application of the SPANdex method.....	389
15.8.5	Previous assessments of <i>R. clavata</i>	390
15.9	Stock assessment	390
15.10	Quality of assessments	390
15.11	Reference points	391
15.12	Conservation considerations	391
15.13	Management considerations	391
15.14	References	392
16	Demersal elasmobranchs - Iceland and East Greenland	444
16.1	Ecoregion and stock boundaries	444
16.2	The fishery	445
16.2.1	History of the fishery	445
16.2.2	The fishery in 2019.....	445
16.2.3	ICES advice applicable	445
16.2.4	Management applicable	445
16.3	Catch data	445
16.3.1	Landings	445
16.3.2	Discards.....	446
16.3.3	Quality of catch data.....	446

16.3.4	Discard survival	446
16.4	Commercial catch composition	446
16.5	Commercial catch and effort data	446
16.6	Fishery-independent surveys.....	446
16.6.1	Surveys in Greenland waters	446
16.6.2	Surveys in Icelandic waters.....	447
16.7	Life-history information	447
16.8	Exploratory assessment models	447
16.9	Stock assessment	447
16.10	Quality of assessments	448
16.11	Reference points	448
16.12	Conservation considerations	448
16.13	Management considerations	448
16.14	References	448
17	Demersal elasmobranchs at the Faroe Islands.....	457
17.1	Ecoregion and stock boundaries	457
17.2	The fishery	457
17.2.1	History of the fishery	457
17.2.2	The fishery in 2019.....	457
17.2.3	ICES advice applicable.....	458
17.2.4	Management applicable	458
17.3	Catch data	458
17.3.1	Landings	458
17.3.2	Discards.....	458
17.3.3	Quality of catch data.....	458
17.3.4	Discard survival	458
17.4	Commercial catch composition	458
17.5	Commercial catch and effort data	458
17.6	Fishery-independent surveys.....	458
17.7	Life-history information	459
17.8	Exploratory assessments.....	459
17.9	Stock assessment	459
17.10	Quality of assessments	459
17.11	Reference points	459
17.12	Conservation considerations	459
17.13	Management considerations	459
17.14	References	460
18	Skates and rays in the Celtic Seas (ICES subareas 6 and 7 (except Division 7.d)).....	466
18.1	Ecoregion and stock boundaries	466
18.2	The fishery	466
18.2.1	History of the fishery	466
18.2.2	The fishery in 2019.....	466
18.2.3	ICES advice applicable.....	466
18.2.4	Management applicable	468
18.2.5	Other management issues	469
18.3	Catch data	470
18.3.1	Landings	470
18.3.2	Skate landing categories	471
18.3.3	Discards.....	472
18.3.4	Discard survival	472
18.3.5	Quality of catch data.....	472
18.4	Commercial catch composition	472
18.4.1	Size composition	472

18.4.2	Quality of data	473
18.5	Commercial catch and effort data	473
18.6	Fishery-independent surveys.....	473
18.6.1	Temporal trends in catch rates	474
18.6.2	Quality of data	474
18.6.2.1	Species identification in surveys	474
18.6.3	New data.....	475
18.7	Life-history information	475
18.7.1	Ecologically important habitats	475
18.8	Exploratory assessment models	475
18.8.1	Productivity-Susceptibility Analysis	475
18.8.2	Previous assessments	475
18.9	Stock assessment	476
18.9.1	Blonde ray <i>Raja brachyura</i> in Subarea 6 and Division 4.a	476
18.9.2	Blonde ray <i>Raja brachyura</i> in Divisions 7.a and 7.f-g.....	476
18.9.3	Blonde ray <i>Raja brachyura</i> in Division 7.e	476
18.9.4	Thornback ray <i>Raja clavata</i> in Subarea 6.....	476
18.9.5	Thornback ray <i>Raja clavata</i> in Divisions 7.a and 7.f-g	477
18.9.6	Thornback ray <i>Raja clavata</i> in Division 7.e	477
18.9.7	Small-eyed ray <i>Raja microocellata</i> in the Bristol Channel (Divisions 7.f- g)	477
18.9.8	Small-eyed ray <i>Raja microocellata</i> in the English Channel (Divisions 7.d-e)	478
18.9.9	Spotted ray <i>Raja montagui</i> in Subarea 6 and Divisions 7.b and 7.j	478
18.9.10	Spotted ray <i>Raja montagui</i> in Divisions 7.a and 7.e-h	478
18.9.11	Cuckoo ray <i>Leucoraja naevus</i> in Subareas 6 and 7 and Divisions 8.a-b and 8.d	479
18.9.12	Sandy ray <i>Leucoraja circularis</i> in the Celtic Seas and adjacent areas	479
18.9.13	Shagreen ray <i>L. fullonica</i> in the Celtic Seas and adjacent areas	480
18.9.14	Common skate <i>Dipturus batis</i> -complex (flapper skate <i>Dipturus intermedium</i> and blue skate <i>Dipturus batis</i>) in Subarea 6 and divisions 7.a-c and 7.e-j	480
18.9.15	Undulate ray <i>Raja undulata</i> in divisions 7.b and 7.j	481
18.9.16	Undulate ray <i>Raja undulata</i> in Divisions 7.d-e (English Channel)	481
18.9.17	Other skates in subareas 6 and 7 (excluding Division 7.d).....	483
18.10	Quality of assessments	483
18.11	Reference points	484
18.12	Conservation considerations	484
18.13	Management considerations	485
18.14	References	486
19	Skates in the Bay of Biscay and Iberian Waters (ICES Subarea 8 and Division 9.a)	533
19.1	Ecoregion and stock boundaries.....	533
19.2	The fishery	534
19.2.1	History of the fishery	534
19.2.2	The fishery in 2019.....	535
19.2.3	ICES Advice applicable	536
19.2.4	Management applicable	537
19.2.4.1	Regional management measures	539
19.3	Catch data	540
19.3.1	Landings	540
19.3.2	Discards.....	541
19.3.3	Discard survival	542
19.3.4	Quality of the catch composition data.....	544
19.4	Commercial catch composition and length frequency distribution.....	544
19.5	Commercial catch–effort data	545
19.5.1	Spanish data for Subarea 8	545
19.5.2	Portuguese data for Division 9.....	545

19.5.2.1 Effort data	545
19.5.2.2 CPUE and E data.....	546
19.5.3 Quality of the catch-effort data	547
19.6 Fishery-independent surveys.....	547
19.6.1 French EVHOE survey (Subarea 8)	547
19.6.2 Spanish survey data (divisions 8.c and 9.a).....	547
19.6.3 Portuguese survey data (Division 9.a)	548
19.6.4 Temporal trends	549
19.7 Life history information	551
19.7.1 Ecologically important habitats	551
19.8 Exploratory assessments.....	551
19.8.1 <i>Raja clavata</i> in the Bay of Biscay	551
19.8.1.1 Data used	551
19.8.1.2 Methodology.....	552
19.8.1.3 Results.....	553
19.8.1.4 Exploratory length-based indicators.....	553
19.8.2 <i>Raja undulata</i> in Divisions 8.a-b.....	553
19.9 Stock assessment	555
19.9.1 Thornback ray (<i>Raja clavata</i>) in Subarea 8 (Bay of Biscay and Cantabrian Sea) (rjc.27.8)	555
19.9.2 Thornback ray (<i>Raja clavata</i>) in Division 9.a (west of Galicia, Portugal, and Gulf of Cadiz) (rjc.27.9a)	556
19.9.2.1 Exploratory length-based indicators.....	556
19.9.3 Cuckoo ray (<i>Leucoraja naevus</i>) in subareas 6-7 (Celtic Sea and West of Scotland) and divisions 8.a-b,d (Bay of Biscay) (rnj.27.678abd)	556
19.9.4 Cuckoo ray (<i>Leucoraja naevus</i>) in Division 8.c (Cantabrian sea) (rjn.27.8.c)	556
19.9.4.1 Exploratory length-based indicators.....	557
19.9.5 Cuckoo ray (<i>Leucoraja naevus</i>) in Division 9.a (west of Galicia, Portugal, and Gulf of Cadiz) (rjn.27.9a).....	557
19.9.6 Spotted ray (<i>Raja montagui</i>) in Subarea 8 (Bay of Biscay and Cantabrian Sea) (rjm.27.8)	558
19.9.7 Spotted ray (<i>Raja montagui</i>) in Division 9.a (west of Galicia, Portugal, and Gulf of Cadiz) (rjm.27.9a).....	558
19.9.7.1 Exploratory LPUE.....	558
19.9.7.2 Exploratory length-based indicators.....	559
19.9.8 Undulate ray (<i>Raja undulata</i>) in divisions 8.a-b (Bay of Biscay) (rju.27.8ab).....	559
19.9.9 Undulate ray (<i>Raja undulata</i>) in Division 8.c (Cantabrian Sea) (rju.27.8c)	560
19.9.10 Undulate ray (<i>Raja undulata</i>) in Division 9.a (west of Galicia, Portugal, and Gulf of Cadiz) (rju.27.9a).....	560
19.9.11 Blonde ray (<i>Raja brachyura</i>) in Division 9.a (west of Galicia, Portugal, and Gulf of Cadiz) (rjh.27.9a)	562
19.9.11.1 Exploratory Yield per recruit and potential spawning ratio.....	563
19.9.11.2 Exploratory of length-based indicators.....	563
19.9.12 Common skate <i>Dipturus batis</i> -complex (flapper skate <i>Dipturus batis</i> and blue skate <i>Dipturus cf. intermedia</i>) in Subarea 8 and Division 9.a (Bay of Biscay and Atlantic Iberian waters) (rjb.27.89a)	563
19.9.13 Other skates in Subarea 8 and Division 9.a (Bay of Biscay and Atlantic Iberian waters) (raj.27.89a).....	564
19.9.14 Summary of the status of skate stocks in the Bay of Biscay and Atlantic Iberian waters	565
19.10 Quality of assessments	565
19.11 Reference points	566
19.12 Conservation considerations	566

19.13	Management considerations	567
19.13.1	Fishery-science projects to estimate abundance of <i>Raja undulata</i> stocks	567
19.13.2	Monitoring of <i>Raja undulata</i> captures.....	569
19.14	References	570
20	Skates and Rays in the Azores and Mid-Atlantic Ridge	630
20.1	Ecoregion and stock boundaries.....	630
20.2	The fishery	630
20.2.1	History the fishery.....	630
20.2.2	The fishery in 2019.....	631
20.2.3	ICES advice applicable	631
20.2.4	Management applicable	631
20.2.4.1	Mid-Atlantic Ridge	631
20.2.4.2	Azores EEZ.....	632
20.3	Catch data	632
20.3.1	Landings	632
20.3.2	Discards.....	632
20.3.3	Quality of catch data.....	632
20.3.4	Discard survival	633
20.3.5	Species composition	633
20.4	Commercial catch composition	633
20.4.1	Length composition of landings.....	633
20.4.2	Length composition of discards	633
20.4.3	Sex ratio of landings.....	633
20.4.4	Quality of data	633
20.5	Commercial catch and effort data	633
20.6	Fishery-independent surveys.....	634
20.7	Life-history information	634
20.8	Exploratory assessment methods.....	634
20.9	Stock assessment	634
20.10	Quality of assessments	634
20.11	Reference points	634
20.12	Conservation consideration	635
20.13	Management considerations	635
20.14	References	635
21	Smooth-hounds in the Northeast Atlantic	643
21.1	Stock distribution.....	643
21.2	The fishery	644
21.2.1	History of the fishery	644
21.2.2	The fishery in 2019.....	644
21.2.3	ICES Advice applicable	644
21.2.4	Management applicable	644
21.3	Catch data	645
21.3.1	Landings	645
21.3.2	Discards.....	645
21.3.3	Quality of catch data.....	645
21.3.4	Discard survival	646
21.4	Commercial catch composition	646
21.4.1	Length Composition of landings	646
21.4.2	Length composition of discards	646
21.4.3	Sex ratio of landings.....	647
21.4.4	Quality of data	647
21.5	Commercial catch and effort data	647
21.6	Fishery-independent information.....	647

21.6.1	Availability of survey data	647
21.6.2	Survey trends	648
21.6.3	Data quality.....	649
21.7	Life-history information	650
21.7.1	Habitat	650
21.7.2	Spawning, parturition and nursery grounds	650
21.7.3	Age and growth.....	650
21.7.4	Reproductive biology	651
21.7.5	Movements and migrations.....	652
21.7.6	Diet and role in ecosystem	652
21.7.7	Conversion factors	653
21.8	Exploratory assessment models	654
21.8.1	Previous studies	654
21.8.2	Data exploration and preliminary assessments.....	654
21.9	Stock assessment	654
21.10	Quality of the assessment.....	655
21.11	Reference points	656
21.12	Conservation considerations	656
21.13	Management considerations	656
21.14	References	656
22	Angel shark <i>Squatina squatina</i> in the Northeast Atlantic	683
22.1	Stock distribution.....	683
22.2	The fishery	683
22.2.1	History of the fishery	683
22.2.2	The fishery in 2019.....	683
22.2.3	ICES Advice applicable	684
22.2.4	Management applicable	684
22.3	Catch data	684
22.3.1	Landings	684
22.3.2	Discards.....	684
22.3.3	Quality of catch data.....	685
22.3.4	Discard survival	685
22.4	Commercial catch composition	685
22.5	Commercial catch and effort data	685
22.5.1	Recreational catch and effort data	685
22.6	Fishery-independent data.....	686
22.7	Life-history information	686
22.7.1	Habitat	686
22.7.2	Spawning, parturition and nursery grounds	686
22.7.3	Age and growth.....	687
22.7.4	Reproductive biology	687
22.7.5	Movements and migrations.....	687
22.7.6	Diet and role in the ecosystem	687
22.8	Exploratory assessment models	687
22.9	Stock assessment	688
22.10	Quality of the assessment.....	688
22.11	Reference points	688
22.12	Conservation considerations	688
22.13	Management considerations	689
22.14	References	689
23	White skate <i>Rostroraja alba</i> in the Northeast Atlantic	701
23.1	Stock distribution.....	701
23.2	The fishery	701

23.2.1	History of the fishery	701
23.2.2	The fishery in 2019.....	701
23.2.3	ICES Advice applicable	701
23.2.4	Management applicable	702
23.3	Catch data	702
23.3.1	Landings	702
23.3.2	Discards.....	702
23.3.3	Quality of catch data.....	702
23.3.4	Discard survival	703
23.4	Commercial catch composition	703
23.5	Commercial catch and effort data	703
23.6	Fishery-independent information.....	703
23.7	Life-history information	703
23.8	Exploratory assessment models	703
23.9	Stock assessment.....	703
23.10	Quality of the assessment.....	704
23.11	Reference points	704
23.12	Conservation considerations	704
23.13	Management considerations	704
23.14	References	704
24	Greenland shark <i>Somniosus microcephalus</i> in the Northeast Atlantic.....	707
24.1	Stock distribution.....	707
24.2	The fishery	707
24.2.1	History of the fishery	707
24.2.2	The fishery in 2019.....	707
24.2.3	ICES Advice applicable	707
24.2.4	Management applicable	708
24.3	Catch data	708
24.3.1	Landings	708
24.3.2	Discards.....	708
24.3.3	Quality of catch data.....	708
24.3.4	Discard survival	708
24.4	Commercial catch composition	709
24.5	Commercial catch and effort data	709
24.5.1	Recreational CPUE data	709
24.6	Fishery-independent information.....	709
24.7	Life-history information	709
24.7.1	Habitat and abundance.....	709
24.7.2	Spawning, parturition and nursery grounds	709
24.7.3	Age and growth.....	710
24.7.4	Reproductive biology	710
24.7.5	Movements and migrations.....	710
24.7.6	Diet and role in ecosystem	710
24.8	Exploratory assessment models	711
24.9	Stock assessment	711
24.10	Quality of the assessment.....	711
24.11	Reference points	711
24.12	Conservation considerations	711
24.13	Management considerations	711
24.14	References	711
25	Catsharks (<i>Scyliorhinidae</i>) in the Northeast Atlantic.....	717
25.1	Stock distribution.....	717
25.2	The fishery	718

25.2.1	History of the fishery	718
25.2.2	The fishery in 2018.....	718
25.2.3	ICES Advice applicable	718
25.2.4	Management applicable	720
25.3	Catch data	720
25.3.1	Landings	720
25.3.2	Discards.....	721
25.3.3	Discard survival	722
25.3.4	Quality of catch data.....	722
25.4	Commercial catch composition	722
25.5	Commercial catch–effort data	723
25.6	Fishery-independent information.....	723
25.7	Life-history information	724
25.8	Exploratory assessment models	725
25.9	Stock assessment.....	725
25.9.1	Approach.....	725
25.9.2	Lesser-spotted dogfish (<i>S. canicula</i>) in Subarea 4, and divisions 3.a and 7.d (North Sea, Skagerrak and Kattegat, Eastern English Channel)	725
25.9.3	Lesser-spotted dogfish (<i>S. canicula</i>) in Subarea 6 and divisions 7.a–c and 7.e–j (Celtic Seas and West of Scotland)	726
25.9.4	Lesser-spotted dogfish (<i>S. canicula</i>) in divisions 8.a–b and 8.d (Bay of Biscay).....	726
25.9.5	Lesser-spotted dogfish (<i>S. canicula</i>) in divisions 8.c and 9.a (Atlantic Iberian waters)	726
25.9.6	Greater-spotted dogfish (<i>S. stellaris</i>) in subareas 6 and 7 (Celtic Seas and West of Scotland)	726
25.9.7	Black-mouth dogfish (<i>Galeus melastomus</i>) in subareas 6 and 7 (Celtic Sea and West of Scotland).....	726
25.9.8	Black-mouth dogfish (<i>Galeus melastomus</i>) in Subarea 8 and Division 9.a (Bay of Biscay and Atlantic Iberian waters).....	726
25.10	Quality of the assessments	727
25.11	Reference points	727
25.12	Conservation considerations	727
25.13	Management considerations	728
25.14	References	728
26	Other issues	748
26.1	Code of conduct and conflict of interest	748
26.2	Productivity survey	748
26.3	WKSATE meeting to be held in November 2020	749
26.4	Joint ICES-ICCAT meeting	750
26.5	Follow recommendations from WKSHARK5	750
26.6	Expected surveys issues due to COVID-19	751
26.7	Future benchmarks	752
26.8	References	753
Annex 1:	List of participants.....	754
Annex 2:	Recommendations	756
Annex 3:	Terms of Reference for next year	757
Annex 4:	Audits	759
Annex 5:	List of Stock Annexes	787
Annex 6:	Working Documents	789

i Executive summary

ICES WGEF meets annually and is responsible for providing assessments and advice on the state of the stocks of sharks, skates, and rays throughout the ICES area. In 2020, WGEF provided advice for 28 stocks of rays and skates distributed in two ecoregions: the Celtic Seas and the Bay of Biscay and Iberian coast. Only one stock of shark, spurdog (*Squalus acanthias*) was subject to advice this year.

Strong improvements in the quality of data used by WGEF have been made in recent years and continued in 2020. The quality of landings data was historically poor for several reasons including that landings were not reported on a species specific level as these are subject to taxonomical confusions. Despite improvements of reported landings in the past decade, quality check and error corrections, reliable time-series of landings do not span more than 10–12 years for most stocks. Estimated discards are uncertain because elasmobranchs are mostly bycatch in small amounts in all types of fisheries. Further, survival of discarded elasmobranchs is thought to be high but quantitative estimates are scarce so that the relationship between discards and dead catches is unknown. As a consequence, for numerous stocks it is not possible to provide catch advice. For those stocks, advice on landings is formulated. With the exception of spurdog, for which an analytical assessment is available, many assessments are based on survey trends only. Trends are derived for scientific surveys, which are considered providing the most reliable data on elasmobranch stocks, whilst for a few stock of the Iberian coast, advice is based on biomass trends derived from catch per unit of effort from commercial fisheries. Also, a part of the stocks cannot be assessed yet. These stocks are classified as ICES category 5 and 6 stocks for which even survey data are lacking and only (minor) landings or some bycatch data are available.

For rays, no assessment was done for 9 out of 15 stocks in the Celtic Seas and for 6 out of 12 stocks in the Bay of Biscay and Iberian stocks. For these stocks advices are only based on landings or catches according to the ICES precautionary approach. In the Celtic Seas, among the six stocks of rays for which the trend in biomass could be estimated, this trend was increasing for two stocks (rjc.27.7afg, rju.27.7de), decreasing for two (rje.27.7fg, rjm.27.67bj) and stable for the last two (rjm.27.7ae-h, rjc.27.6). In the Bay of Biscay and Iberian coast, among the six stocks of rays for which the trend in biomass could be estimated, this trend was increasing for five stocks (rjh.27.9a, rjn.27.8c, rjn.27.9a, rjm.27.8, rjc.27.9a) and stable for one (rjc.27.8). Stocks in ICES category 5 include spotted ray in the Atlantic Iberian waters (rjm.27.9a), for which recent survey data were missing. Lastly, one stock straddles the two ecoregions (rjn.27.678abd) and had an increasing trend while the assessment of spurdog suggests an increase in biomass of this stock, which is also reflected in some surveys as shown in the report.

The high proportion of stocks for which the trend cannot be estimated, imply that more data and further work is needed to better monitor rays stocks. Some of this work is scheduled in the WKS KATE workshop to be held in November to evaluate which surveys and indicators are suitable to assess and deliver advice for elasmobranch stocks.

ii Expert group information

Expert group name	Working Group on Elasmobranch Fishes (WGEF)
Expert group cycle	Annual
Year cycle started	2020
Reporting year in cycle	1/1
Chair(s)	Jurgen Batsleer, Netherlands
	Pascal Lorance, France
Meeting venue(s) and dates	16–25 June 2020, online meeting, (31 participants)