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Reply to the Canadian request for advice of shrimps in Subarea 0 and 1.

by

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Summary

As a reply to the Canadian request for advice of shrimps in Subarea 0 and 1, this document present information for catch levels from 100 Kt to 135 Kt in steps of 5Kt. Information includes fishable biomass relative to BMSY, fishing mortality expressed as the ratio of catch to forecast fishable biomass, probabilities of transgressing NAFO reference points Z_{msy} , B_{msy} and B_{lim} , forecast estimable (i.e. cod) predation as a proportion of estimable removals, and present fishable biomass expressed as a percentage of that to be expected. Present stock size in relation of that observed historically is found in the assessment SCR Doc 018/56. Greenland provide assessment of the same area and all relevant document can be found in several SCR docs at NAFO website as well as in the NIPAG report.

Results and discussions

The Canadian request for advice reads in part:

Canada requests the Scientific Council to consider the following options in assessing and projecting future stock levels for Shrimp in Subareas 0 and 1:

- A) The status of the stock should be determined and management options evaluated for catch options ranging from 30,000 t to the catch corresponding to Z_{MSY} , in 5,000-10,000 t increments (subject to the discretion of Scientific Council), with forecasts for the next 5 years if possible.
- B) These options should be evaluated in relation to the Northwest Atlantic Fisheries Organization Precautionary Approach Framework and presented in the form of risk analyses related to the limit reference points B_{lim} and Z_{MSY} .
- C) Presentation of the results should include the following:
 - i) a graph and table of historical yield and fishing mortality for the longest time period possible;
 - ii) a graph of biomass relative to B_{MSY} , and recruitment levels for the longest time period possible.



- iii) a graph of the stock trajectory compared to Blim and/or B MSY and Z MSY;
- iv) graphs and tables of total mortality (Z) and fishable biomass for a range of projected catch options (as noted in 2 a) for the years 2019 to 2023 if possible. Projections should include both catch options and a range of cod biomass levels considered appropriate by SC. Results should include risk analyses of falling below BMSY and Blim, and of exceeding Z MSY;
- v) a graph of the total area fished for the longest time period possible; and
- vi) any other graph or table the Scientific Council feels is relevant.

Ad a). The following pages present information for catch levels from 100 Kt to 135 Kt in steps of 5Kt. Information includes fishable biomass relative to BMSY, fishing mortality expressed as the ratio of catch to forecast fishable biomass, probabilities of transgressing NAFO reference points Zmsy, Bmsy and Blim, forecast estimable (i.e. cod) predation as a proportion of estimable removals, and present fishable biomass expressed as a percentage of that to be expected. Present stock size in relation of that observed historically is found in the assessment SCR Doc. 018/56.

Ad b) Risks of transgressing NAFO reference points are tabulated.

Ad c)

- i) Historical catches are shown in the fishery SCR Doc. 017/57. Historical total mortality is shown in the assessment SCR Doc. 017/56.
- ii) Historical biomass relative to Bmsy is shown in the assessment SCR Doc. 018/56 and in the modelling SCR Doc 16/047 and 018/060. The meaning of 'recruitment levels' is not clear, but historical numbers of 'age-2' shrimps are shown in the survey SCR Doc. 018/55 and the assessment SCR Doc. 018/56.
- iii) It is not clear how 'stock trajectory' is to be differentiated from 'biomass' requested under ii), but past values of relative biomass and relative mortality are shown in the assessment SCR Doc. and the modelling SCR Doc. 018/56 and 018/060.
- iv) See a)
- v) It is not clear what is meant by 'total area fished'; standardised and unstandardised effort are shown in the fishery SCR Doc. 018/57 and 'effective statistical areas fished' is shown in the fishery SCR Doc. 018/57 by both catch and effort.

References

BURMEISTER, AD., AND F.F RIGET. 2018. A Provisional Assessment of the Shrimp Stock off West Greenland in 2018. NAFO SCR Doc. 018/056, Ser. No. N6870. 17pp.

Tables

Please have a look at the following pages.



Catch level 100 Kt; Cod 5 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.16	1.17	1.19	1.19	1.21
Exploitation rate (catch) (%)	7.71	7.64	7.52	7.49	7.40
P, Z greater than Zmsy (%)	18.0	19.2	19.7	19.8	20.4
P, FB less than Bmsy (%)	30.6	30.3	30.0	29.9	30.0
P, FB less than Blim (%)	0.0	0.0	0.1	0.2	0.5
Estimable predation (Kt)	2.2	2.2	2.2	2.2	2.2
Estimable predation (% of removals)	2.1	2.1	2.1	2.1	2.2
Relative fishable biomass, end current year	147	146	143	143	141

Catch level 100 Kt; Cod 10 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.16	1.17	1.18	1.19	1.20
Exploitation rate (catch) (%)	7.74	7.66	7.59	7.50	7.48
P, Z greater than Zmsy (%)	19.9	20.5	21.2	22.3	22.5
P, FB less than Bmsy (%)	30.2	30.5	31.0	31.1	31.0
P, FB less than Blim (%)	0.0	0.0	0.1	0.1	0.3
Estimable predation (Kt)	4.4	4.3	4.3	4.3	4.3
Estimable predation (% of removals)	4.2	4.2	4.2	4.2	4.2
Relative fishable biomass, end current year	148	146	145	143	143

Catch level 100 Kt; Cod 15 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.15	1.16	1.17	1.16	1.17
Exploitation rate (catch) (%)	7.76	7.71	7.67	7.70	7.67
P, Z greater than Zmsy (%)	22.1	23.2	24.0	24.4	24.7
P, FB less than Bmsy (%)	31.6	31.8	32.5	32.1	33.1
P, FB less than Blim (%)	0.0	0.0	0.0	0.2	0.4
Estimable predation (Kt)	6.5	6.5	6.5	6.4	6.4
Estimable predation (% of removals)	6.1	6.1	6.1	6.0	6.0
Relative fishable biomass, end current year	148	147	146	147	146

Catch level 100 Kt; Cod 20 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.15	1.15	1.17	1.16	1.17
Exploitation rate (catch) (%)	7.79	7.76	7.67	7.68	7.63
P, Z greater than Zmsy (%)	24.0	24.8	25.6	26.2	27.4
P, FB less than Bmsy (%)	31.6	32.2	32.6	33.1	33.5
P, FB less than Blim (%)	0.0	0.0	0.1	0.3	0.4
Estimable predation (Kt)	8.7	8.6	8.6	8.5	8.5
Estimable predation (% of removals)	8.0	7.9	7.9	7.8	7.8
Relative fishable biomass, end current year	149	148	146	146	145

Catch level 100 Kt; Cod 25 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.15	1.15	1.16	1.16	1.17
Exploitation rate (catch) (%)	7.78	7.81	7.74	7.74	7.64
P, Z greater than Zmsy (%)	26.4	26.8	28.2	29.2	29.0
P, FB less than Bmsy (%)	32.2	32.7	33.6	33.1	33.4
P, FB less than Blim (%)	0.0	0.0	0.1	0.3	0.4
Estimable predation (Kt)	10.9	10.7	10.7	10.6	10.6
Estimable predation (% of removals)	9.8	9.7	9.7	9.6	9.6
Relative fishable biomass, end current year	148	149	148	148	146

Catch level 100 Kt; Cod 30 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.15	1.14	1.15	1.15	1.15
Exploitation rate (catch) (%)	7.80	7.83	7.80	7.76	7.80
P, Z greater than Zmsy (%)	28.4	29.2	30.1	30.6	31.7
P, FB less than Bmsy (%)	31.6	33.1	34.3	35.0	35.1
P, FB less than Blim (%)	0.0	0.0	0.1	0.2	0.3
Estimable predation (Kt)	13.1	12.9	12.8	12.6	12.5
Estimable predation (% of removals)	11.6	11.4	11.3	11.2	11.1
Relative fishable biomass, end current year	149	149	149	148	149

Catch level 100 Kt; Cod 35 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.15	1.15	1.14	1.15	1.15
Exploitation rate (catch) (%)	7.81	7.79	7.87	7.80	7.81
P, Z greater than Zmsy (%)	30.8	31.6	32.8	33.2	33.5
P, FB less than Bmsy (%)	31.5	33.4	34.0	35.5	35.2
P, FB less than Blim (%)	0.0	0.0	0.0	0.2	0.4
Estimable predation (Kt)	15.2	15.2	14.8	14.6	14.5
Estimable predation (% of removals)	13.2	13.2	12.9	12.8	12.7
Relative fishable biomass, end current year	149	149	150	149	149

Catch level 105 Kt; Cod 5 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.15	1.17	1.18	1.19	1.19
Exploitation rate (catch) (%)	8.14	8.05	7.98	7.92	7.87
P, Z greater than Zmsy (%)	22.0	23.0	23.9	24.2	25.2
P, FB less than Bmsy (%)	31.3	31.1	31.2	32.0	31.6
P, FB less than Blim (%)	0.0	0.0	0.1	0.2	0.4
Estimable predation (Kt)	2.2	2.2	2.2	2.2	2.1
Estimable predation (% of removals)	2.0	2.0	2.0	2.0	2.0
Relative fishable biomass, end current year	148	146	145	144	143

Catch level 105 Kt; Cod 10 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.15	1.16	1.16	1.17	1.18
Exploitation rate (catch) (%)	8.16	8.12	8.08	8.02	7.95
P, Z greater than Zmsy (%)	24.2	25.2	26.0	25.7	26.4
P, FB less than Bmsy (%)	30.9	32.0	31.6	31.8	33.0
P, FB less than Blim (%)	0.0	0.0	0.1	0.2	0.4
Estimable predation (Kt)	4.4	4.3	4.3	4.3	4.3
Estimable predation (% of removals)	4.0	4.0	3.9	3.9	3.9
Relative fishable biomass, end current year	148	147	147	146	144

Catch level 105 Kt; Cod 15 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.14	1.14	1.16	1.16	1.16
Exploitation rate (catch) (%)	8.24	8.22	8.12	8.08	8.12
P, Z greater than Zmsy (%)	26.3	28.2	28.8	29.3	28.8
P, FB less than Bmsy (%)	31.9	33.0	33.3	33.9	34.0
P, FB less than Blim (%)	0.0	0.0	0.1	0.2	0.4
Estimable predation (Kt)	6.5	6.5	6.4	6.4	6.3
Estimable predation (% of removals)	5.9	5.8	5.7	5.7	5.7
Relative fishable biomass, end current year	150	149	147	147	147

Catch level 105 Kt; Cod 20 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.15	1.15	1.15	1.14	1.15
Exploitation rate (catch) (%)	8.20	8.20	8.18	8.21	8.20
P, Z greater than Zmsy (%)	28.4	29.4	29.7	30.2	30.8
P, FB less than Bmsy (%)	31.9	32.3	33.2	33.6	34.3
P, FB less than Blim (%)	0.0	0.0	0.0	0.2	0.5
Estimable predation (Kt)	8.7	8.6	8.5	8.5	8.4
Estimable predation (% of removals)	7.7	7.6	7.5	7.5	7.4
Relative fishable biomass, end current year	149	149	149	149	149

Catch level 105 Kt; Cod 25 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.14	1.14	1.14	1.15	1.14
Exploitation rate (catch) (%)	8.25	8.23	8.22	8.19	8.21
P, Z greater than Zmsy (%)	30.6	31.9	32.9	33.2	34.1
P, FB less than Bmsy (%)	32.3	34.3	34.5	35.0	35.5
P, FB less than Blim (%)	0.0	0.0	0.1	0.2	0.6
Estimable predation (Kt)	10.9	10.7	10.6	10.4	10.4
Estimable predation (% of removals)	9.4	9.3	9.1	9.0	9.0
Relative fishable biomass, end current year	150	149	149	149	149

Catch level 105 Kt; Cod 30 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.14	1.13	1.13	1.12	1.12
Exploitation rate (catch) (%)	8.22	8.28	8.31	8.36	8.41
P, Z greater than Zmsy (%)	33.1	34.4	35.0	36.3	37.2
P, FB less than Bmsy (%)	32.1	34.1	35.7	36.9	37.4
P, FB less than Blim (%)	0.0	0.0	0.1	0.4	0.6
Estimable predation (Kt)	13.1	12.7	12.5	12.3	12.0
Estimable predation (% of removals)	11.1	10.8	10.7	10.5	10.3
Relative fishable biomass, end current year	149	150	151	152	153

Catch level 105 Kt; Cod 35 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.13	1.13	1.12	1.11	1.11
Exploitation rate (catch) (%)	8.28	8.35	8.36	8.43	8.45
P, Z greater than Zmsy (%)	35.5	36.7	37.5	38.5	39.0
P, FB less than Bmsy (%)	33.3	35.4	36.2	37.3	39.2
P, FB less than Blim (%)	0.0	0.0	0.1	0.3	0.7
Estimable predation (Kt)	15.2	15.0	14.7	14.6	14.3
Estimable predation (% of removals)	12.7	12.5	12.3	12.2	11.9
Relative fishable biomass, end current year	150	152	152	153	153

Catch level 110 Kt; Cod 5 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.14	1.15	1.15	1.16	1.16
Exploitation rate (catch) (%)	8.62	8.56	8.53	8.49	8.46
P, Z greater than Zmsy (%)	26.5	27.8	28.9	29.1	30.1
P, FB less than Bmsy (%)	32.1	33.2	33.3	33.4	34.0
P, FB less than Blim (%)	0.0	0.0	0.1	0.2	0.5
Estimable predation (Kt)	2.2	2.2	2.1	2.1	2.1
Estimable predation (% of removals)	1.9	1.9	1.9	1.9	1.9
Relative fishable biomass, end current year	149	148	148	147	147

Catch level 110 Kt; Cod 10 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.14	1.15	1.15	1.15	1.15
Exploitation rate (catch) (%)	8.61	8.56	8.58	8.55	8.54
P, Z greater than Zmsy (%)	28.5	29.6	30.4	31.1	32.2
P, FB less than Bmsy (%)	32.3	33.7	34.8	35.7	35.6
P, FB less than Blim (%)	0.0	0.1	0.2	0.3	0.6
Estimable predation (Kt)	4.4	4.3	4.2	4.2	4.2
Estimable predation (% of removals)	3.8	3.8	3.7	3.7	3.6
Relative fishable biomass, end current year	149	148	149	148	148

Catch level 110 Kt; Cod 15 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.13	1.14	1.14	1.14	1.13
Exploitation rate (catch) (%)	8.68	8.62	8.65	8.65	8.68
P, Z greater than Zmsy (%)	30.6	32.2	33.1	34.3	34.9
P, FB less than Bmsy (%)	32.2	33.6	34.5	36.0	37.1
P, FB less than Blim (%)	0.0	0.0	0.1	0.2	0.6
Estimable predation (Kt)	6.5	6.4	6.4	6.3	6.2
Estimable predation (% of removals)	5.6	5.5	5.5	5.4	5.3
Relative fishable biomass, end current year	150	149	150	150	150

Catch level 110 Kt; Cod 20 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.14	1.14	1.14	1.14	1.12
Exploitation rate (catch) (%)	8.66	8.64	8.62	8.65	8.75
P, Z greater than Zmsy (%)	33.0	34.0	34.4	35.4	36.1
P, FB less than Bmsy (%)	32.8	33.6	35.4	36.2	37.2
P, FB less than Blim (%)	0.0	0.0	0.0	0.2	0.6
Estimable predation (Kt)	8.7	8.5	8.5	8.3	8.2
Estimable predation (% of removals)	7.3	7.2	7.1	7.0	6.9
Relative fishable biomass, end current year	150	150	149	150	152

Catch level 110 Kt; Cod 25 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.13	1.14	1.12	1.12	1.12
Exploitation rate (catch) (%)	8.68	8.66	8.75	8.78	8.82
P, Z greater than Zmsy (%)	35.1	36.4	38.0	39.9	40.2
P, FB less than Bmsy (%)	33.1	35.2	36.5	37.5	39.4
P, FB less than Blim (%)	0.0	0.1	0.2	0.4	0.8
Estimable predation (Kt)	10.9	10.8	10.6	10.3	10.2
Estimable predation (% of removals)	9.0	8.9	8.8	8.5	8.5
Relative fishable biomass, end current year	150	150	152	152	153

Catch level 110 Kt; Cod 30 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.14	1.13	1.12	1.11	1.11
Exploitation rate (catch) (%)	8.63	8.71	8.80	8.84	8.90
P, Z greater than Zmsy (%)	37.6	38.5	40.1	41.3	41.8
P, FB less than Bmsy (%)	33.1	35.8	36.9	38.3	40.1
P, FB less than Blim (%)	0.0	0.0	0.0	0.3	0.6
Estimable predation (Kt)	13.1	12.8	12.5	12.3	12.1
Estimable predation (% of removals)	10.6	10.4	10.2	10.1	9.9
Relative fishable biomass, end current year	150	151	153	153	154

Catch level 110 Kt; Cod 35 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.13	1.12	1.11	1.11	1.10
Exploitation rate (catch) (%)	8.71	8.78	8.86	8.87	8.94
P, Z greater than Zmsy (%)	40.4	42.2	43.1	43.7	44.3
P, FB less than Bmsy (%)	34.5	36.5	38.2	38.8	41.6
P, FB less than Blim (%)	0.0	0.1	0.2	0.4	0.9
Estimable predation (Kt)	15.2	14.9	14.6	14.3	14.1
Estimable predation (% of removals)	12.2	11.9	11.7	11.5	11.3
Relative fishable biomass, end current year	151	152	153	154	155

Catch level 115 Kt; Cod 5 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.14	1.14	1.15	1.15	1.15
Exploitation rate (catch) (%)	9.02	9.05	8.98	8.94	8.96
P, Z greater than Zmsy (%)	30.8	32.8	32.2	33.0	33.4
P, FB less than Bmsy (%)	32.4	33.5	34.5	34.8	35.2
P, FB less than Blim (%)	0.0	0.0	0.2	0.4	0.8
Estimable predation (Kt)	2.2	2.2	2.1	2.1	2.1
Estimable predation (% of removals)	1.9	1.8	1.8	1.8	1.8
Relative fishable biomass, end current year	150	150	149	148	149

Catch level 115 Kt; Cod 10 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.14	1.13	1.14	1.13	1.13
Exploitation rate (catch) (%)	9.05	9.09	9.06	9.14	9.13
P, Z greater than Zmsy (%)	32.9	33.2	34.8	35.6	36.8
P, FB less than Bmsy (%)	32.1	34.0	35.6	37.1	37.7
P, FB less than Blim (%)	0.0	0.0	0.2	0.5	0.9
Estimable predation (Kt)	4.4	4.3	4.2	4.1	4.0
Estimable predation (% of removals)	3.6	3.6	3.5	3.4	3.4
Relative fishable biomass, end current year	150	151	150	152	151

Catch level 115 Kt; Cod 15 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.13	1.13	1.12	1.11	1.12
Exploitation rate (catch) (%)	9.09	9.12	9.22	9.24	9.21
P, Z greater than Zmsy (%)	35.0	36.5	38.2	39.3	40.6
P, FB less than Bmsy (%)	32.7	35.3	36.9	38.9	39.5
P, FB less than Blim (%)	0.0	0.0	0.1	0.4	0.9
Estimable predation (Kt)	6.5	6.4	6.3	6.2	6.0
Estimable predation (% of removals)	5.4	5.3	5.2	5.1	5.0
Relative fishable biomass, end current year	151	151	153	153	153

Catch level 115 Kt; Cod 20 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.13	1.13	1.11	1.12	1.11
Exploitation rate (catch) (%)	9.07	9.11	9.23	9.22	9.28
P, Z greater than Zmsy (%)	37.7	39.1	40.2	41.1	41.6
P, FB less than Bmsy (%)	34.0	36.0	37.0	38.1	39.5
P, FB less than Blim (%)	0.0	0.0	0.2	0.4	0.8
Estimable predation (Kt)	8.7	8.5	8.3	8.2	8.0
Estimable predation (% of removals)	7.0	6.9	6.7	6.7	6.5
Relative fishable biomass, end current year	150	151	153	153	154

Catch level 115 Kt; Cod 25 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.13	1.13	1.12	1.11	1.09
Exploitation rate (catch) (%)	9.09	9.09	9.16	9.26	9.40
P, Z greater than Zmsy (%)	40.0	41.1	42.0	43.0	44.1
P, FB less than Bmsy (%)	32.9	35.4	37.3	38.9	40.6
P, FB less than Blim (%)	0.0	0.0	0.2	0.5	1.0
Estimable predation (Kt)	10.9	10.7	10.5	10.1	10.0
Estimable predation (% of removals)	8.7	8.5	8.3	8.1	8.0
Relative fishable biomass, end current year	151	151	152	153	156

Catch level 115 Kt; Cod 30 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.12	1.12	1.10	1.09	1.07
Exploitation rate (catch) (%)	9.15	9.23	9.32	9.40	9.58
P, Z greater than Zmsy (%)	42.5	44.0	45.4	46.8	47.3
P, FB less than Bmsy (%)	33.7	37.3	39.3	40.9	42.1
P, FB less than Blim (%)	0.0	0.0	0.1	0.4	0.9
Estimable predation (Kt)	13.1	12.7	12.3	12.0	11.7
Estimable predation (% of removals)	10.2	9.9	9.6	9.4	9.2
Relative fishable biomass, end current year	152	153	154	156	159

Catch level 115 Kt; Cod 35 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.13	1.11	1.10	1.08	1.07
Exploitation rate (catch) (%)	9.10	9.24	9.36	9.54	9.65
P, Z greater than Zmsy (%)	44.9	46.4	47.2	49.3	49.5
P, FB less than Bmsy (%)	33.8	37.1	39.6	41.3	43.7
P, FB less than Blim (%)	0.0	0.1	0.2	0.5	1.1
Estimable predation (Kt)	15.2	14.8	14.3	13.9	13.5
Estimable predation (% of removals)	11.7	11.4	11.0	10.8	10.5
Relative fishable biomass, end current year	151	153	155	158	160

Catch level 120 Kt; Cod 5 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.14	1.14	1.13	1.12	1.11
Exploitation rate (catch) (%)	9.38	9.43	9.47	9.57	9.64
P, Z greater than Zmsy (%)	35.2	36.5	37.2	38.5	38.8
P, FB less than Bmsy (%)	32.7	34.2	36.0	36.8	38.6
P, FB less than Blim (%)	0.0	0.0	0.2	0.3	0.7
Estimable predation (Kt)	2.2	2.2	2.1	2.1	2.0
Estimable predation (% of removals)	1.8	1.8	1.7	1.7	1.7
Relative fishable biomass, end current year	149	150	150	152	153

Catch level 120 Kt; Cod 10 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.14	1.13	1.12	1.12	1.12
Exploitation rate (catch) (%)	9.42	9.50	9.56	9.63	9.61
P, Z greater than Zmsy (%)	37.3	38.9	40.2	40.9	41.1
P, FB less than Bmsy (%)	33.6	36.0	36.5	38.0	38.7
P, FB less than Blim (%)	0.0	0.0	0.2	0.5	1.0
Estimable predation (Kt)	4.4	4.2	4.2	4.1	4.1
Estimable predation (% of removals)	3.5	3.4	3.4	3.3	3.3
Relative fishable biomass, end current year	150	151	152	153	153

Catch level 120 Kt; Cod 15 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.13	1.12	1.11	1.10	1.08
Exploitation rate (catch) (%)	9.51	9.58	9.71	9.72	9.91
P, Z greater than Zmsy (%)	39.6	41.7	42.9	43.6	43.9
P, FB less than Bmsy (%)	34.0	36.1	38.0	39.5	41.5
P, FB less than Blim (%)	0.0	0.1	0.3	0.7	1.3
Estimable predation (Kt)	6.5	6.4	6.2	6.1	5.9
Estimable predation (% of removals)	5.2	5.1	4.9	4.8	4.7
Relative fishable biomass, end current year	151	152	154	154	157

Catch level 120 Kt; Cod 20 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.13	1.12	1.11	1.10	1.09
Exploitation rate (catch) (%)	9.54	9.62	9.71	9.80	9.87
P, Z greater than Zmsy (%)	42.3	44.2	45.0	46.1	46.2
P, FB less than Bmsy (%)	34.3	36.5	38.1	39.8	41.3
P, FB less than Blim (%)	0.0	0.1	0.4	0.7	1.4
Estimable predation (Kt)	8.7	8.5	8.2	8.1	7.9
Estimable predation (% of removals)	6.8	6.6	6.4	6.3	6.1
Relative fishable biomass, end current year	152	153	154	156	157

Catch level 120 Kt; Cod 25 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.13	1.11	1.10	1.08	1.07
Exploitation rate (catch) (%)	9.47	9.64	9.76	9.95	10.02
P, Z greater than Zmsy (%)	44.7	46.3	47.3	48.2	49.7
P, FB less than Bmsy (%)	33.9	37.3	39.2	41.9	43.4
P, FB less than Blim (%)	0.0	0.0	0.3	0.6	1.3
Estimable predation (Kt)	10.9	10.7	10.3	10.0	9.7
Estimable predation (% of removals)	8.3	8.2	7.9	7.7	7.5
Relative fishable biomass, end current year	150	153	155	158	159

Catch level 120 Kt; Cod 30 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.12	1.10	1.09	1.07	1.06
Exploitation rate (catch) (%)	9.58	9.75	9.88	10.01	10.17
P, Z greater than Zmsy (%)	47.2	48.8	49.8	51.1	52.1
P, FB less than Bmsy (%)	34.4	37.5	40.4	42.9	44.4
P, FB less than Blim (%)	0.0	0.1	0.2	0.6	1.2
Estimable predation (Kt)	13.1	12.6	12.2	11.9	11.5
Estimable predation (% of removals)	9.8	9.5	9.3	9.0	8.7
Relative fishable biomass, end current year	152	155	157	159	162

Catch level 120 Kt; Cod 35 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.12	1.11	1.08	1.06	1.05
Exploitation rate (catch) (%)	9.57	9.69	9.90	10.10	10.27
P, Z greater than Zmsy (%)	49.5	50.3	51.1	52.3	54.1
P, FB less than Bmsy (%)	34.3	37.6	41.0	43.7	45.9
P, FB less than Blim (%)	0.0	0.0	0.2	0.8	1.6
Estimable predation (Kt)	15.2	14.8	14.3	13.8	13.2
Estimable predation (% of removals)	11.3	11.0	10.7	10.3	9.9
Relative fishable biomass, end current year	152	154	157	160	163

Catch level 125 Kt; Cod 5 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.14	1.13	1.12	1.11	1.10
Exploitation rate (catch) (%)	9.82	9.89	9.99	10.09	10.17
P, Z greater than Zmsy (%)	39.4	41.3	42.1	42.9	44.1
P, FB less than Bmsy (%)	33.2	35.9	37.4	38.7	40.1
P, FB less than Blim (%)	0.0	0.0	0.2	0.5	1.3
Estimable predation (Kt)	2.2	2.1	2.1	2.0	2.0
Estimable predation (% of removals)	1.7	1.7	1.6	1.6	1.6
Relative fishable biomass, end current year	150	151	152	154	155

Catch level 125 Kt; Cod 10 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.13	1.12	1.11	1.09	1.08
Exploitation rate (catch) (%)	9.90	10.01	10.12	10.24	10.31
P, Z greater than Zmsy (%)	42.1	43.0	44.4	44.9	46.6
P, FB less than Bmsy (%)	34.0	36.7	38.3	40.1	41.4
P, FB less than Blim (%)	0.0	0.1	0.2	0.5	1.1
Estimable predation (Kt)	4.4	4.2	4.1	4.0	3.9
Estimable predation (% of removals)	3.4	3.2	3.2	3.1	3.0
Relative fishable biomass, end current year	151	153	154	156	157

Catch level 125 Kt; Cod 15 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.12	1.11	1.09	1.08	1.08
Exploitation rate (catch) (%)	9.96	10.07	10.28	10.34	10.40
P, Z greater than Zmsy (%)	44.6	46.3	47.2	48.6	49.7
P, FB less than Bmsy (%)	34.4	36.9	39.5	42.3	43.3
P, FB less than Blim (%)	0.0	0.0	0.2	0.8	1.3
Estimable predation (Kt)	6.5	6.4	6.2	6.0	5.8
Estimable predation (% of removals)	5.0	4.8	4.7	4.6	4.5
Relative fishable biomass, end current year	152	154	157	158	159

Catch level 125 Kt; Cod 20 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.12	1.10	1.08	1.08	1.06
Exploitation rate (catch) (%)	9.96	10.13	10.31	10.37	10.60
P, Z greater than Zmsy (%)	47.1	48.5	50.1	50.8	51.7
P, FB less than Bmsy (%)	34.6	38.0	40.0	42.3	44.6
P, FB less than Blim (%)	0.0	0.0	0.2	0.6	1.6
Estimable predation (Kt)	8.7	8.4	8.1	7.9	7.7
Estimable predation (% of removals)	6.5	6.3	6.1	5.9	5.8
Relative fishable biomass, end current year	152	154	157	158	162

Catch level 125 Kt; Cod 25 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.12	1.10	1.08	1.06	1.05
Exploitation rate (catch) (%)	10.00	10.15	10.37	10.57	10.68
P, Z greater than Zmsy (%)	49.3	50.4	51.5	52.4	54.0
P, FB less than Bmsy (%)	35.1	38.1	41.0	44.0	45.1
P, FB less than Blim (%)	0.0	0.1	0.3	0.7	1.7
Estimable predation (Kt)	10.9	10.5	10.2	9.8	9.5
Estimable predation (% of removals)	8.0	7.7	7.5	7.3	7.1
Relative fishable biomass, end current year	153	155	158	161	163

Catch level 125 Kt; Cod 30 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.11	1.09	1.07	1.06	1.04
Exploitation rate (catch) (%)	10.05	10.25	10.42	10.57	10.77
P, Z greater than Zmsy (%)	51.4	53.0	54.4	55.4	56.0
P, FB less than Bmsy (%)	35.5	38.9	42.2	44.1	46.0
P, FB less than Blim (%)	0.0	0.1	0.3	0.8	1.8
Estimable predation (Kt)	13.1	12.5	12.0	11.6	11.2
Estimable predation (% of removals)	9.5	9.1	8.7	8.5	8.2
Relative fishable biomass, end current year	153	156	159	161	164

Catch level 125 Kt; Cod 35 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.11	1.10	1.07	1.05	1.02
Exploitation rate (catch) (%)	10.07	10.20	10.47	10.66	10.93
P, Z greater than Zmsy (%)	53.2	54.7	55.9	56.8	58.4
P, FB less than Bmsy (%)	35.7	39.6	42.7	45.4	47.8
P, FB less than Blim (%)	0.0	0.1	0.4	1.0	2.2
Estimable predation (Kt)	15.2	14.4	13.9	13.4	12.8
Estimable predation (% of removals)	10.9	10.4	10.0	9.6	9.3
Relative fishable biomass, end current year	154	156	160	163	167

Catch level 130 Kt; Cod 5 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.13	1.12	1.10	1.09	1.08
Exploitation rate (catch) (%)	10.29	10.40	10.53	10.69	10.76
P, Z greater than Zmsy (%)	44.4	45.4	45.9	47.7	48.9
P, FB less than Bmsy (%)	33.6	36.6	38.8	41.6	42.5
P, FB less than Blim (%)	0.0	0.1	0.2	0.7	1.4
Estimable predation (Kt)	2.2	2.1	2.1	2.0	1.9
Estimable predation (% of removals)	1.6	1.6	1.6	1.5	1.4
Relative fishable biomass, end current year	151	153	154	157	158

Catch level 130 Kt; Cod 10 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.12	1.10	1.09	1.08	1.06
Exploitation rate (catch) (%)	10.35	10.53	10.65	10.81	10.96
P, Z greater than Zmsy (%)	46.9	48.6	49.7	50.4	52.0
P, FB less than Bmsy (%)	34.4	37.1	39.2	42.4	44.7
P, FB less than Blim (%)	0.0	0.0	0.3	0.9	1.7
Estimable predation (Kt)	4.4	4.2	4.1	4.0	3.9
Estimable predation (% of removals)	3.2	3.1	3.1	3.0	2.9
Relative fishable biomass, end current year	152	154	156	158	161

Catch level 130 Kt; Cod 15 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.12	1.10	1.08	1.06	1.05
Exploitation rate (catch) (%)	10.37	10.56	10.78	10.96	11.12
P, Z greater than Zmsy (%)	49.3	50.4	51.8	53.2	53.6
P, FB less than Bmsy (%)	34.9	38.7	41.6	43.7	45.7
P, FB less than Blim (%)	0.0	0.0	0.3	0.9	2.0
Estimable predation (Kt)	6.5	6.3	6.1	5.9	5.7
Estimable predation (% of removals)	4.8	4.6	4.5	4.3	4.2
Relative fishable biomass, end current year	152	155	158	161	163

Catch level 130 Kt; Cod 20 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.13	1.11	1.08	1.06	1.04
Exploitation rate (catch) (%)	10.33	10.51	10.78	10.97	11.21
P, Z greater than Zmsy (%)	51.0	52.1	53.3	54.7	55.7
P, FB less than Bmsy (%)	34.5	38.3	41.6	43.9	46.5
P, FB less than Blim (%)	0.0	0.0	0.3	0.9	2.0
Estimable predation (Kt)	8.7	8.4	8.0	7.8	7.5
Estimable predation (% of removals)	6.3	6.1	5.8	5.7	5.5
Relative fishable biomass, end current year	151	154	158	161	164

Catch level 130 Kt; Cod 25 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.12	1.09	1.07	1.04	1.03
Exploitation rate (catch) (%)	10.42	10.65	10.86	11.20	11.33
P, Z greater than Zmsy (%)	53.1	55.0	56.4	57.1	58.7
P, FB less than Bmsy (%)	34.7	39.4	42.4	46.0	47.5
P, FB less than Blim (%)	0.0	0.0	0.4	1.1	2.2
Estimable predation (Kt)	10.9	10.5	10.0	9.6	9.3
Estimable predation (% of removals)	7.7	7.5	7.2	6.9	6.6
Relative fishable biomass, end current year	153	156	159	164	166

Catch level 130 Kt; Cod 30 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.11	1.08	1.05	1.03	1.00
Exploitation rate (catch) (%)	10.45	10.77	11.04	11.29	11.62
P, Z greater than Zmsy (%)	55.0	56.9	58.3	59.7	60.4
P, FB less than Bmsy (%)	35.3	40.5	44.6	46.8	49.9
P, FB less than Blim (%)	0.0	0.1	0.2	0.9	2.2
Estimable predation (Kt)	13.1	12.5	11.9	11.3	10.8
Estimable predation (% of removals)	9.1	8.8	8.4	8.0	7.7
Relative fishable biomass, end current year	153	158	162	166	170

Catch level 130 Kt; Cod 35 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.12	1.09	1.06	1.03	1.01
Exploitation rate (catch) (%)	10.43	10.70	10.97	11.28	11.56
P, Z greater than Zmsy (%)	56.9	58.0	59.0	60.2	61.7
P, FB less than Bmsy (%)	34.7	39.3	43.6	46.3	49.5
P, FB less than Blim (%)	0.0	0.1	0.3	1.1	2.6
Estimable predation (Kt)	15.2	14.6	13.9	13.3	12.7
Estimable predation (% of removals)	10.5	10.1	9.6	9.3	8.9
Relative fishable biomass, end current year	153	157	161	165	169

Catch level 135 Kt; Cod 5 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.13	1.11	1.09	1.06	1.04
Exploitation rate (catch) (%)	10.70	10.92	11.12	11.36	11.57
P, Z greater than Zmsy (%)	49.0	49.8	51.2	52.4	53.7
P, FB less than Bmsy (%)	34.4	37.4	40.9	43.6	45.5
P, FB less than Blim (%)	0.0	0.1	0.3	1.0	2.2
Estimable predation (Kt)	2.2	2.1	2.0	1.9	1.9
Estimable predation (% of removals)	1.6	1.5	1.5	1.4	1.4
Relative fishable biomass, end current year	151	154	157	160	163

Catch level 135 Kt; Cod 10 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.11	1.10	1.08	1.06	1.03
Exploitation rate (catch) (%)	10.84	11.00	11.22	11.38	11.69
P, Z greater than Zmsy (%)	51.0	52.6	54.0	55.3	55.2
P, FB less than Bmsy (%)	35.1	38.5	41.5	44.8	46.8
P, FB less than Blim (%)	0.0	0.1	0.5	1.2	2.6
Estimable predation (Kt)	4.4	4.2	4.0	3.9	3.7
Estimable predation (% of removals)	3.1	3.0	2.9	2.8	2.7
Relative fishable biomass, end current year	153	155	158	161	165

Catch level 135 Kt; Cod 15 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.12	1.09	1.08	1.05	1.03
Exploitation rate (catch) (%)	10.83	11.05	11.20	11.49	11.75
P, Z greater than Zmsy (%)	53.0	54.9	55.7	56.8	58.3
P, FB less than Bmsy (%)	35.1	39.4	42.4	45.6	47.2
P, FB less than Blim (%)	0.0	0.1	0.3	1.2	2.6
Estimable predation (Kt)	6.5	6.3	6.0	5.8	5.6
Estimable predation (% of removals)	4.6	4.4	4.3	4.1	4.0
Relative fishable biomass, end current year	153	156	158	162	166

Catch level 135 Kt; Cod 20 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.11	1.09	1.07	1.04	1.02
Exploitation rate (catch) (%)	10.84	11.13	11.30	11.64	11.86
P, Z greater than Zmsy (%)	55.0	56.4	57.4	58.5	60.1
P, FB less than Bmsy (%)	35.4	39.2	42.3	46.0	48.3
P, FB less than Blim (%)	0.0	0.1	0.4	1.3	2.6
Estimable predation (Kt)	8.7	8.4	8.0	7.6	7.3
Estimable predation (% of removals)	6.1	5.8	5.6	5.3	5.1
Relative fishable biomass, end current year	153	157	159	164	167

Catch level 135 Kt; Cod 30 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.10	1.07	1.04	1.01	0.97
Exploitation rate (catch) (%)	10.99	11.24	11.64	11.97	12.40
P, Z greater than Zmsy (%)	58.7	60.6	62.4	63.2	63.8
P, FB less than Bmsy (%)	36.8	42.6	46.1	49.0	52.3
P, FB less than Blim (%)	0.0	0.1	0.4	1.3	3.0
Estimable predation (Kt)	13.1	12.5	11.7	11.2	10.6
Estimable predation (% of removals)	8.8	8.4	8.0	7.6	7.3
Relative fishable biomass, end current year	155	159	164	169	175

Catch level 135 Kt; Cod 35 Kt					
	2019	2020	2021	2022	2023
Fishable Biomass, end of year, w.r.t Bmsy	1.11	1.07	1.05	1.01	0.98
Exploitation rate (catch) (%)	10.90	11.26	11.56	11.98	12.38
P, Z greater than Zmsy (%)	60.5	62.0	63.1	64.0	65.5
P, FB less than Bmsy (%)	36.1	41.4	45.3	49.2	52.3
P, FB less than Blim (%)	0.0	0.1	0.5	1.5	3.4
Estimable predation (Kt)	15.2	14.5	13.7	13.0	12.3
Estimable predation (% of removals)	10.1	9.7	9.2	8.8	8.4
Relative fishable biomass, end current year	154	159	163	169	175