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

by

AnnDorte Burmeister

Pinngortitaleriffik, Greenland Institute of Natural Resources

Box 570, DK-3900 Nuuk, Greenland

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 85 Kt to 120 Kt in steps of 5Kt. Information includes fishable biomass relative to B_{MSY} , 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 019/46. 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 2020 to 2024 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 85 Kt to 120 Kt in steps of 5 Kt. Information includes fishable biomass relative to B_{MSY} , fishing mortality expressed as the ratio of catch to forecast fishable biomass, probabilities of transgressing NAFO reference points Z_{msy} , B_{msy} 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. 019/46.

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

Ad c)

- i) Historical catches are shown in the fishery SCR Doc. 19/044 and 19/045. Historical total mortality is shown in the assessment SCR Doc. 019/046.
- ii) Historical biomass relative to B_{msy} is shown in the assessment SCR Doc. 19/046 and in the modelling SCR Doc 16/047 and 19/046. The meaning of 'recruitment levels' is not clear, but historical numbers of 'age-2' shrimps are shown in the survey SCR Doc. 19/043 and the assessment SCR Doc. 19/046.
- 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. 19/043 and 19/046.
- 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. 19/044 and 'effective statistical areas fished' is shown in the fishery SCR Doc. 19/044 by both catch and effort.

References

BURMEISTER, AD., AND F.F RIGET. 2019. A Provisional Assessment of the Shrimp Stock off West Greenland in 2019. NAFO SCR Doc. 19/046, Ser. No. N7010. 22pp.

Tables

Catch level 85 Kt; Cod 10 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.27	1.28	1.30	1.30	1.31
Exploitation rate (catch) (%)	4.47	4.43	4.37	4.35	4.33
P, Z greater than Zmsy (%)	13.6	14.4	15.1	15.5	16.1
P, FB less than Bmsy (%)	21.3	22.1	22.6	23.6	24.0
P, FB less than Blim (%)	0.0	0.0	0.1	0.1	0.1
Estimable predation (Kt)	3.7	3.7	3.7	3.6	3.6
Estimable predation (% of removals)	4.2	4.1	4.1	4.1	4.1
Relative fishable biomass, end current year	100	99	97	97	97

Catch level 85 Kt; Cod 15 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.27	1.28	1.28	1.29	1.29
Exploitation rate (catch) (%)	4.45	4.44	4.44	4.39	4.40
P, Z greater than Zmsy (%)	15.1	16.0	16.9	17.7	18.2
P, FB less than Bmsy (%)	22.0	22.9	23.5	24.4	25.0
P, FB less than Blim (%)	0.0	0.0	0.0	0.1	0.2
Estimable predation (Kt)	5.6	5.5	5.4	5.4	5.3
Estimable predation (% of removals)	6.1	6.0	6.0	6.0	5.9
Relative fishable biomass, end current year	99	99	99	98	98

Catch level 85 Kt; Cod 20 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.27	1.27	1.28	1.29	1.30
Exploitation rate (catch) (%)	4.48	4.45	4.42	4.39	4.38
P, Z greater than Zmsy (%)	16.9	17.5	18.1	18.7	19.2
P, FB less than Bmsy (%)	22.4	22.9	23.6	25.0	25.2
P, FB less than Blim (%)	0.0	0.0	0.0	0.1	0.2
Estimable predation (Kt)	7.4	7.3	7.3	7.2	7.1
Estimable predation (% of removals)	8.0	7.9	7.9	7.8	7.7
Relative fishable biomass, end current year	100	99	98	98	98

 Catch level 85 Kt; Cod 25 Kt

	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.27	1.28	1.28	1.28	1.29
Exploitation rate (catch) (%)	4.46	4.41	4.43	4.42	4.39
P, Z greater than Zmsy (%)	18.4	19.3	19.8	20.5	20.9
P, FB less than Bmsy (%)	22.0	23.6	24.4	25.1	25.9
P, FB less than Blim (%)	0.0	0.0	0.1	0.1	0.1
Estimable predation (Kt)	9.3	9.2	9.0	9.0	8.9
Estimable predation (% of removals)	9.8	9.7	9.6	9.6	9.5
Relative fishable biomass, end current year	99	98	99	98	98

 Catch level 85 Kt; Cod 30 Kt

	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.28	1.28	1.27	1.27	1.27
Exploitation rate (catch) (%)	4.44	4.44	4.45	4.48	4.46
P, Z greater than Zmsy (%)	19.9	20.3	21.4	22.3	23.0
P, FB less than Bmsy (%)	22.2	23.5	24.9	25.9	26.3
P, FB less than Blim (%)	0.0	0.0	0.0	0.1	0.2
Estimable predation (Kt)	11.1	11.0	10.8	10.6	10.5
Estimable predation (% of removals)	11.6	11.4	11.3	11.1	11.0
Relative fishable biomass, end current year	99	99	99	100	99

 Catch level 90 Kt; Cod 10 Kt

	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.27	1.28	1.28	1.29	1.29
Exploitation rate (catch) (%)	4.71	4.71	4.71	4.66	4.64
P, Z greater than Zmsy (%)	16.7	17.6	18.2	18.8	19.5
P, FB less than Bmsy (%)	22.0	23.6	23.8	24.4	24.7
P, FB less than Blim (%)	0.0	0.0	0.0	0.0	0.1
Estimable predation (Kt)	3.7	3.6	3.6	3.6	3.5
Estimable predation (% of removals)	4.0	3.9	3.8	3.8	3.8
Relative fishable biomass, end current year	99	99	99	98	98

Catch level 90 Kt; Cod 15 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.27	1.28	1.28	1.28	1.28
Exploitation rate (catch) (%)	4.73	4.70	4.69	4.70	4.68
P, Z greater than Zmsy (%)	18.4	18.9	19.7	21.0	21.3
P, FB less than Bmsy (%)	22.4	23.5	24.9	25.7	26.1
P, FB less than Blim (%)	0.0	0.0	0.1	0.1	0.3
Estimable predation (Kt)	5.6	5.5	5.4	5.3	5.3
Estimable predation (% of removals)	5.8	5.8	5.7	5.6	5.6
Relative fishable biomass, end current year	100	99	99	99	99

Catch level 90 Kt; Cod 20 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.26	1.26	1.28	1.28	1.27
Exploitation rate (catch) (%)	4.75	4.78	4.69	4.70	4.71
P, Z greater than Zmsy (%)	20.0	20.8	21.2	22.1	23.0
P, FB less than Bmsy (%)	23.0	24.2	24.9	26.2	27.0
P, FB less than Blim (%)	0.0	0.0	0.1	0.1	0.2
Estimable predation (Kt)	7.4	7.3	7.2	7.1	7.1
Estimable predation (% of removals)	7.6	7.5	7.4	7.3	7.3
Relative fishable biomass, end current year	100	101	99	99	99

Catch level 90 Kt; Cod 25 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.26	1.27	1.27	1.28	1.29
Exploitation rate (catch) (%)	4.75	4.72	4.71	4.71	4.65
P, Z greater than Zmsy (%)	21.6	22.8	23.1	23.9	24.2
P, FB less than Bmsy (%)	22.7	24.8	25.7	25.8	26.5
P, FB less than Blim (%)	0.0	0.0	0.0	0.1	0.3
Estimable predation (Kt)	9.3	9.1	9.0	9.0	8.9
Estimable predation (% of removals)	9.3	9.2	9.1	9.1	9.0
Relative fishable biomass, end current year	100	99	99	99	98

Catch level 90 Kt; Cod 30 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.26	1.27	1.27	1.27	1.27
Exploitation rate (catch) (%)	4.78	4.72	4.72	4.74	4.72
P, Z greater than Zmsy (%)	23.0	24.0	24.7	25.5	26.1
P, FB less than Bmsy (%)	22.8	25.2	25.7	26.4	27.6
P, FB less than Blim (%)	0.0	0.0	0.1	0.1	0.3
Estimable predation (Kt)	11.1	10.9	10.7	10.6	10.4
Estimable predation (% of removals)	11.0	10.8	10.6	10.5	10.4
Relative fishable biomass, end current year	101	99	99	100	99

 Catch level 95 Kt; Cod 10 Kt

	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.26	1.27	1.27	1.27	1.28
Exploitation rate (catch) (%)	5.01	5.00	5.01	4.98	4.96
P, Z greater than Zmsy (%)	20.0	21.1	21.9	22.8	23.2
P, FB less than Bmsy (%)	22.8	23.5	24.6	26.0	27.1
P, FB less than Blim (%)	0.0	0.0	0.1	0.1	0.2
Estimable predation (Kt)	3.7	3.6	3.6	3.6	3.5
Estimable predation (% of removals)	3.8	3.7	3.7	3.6	3.6
Relative fishable biomass, end current year	100	100	100	99	99

 Catch level 95 Kt; Cod 15 Kt

	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.26	1.26	1.27	1.26	1.27
Exploitation rate (catch) (%)	5.01	5.02	4.98	5.01	4.99
P, Z greater than Zmsy (%)	21.6	22.2	24.0	24.3	25.3
P, FB less than Bmsy (%)	22.7	24.0	25.2	26.3	27.4
P, FB less than Blim (%)	0.0	0.0	0.1	0.2	0.2
Estimable predation (Kt)	5.6	5.5	5.3	5.3	5.2
Estimable predation (% of removals)	5.5	5.4	5.3	5.3	5.2
Relative fishable biomass, end current year	100	100	99	100	99

 Catch level 95 Kt; Cod 20 Kt

	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.26	1.25	1.26	1.27	1.26
Exploitation rate (catch) (%)	5.04	5.05	5.04	4.99	5.03
P, Z greater than Zmsy (%)	23.2	24.2	25.1	25.3	26.7
P, FB less than Bmsy (%)	23.3	24.7	26.0	27.2	28.2
P, FB less than Blim (%)	0.0	0.0	0.2	0.2	0.3
Estimable predation (Kt)	7.4	7.3	7.1	7.0	6.9
Estimable predation (% of removals)	7.2	7.1	7.0	6.9	6.8
Relative fishable biomass, end current year	100	101	101	100	100

 Catch level 95 Kt; Cod 25 Kt

	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.26	1.26	1.24	1.25	1.24
Exploitation rate (catch) (%)	5.04	5.05	5.10	5.07	5.10
P, Z greater than Zmsy (%)	24.5	26.2	27.0	27.6	28.2
P, FB less than Bmsy (%)	22.8	25.1	26.5	28.1	28.6
P, FB less than Blim (%)	0.0	0.0	0.0	0.1	0.2
Estimable predation (Kt)	9.3	9.1	8.9	8.8	8.7
Estimable predation (% of removals)	8.9	8.7	8.6	8.5	8.4
Relative fishable biomass, end current year	101	101	102	101	102

Catch level 100 Kt; Cod 10 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.26	1.26	1.26	1.26	1.27
Exploitation rate (catch) (%)	5.29	5.29	5.30	5.28	5.27
P, Z greater than Zmsy (%)	23.2	24.8	25.4	26.2	27.1
P, FB less than Bmsy (%)	22.2	24.3	26.2	27.3	28.0
P, FB less than Blim (%)	0.0	0.0	0.1	0.2	0.3
Estimable predation (Kt)	3.7	3.6	3.5	3.5	3.5
Estimable predation (% of removals)	3.6	3.5	3.4	3.4	3.3
Relative fishable biomass, end current year	100	100	100	100	100

Catch level 100 Kt; Cod 15 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.26	1.25	1.25	1.25	1.25
Exploitation rate (catch) (%)	5.30	5.32	5.35	5.35	5.35
P, Z greater than Zmsy (%)	24.8	26.0	27.1	27.9	29.0
P, FB less than Bmsy (%)	23.2	25.1	26.5	28.0	29.4
P, FB less than Blim (%)	0.0	0.0	0.1	0.1	0.2
Estimable predation (Kt)	5.6	5.4	5.3	5.2	5.1
Estimable predation (% of removals)	5.3	5.2	5.1	5.0	4.9
Relative fishable biomass, end current year	100	101	101	101	101

Catch level 100 Kt; Cod 20 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.26	1.26	1.25	1.24	1.24
Exploitation rate (catch) (%)	5.30	5.31	5.34	5.37	5.36
P, Z greater than Zmsy (%)	26.6	27.3	28.9	29.0	30.0
P, FB less than Bmsy (%)	23.0	25.0	26.5	28.5	30.0
P, FB less than Blim (%)	0.0	0.0	0.1	0.1	0.4
Estimable predation (Kt)	7.4	7.3	7.1	7.0	6.9
Estimable predation (% of removals)	6.9	6.8	6.7	6.6	6.5
Relative fishable biomass, end current year	100	101	101	102	102

Catch level 100 Kt; Cod 25 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.26	1.25	1.25	1.24	1.24
Exploitation rate (catch) (%)	5.31	5.32	5.32	5.37	5.38
P, Z greater than Zmsy (%)	28.1	29.2	30.1	30.9	32.0
P, FB less than Bmsy (%)	23.0	25.3	27.1	28.1	29.8
P, FB less than Blim (%)	0.0	0.0	0.1	0.2	0.4
Estimable predation (Kt)	9.3	9.1	8.9	8.8	8.7
Estimable predation (% of removals)	8.5	8.3	8.2	8.1	8.0
Relative fishable biomass, end current year	101	101	101	102	102

Catch level 100 Kt; Cod 30 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.26	1.26	1.25	1.24	1.23
Exploitation rate (catch) (%)	5.30	5.28	5.32	5.39	5.40
P, Z greater than Zmsy (%)	29.9	30.4	31.4	31.8	32.9
P, FB less than Bmsy (%)	23.0	25.3	27.0	28.9	29.7
P, FB less than Blim (%)	0.0	0.0	0.1	0.2	0.3
Estimable predation (Kt)	11.1	11.0	10.8	10.7	10.4
Estimable predation (% of removals)	10.0	9.9	9.7	9.6	9.4
Relative fishable biomass, end current year	100	100	101	102	102

Catch level 105 Kt; Cod 10 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.25	1.26	1.25	1.24	1.23
Exploitation rate (catch) (%)	5.59	5.58	5.62	5.65	5.68
P, Z greater than Zmsy (%)	26.6	27.3	29.0	30.1	30.6
P, FB less than Bmsy (%)	22.7	24.7	27.4	28.4	30.3
P, FB less than Blim (%)	0.0	0.0	0.0	0.2	0.4
Estimable predation (Kt)	3.7	3.6	3.5	3.5	3.4
Estimable predation (% of removals)	3.4	3.3	3.3	3.2	3.1
Relative fishable biomass, end current year	101	101	101	102	102

Catch level 105 Kt; Cod 15 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.26	1.26	1.25	1.24	1.23
Exploitation rate (catch) (%)	5.56	5.56	5.60	5.63	5.71
P, Z greater than Zmsy (%)	28.1	29.4	29.9	30.9	32.1
P, FB less than Bmsy (%)	23.4	25.2	26.9	28.3	29.4
P, FB less than Blim (%)	0.0	0.0	0.1	0.1	0.3
Estimable predation (Kt)	5.6	5.4	5.3	5.3	5.2
Estimable predation (% of removals)	5.0	4.9	4.8	4.8	4.7
Relative fishable biomass, end current year	100	100	101	102	103

Catch level 105 Kt; Cod 20 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.25	1.25	1.24	1.23	1.22
Exploitation rate (catch) (%)	5.59	5.62	5.64	5.70	5.74
P, Z greater than Zmsy (%)	29.8	30.9	32.3	33.1	33.8
P, FB less than Bmsy (%)	23.3	26.4	28.0	29.1	31.1
P, FB less than Blim (%)	0.0	0.0	0.0	0.3	0.6
Estimable predation (Kt)	7.4	7.3	7.0	6.9	6.8
Estimable predation (% of removals)	6.6	6.5	6.3	6.2	6.1
Relative fishable biomass, end current year	101	101	102	103	104

Catch level 105 Kt; Cod 25 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.25	1.25	1.24	1.23	1.23
Exploitation rate (catch) (%)	5.59	5.61	5.67	5.67	5.70
P, Z greater than Zmsy (%)	31.8	32.6	32.9	34.0	34.6
P, FB less than Bmsy (%)	23.3	25.7	27.5	28.9	30.9
P, FB less than Blim (%)	0.0	0.0	0.1	0.2	0.3
Estimable predation (Kt)	9.3	9.0	8.9	8.8	8.6
Estimable predation (% of removals)	8.1	7.9	7.8	7.7	7.6
Relative fishable biomass, end current year	101	101	102	102	103

Catch level 105 Kt; Cod 30 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.25	1.24	1.23	1.23	1.22
Exploitation rate (catch) (%)	5.61	5.63	5.68	5.70	5.73
P, Z greater than Zmsy (%)	33.6	34.0	35.6	36.9	36.9
P, FB less than Bmsy (%)	23.8	26.7	29.7	31.4	32.4
P, FB less than Blim (%)	0.0	0.0	0.1	0.4	0.7
Estimable predation (Kt)	11.1	10.8	10.6	10.3	10.1
Estimable predation (% of removals)	9.6	9.3	9.2	8.9	8.8
Relative fishable biomass, end current year	101	102	102	103	103

Catch level 110 Kt; Cod 10 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.26	1.25	1.25	1.24	1.23
Exploitation rate (catch) (%)	5.84	5.87	5.87	5.92	5.95
P, Z greater than Zmsy (%)	30.3	30.6	32.2	32.7	33.6
P, FB less than Bmsy (%)	23.6	25.8	27.4	29.1	30.3
P, FB less than Blim (%)	0.0	0.0	0.1	0.2	0.4
Estimable predation (Kt)	3.7	3.6	3.5	3.5	3.4
Estimable predation (% of removals)	3.3	3.2	3.1	3.0	3.0
Relative fishable biomass, end current year	101	101	101	102	102

 Catch level 110 Kt; Cod 15 Kt

	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.25	1.24	1.23	1.22	1.22
Exploitation rate (catch) (%)	5.87	5.92	5.95	6.01	6.01
P, Z greater than Zmsy (%)	32.0	32.9	33.5	34.7	35.8
P, FB less than Bmsy (%)	23.8	26.8	28.0	30.2	31.6
P, FB less than Blim (%)	0.0	0.0	0.1	0.3	0.5
Estimable predation (Kt)	5.6	5.4	5.3	5.2	5.1
Estimable predation (% of removals)	4.8	4.7	4.6	4.5	4.4
Relative fishable biomass, end current year	101	102	103	103	103

 Catch level 110 Kt; Cod 20 Kt

	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.25	1.24	1.23	1.22	1.21
Exploitation rate (catch) (%)	5.87	5.91	5.96	6.03	6.06
P, Z greater than Zmsy (%)	33.7	34.0	35.4	36.6	37.1
P, FB less than Bmsy (%)	23.8	26.5	29.2	30.2	31.4
P, FB less than Blim (%)	0.0	0.1	0.1	0.2	0.6
Estimable predation (Kt)	7.4	7.2	7.0	6.9	6.7
Estimable predation (% of removals)	6.3	6.1	6.0	5.9	5.8
Relative fishable biomass, end current year	101	102	103	104	104

 Catch level 110 Kt; Cod 25 Kt

	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.24	1.24	1.24	1.22	1.20
Exploitation rate (catch) (%)	5.89	5.92	5.91	6.04	6.10
P, Z greater than Zmsy (%)	35.1	35.9	36.7	38.1	39.2
P, FB less than Bmsy (%)	23.6	25.9	29.0	31.1	32.6
P, FB less than Blim (%)	0.0	0.0	0.1	0.3	0.7
Estimable predation (Kt)	9.3	9.0	8.9	8.6	8.4
Estimable predation (% of removals)	7.8	7.6	7.4	7.3	7.1
Relative fishable biomass, end current year	102	102	102	104	105

 Catch level 110 Kt; Cod 30 Kt

	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.25	1.23	1.21	1.20	1.19
Exploitation rate (catch) (%)	5.86	5.97	6.05	6.10	6.17
P, Z greater than Zmsy (%)	36.5	37.5	38.5	39.9	40.9
P, FB less than Bmsy (%)	23.9	27.2	30.0	32.3	34.3
P, FB less than Blim (%)	0.0	0.0	0.2	0.4	0.7
Estimable predation (Kt)	11.1	10.8	10.4	10.2	10.0
Estimable predation (% of removals)	9.2	8.9	8.7	8.5	8.3
Relative fishable biomass, end current year	101	103	104	105	106

Catch level 115 Kt; Cod 10 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.25	1.25	1.24	1.23	1.22
Exploitation rate (catch) (%)	6.13	6.13	6.19	6.22	6.29
P, Z greater than Zmsy (%)	34.0	34.4	35.5	36.6	37.4
P, FB less than Bmsy (%)	23.4	26.5	28.6	30.0	31.6
P, FB less than Blim (%)	0.0	0.0	0.0	0.2	0.5
Estimable predation (Kt)	3.7	3.6	3.5	3.5	3.4
Estimable predation (% of removals)	3.1	3.0	3.0	2.9	2.9
Relative fishable biomass, end current year	101	101	102	103	104

Catch level 115 Kt; Cod 15 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.24	1.23	1.22	1.20	1.20
Exploitation rate (catch) (%)	6.17	6.21	6.30	6.37	6.42
P, Z greater than Zmsy (%)	35.1	36.7	37.7	39.1	39.2
P, FB less than Bmsy (%)	24.1	26.6	29.3	31.0	32.9
P, FB less than Blim (%)	0.0	0.0	0.0	0.2	0.6
Estimable predation (Kt)	5.6	5.4	5.2	5.1	5.0
Estimable predation (% of removals)	4.6	4.5	4.4	4.2	4.2
Relative fishable biomass, end current year	102	102	104	105	106

Catch level 115 Kt; Cod 20 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.24	1.23	1.22	1.21	1.18
Exploitation rate (catch) (%)	6.17	6.24	6.28	6.36	6.48
P, Z greater than Zmsy (%)	36.6	38.6	38.9	39.8	41.0
P, FB less than Bmsy (%)	24.9	27.9	29.5	31.6	33.6
P, FB less than Blim (%)	0.0	0.0	0.1	0.3	0.8
Estimable predation (Kt)	7.4	7.1	7.0	6.8	6.7
Estimable predation (% of removals)	6.1	5.9	5.7	5.6	5.5
Relative fishable biomass, end current year	102	103	104	105	107

Catch level 115 Kt; Cod 25 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.25	1.23	1.21	1.19	1.18
Exploitation rate (catch) (%)	6.15	6.23	6.32	6.42	6.52
P, Z greater than Zmsy (%)	38.0	39.7	40.4	41.7	42.5
P, FB less than Bmsy (%)	24.2	27.1	30.7	33.0	34.8
P, FB less than Blim (%)	0.0	0.1	0.2	0.4	0.9
Estimable predation (Kt)	9.3	9.0	8.7	8.4	8.3
Estimable predation (% of removals)	7.5	7.2	7.0	6.8	6.7
Relative fishable biomass, end current year	101	103	104	106	107

Catch level 115 Kt; Cod 30 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.25	1.22	1.21	1.20	1.18
Exploitation rate (catch) (%)	6.16	6.27	6.34	6.39	6.51
P, Z greater than Zmsy (%)	39.5	40.8	41.9	42.9	44.1
P, FB less than Bmsy (%)	24.6	27.7	30.6	33.4	35.9
P, FB less than Blim (%)	0.0	0.0	0.2	0.6	1.0
Estimable predation (Kt)	11.1	10.7	10.4	10.1	9.9
Estimable predation (% of removals)	8.8	8.5	8.3	8.1	7.9
Relative fishable biomass, end current year	101	103	104	105	107

Catch level 120 Kt; Cod 10 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.25	1.24	1.22	1.21	1.20
Exploitation rate (catch) (%)	6.38	6.45	6.54	6.62	6.68
P, Z greater than Zmsy (%)	36.5	37.7	38.1	40.0	40.6
P, FB less than Bmsy (%)	23.8	26.1	28.9	30.6	33.2
P, FB less than Blim (%)	0.0	0.1	0.2	0.4	0.9
Estimable predation (Kt)	3.7	3.6	3.5	3.4	3.3
Estimable predation (% of removals)	3.0	2.9	2.8	2.8	2.7
Relative fishable biomass, end current year	101	102	103	105	105

Catch level 120 Kt; Cod 15 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.25	1.22	1.21	1.19	1.18
Exploitation rate (catch) (%)	6.43	6.54	6.62	6.71	6.80
P, Z greater than Zmsy (%)	37.9	40.4	41.4	42.5	43.8
P, FB less than Bmsy (%)	25.2	28.8	31.7	33.2	35.2
P, FB less than Blim (%)	0.0	0.0	0.2	0.3	0.9
Estimable predation (Kt)	5.6	5.4	5.2	5.0	4.9
Estimable predation (% of removals)	4.4	4.3	4.2	4.0	4.0
Relative fishable biomass, end current year	101	103	104	106	107

Catch level 120 Kt; Cod 20 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.24	1.21	1.21	1.18	1.17
Exploitation rate (catch) (%)	6.47	6.60	6.62	6.77	6.87
P, Z greater than Zmsy (%)	39.8	41.3	43.0	43.8	44.7
P, FB less than Bmsy (%)	25.2	29.3	31.5	34.0	36.4
P, FB less than Blim (%)	0.0	0.0	0.3	0.6	1.2
Estimable predation (Kt)	7.4	7.1	6.9	6.8	6.6
Estimable predation (% of removals)	5.8	5.6	5.4	5.3	5.2
Relative fishable biomass, end current year	102	104	105	107	108

Catch level 120 Kt; Cod 25 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.24	1.21	1.19	1.17	1.15
Exploitation rate (catch) (%)	6.45	6.60	6.71	6.84	6.93
P, Z greater than Zmsy (%)	41.1	42.7	43.8	45.3	46.4
P, FB less than Bmsy (%)	25.7	29.0	32.3	34.9	37.3
P, FB less than Blim (%)	0.0	0.0	0.2	0.5	1.0
Estimable predation (Kt)	9.3	8.9	8.6	8.3	8.1
Estimable predation (% of removals)	7.2	6.9	6.7	6.5	6.3
Relative fishable biomass, end current year	102	104	106	108	109

Catch level 120 Kt; Cod 30 Kt					
	2020	2021	2022	2023	2024
Fishable Biomass, end of year, w.r.t Bmsy	1.24	1.22	1.20	1.18	1.17
Exploitation rate (catch) (%)	6.44	6.55	6.67	6.77	6.84
P, Z greater than Zmsy (%)	42.3	43.9	45.3	46.4	47.7
P, FB less than Bmsy (%)	25.2	28.6	32.2	34.2	35.9
P, FB less than Blim (%)	0.0	0.0	0.2	0.6	1.1
Estimable predation (Kt)	11.1	10.6	10.3	10.0	9.7
Estimable predation (% of removals)	8.5	8.1	7.9	7.7	7.5
Relative fishable biomass, end current year	102	103	105	107	108