



**FC Working Group of Fishery Managers and Scientists on
Management Strategy Evaluation (WGFMS-MSE) – September 2011**

**On “*Exceptional Circumstances*” Provisions for the Management Strategy
for the Greenland Halibut Stock in Subarea 2 + Divisions 3KLMNO based
on Survey Results occurring Outside the Range Simulated**

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The primary basis for considering “*Exceptional Circumstances*” to apply when a Management Strategy (MS) has been adopted for a resource, is that the resource has moved outside the range compatible with the various scenarios considered in the simulation testing on which selection of the Strategy was founded. Acknowledging that such “*Exceptional Circumstances*” apply necessitates a review and possible revision of the management measure indicated under implementation of the MS.

For an empirical MS such as that adopted by NAFO for Greenland Halibut in Subarea 2 + Divisions 3KLMNO, probably the clearest indications that this has occurred would be provided by the survey estimates of abundance, falling outside the range of values projected to occur in these simulation tests. These survey estimates are particularly important in this instance as they provide the (only) inputs to the harvest control rule used to calculate catch limits within the MS.

Figure 1 shows these projections for each of the three surveys whose results are utilised in the harvest control rule of the MS adopted for this Greenland Halibut stock under the Reference Case SCAA operating model (SCAA0) used in the simulation testing. The results are shown in the form of probability envelopes about the median future survey trajectories projected: specifically here the 50%, 75% and 95% probability envelopes are plotted. Numerical values for these envelopes are provided in Table 1.

More usual practice is to utilise the full Reference Set of operating models, rather than the Reference Case alone, to provide such probability envelopes. The corresponding results here are shown here in Figure 2 and Table 2, where the Reference Case (SCAA0) and each of the other models within the Reference Set (SCAA1 to SCAA7) have been equally weighted in computing the probability envelopes.

The Figures also show the first set of survey results to eventuate following adoption of this MS. Note that the Canadian Fall and EU survey results fall well within the probability envelopes shown, though the Canadian Spring survey result is on the verge of being above the upper 2.5%-ile of the projected distributions.

It might be desirable to select a particular probability interval as a guide to determining whether a declaration of “*Exceptional Circumstances*” is considered to be warranted on the basis of this criterion. A more conservative choice might be appropriate in the early stages of

the application of a MS to a resource while experience is gained. Thus, for example, for the South African hake resource for which this approach has been used for almost two decades, a 95% probability interval has been adopted for such purposes [Rademeyer *et al.*, 2010], whereas for Canadian Pollock for which the approach has only very recently been instituted, a 90% interval has been chosen [DFO, 2011.].

Results here have been presented for the SCAA based operating models used in testing the MS adopted for this resource. It would be desirable for similar results to be generated from the XSA models also used in this testing process.

References

- DFO. 2011. Western component (4Xopqrs5) pollock Management Strategy Evaluation. DFO Canadian Science Advisory Secretariat, Science Advisory Report 2011/054.
- Rademeyer RA, Fairweather T, Glazer JP, Leslie RL and Butterworth DS. 2010. The 2010 Operational Management Procedure for the South African *Merluccius paradoxus* and *M. capensis* resources. Unpublished document, Department of Agriculture, Forestry and Fisheries, Fisheries Branch, South Africa. FISHERIES/2010/OCTOBER/SWG-DEM/59.

Table 1: Medians and 50%, 75% and 95% probability envelopes for the projected survey catch rates under the Management Strategy adopted for the Reference Case SCAA operating model (SCAA0).

	Canadian Fall							EU (0-1400m)							Canadian Spring								
	Percentiles							Percentiles							Percentiles								
	2.5	12.5	25.0	50.0	75.0	87.5	97.5	2.5	12.5	25.0	50.0	75.0	87.5	97.5	2.5	12.5	25.0	50.0	75.0	87.5	97.5		
2010	7.07	10.40	12.69	16.25	19.95	22.85	28.18	2010	14.90	19.60	22.70	27.73	33.69	38.78	48.83	2010	0.26	0.40	0.51	0.72	1.00	1.29	1.92
2011	6.47	10.06	12.43	16.13	20.22	23.58	29.67	2011	13.45	18.03	21.29	26.59	32.87	37.91	48.70	2011	0.27	0.45	0.59	0.88	1.30	1.70	2.66
2012	6.67	10.34	12.69	16.54	21.03	24.32	30.65	2012	12.34	17.11	20.43	25.72	32.28	37.53	47.87	2012	0.32	0.52	0.70	1.04	1.54	2.01	3.29
2013	7.13	10.52	12.94	16.84	21.10	24.68	31.37	2013	12.19	16.84	20.39	25.81	32.71	38.55	50.57	2013	0.37	0.58	0.78	1.17	1.74	2.28	3.77
2014	7.13	10.55	13.20	17.00	21.43	25.22	32.14	2014	12.76	17.46	21.10	27.15	34.33	40.79	53.22	2014	0.37	0.60	0.81	1.23	1.84	2.45	3.87
2015	7.51	11.13	13.59	17.65	22.25	26.06	33.28	2015	13.17	18.08	21.68	27.82	35.37	42.03	54.75	2015	0.38	0.61	0.82	1.24	1.87	2.50	4.16
2016	7.50	11.22	13.86	17.91	22.71	26.51	33.51	2016	13.34	18.16	21.58	27.77	35.22	41.81	55.21	2016	0.37	0.63	0.84	1.25	1.93	2.55	4.20
2017	7.24	11.04	13.55	17.65	22.40	26.28	33.30	2017	13.38	18.14	22.04	28.59	36.40	43.09	56.37	2017	0.40	0.65	0.86	1.29	1.94	2.61	4.28
2018	7.60	11.35	14.13	18.40	23.24	26.95	34.52	2018	13.80	18.98	22.72	29.26	37.19	43.75	58.11	2018	0.43	0.68	0.90	1.35	2.01	2.65	4.44
2019	7.80	12.08	14.85	19.25	24.27	28.34	35.84	2019	14.00	19.33	23.43	30.27	38.31	45.14	60.92	2019	0.41	0.70	0.93	1.43	2.14	2.88	4.69
2020	7.83	12.35	15.26	19.96	25.16	29.34	37.46	2020	14.27	20.12	24.05	31.07	39.55	47.28	61.95	2020	0.45	0.71	0.97	1.49	2.25	3.01	4.83
2021	8.60	13.23	16.10	20.79	26.08	30.44	38.34	2021	15.03	20.79	25.23	32.45	40.89	48.37	64.97	2021	0.45	0.75	1.00	1.52	2.34	3.12	5.11
2022	9.17	13.59	16.67	21.54	27.21	32.03	40.85	2022	15.55	21.65	26.03	33.28	42.59	49.77	65.32	2022	0.45	0.76	1.02	1.56	2.39	3.15	5.03
2023	8.98	13.75	16.88	22.02	27.85	32.54	41.22	2023	16.15	22.36	26.74	34.60	44.26	51.98	66.80	2023	0.46	0.77	1.03	1.59	2.43	3.20	5.23
2024	9.11	13.89	16.97	22.18	28.01	32.47	41.88	2024	16.95	23.34	27.93	35.94	45.70	53.71	70.17	2024	0.50	0.82	1.08	1.63	2.44	3.28	5.45
2025	9.35	13.96	17.15	22.56	28.38	33.20	41.96	2025	17.44	24.04	29.18	37.10	47.38	55.57	73.66	2025	0.49	0.82	1.09	1.65	2.49	3.34	5.47
2026	9.35	14.20	17.44	22.70	28.63	33.12	42.58	2026	17.57	24.78	30.13	38.55	48.99	58.21	77.93	2026	0.51	0.83	1.12	1.71	2.55	3.43	5.38
2027	9.78	14.29	17.45	22.85	28.86	33.53	43.43	2027	18.47	25.54	30.84	39.64	50.31	58.88	76.02	2027	0.49	0.82	1.10	1.65	2.49	3.40	5.56
2028	9.77	14.15	17.47	22.60	28.90	34.26	43.97	2028	18.47	25.55	30.77	39.99	51.51	61.12	79.73	2028	0.50	0.82	1.12	1.69	2.52	3.37	5.42
2029	9.57	14.55	17.84	23.08	29.24	34.23	42.89	2029	19.21	27.04	32.54	41.87	53.58	63.14	81.20	2029	0.48	0.82	1.12	1.70	2.54	3.39	5.42
2030	9.92	14.70	17.99	23.28	29.44	34.40	44.16	2030	19.45	26.98	32.82	42.13	53.85	63.59	82.20	2030	0.51	0.85	1.14	1.70	2.55	3.42	5.45
2031	9.52	14.28	17.90	23.30	29.54	34.57	43.99	2031	20.06	27.01	33.02	43.00	54.46	64.43	83.77	2031	0.51	0.84	1.13	1.71	2.57	3.40	5.54

Table 2: Medians and 50%, 75% and 95% probability envelopes for the projected survey catch rates under the Management Strategy adopted for the full SCAA Reference Set (SCAA0 to SCAA7), where each operating model within the Set is accorded the same weight.

	Canadian Fall							EU (0-1400m)							Canadian Spring								
	Percentiles							Percentiles							Percentiles								
	2.5	12.5	25.0	50.0	75.0	87.5	97.5	2.5	12.5	25.0	50.0	75.0	87.5	97.5	2.5	12.5	25.0	50.0	75.0	87.5	97.5		
2010	6.56	9.80	12.02	15.55	19.54	22.83	29.93	2010	14.18	18.76	21.89	27.03	33.24	38.55	48.95	2010	0.26	0.39	0.50	0.70	0.98	1.25	1.88
2011	5.95	9.29	11.59	15.30	19.69	23.41	31.25	2011	12.33	16.76	19.98	25.47	32.00	37.43	49.15	2011	0.26	0.43	0.56	0.84	1.25	1.64	2.56
2012	6.09	9.50	11.81	15.67	20.34	24.18	32.84	2012	10.98	15.53	18.76	24.21	31.12	36.93	49.02	2012	0.30	0.49	0.66	0.98	1.46	1.92	3.17
2013	6.39	9.68	12.05	15.94	20.60	24.61	33.94	2013	10.35	14.88	18.25	24.01	31.16	37.47	51.11	2013	0.35	0.55	0.74	1.11	1.66	2.20	3.69
2014	6.39	9.74	12.20	16.24	21.09	25.37	34.46	2014	10.62	15.25	18.78	24.94	32.67	39.43	53.57	2014	0.35	0.57	0.77	1.17	1.77	2.38	3.86
2015	6.76	10.25	12.79	17.05	22.15	26.56	36.23	2015	10.72	15.64	19.35	25.71	33.82	40.93	55.99	2015	0.35	0.58	0.78	1.20	1.81	2.45	4.16
2016	6.68	10.42	13.14	17.60	22.93	27.33	36.68	2016	10.55	15.57	19.20	25.68	33.78	40.81	55.92	2016	0.35	0.60	0.81	1.23	1.89	2.54	4.23
2017	6.48	10.31	13.00	17.51	23.01	27.46	36.14	2017	10.01	15.48	19.52	26.51	35.00	42.24	57.64	2017	0.38	0.63	0.83	1.28	1.94	2.62	4.41
2018	6.84	10.67	13.62	18.48	24.14	28.57	37.61	2018	10.31	16.04	20.30	27.43	36.23	43.55	59.84	2018	0.40	0.66	0.88	1.33	2.03	2.70	4.55
2019	7.19	11.28	14.45	19.53	25.38	30.10	39.44	2019	10.27	16.43	21.10	28.85	38.04	45.55	62.98	2019	0.40	0.68	0.91	1.43	2.18	2.96	4.89
2020	7.42	11.69	14.95	20.32	26.45	31.29	41.25	2020	10.50	17.10	22.03	30.02	39.94	48.23	65.08	2020	0.43	0.70	0.96	1.50	2.28	3.09	5.11
2021	7.86	12.40	15.81	21.23	27.50	32.56	42.15	2021	11.00	17.72	23.13	31.76	41.90	50.25	68.46	2021	0.43	0.73	0.99	1.53	2.38	3.22	5.32
2022	8.30	12.96	16.35	21.98	28.54	34.04	44.71	2022	11.35	18.55	24.10	33.14	43.81	52.20	70.01	2022	0.43	0.75	1.02	1.58	2.44	3.25	5.24
2023	8.30	13.14	16.54	22.39	29.13	34.56	44.81	2023	11.88	19.20	25.02	34.43	45.62	55.06	72.98	2023	0.45	0.76	1.03	1.59	2.46	3.29	5.33
2024	8.37	13.17	16.63	22.50	29.23	34.60	45.56	2024	12.36	20.24	26.19	36.13	47.78	57.29	76.45	2024	0.48	0.79	1.07	1.63	2.49	3.37	5.65
2025	8.57	13.28	16.74	22.75	29.60	34.92	45.27	2025	12.88	20.82	27.14	37.42	49.70	59.74	81.30	2025	0.47	0.79	1.07	1.65	2.53	3.41	5.69
2026	8.50	13.29	16.97	22.90	29.72	35.11	45.67	2026	13.23	21.48	28.10	38.88	51.59	62.51	85.62	2026	0.48	0.81	1.10	1.70	2.57	3.48	5.59
2027	8.66	13.39	16.95	22.93	29.96	35.47	46.73	2027	13.48	22.02	28.77	39.88	53.10	63.72	85.21	2027	0.46	0.79	1.08	1.64	2.51	3.43	5.68
2028	8.64	13.29	16.80	22.78	29.97	35.83	47.34	2028	13.50	22.03	28.74	40.22	54.27	65.75	89.06	2028	0.46	0.79	1.09	1.68	2.55	3.40	5.63
2029	8.61	13.47	17.16	23.19	30.27	36.08	46.61	2029	13.87	23.03	30.26	41.90	56.15	68.07	91.63	2029	0.46	0.79	1.09	1.69	2.57	3.44	5.64
2030	8.76	13.59	17.32	23.37	30.64	36.41	47.95	2030	14.04	22.99	30.20	42.23	56.45	68.23	92.68	2030	0.47	0.81	1.10	1.68	2.57	3.48	5.63
2031	8.37	13.29	17.04	23.37	30.71	36.52	47.97	2031	14.07	23.09	30.30	42.80	57.05	69.10	94.39	2031	0.47	0.80	1.09	1.69	2.59	3.47	5.71

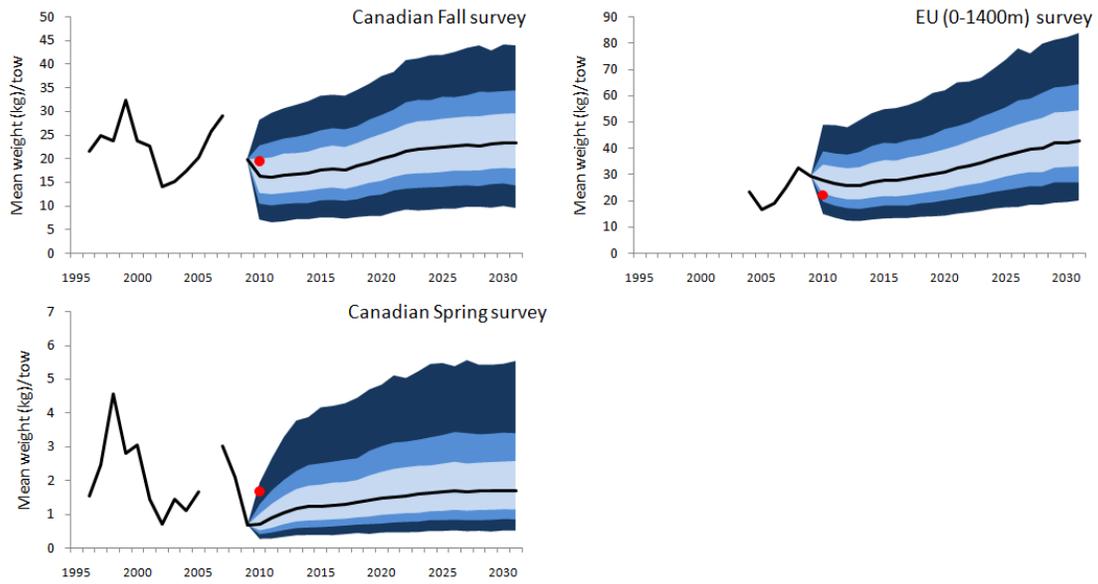


Fig. 1: Projected survey catch rates under the Management Strategy adopted for the Reference Case SCAA operating model (SCAA0). The past values are actual observations, while the projections show medians and 50%, 75% and 95% probability envelopes through use of different shades/colourations. The red dots on each plot show survey results subsequent to adoption of this Management Strategy.

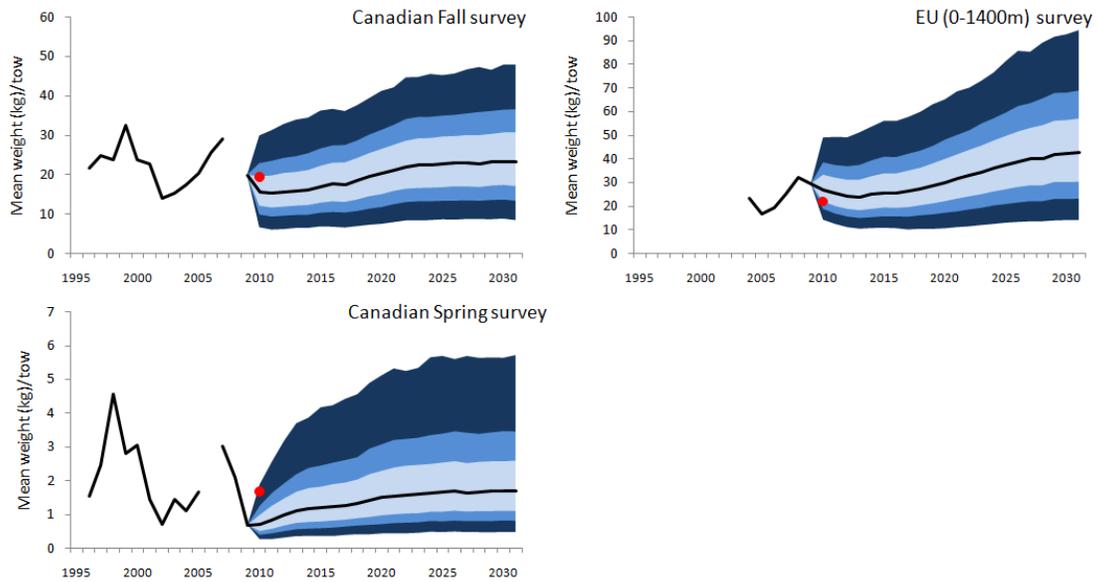


Fig. 2: As for Fig. 1, except that here results are shown for the full SCAA Reference Set (SCAA0 to SCAA7), where each operating model within the Set is accorded the same weight.