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REPORT

Advice on fishing opportunities for Barents Sea shrimp in 2023



Institute of Marine Research – IMR



Polar branch of the FSBSI "VINRO" ("PINRO")

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Advice on fishing opportunities for Barents Sea shrimp in 2023

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1 - Advice on fishing opportunities

Based on the MSY approach and an updated assessment methodology endorsed by an international panel of experts in 2022 (ICES 2022), the catches in 2023 should not exceed 153 000 tonnes.

2 - Stock development over time

Fishing pressure on the stock is below F_{MSY} and F_{lim} and stock biomass is above $MSY_{Btrigger}$ and B_{lim} .

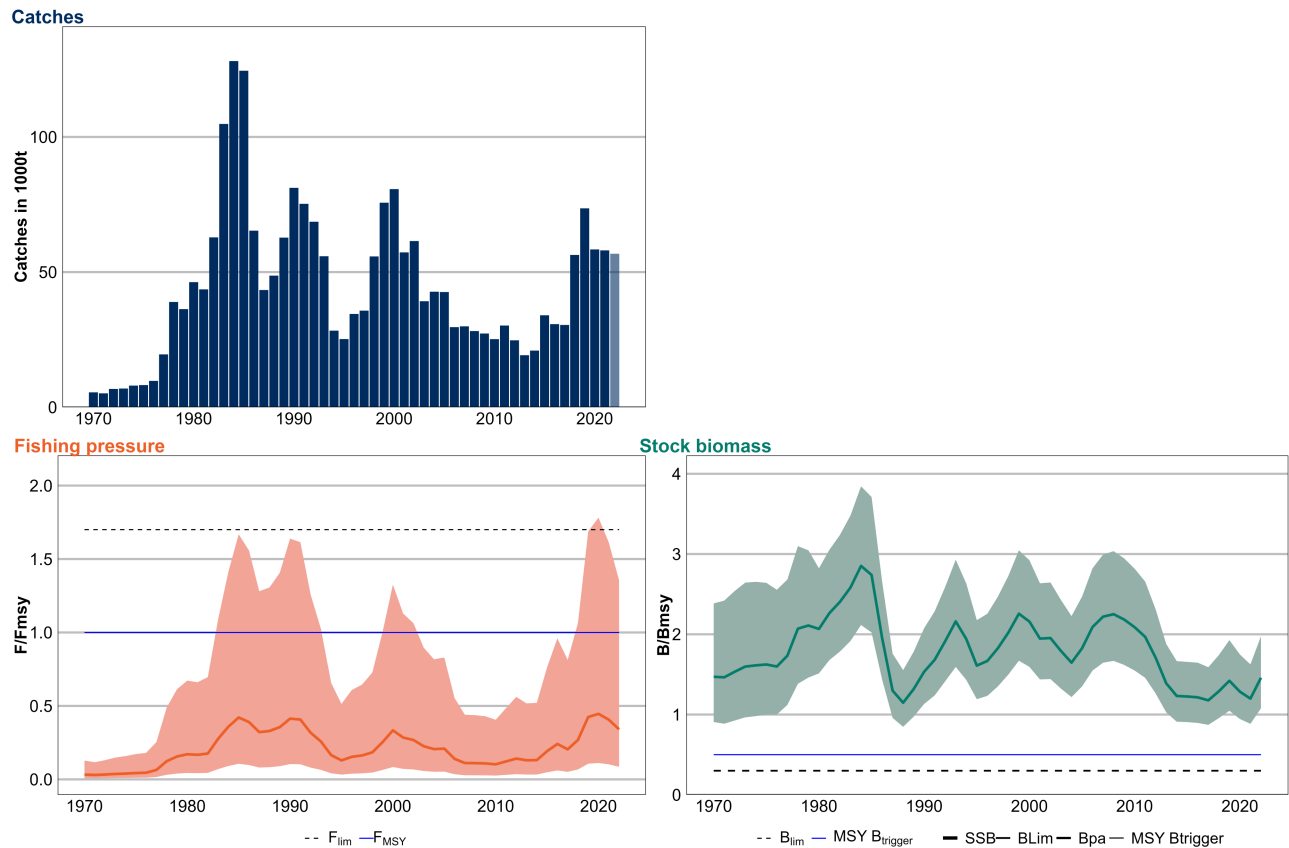


Figure 1 : Northern shrimp in ICES subareas 1 and 2. Summary of the stock assessment. Top: total catches (the paler bar is preliminary estimation for 2022). Bottom: biomass and fishing mortality relative to B_{MSY} and F_{MSY} , respectively, with 95% confidence intervals.

3 - Catch scenarios

Table 1 : Northern shrimp in ICES subareas 1 and 2. The basis for the catch scenarios.

Variable	Value	Notes
Mean F_{2022}/F_{MSY}	0.30	Corresponds to the estimated catch in 2022.
Mean B_{2022}/B_{MSY}	1.67	B_{2022} is the biomass at the end of 2022, considering the estimated catch in 2022.
Catch 2022 (t)	56 792	Preliminary data All catches are assumed to be landed; in tonnes.

Table 2 : Northern shrimp in ICES subareas 1 and 2. Annual catch scenarios for 2023.

Basis	Fish at F_{MSY}	F_{MSY} mode	Constant catch			
Catches (kt)	188	153	100	125	150	175
Stock size (B/B_{MSY})	1.54	1.58	1.63	1.61	1.58	1.55
Fishing mortality (F/F_{MSY})	1.00	0.80	0.52	0.65	0.79	0.93
Probability of falling below B_{lim}	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Probability of falling below $B_{trigger}$	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Probability of exceeding F_{msy}	50.0%	39.1%	20.0%	29.2%	38.1%	46.2%
Probability of exceeding F_{lim}	24.8%	16.9%	6.4%	11.0%	16.3%	21.9%

4 - Basis of the advice

Table 3 : Northern shrimp in ICES subareas 1 and 2. The basis of the advice.

Advice basis	MSY approach using F_{MSY} .
Management plan	No agreed precautionary management plan for northern shrimp in this area.

5 - Quality of assessment

This stock was benchmarked in 2022 (ICES, 2022). Revised methods for estimation of CPUE and survey index, updated stock priors and a change of the modeling framework (SpiCT) were accepted. Combined, this did not alter the overall trends over time or the state of the stock in respect to reference points. Compared to the pre-benchmark assessment in 2021, this year's assessment has resulted in a downward revision of stock biomass and an upward revision of F .

The 2022 survey data from the Russian EEZ (approximately 50% of the entire survey area) was not available in time for the stock assessment. The incomplete survey data set for 2022 adds uncertainty to the assessment.

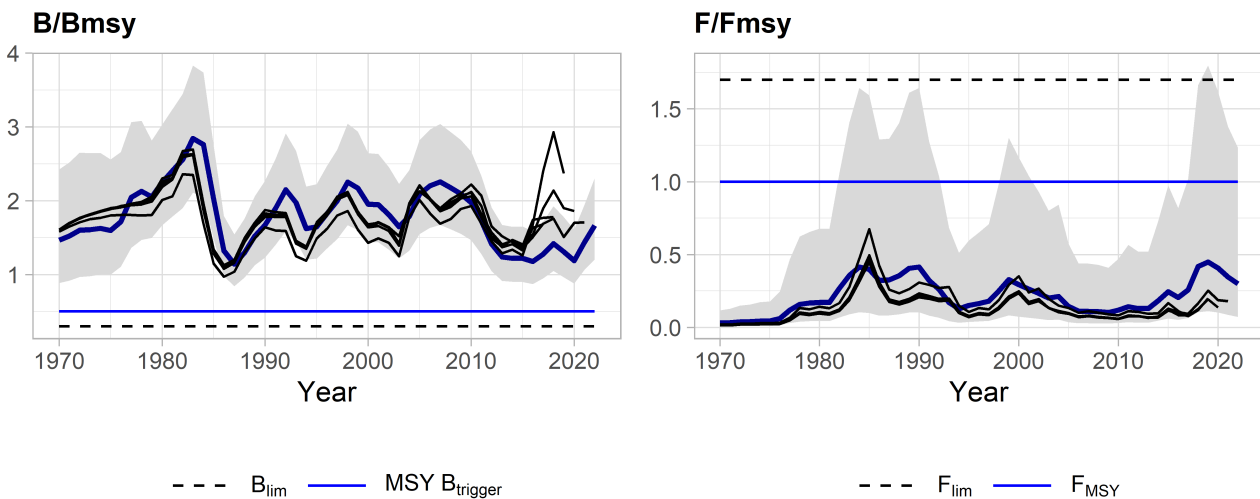


Figure 2 : Northern shrimp in ICES subareas 1 and 2. Current (bold dark-blue line) and historical assessment results (previous four years) .

6 - Issues relevant for the advice

The advice was derived by IMR (Institute of Marine Research) based on the assessment framework endorsed in 2022 by the benchmark workshop on *Pandalus* stocks (WKPRAWN) (ICES 2022). The mode of the probability distribution of F_{MSY} is used as the basis for the advice, given the higher uncertainty on the right-hand side of its probability distribution. Catches corresponding to the fishing mortality at median F_{MSY} would imply catches of 188 000 tonnes in 2023.

7 - Reference points

Table 4 : Northern shrimp in ICES subareas 1 and 2. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	$0.5 \times B_{MSY}^*$	Relative value. B_{MSY} is estimated directly from the assessment model and changes when the assessment is updated.	ICES (2013)
MSY approach	F_{MSY}	$r/2^*$	Relative value. F_{MSY} is estimated directly from the assessment model and changes when the assessment is updated.	ICES (2013)
Precautionary approach	B_{lim}	$0.3 \times B_{MSY}$	Relative value (equilibrium yield at this biomass is 50% of MSY).	ICES (2013)
Precautionary approach	B_{pa}	Not defined	**	
Precautionary approach	F_{lim}	$1.7 \times F_{MSY}$	Relative value (the F that drives the stock to B_{lim}).*	ICES (2013)
Precautionary approach	F_{pa}	Not defined	**	

* Fishing mortality is presented in relation to F_{MSY} , and total stock biomass is presented in relation to B_{MSY} . r is the intrinsic biomass growth rate. These values are directly estimated from the stock assessment and change when the assessment is updated. ** B_{pa} and F_{pa} are not defined as the assessment provides direct estimates of the probabilities of $B < B_{lim}$ and of $F > F_{lim}$.

8 - Basis of the assessment

Table 5 : Northern shrimp in ICES subareas 1 and 2. Basis of the assessment and advice.

Assessment type	Surplus production in continuous time (SPiCT)
Input data	Fishery catches 1970–2022. Three survey indices: the Norwegian shrimp survey 1982–2004 [G3653], the Russian shrimp survey 1984–2005 [G4941], and the Norwegian–Russian ecosystem survey (Eco-Norw-Q3 [A5216]) since 2004; one fishery-based index (standardized CPUE from Norwegian logbooks) since 1980.
Discards and bycatch	Discarding is considered to be negligible.
Other information	None

9 - History of the advice, catch, and management

Table 6 : Northern shrimp in ICES subareas 1 and 2. ICES advice and official landings. Weights are in tonnes.

Year	Advice	Catches corresponding to advice	Agreed TAC	ICES catches
2005	No increase compared to 2004	43600	-	42 618
2006	No increase in catch above recent level	40000	-	29 627
2007	Catch that will prevent exceeding F_{lim} in the long term	50000	-	29 931
2008	Catch that will prevent exceeding F_{lim} in the long term	50000	-	28 188
2009	Catch that will prevent exceeding F_{lim} in the long term	50000	-	27 272
2010	Catch that will prevent exceeding F_{lim} in the long term	50000	-	25 198
2011	Catch that will prevent exceeding F_{MSY} in the long term	60000	-	30 226
2012	Catch that will prevent exceeding F_{MSY} in the long term	60000	-	24 756
2013	Catch that will maintain stock at current high biomass	60000	-	19 249
2014	No new advice, same as for 2013	60000	-	20 964
2015	Move exploitation towards F_{MSY}	< 70000	-	34 022
2016	Move exploitation towards F_{MSY}	< 70000	-	30 749
2017	Move exploitation towards F_{MSY}	$\leq$ 70000	-	30 442
2018	MSY approach: move exploitation towards F_{MSY}	$\leq$ 70000	-	56 341
2019	MSY approach: move exploitation towards F_{MSY}	$\leq$ 70000	-	76 086
2020	MSY approach: mode of the F_{MSY} distribution as basis	$\leq$ 150000	-	61 877
2021	MSY approach: mode of the F_{MSY} distribution as basis	$\leq$ 140000	-	58 030
2022	MSY approach: mode of the F_{MSY} distribution as basis	$\leq$ 140000	-	56 791
2023	MSY approach: mode of the F_{MSY} distribution as basis	$\leq$ 1 53 000		

10 - History of the catch and landings

Table 7 : Northern shrimp in ICES subareas 1 and 2. ICES catches (tonnes). "Others" are EU, Iceland, Faroes, Greenland, and UK.

Year	Norway	Russia	Others	Total
1970	5508	0	0	5508
1971	5116	0	26	5142
1972	6772	0	0	6772
1973	6921	0	0	6921
1974	8008	0	0	8008
1975	8197	0	2	8199
1976	9752	0	0	9752
1977	14700	0	4854	19554
1978	20484	18270	189	38943
1979	25435	10474	390	36299
1980	35061	11219	0	46280
1981	32713	9886	1011	43610
1982	43451	15552	3835	62838
1983	70798	29105	4903	104806
1984	76636	43180	8246	128062
1985	82123	32104	10262	124489
1986	48569	10216	6538	65323
1987	31353	6690	5324	43367
1988	32021	12320	4348	48689
1989	47064	12252	3432	62748
1990	54182	20295	6687	81164
1991	39663	29434	6156	75253
1992	39657	20944	8021	68622
1993	32663	22397	806	55866
1994	20162	7108	1063	28333
1995	19337	3564	2319	25220
1996	25445	5747	3320	34512
1997	29079	1493	5163	35735
1998	44792	4895	6103	55790
1999	52612	10765	12293	75670
2000	55333	19596	5768	80697
2001	43031	5846	8408	57285
2002	48799	3790	8899	61488
2003	34172	2776	2277	39225
2004	35918	2410	4406	42734
2005	37253	435	4930	42618

Year	Norway	Russia	Others	Total
2006	27352	4	2271	29627
2007	25558	192	4180	29930
2008	20662	417	7109	28188
2009	19784	0	7489	27273
2010	16776	0	8419	25195
2011	19928	0	10298	30226
2012	14159	5	10600	24763
2013	8846	1067	9335	19248
2014	10234	741	9989	20964
2015	16618	1151	16253	34022
2016	10898	2491	17359	30749
2017	7010	3849	19582	30442
2018	23126	12561	20654	56341
2019	23925	28081	21576	73582
2020	19116	21265	18000	58380
2021*	30281	12378	15370	58030
2022*	368 62	3790	1613 8	56791

*Preliminary

11 - Summary of the assessment

Table 8 : Northern shrimp in ICES subareas 1 and 2. Assessment summary. Biomass is relative to BMSY at the end of the year and fishing mortality relative to FMSY. High and low values are the 95% confidence intervals. Catches are in tonnes. Catches for 2021 and 2022 are preliminary.

Year	B/B _{MSY}			Catch (t)	F /F _{MSY}		
	Mean	Low	High		Mean	Low	High
1970	1.47	0.89	2.43	5508	0.03	0.01	0.12
1971	1.52	0.92	2.52	5142	0.03	0.01	0.13
1972	1.60	0.97	2.65	6772	0.04	0.01	0.15
1973	1.61	0.98	2.65	6921	0.04	0.01	0.16
1974	1.63	1.00	2.65	8008	0.04	0.01	0.17
1975	1.60	1.00	2.56	8199	0.05	0.01	0.18
1976	1.72	1.11	2.66	9752	0.06	0.02	0.24
1977	2.05	1.36	3.06	19554	0.12	0.03	0.47
1978	2.13	1.47	3.08	38943	0.16	0.04	0.62
1979	2.05	1.50	2.82	36299	0.17	0.04	0.66
1980	2.25	1.67	3.03	46280	0.17	0.04	0.68
1981	2.41	1.79	3.24	43610	0.17	0.04	0.68
1982	2.56	1.90	3.45	62838	0.27	0.07	1.06
1983	2.84	2.11	3.83	104806	0.36	0.09	1.41
1984	2.76	2.04	3.74	128062	0.42	0.10	1.64
1985	2.02	1.49	2.75	124489	0.40	0.10	1.59
1986	1.32	0.98	1.79	65323	0.32	0.08	1.29
1987	1.14	0.84	1.55	43367	0.33	0.08	1.29
1988	1.30	0.96	1.76	48689	0.36	0.09	1.40
1989	1.52	1.13	2.06	62748	0.41	0.10	1.61
1990	1.67	1.23	2.27	81164	0.41	0.10	1.64
1991	1.90	1.40	2.57	75253	0.32	0.08	1.28
1992	2.15	1.59	2.91	68622	0.26	0.07	1.04
1993	1.98	1.46	2.68	55866	0.17	0.04	0.68
1994	1.62	1.20	2.19	28333	0.13	0.03	0.51
1995	1.65	1.22	2.23	25220	0.15	0.04	0.60
1996	1.83	1.35	2.47	34512	0.16	0.04	0.65
1997	2.00	1.48	2.69	35735	0.18	0.05	0.71
1998	2.25	1.67	3.04	55790	0.25	0.06	0.99
1999	2.17	1.61	2.94	75670	0.33	0.08	1.30
2000	1.96	1.44	2.65	80697	0.29	0.07	1.17
2001	1.95	1.44	2.64	57285	0.26	0.07	1.04
2002	1.81	1.34	2.46	61488	0.23	0.06	0.93
2003	1.65	1.22	2.23	39225	0.20	0.05	0.80

Year	B/B			Catch (t)	F /F		
	Mean	L ow	High		Mean	Low	High
2004	1.79	1.32	2.41	42734	0.21	0.05	0.84
2005	2.09	1.55	2.82	42618	0.14	0.04	0.57
2006	2.20	1.63	2.97	29627	0.11	0.03	0.44
2007	2.26	1.67	3.04	29930	0.11	0.03	0.44
2008	2.18	1.62	2.93	28188	0.11	0.03	0.43
2009	2.09	1.55	2.82	27273	0.10	0.03	0.41
2010	1.98	1.47	2.67	25195	0.12	0.03	0.47
2011	1.73	1.28	2.33	30226	0.14	0.04	0.57
2012	1.41	1.04	1.91	24763	0.13	0.03	0.52
2013	1.24	0.92	1.67	19248	0.13	0.03	0.52
2014	1.22	0.90	1.65	20964	0.18	0.05	0.73
2015	1.22	0.90	1.65	34022	0.24	0.06	0.97
2016	1.18	0.87	1.59	30749	0.21	0.05	0.82
2017	1.28	0.95	1.72	30442	0.26	0.07	1.02
2018	1.42	1.05	1.93	56341	0.42	0.11	1.66
2019	1.31	0.96	1.78	73582	0.45	0.11	1.80
2020	1.19	0.88	1.61	58380	0.41	0.10	1.62
2021	1.44	1.06	1.94	58030	0.35	0.09	1.38
2022	1.67	1.20	2.31	56792	0.30	0.07	1.23

12 - Sources and references

Hvingel, C. and Zimmerman, F. 2023. Stock assessment report for Northern shrimp (*Pandalus borealis*) in the Barents Sea (ICES Subareas 1 and 2). IMR-PINRO report series 2 -2023 .

ICES. 2013. Report of the Inter-Benchmark Protocol on Pandalus in Skagerrak and the Norwegian Deep (IBPPand), 12–19 September 2013, Dartmouth, NS, Canada. ICES CM 2013/ACOM:71. 10 pp. <https://doi.org/10.17895/ices.pub.5688>.

ICES. 2022. Benchmark workshop on Pandalus stocks (WKPRAWN). Edited by C. Lordan, and J. Lövgren. <https://doi.org/10.17895/ices.pub.19714204.v1>



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