Supplementary material for: Sander, G. & Mikkelsen, E. 2025. Arctic shipping 2013–2022: the traffic has grown, with big variation between regions, seasons and ship types. *Polar Research 44*. Correspondence: Gunnar Sander, Norwegian Institute for Water Research, Fram Centre, P.O. Box 6606 Stakkevollan, NO-9296 Tromsø, Norway. E-mail: gus@niva.no

This supplementary document presents tables with data that were used to produce the figures in the article, as well as other tables and figures referred to in the article. After these tables and figures are presented, additional supplementary tables and figures—which are not mentioned in the article—are provided.

Supplementary Table S1. Share of yearly distance by month (1-12) and year for the High-Arctic LMEs, except the Barents Sea.

Month	2013 (%)	2014 (%)	2015 (%)	2016 (%)	2017 (%)	2018 (%)	2019 (%)	2020 (%)	2021 (%)	2022 (%)
1	1.6	2.3	2.6	2.5	2.8	3.3	3.3	3.5	3.5	3.8
2	1.6	1.7	1.9	2.2	2.4	2.9	2.7	3.3	2.9	3.2
3	2.0	1.9	2.5	2.8	3.5	2.9	3.3	3.3	3.1	3.6
4	3.0	2.7	3.1	3.3	3.2	3.1	3.6	3.9	3.5	4.2
5	3.4	3.3	3.8	3.9	4.1	3.8	5.0	5.3	5.2	4.9
6	5.1	4.9	6.7	6.3	7.7	7.9	7.0	7.8	7.2	6.8
7	12.4	12.4	12.7	13.1	13.4	13.4	12.6	12.7	11.6	11.6
8	22.0	22.3	21.1	21.2	19.7	20.0	21.0	17.4	17.6	19.0
9	22.7	23.3	21.6	21.0	19.6	18.6	18.8	17.6	18.1	18.6
10	15.6	14.8	12.7	12.8	12.6	12.5	11.8	13.8	14.1	12.7
11	7.0	6.5	6.7	6.6	6.6	6.7	6.5	6.7	7.9	6.8
12	3.6	3.8	4.5	4.3	4.4	4.9	4.4	4.7	5.4	4.9
Sum	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Sum summer (months 7-10)	72.6	72.8	68.2	68.1	65.3	64.5	64.2	61.5	61.4	61.9
Sum rest of the year	27.4	27.2	31.8	31.9	34.7	35.5	35.8	38.5	38.6	38.1

Supplementary Table S2. Distance sailed by ship type and year, for High Arctic LMEs, except the Barents Sea.

Ship type	2013 (nm)	2022 (nm)	2013 %	2022 %	% change 2013-2022
Bulk carriers	72018	306106	2.6	5.4	325
Chemical tankers	186031	255726	6.7	4.5	37
Container ships	199139	126317	7.1	2.2	-37
Crude oil tankers	38740	279947	1.4	4.9	623
Cruise ships	153896	304961	5.5	5.4	98
Fishing vessels	769536	1107709	27.6	19.6	44
Gas tankers	5680	410232	0.2	7.2	7122
General cargo ships	400540	1026624	14.4	18.1	156
Offshore supply ships	25735	44501	0.9	0.8	73
Oil product tankers	138647	137183	5.0	2.4	-1
Other activities	654643	1470923	23.5	26.0	125
Other service offshore vessels	8978	12328	0.3	0.2	37
Passenger ships	96810	127197	3.5	2.2	31
Refrigerated cargo ships	28808	32577	1.0	0.6	13
Ro-Ro cargo ships	11175	20021	0.4	0.4	79
Sum	2790377	5662352	100.0	100.0	103

Supplementary Table S3. Distance sailed by ship type and year, for the three NSR-related LMEs. These are the numbers behind Fig. 8. The values are in units of 1000 nm, except for three columns showing percentages.

Ship type	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Share 2013 (%)	Share 2022 (%)	Change 2013-2022	% change 2013-2022
Bulk carriers	19	46	53	57	29	8	13	47	85	41	2.3	1.8	22	116
Chemical tankers	42	38	56	93	85	104	72	64	91	92	5.1	4.1	51	122
Container ships	32	0	13	0	1	2	0	0	0	0	3.9	0.0	-32	-100
Crude oil tankers	31	42	34	92	238	268	332	333	290	279	3.8	12.4	248	806
Cruise ships	35	16	34	42	50	28	60	44	50	45	4.3	2.0	9	26
Fishing vessels	28	46	61	42	53	26	30	44	34	59	3.4	2.6	31	109
Gas tankers	4	0	0	0	18	127	302	353	379	352	0.5	15.6	348	7945
General cargo ships	217	329	379	586	482	409	465	577	675	676	26.5	30.0	459	212
Offshore supply ships	16	63	29	17	24	36	73	101	77	35	1.9	1.6	19	123
Oil product tankers	112	151	120	188	134	85	147	140	133	122	13.7	5.4	9	8
Other activities	277	400	368	449	355	340	402	529	577	525	33.7	23.3	249	90
Other service offshore vessels	0	7	5	10	15	8	6	13	15	5	0.0	0.2	5	x
Passenger ships	7	37	12	11	21	6	22	20	18	15	0.8	0.6	8	123
Refrigerated cargo ships	0	5	6	2	8	4	12	3	7	4	0.0	0.2	4	2358
Ro-Ro cargo ships	0	3	2	4	0	1	3	3	3	2	0.0	0.1	2	x
Sum	820	1 183	1 172	1 594	1 514	1 452	1 938	2 271	2 433	2 253	100.0	100.0	1 433	175

Supplementary Table S4. Number of vessel-crossings in both directions over crossing lines in the NSR. Their locations can be found in Fig. 2.

Crossing lines (see Fig. 2)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
1 Long Strait	151	116	130	178	126	125	176	232	264	159
1 Wrangel Island–North Pole	26	125	53	41	35	30	40	42	30	18
2 Dmitry Laptev Strait	59	89	81	78	75	81	76	77	99	92
2 Sannikov Strait	58	71	82	104	57	70	91	89	86	93
2 New Siberian Island–North Pole	64	126	85	64	82	57	89	160	198	92
3 Vilkitsky Strait–Shokalskiy Strait	218	201	172	269	257	198	249	285	368	271
3 Franz Josef Land-Severnaya Zemlya	21	10	5	60	10	2	19	9	9	2
4 Franz Josef Land-Novaya Zemlya	158	197	225	327	358	393	469	368	639	606
4 Kara Port–Yugorski Shar Strait	285	565	595	872	891	956	1379	1625	1563	840

Supplementary Table S5. Distance sailed by ship type and year for the three NWP-related LMEs. The values are in units of 1000 nm, except for three columns showing percentages.

Ship type	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Share 2013 (%)	Share 2022 (%)	Change 2013-2022	% change 2013-2022
Bulk carriers	5	5	34	84	132	176	210	177	184	169	0.5	9.8	164	3359
Chemical tankers	91	82	90	85	83	91	83	78	77	76	9.4	4.4	-15	-16
Container ships	136	135	129	128	127	120	108	94	102	105	14.1	6.1	-31	-23
Crude oil tankers	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	x
Cruise ships	75	72	94	91	96	97	116	0	0	160	7.7	9.3	85	114
Fishing vessels	345	421	367	439	427	449	527	653	469	485	35.7	28.1	140	41
Gas tankers	0	0	10	0	0	0	0	0	0	0	0.0	0.0	0	x
General cargo ships	69	66	61	68	128	139	166	160	163	182	7.1	10.5	113	163
Offshore supply ships	2	0	4	5	11	4	10	6	10	1	0.2	0.1	-1	-43
Oil product tankers	3	5	0	0	3	2	4	4	3	7	0.3	0.4	4	135
Other activities	150	149	174	171	188	173	220	177	339	451	15.5	26.2	302	202
Other service offshore vessels	9	7	0	0	0	2	5	0	0	3	0.9	0.2	-6	-67
Passenger ships	59	65	67	78	71	81	82	61	71	82	6.1	4.8	23	40
Refrigerated cargo ships	20	22	20	28	20	20	19	22	0	0	2.1	0.0	-20	-100
Ro-Ro cargo ships	4	5	6	8	9	2	2	3	2	4	0.4	0.3	0	8
Sum	967	1 036	1 056	1 185	1 295	1 356	1 550	1 433	1 421	1 725	100.0	100.0	758	78

Supplementary Table S6. Nautical miles sailed by ship type and year in the Central Arctic Ocean LME. The values are in nm (not 1000 nm).

Ship type/year	Total distance per year (nm)		Ship type/year	Total distance per year (nm)
Bulk carriers			General cargo ships	
2018	75		2020	755
Chemical tankers			Oil product tankers	
2019	52		2020	43
Container ships			2021	0
2017	67		Other activities	
2020	441		2013	8 068
Cruise ships			2014	26 174
2013	2 313		2015	20 871
2014	4 712		2016	16 229
2015	870		2017	8 892
2019	1 315		2018	15 871
2020	1 913		2019	18 349
2021	1 095		2020	25 500
2022	3 888		2021	14 067
Fishing vessels			2022	11 868
2013	0		Passenger ships	
2018	187		2018	29
2020	0			
2021	14 067			
2022	11 868			

Supplementary Table S7. Distance sailed (in nm) by month and year, for the High-Arctic LMEs, except the Barents Sea, with trend line characteristics and average growth per year over the period.

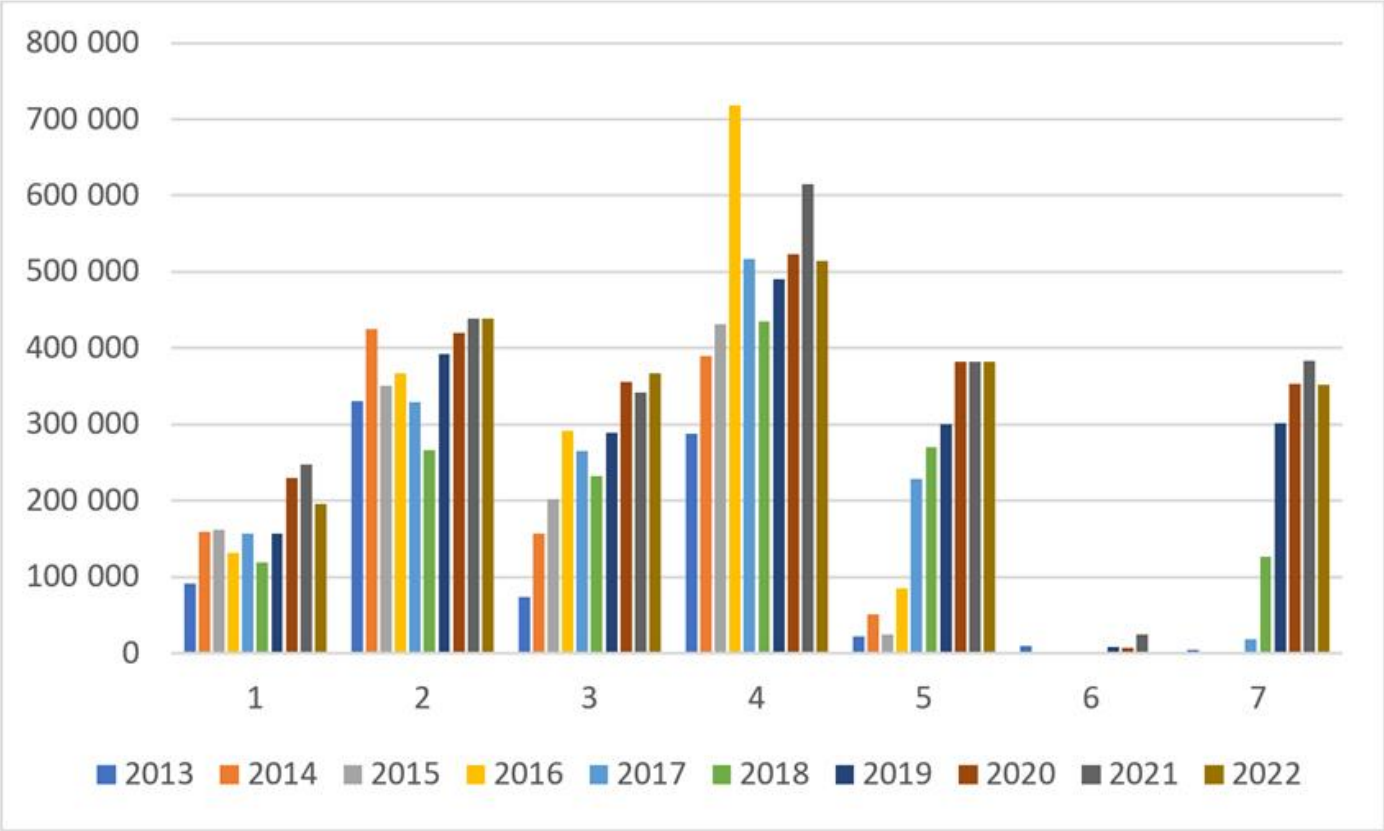
Month	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Slope	Constant	Average annual growth (%)
1	43939	75530	92314	102744	120530	139717	169771	191245	190567	213190	18445	32507	43
2	44051	57217	67857	89369	104129	123473	140624	178411	155705	180880	16041	25947	35
3	56126	63887	87919	113682	149921	124292	170310	181029	170252	201458	16135	43143	29
4	85041	89774	107916	133367	135117	133309	183702	210484	188166	237683	16512	59637	20
5	96101	107475	133303	158371	175923	162578	255987	285244	285595	275649	23648	63557	21
6	143081	160452	234583	259369	328114	334296	361235	419745	392838	383918	30496	134036	19
7	346154	407586	447282	537007	575614	569186	650280	687477	633528	656002	35785	354192	10
8	612539	736128	743196	864909	843365	850411	1080103	943450	961924	1078424	45015	623863	8
9	632485	768834	758905	858154	837695	791580	966349	951110	984438	1053423	39619	642392	7
10	436008	487280	446919	522891	538607	533253	609130	746540	766523	718393	37864	372300	7
11	193961	215748	236774	271706	284197	286170	334724	364671	430417	384526	24535	165347	11
12	100892	125069	157689	174262	189348	207165	224383	256116	293669	278806	20859	86015	20
Sum	2790377	3294979	3514657	4085832	4282560	4255429	5146598	5415521	5453621	5662352	324956	2602934	11

Supplementary Table S8. Distance sailed (1000 nm) by ship type and year, for all High-Arctic LMEs.

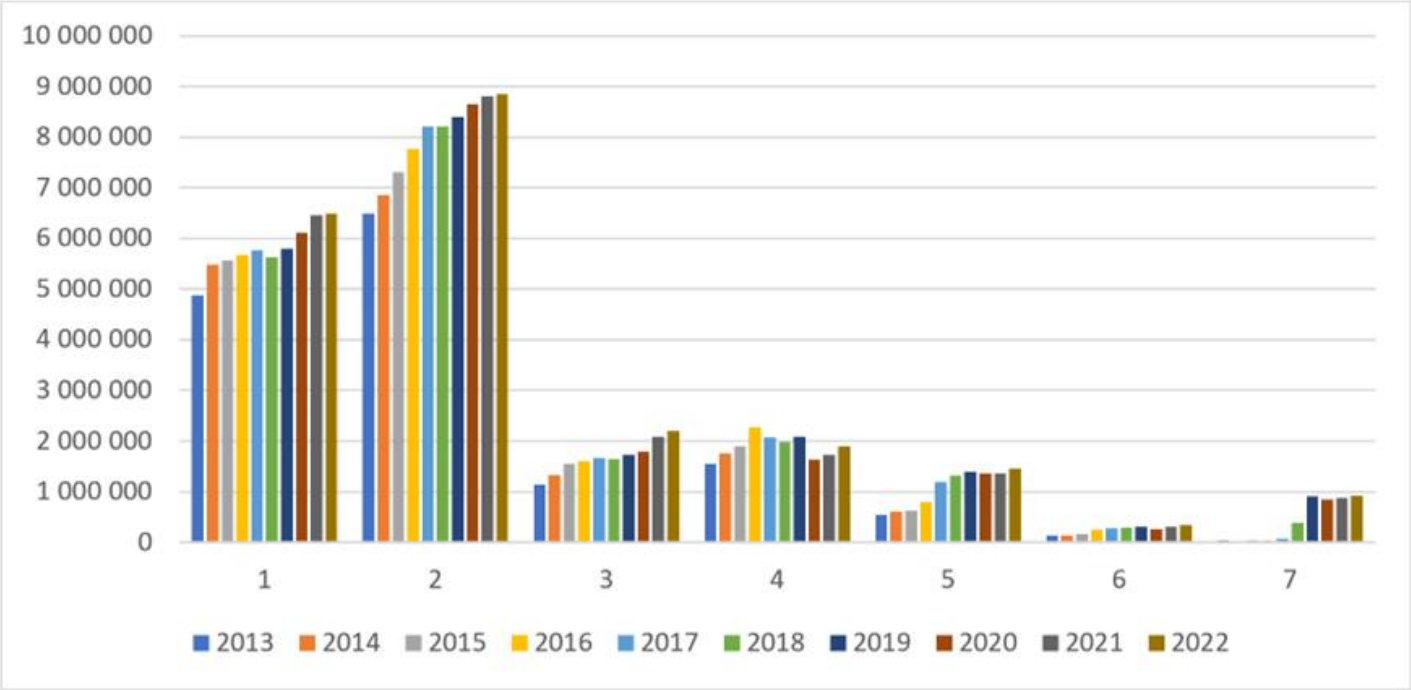
Ship type	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Share 2013 (%)	Share 2022 (%)	Change 2013-2022	% change 2013-2022
Bulk carriers	663	741	810	822	935	925	977	892	926	846	4.5	3.8	182	28
Chemical tankers	532	471	587	637	698	806	635	558	633	608	3.6	2.7	75	14
Container ships	232	182	212	183	192	183	158	146	153	144	1.6	0.6	-89	-38
Crude oil tankers	193	250	287	469	809	872	988	929	851	857	1.3	3.9	664	343
Cruise ships	421	416	473	469	507	572	647	138	120	858	2.8	3.9	437	104
Fishing vessels	5 661	5 902	6 459	6 768	7 010	7 098	7 248	8 090	7 048	7 093	38.3	32.0	1 432	25
Gas tankers	34	30	48	34	63	381	902	846	860	909	0.2	4.1	875	2552
General cargo ships	2 099	2 368	2 697	3 066	2 963	2 849	2 855	3 133	3 430	2 979	14.2	13.4	880	42
Offshore supply ships	301	471	346	324	378	366	370	493	519	377	2.0	1.7	76	25
Oil product tankers	353	390	326	483	408	383	476	471	438	411	2.4	1.9	58	16
Other activities	2 016	2 447	2 411	2 462	2 538	2 302	2 680	2 578	4 173	4 496	13.6	20.3	2 480	123
Other service offshore vessels	98	181	81	54	95	60	68	87	74	83	0.7	0.4	-15	-15
Passenger ships	1 784	1 906	2 034	2 201	2 211	2 213	2 161	1 853	1 979	2 071	12.1	9.3	287	16
Refrigerated cargo ships	313	364	344	369	386	374	364	378	342	361	2.1	1.6	48	15
Ro-Ro cargo ships	72	76	75	65	65	67	70	63	66	66	0.5	0.3	-6	-8
Sum	14 773	16 195	17 190	18 406	19 258	19 452	20 601	20 657	21 611	22 158	100.0	100.0	7 385	50

Supplementary Table S9. Number of vessel-crossings in both directions over crossing lines in the NWP.

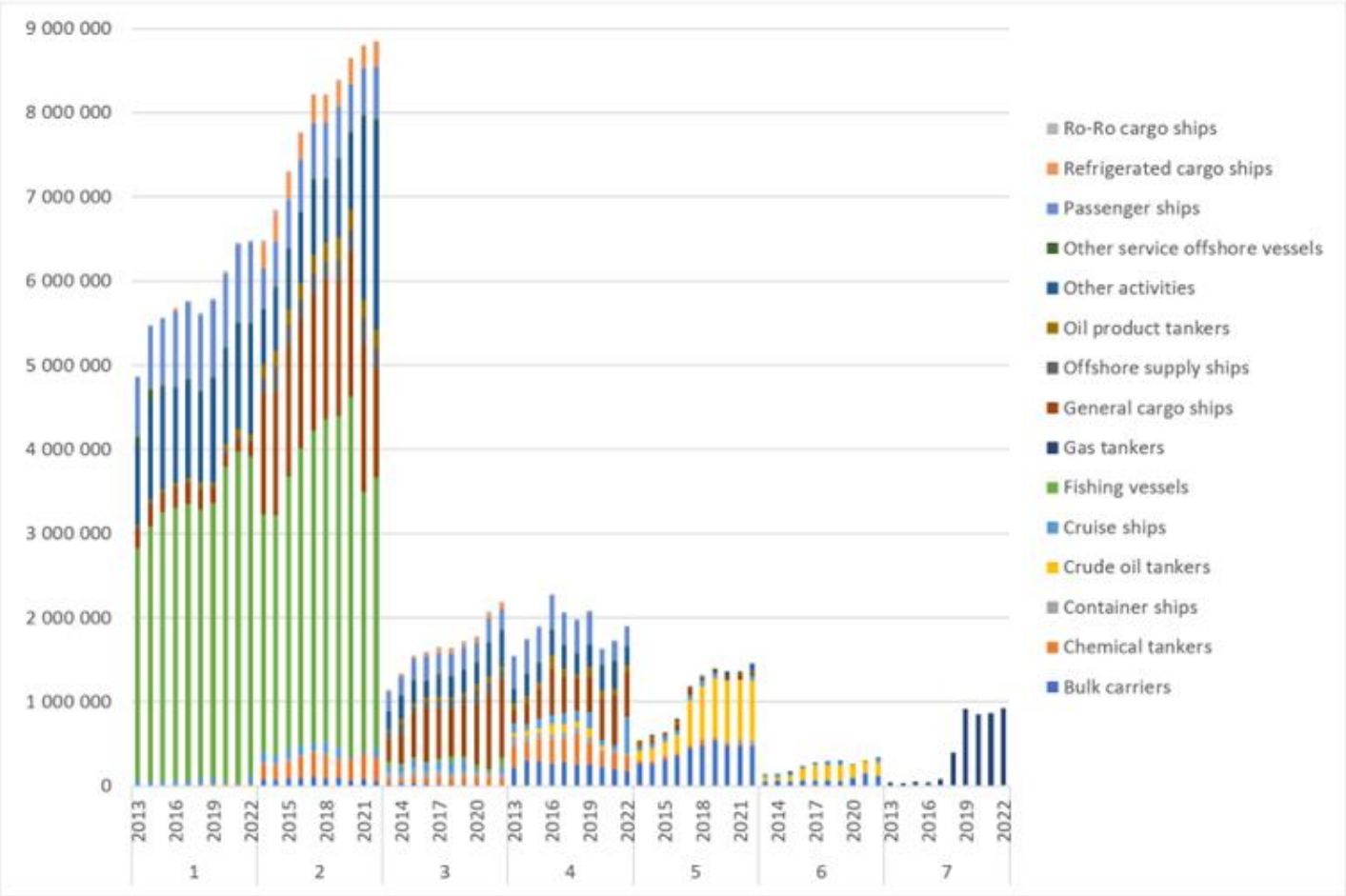
Crossing line	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Davis Strait north of Illulisat	460	491	368	508	570	638	753	659	529	483
5 Fry and Hecla Strait	6	13	8	18	16	2	14	17	2	9
6 Lancaster Sound	26	33	34	25	32	37	44	12	30	33
7 McClure Strait			6				2	1	1	3
7 Prince Wales Strait		1	2	1			0	0	2	0
9 Victoria Strait	20	25	26	25	34	22	39	30	44	28



Supplementary Fig. S1. Distance sailed (nm) in LMEs in the NSR, by ship size class (1-7) and year.



Supplementary Fig. S2. Distance sailed (nm) by ship size class (1-7) and year, for all High-Arctic LMEs including the Barents Sea.



Supplementary Fig. S3. Distance sailed in High-Arctic LMEs, by ship size class (1-7), year and ship type.

Additional tables and figures—not referred to in the article—follow.

Supplementary Table S10. The selection of LMEs from ASTD and their assignment to regions for analysis.

LMEs in ASTD	High Arctic	NSR	NWP
Aleutian Islands			
Baffin Bay	x		x
Barents Sea	x		
Beaufort Sea	x		x
Central Arctic	x		
Chukchi Sea	x		
East Bering Sea			
East Siberian Sea	x	x	
Fareo Plateau			
Greenland Sea	x		
Hudson Bay			
Iceland			
Kara Sea	x	x	
Labrador Sea	x		
Laptev Sea	x	x	
Northern Canadian Archipelago	x		X
Norwegian Sea			
West Bering Sea			

Supplementary Table S11. Ship size class and ship size range in gross tonnage (GT).

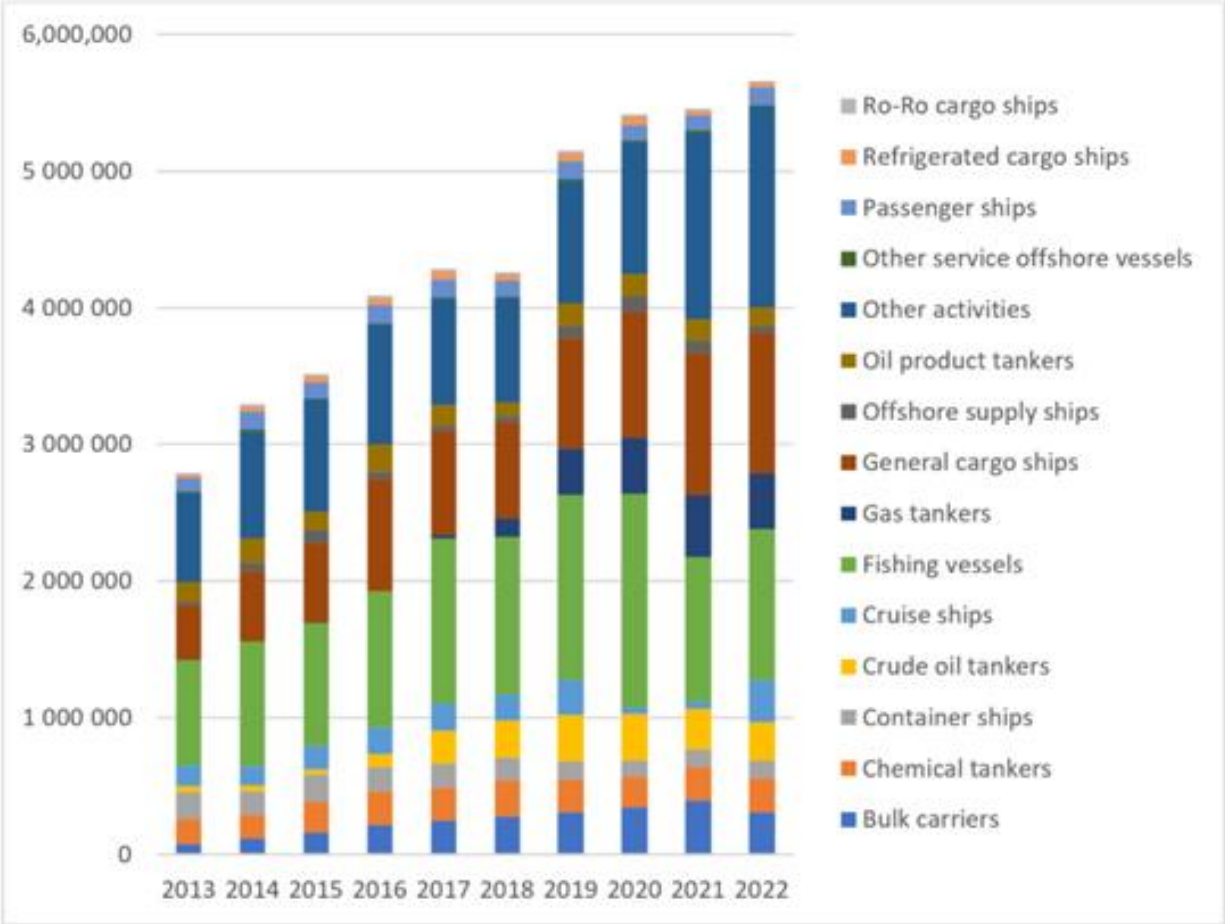
Ship size class	Ship size (GT)
1	<1000
2	1000-4999
3	5000-9999
4	10000-24999
5	25000-49999
6	50000-99999
7	≥100000

Supplementary Table S12. Distance sailed (1000 nm) by month and year for all the High-Arctic LMEs, with trend line characteristics and average growth per year over the period. This table is relevant for the section "Trends in High-Arctic shipping."

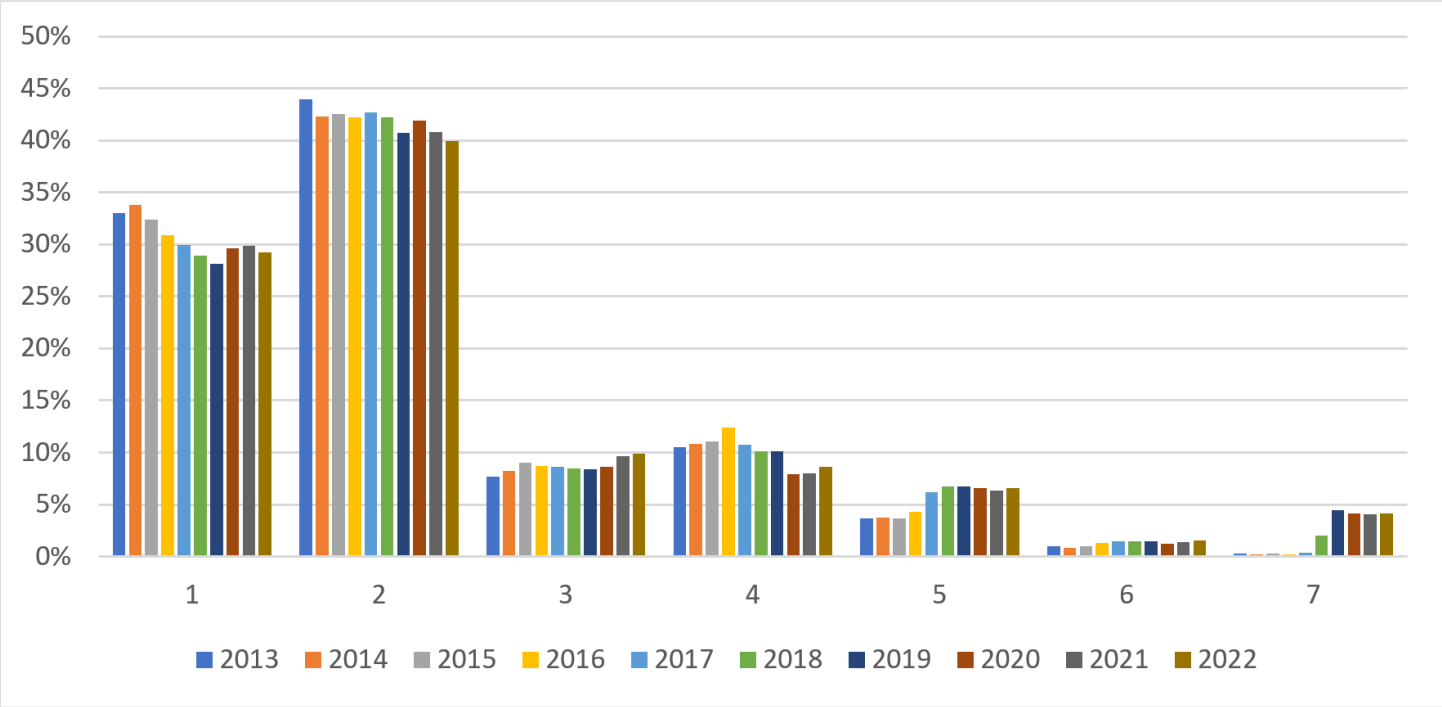
Month	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Slope	Constant	Average annual growth (%)
1	928	987	1026	1137	1167	1274	1324	1365	1331	1435	57	943	5.0
2	939	937	949	1079	1080	1200	1185	1282	1194	1330	45	915	3.9
3	927	979	1119	1140	1350	1332	1413	1392	1446	1610	70	955	6.3
4	949	988	1096	1318	1221	1231	1420	1360	1454	1544	62	978	5.6
5	1001	1181	1227	1362	1365	1413	1604	1518	1624	1643	67	1091	5.7
6	1232	1395	1576	1603	1644	2052	1810	1619	1748	1846	56	1401	4.6
7	1531	1767	1735	1905	2151	2011	2194	2081	2133	2195	67	1671	4.1
8	1809	2043	2063	2253	2306	2285	2534	2368	2464	2535	72	1943	3.8
9	1734	1935	1964	2171	2180	2067	2342	2322	2440	2446	73	1829	3.9
10	1561	1748	1729	1783	1942	1824	2003	2239	2336	2226	80	1579	4.0
11	1206	1327	1470	1485	1572	1530	1613	1771	1925	1914	75	1243	5.3
12	954	909	1236	1171	1279	1233	1158	1339	1515	1433	54	977	4.6
Sum	14773	16195	17190	18406	19258	19452	20601	20657	21611	22158	779	15 526	4.6

Supplementary Table S13. Share of yearly distance by month and year for all the High-Arctic LMEs. This table is relevant for the section "Trends in High-Arctic shipping."

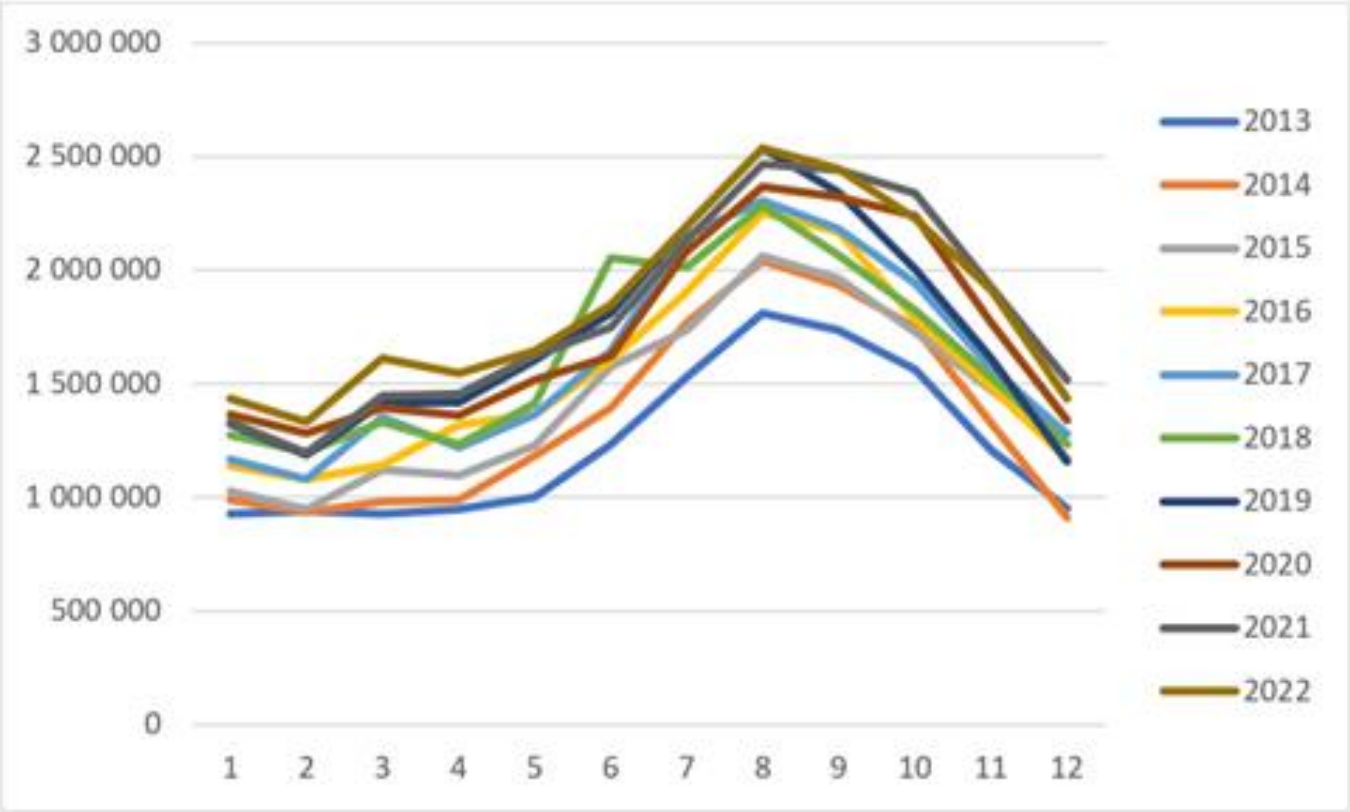
Month	2013 (%)	2014 (%)	2015 (%)	2016 (%)	2017 (%)	2018 (%)	2019 (%)	2020 (%)	2021 (%)	2022 (%)
1	6.3	6.1	6.0	6.2	6.1	6.5	6.4	6.6	6.2	6.5
2	6.4	5.8	5.5	5.9	5.6	6.2	5.8	6.2	5.5	6.0
3	6.3	6.0	6.5	6.2	7.0	6.8	6.9	6.7	6.7	7.3
4	6.4	6.1	6.4	7.2	6.3	6.3	6.9	6.6	6.7	7.0
5	6.8	7.3	7.1	7.4	7.1	7.3	7.8	7.3	7.5	7.4
6	8.3	8.6	9.2	8.7	8.5	10.5	8.8	7.8	8.1	8.3
7	10.4	10.9	10.1	10.4	11.2	10.3	10.7	10.1	9.9	9.9
8	12.2	12.6	12.0	12.2	12.0	11.7	12.3	11.5	11.4	11.4
9	11.7	12.0	11.4	11.8	11.3	10.6	11.4	11.2	11.3	11.0
10	10.6	10.8	10.1	9.7	10.1	9.4	9.7	10.8	10.8	10.0
11	8.2	8.2	8.6	8.1	8.2	7.9	7.8	8.6	8.9	8.6
12	6.5	5.6	7.2	6.4	6.6	6.3	5.6	6.5	7.0	6.5
Sum	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Sum summer (months 7-10)	44.9	46.3	43.6	44.1	44.6	42.1	44.0	43.6	43.4	42.4
Sum rest of the year	55.1	53.7	56.4	55.9	55.4	57.9	56.0	56.4	56.6	57.6



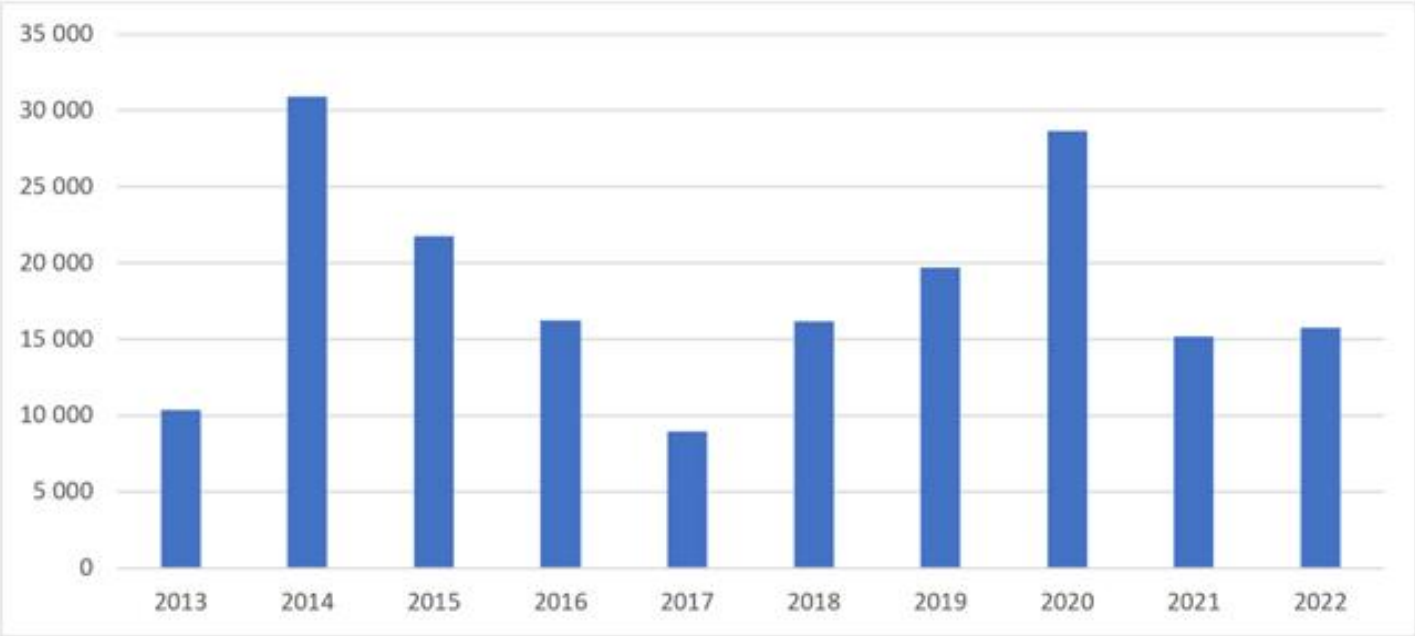
Supplementary Fig. S4. Distance sailed by ship type and year for High-Arctic LMEs, excluding the Barents Sea.



Supplementary Fig. S5. Share of annual total distance sailed by ship size class (1-7) and year, for all High-Arctic LMEs, including the Barents Sea.



Supplementary Fig. S6. Distance sailed by month and year in all the High-Arctic LMEs, including the Barents Sea. This corresponds to Fig. 5, which presents data without the Barents Sea.



Supplementary Fig. S7. Distance sailed by year in the Central Arctic Ocean LME (nm). This table is relevant for the section "The Central Arctic Ocean."