

Briefing 1

Heavy Fuel Oil use in the IMO Polar Code Arctic

Summarized by Flag State, 2015

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## Introduction

The use of heavy fuel oil (HFO) as a marine fuel poses serious environmental and economic risks, especially in ecologically sensitive areas like the Arctic. Using HFO is risky not only because of potential fuel oil spills, but also because burning it produces harmful air and climate pollutants, including black carbon (BC). As ship traffic increases in the Arctic, the risk to the Arctic environment and its peoples will also increase.

The International Council on Clean Transportation (ICCT) has been investigating the use of HFO in the Arctic and the BC emissions that result from it. In 2017, the ICCT published a report titled *Prevalence of Heavy Fuel Oil and Black Carbon in Arctic Shipping, 2015 to 2025*<sup>1</sup> which showed that while less than half of the number of ships in Arctic waters, as defined in the IMO Polar Code, operated on HFO, it represented 76% of the quantity of fuel onboard Arctic ships, since larger ships (with larger fuel tanks) tend to use HFO. The Clean Arctic Alliance, a coalition of environmental non-profit organizations, has used this and other research findings to advocate for an end to the use of HFO in the Arctic. In light of recent advocacy efforts, and as proposed by several IMO Member States, the IMO has agreed to consider ways to reduce the risks of HFO in the Arctic, with the work commencing in 2018.

There are eight Arctic states; however, ships that operate in the Arctic fly many flags. This briefing paper takes a closer look at the use and carriage (as fuel) of HFO by ships operating in the Arctic, summarized by flag state. We focus on ships operating in Arctic waters as defined in the IMO's Polar Code, which we refer to as the "IMO Arctic" (Figure 1).

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<sup>1</sup> Comer, B., Olmer, N., Mao, X., Roy, B., and Rutherford, D. (2017). *Prevalence of heavy fuel oil and black carbon in Arctic shipping, 2015 to 2025*. The International Council on Clean Transportation. Available at: <http://www.theicct.org/2015-heavy-fuel-oil-use-and-black-carbon-emissions-from-ships-in-arctic-projections-2020-2025>



Figure 1. The Arctic as defined in the Polar Code (the "IMO Arctic").

## Methodology

To analyze the risks of using HFO as a marine fuel in Arctic waters we consider the metrics in Table 1 and summarize the results by flag state.

Table 1. Metrics

Metric	Unit	Description <sup>2</sup>
HFO used	tonnes	Quantity of HFO a ship burned
HFO carried	tonnes	Quantity of HFO a ship had in its bunker fuel tanks
Distance-weighted HFO carried	tonne-nautical miles	Product of HFO carriage and distance the ship sailed
BC emitted	tonnes	Quantity of BC a ship emitted

<sup>2</sup> Estimated according to the methodology in the report referenced in footnote #1.

## Results

In 2015 in the IMO Arctic, 2,086 ships operated for 2.6 million hours, traveling 10.3 million nautical miles, with 1.1 million tonnes of fuel onboard, collectively, at any given time. These ships consumed 436 thousand tonnes of fuel and emitted 193 tonnes of BC. As shown in Figure 2, 889 of the 2,089 ships, or 42%, operated on HFO in the IMO Arctic in 2015. HFO represented 57% of fuel use by weight, 76% of fuel carried by weight, and 56% of distance-weighted fuel carried. In total, 68% of the 193 tonnes of BC these ships emitted resulted from burning HFO.

The appendix contains summary statistics related to HFO use and carriage as fuel by flag state.

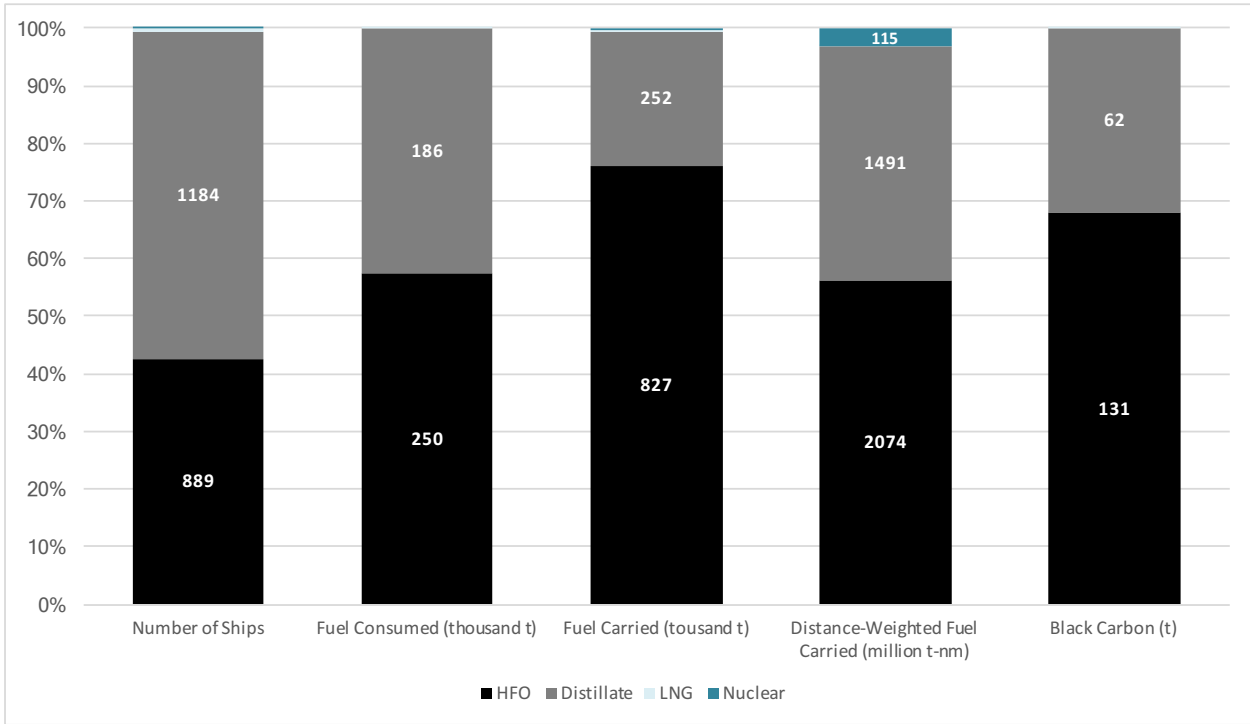


Figure 2. Fuel used, fuel carried, and black carbon emitted in the IMO Arctic, 2015

### HFO use and BC emissions

Ships flew 65 flags in the IMO Arctic in 2015. However, ships registered in Russia consumed the most HFO by far in the IMO Arctic in 2015 (Figure 3), distantly followed by Canada and Denmark (DIS).<sup>3</sup> Russian-flagged ships consumed over 140 thousand tonnes of HFO in the IMO Arctic in 2015, emitting approximately 74 tonnes of BC, 9-times more BC than Canada, whose HFO-fueled fleet emitted approximately 8 tonnes of BC (Figure 4). As such, HFO-fueled Russian-

<sup>3</sup> DIS is the Danish International Register of Shipping, which includes merchant ships (excluding fishing vessels) above 20 gross tonnes and includes Danish ships as well as foreign ships, in some cases (e.g., when a foreign company is controlled by a Danish shipping company). More information can be found here: <https://www.dma.dk/SynRegistrering/SkibsregistreringAfgifter/DIS/Sider/default.aspx>

flagged ships accounted for 56% of HFO consumption and 38% of BC emissions from all ships in the IMO Arctic in 2015. This is unsurprising when one considers that Russian-flagged ships represented 332 of 889, or 37%, of HFO-fueled ships operating in the IMO Arctic in 2015. However, HFO-fueled ships registered to non-Arctic countries account for a substantial amount of HFO use and BC emissions, representing 28% of HFO use and 19% of BC emissions from all ships in the IMO Arctic.

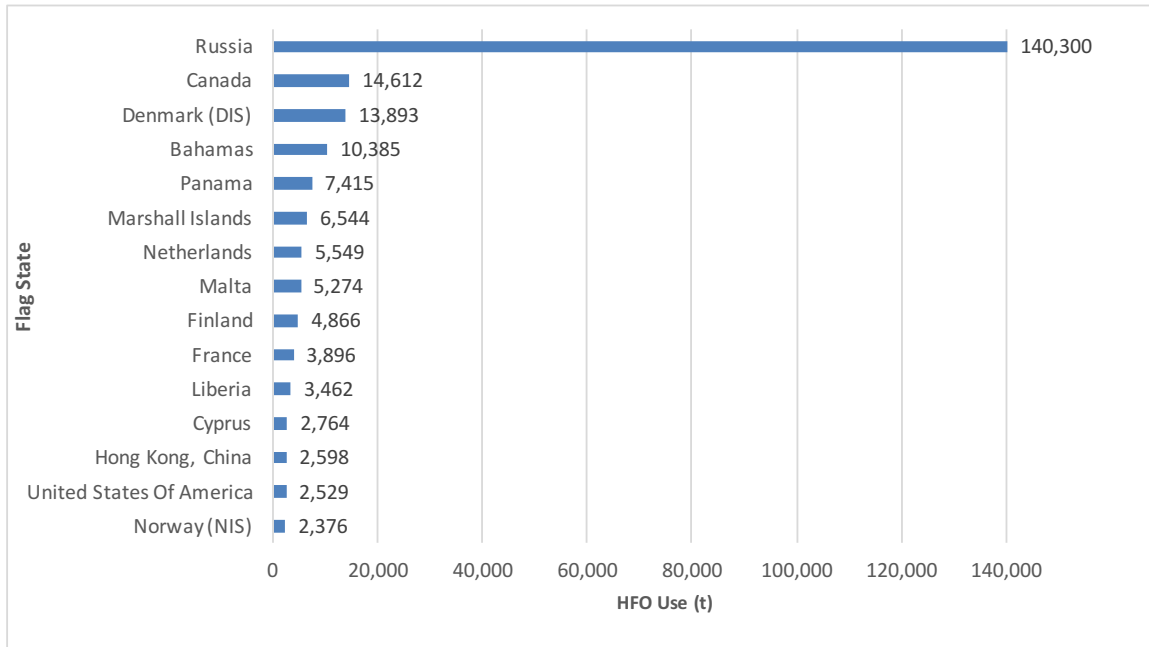


Figure 3. HFO use (t) by flag state (top 15) in the IMO Arctic, 2015

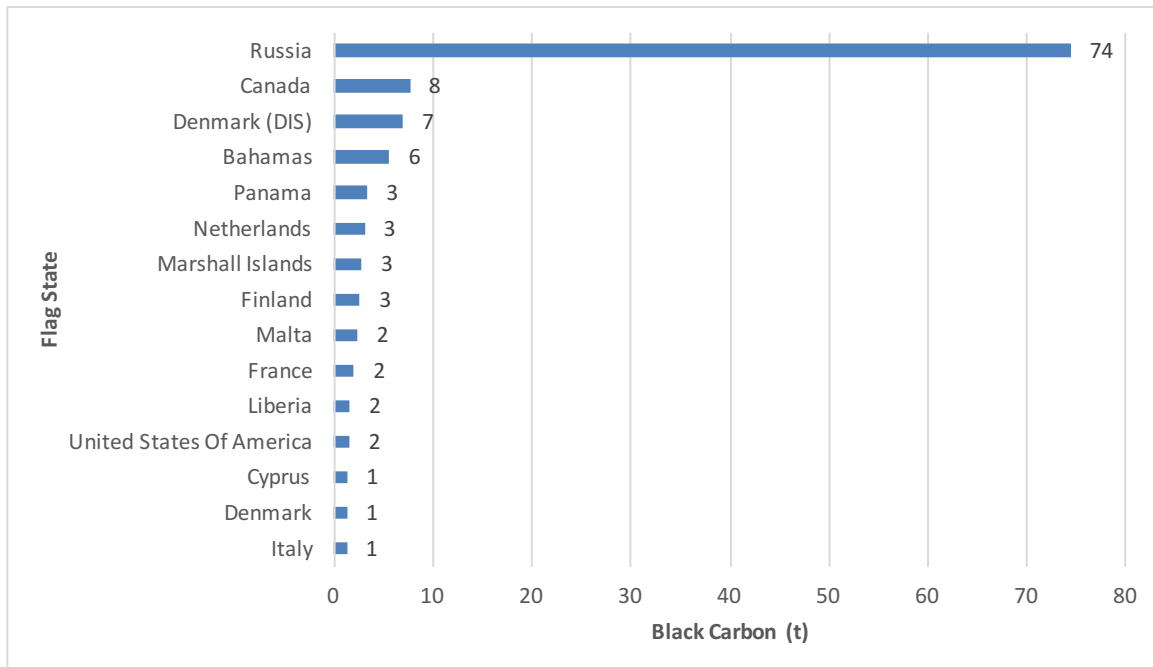


Figure 4. Black carbon emissions (t) by HFO-fueled ships by flag state (top 15) in the IMO Arctic, 2015.

## HFO Carriage as Fuel

Ships registered to Russia carried the most HFO onboard as fuel. Russian-flagged ships carried over 168 thousand tonnes of HFO as fuel, equivalent to 20% of HFO onboard in the IMO Arctic in 2015. However, prominent flag states with large cargo ships (with large fuel tanks) in their registries, including Panama, Marshall Islands, Liberia, and Singapore round out the top 5 (Figure 5). Only three Arctic states – Russia, Canada, and Denmark (DIS) – are included in the top 15 flag states in terms of HFO fuel carriage. In fact, non-Arctic flagged ships represent 74% of HFO carriage as fuel.

When each ship's fuel carriage is multiplied by the distance it sailed, Russian-flagged ships dominate (Figure 6), representing 10-times as much as the next closest flag state, Canada, and 59% of total distance-weighted HFO carriage. We would expect Russian-flagged ships to account for the most HFO carriage and distance-weighted carriage given that Russia has 332 HFO-fueled ships, compared to only 26 registered to Canada. Notice that ships flagged to Arctic countries make up the top three in terms of distance-weighted HFO carriage, followed by prominent flag states that tend to register larger commercial ships (Panama, Marshall Islands, Bahamas, etc.). Ships registered to non-Arctic countries represent 27% of distance-weighted HFO fuel carriage.

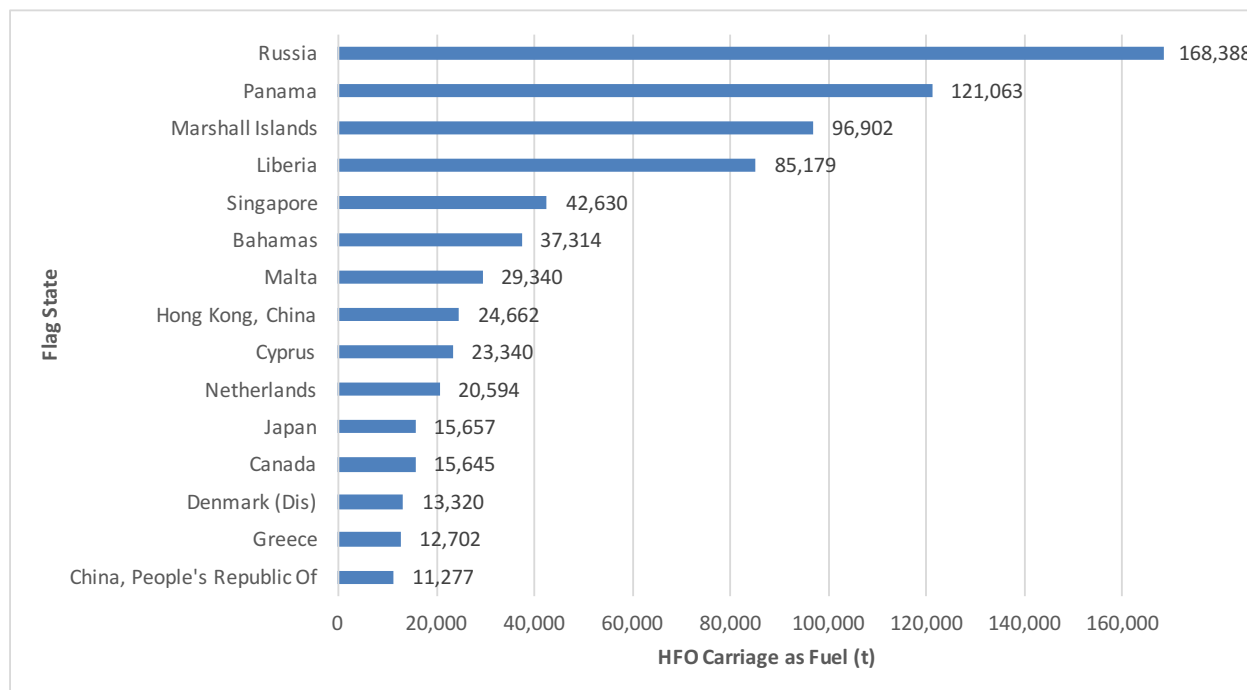


Figure 5. HFO fuel onboard at any given time by flag state (top 15) in the IMO Arctic, 2015

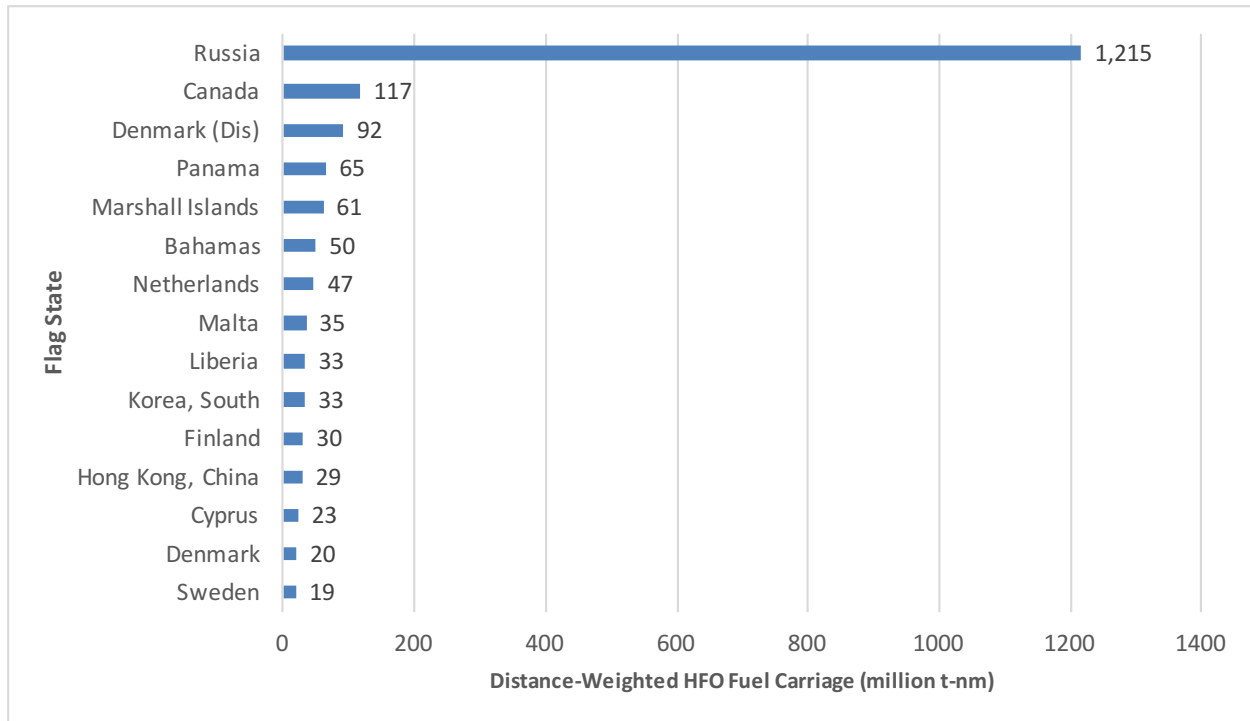


Figure 6. Distance-weighted HFO fuel carriage by flag state (top 15) in the IMO Arctic, 2015

## Conclusions

In 2015 in the IMO Arctic, 889 of 2,086, or 42%, of ships operated on HFO. Moreover, HFO represented 57% of fuel use, 76% of fuel carried, and 56% of distance-weighted fuel carried. Additionally, HFO-fueled ships emitted 131 tonnes of BC in the IMO Arctic in 2015, or 68% of BC emitted from all ships.

Russia had 332 HFO-fueled ships flying its flag in the IMO Arctic in 2015, by far the most of any flag state. As such, ships registered in Russia used the most HFO, emitted the most BC, carried the most HFO as fuel, and led in distance-weighted HFO fuel carriage as well. Indeed, HFO-fueled Russian-flagged fishing vessels accounted for 56% of HFO use, 38% of BC emissions, 20% of HFO carriage as fuel, and 59% of distance-weighted HFO fuel carriage.

On an individual flag state basis, Russia dominates HFO-fueled shipping activity in the IMO Arctic. However, non-Arctic flagged ships account for a substantial amount of HFO use and carriage and BC emissions. Indeed, HFO-fueled ships registered to non-Arctic countries represent 28% of HFO use, 74% of HFO carriage as fuel, 27% of distance-weighted HFO carriage as fuel, and 19% of BC emissions from all ships in the Arctic. Thus, actions from Russia to phase out the use of HFO in all or a portion of its fleet could have a dramatic impact on reducing the risks of HFO from ships in IMO Arctic. However, there are large ships registered to non-Arctic countries that use and carry a considerable amount of HFO and emit BC that pose a threat to the Arctic. Therefore, it seems that a region-wide regulation that applies to the entire Arctic, regardless of flag, would offer the best protection against the risks of HFO.



## Appendix

### Summary Statistics for HFO-fueled Ships Operating in the IMO Arctic in 2015 by Flag State

Table A-1: Summary statistics for HFO-fueled ships operating in the IMO Arctic in 2015, by flag state (across 3 pp.)

Flag State	Number of Ships	Operating Hours	Distance Traveled (nm)	Fuel Consumed (t)	Fuel Carried (t)	Distance-Weighted Fuel Carried (million t-nm)*	Black Carbon (t)
Russia	332	518,551	2,147,068	140,300	168,388	1,215	74
Canada	26	40,479	186,319	14,612	15,645	117	8
Denmark (Dis)	12	30,455	201,142	13,893	13,320	92	7
Panama	72	12,102	50,398	7,415	121,063	65	3
Marshall Islands	65	10,527	53,657	6,544	96,902	61	3
Bahamas	36	14,233	107,558	10,385	37,314	50	6
Netherlands	27	8,234	59,985	5,549	20,594	47	3
Malta	25	7,286	47,248	5,274	29,340	35	2
Liberia	44	6,194	38,730	3,462	85,179	33	2
Korea, South	10	17,761	81,324	1,708	4,494	33	1
Finland	6	6,277	25,946	4,866	4,737	30	3
Hong Kong, China	19	4,356	22,702	2,598	24,662	29	1
Cyprus	23	7,351	37,770	2,764	23,340	23	1
Denmark	4	28,206	74,866	2,253	968	20	1
Sweden	3	1,818	10,620	794	3,420	19	1
Gibraltar	5	2,128	12,295	354	5,828	17	<1
Curacao	2	908	7,866	1,042	4,226	17	<1
China, People's Republic Of	8	4,505	20,831	486	11,277	15	<1
Singapore	18	3,075	12,323	1,102	42,630	14	<1

Flag State	Number of Ships	Operating Hours	Distance Traveled (nm)	Fuel Consumed (t)	Fuel Carried (t)	Distance-Weighted Fuel Carried (million t-nm)*	Black Carbon (t)
United States Of America	14	8,698	24,617	2,529	9,907	13	2
Faeroe Islands	6	9,986	44,293	897	1,231	12	1
Italy	7	2,230	13,563	2,266	8,365	12	1
Spain	3	11,423	44,018	769	900	10	1
Belgium	1	1,992	10,665	1,004	960	10	1
St Kitts & Nevis	7	7,531	29,441	1,477	3,693	8	1
Latvia	4	15,752	67,193	1,139	477	8	1
Norway (Nis)	7	5,322	19,665	2,376	7,043	8	1
Bermuda	4	459	5,042	1,558	9,910	7	1
France	3	2,872	24,082	3,896	907	7	2
Norway	10	8,707	25,774	535	2,382	6	<1
Antigua & Barbuda	9	1,088	9,817	689	5,418	6	<1
Cayman Islands	4	1,702	2,437	702	5,779	5	<1
Croatia	1	530	4,030	573	1,018	4	<1
Sierra Leone	5	5,294	17,994	955	1,217	4	<1
Greece	6	574	2,841	279	12,702	4	<1
Luxembourg	1	2,179	10,956	465	311	3	<1
Lithuania	1	1,914	4,806	252	519	2	<1
Portugal (Mar)	3	643	2,798	357	2,481	2	<1
Philippines	5	379	1,477	196	2,705	2	<1
France (Fis)	1	2,043	1,944	345	1,007	2	<1
Japan	15	143	1,509	158	15,657	2	<1
Faeroes (Fas)	4	8,345	15,693	466	494	1	<1
Kiribati	1	651	1,635	135	455	1	<1
United Kingdom	4	316	1,386	81	3,104	1	<1
Seychelles	1	2	518	3	1,118	1	<1

Flag State	Number of Ships	Operating Hours	Distance Traveled (nm)	Fuel Consumed (t)	Fuel Carried (t)	Distance-Weighted Fuel Carried (million t-nm)*	Black Carbon (t)
Iceland	2	5,489	2,031	259	327	<1	<1
Libya	1	7	82	8	920	<1	<1
Cook Islands	1	3	1,385	<1	35	<1	<1
Isle of Man	2	2	28	3	2,940	<1	<1
Turkey	2	2	32	1	1,149	<1	<1
Vanuatu	1	1	11	1	1,159	<1	<1
India	2	2	12	<1	2,082	<1	<1
Vietnam	2	2	17	1	747	<1	<1
Poland	1	1	10	<1	485	<1	<1
Irish Republic	1	1	9	<1	365	<1	<1
Moldova	1	1	30	<1	94	<1	<1
Malaysia	1	1	1	<1	1,385	<1	<1
Nigeria	1	2	5	<1	140	<1	<1
Azerbaijan	1	1	3	<1	52	<1	<1
Switzerland	1	1	<1	<1	970	<1	<1
Chinese Taipei	1	1	1	<1	151	<1	<1
Togo	1	1	<1	<1	305	<1	<1
Kazakhstan	1	1	<1	<1	6	<1	<1
St Vincent & The Grenadines	1	1	<1	<1	815	<1	<1
Belize	1	1	<1	<1	131	<1	<1
<b>Total</b>	<b>2,086</b>	<b>2,582,408</b>	<b>10,322,457</b>	<b>436,427</b>	<b>1,085,438</b>	<b>3,682</b>	<b>193</b>

\*Ordered by distance-weighted fuel carried