

Briefing 4

Heavy Fuel Oil use by Cruise Ships in the  
IMO Polar Code Arctic, 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.

Many types of ships use HFO, including cruise ships. Cruise ships bring tourists to the Arctic who are keen to get a glimpse of a unique part of the world. While Arctic cruises offer an opportunity for people to learn about this ecosystem and the peoples who call the Arctic home, these journeys pose a threat to the Arctic environment through air and climate pollution emissions, including BC, and through the risks of HFO spills.

This paper takes a closer look at the use of HFO by cruise ships 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

IHS, a company that, among other things, maintains a list of commercial ships and their characteristics, categorizes ships into various categories called "ship classes." One ship class is called "cruise." There were 63 cruise ships operating in the IMO Arctic in 2015. However, some cruise ships operating in the Arctic are not the stereotypical luxury cruise ships that you might book for a holiday. For instance, some Arctic "cruise" ships are icebreakers that mainly carry out exploration and research operations, but occasionally offer tourism cruises to the North Pole and other destinations.

Of the 63 cruise ships that operated in the IMO Arctic in 2015, 40 operated on HFO, 22 operated on distillate, and one was nuclear powered.<sup>2</sup> From a climate perspective, the risks of using HFO as a fuel in the Arctic are related to the amount of HFO consumed, since burning HFO emits climate warming pollutants, including BC. From a spill risk perspective, the risks of using HFO in the Arctic are related to the amount of HFO carried onboard ships in their fuel tanks and the distance HFO-fueled ships sail in Arctic waters.

<sup>2</sup> The nuclear-powered ship is the 100-passenger Russian icebreaker *Yamal*, IMO number 9077549.

To analyze the risks of using HFO as a marine fuel in the Arctic we consider the metrics in Table 1.

Table 1. Metrics

Metric	Unit	Description <sup>3</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

## Results

As shown in Figure 2, 40 of the 63 cruise ships, or 63%, operated on HFO in the IMO Arctic in 2015. The majority of the fuel used and carried by cruise ships was HFO, representing 71% of fuel use, 85% of fuel carried, and 64% of distance-weighted fuel carried. If we ignore the nuclear-powered vessel, HFO equals 74% of distance-weighted fuel carriage for oil-based fuels.

The appendix contains summary statistics related to HFO use and carriage as fuel by flag state and group beneficial owner (GBO).

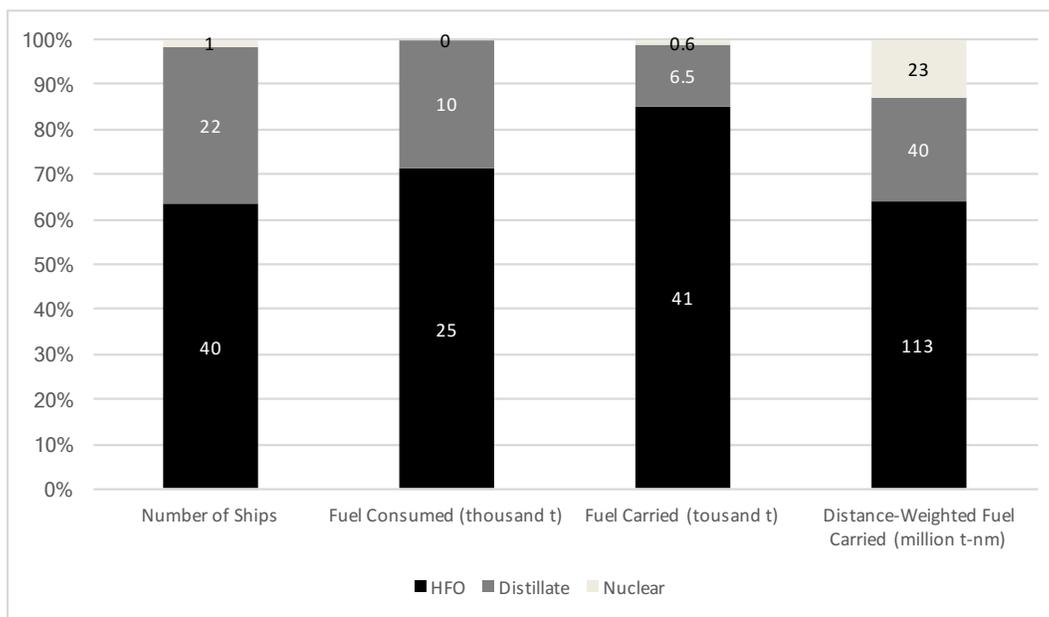


Figure 2. The fuels used and carried by cruise ships in the IMO Arctic, 2015

<sup>3</sup> Estimated according to the methodology in the report referenced in footnote #1.

## HFO use and BC

By flag state: Cruise ships flew nine different flags in 2015. Ships registered in the Bahamas consumed the most HFO in the IMO Arctic in 2015 (Figure 3), followed by France and Russia. Bahama-flagged cruise ships consumed nearly 10 thousand tonnes of HFO, emitting over 5 tonnes of BC, the most of any flag state (see Appendix). This is not surprising given that Bahama-flagged cruise ships represented 18 of the 40 HFO-fueled cruise ships operating in the IMO Arctic in 2015.

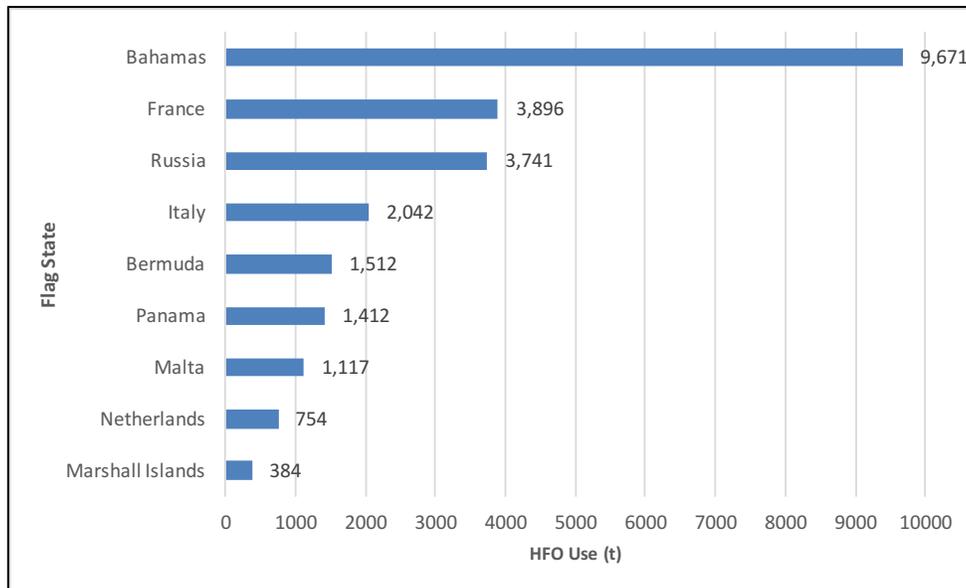


Figure 3. HFO use (t) by cruise ships in the IMO Arctic by flag state, 2015

By Group Beneficial Owner (GBO): Rosmorport, which is run by the Russian government, had one ship operating on HFO in the IMO Arctic in 2015, the *Kapitan Dranitsyn*. This ship consumed the most HFO in 2015 (~3,500 t) and emitted the most BC (1.9 t), more even than the 8 ships owned by Carnival Corporation<sup>4</sup> combined (~2,800 t HFO consumed; 1.6 t BC emitted, see Appendix). The *Kapitan Dranitsyn* is not a typical “cruise ship” (Figure 5). It is primarily a Russian ice breaker and research vessel that also occasionally takes tourists (up to 102 passengers) to various Arctic destinations, including the North Pole. Sunstone Ships, which ranks second in HFO use (~2,840 t) operates more typical cruise ships, the 380-passenger *Ocean Endeavour* and the 120-passenger *Sea Spirit*. However, these ships are still quite small when compared to the eight Carnival Corporation ships, five of which hold over 2000 passengers, including the 2500-passenger AIDAluna (Figure 6). Of the 8 Carnival ships, the AIDAluna operated the most in the IMO Arctic, traveling 3,400 nm, and consumed the most HFO (1,365 t).

<sup>4</sup> AIDAluna (9334868), Costa Neoromantica (8821046), Prinsendam (8700280), Veendam (9102992), Eurodam (9378448), AIDamar (9490052), AIDAdiva (9334856), Coral Princess (9229659).

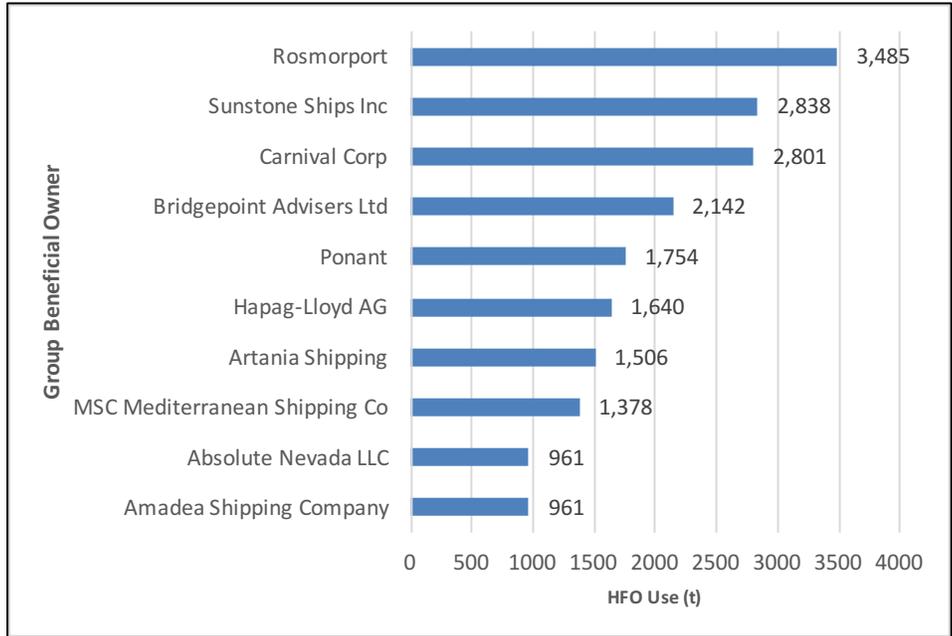


Figure 4. HFO use (t) by cruise ships in the IMO Arctic by Group Beneficial Owner (Top 10 by HFO use), 2015



Image Source: Victory Cruises<sup>5</sup>

Figure 5. The Kapitan Dranitsyn breaking ice in the Arctic

<sup>5</sup> <http://www.victory-cruises.com/graphics4/pKapitanDranitsyn.jpg>



Image source: Cruise Industry News<sup>6</sup>

Figure 6. Carnival Corporation's AIDAluna in Longyearbyen, Svalbard on 21 July 2017.

### ***HFO Carriage as Fuel***

**By flag state:** Ships registered to the Bahamas carried the most HFO onboard as fuel, carrying nearly three-times as much as the next closest flag state, Italy (Figure 7). However, when we multiply each ship's fuel carriage by the distance it sailed, we find that ships registered to Russia (2 ships) and the Bahamas (18 ships) accounted for the most distance-weighted HFO carriage as fuel, much more than the other flag states (Figure 8). Even though the Bahamas has many times more HFO-fueled cruise ships operating the IMO Arctic than Russia, the Bahama-flagged ships that traveled the greatest distances in the IMO Arctic in 2015 also tended to be the smaller ships that have smaller fuel tanks; whereas the Russian-flagged *Kapitan Dranitsyn* alone accounted for distance-weighted HFO fuel carriage of approximately 37 million t-nm because she has a large fuel tank (~2700 t capacity) and sailed many miles in 2015 (~13,700 nm).

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<sup>6</sup> [https://www.cruiseindustrynews.com/images/stories/wire/2017/july/IMG\\_0849.JPG](https://www.cruiseindustrynews.com/images/stories/wire/2017/july/IMG_0849.JPG)

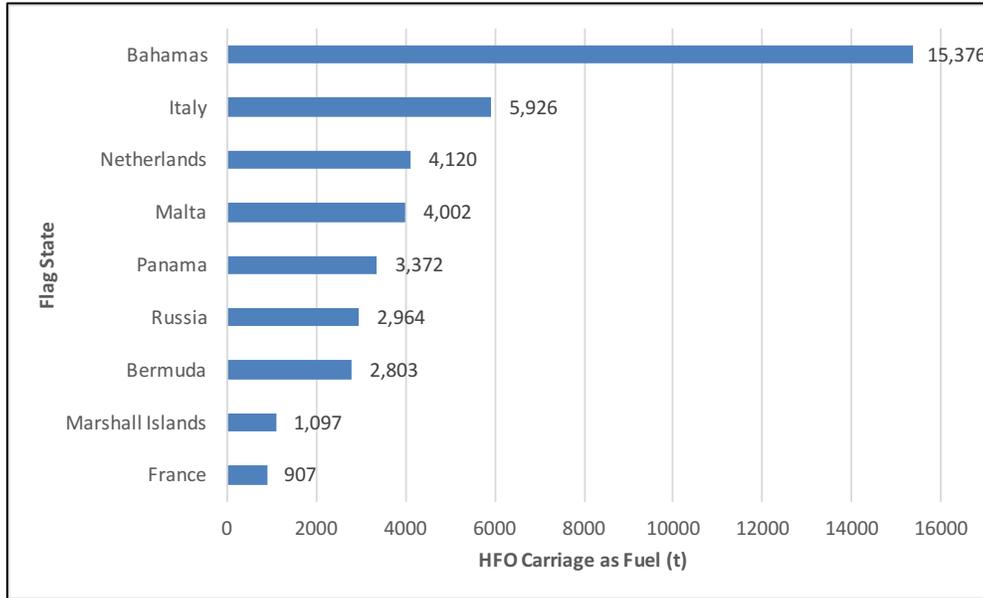


Figure 7. HFO fuel onboard at any given time by cruise ships in the IMO Arctic by flag state, 2015

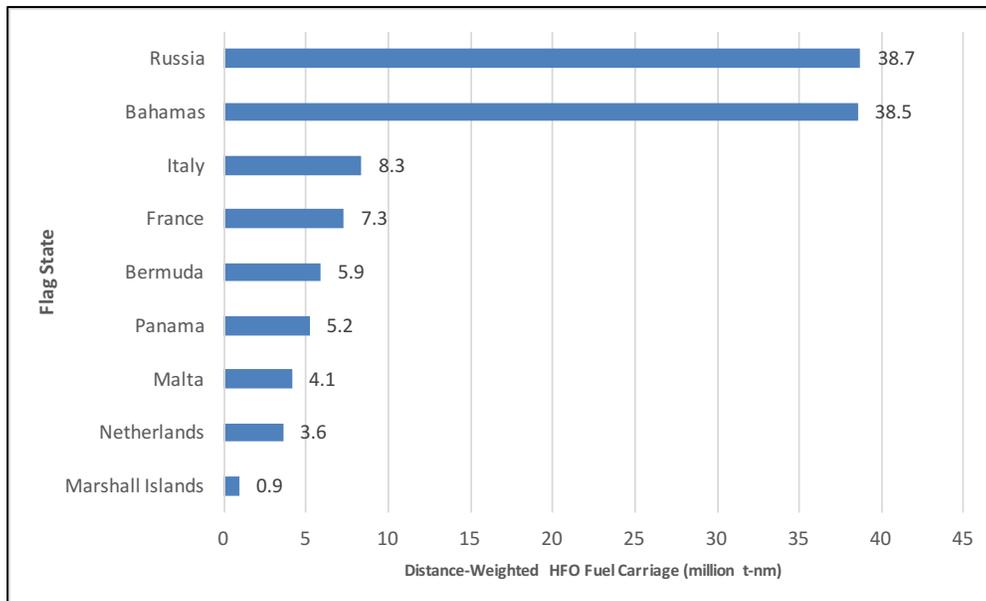


Figure 8. Distance-weighted HFO fuel carriage by cruise ships in the IMO Arctic by flag state, 2015

By GBO: Carnival Corporation, with its 8 HFO-fueled ships, carried the most HFO onboard cruise ships in the IMO Arctic in 2015, nearly three times as much as the next company, Norwegian Cruise Line Holdings, which has 4 ships operating in the IMO Arctic (Figure 9). Rosmorport, especially its ship the *Kapitan Dranitsyn*, is responsible for the most distance-weighted HFO carriage as fuel (Figure 10), three times more than Carnival Corp. The *Kapitan Dranitsyn* actively operates in the IMO Arctic and has a large fuel tank, both of which contribute to its dominance in distance-weighted HFO fuel carriage.

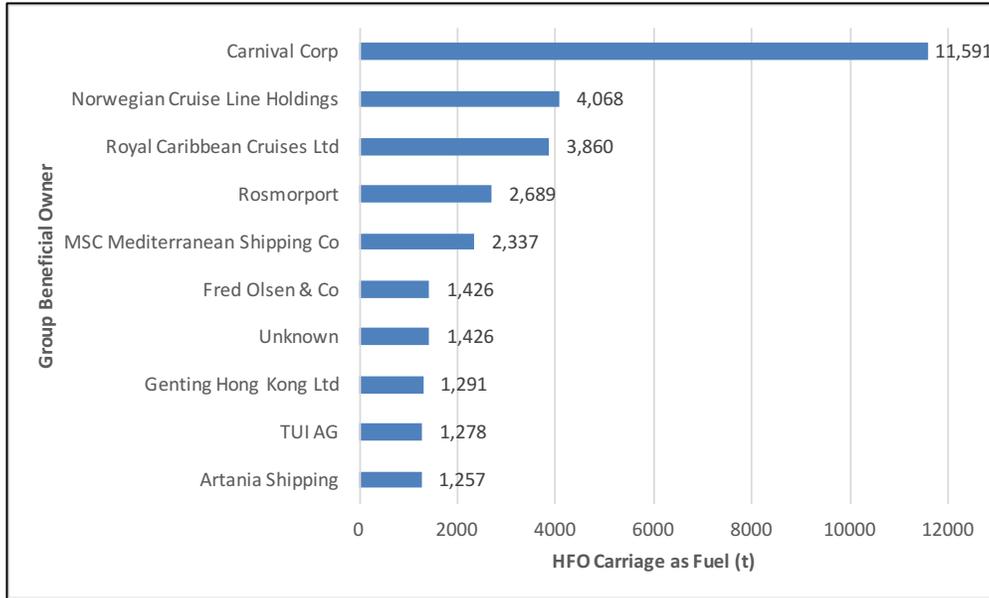


Figure 9. HFO fuel onboard at any given time by cruise ships in the IMO Arctic by group beneficial owner, 2015

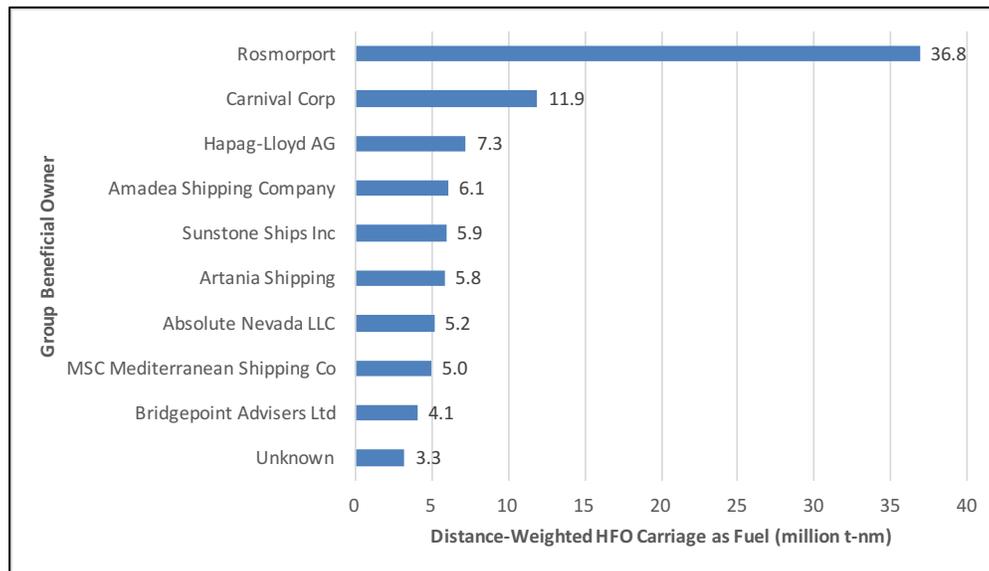


Figure 10. Distance-weighted HFO fuel carriage by cruise ships in the IMO Arctic by group beneficial owner, 2015

## Conclusions

Forty (40) of 62 cruise ships operated on HFO in the IMO Arctic in 2015. For cruise ships, HFO represented 71% of fuel use, 85% of fuel carried, and 64% of distance-weighted fuel carried (or 74% if nuclear fuel is ignored).

Regarding flag states, the Bahamas had 18 HFO-fueled cruise ships flying its flag in the IMO Arctic in 2015, by far the most of any flag state. As such, ships registered in the Bahamas used the most HFO, emitted the most BC, and carried the most HFO. Moreover, with the exception of two Russian-flagged ships, all of the HFO-fueled cruise ships operating in the Arctic are registered to non-Arctic states. We also find that Russia and the Bahamas account for the most distance-weighted HFO fuel carriage, each representing more than 4-times as much as the next flag state, Italy.

Regarding group beneficial owners, Carnival Corporation owns 8 of the 40 HFO-fueled cruise ships operating in the IMO Arctic in 2015, more than any other company. These 8 ships consumed a total of ~2,800 tonnes of HFO (ranked 3rd), emitted 1.6 tonnes of BC (ranked 2nd), had a total of ~11,600 tonnes of HFO in their fuel tanks at any given time (ranked 1st), and had a distance-weighted fuel carriage of 12 million t-nm (ranked 2nd). However, the Russian-owned Rosmorport, with its ship the *Kapitan Dranitsyn*, is responsible for the most HFO use, BC emitted, and distance-weighted HFO fuel carriage in the IMO Arctic in 2015.

Given these results, it seems that any actions to reduce the risks of HFO from cruise ships will need to apply to ships registered not only to Arctic states, but also to non-Arctic states. Additionally, given that much of the HFO use and carriage as fuel is concentrated in a handful of GBOs, including Rosmorport, Sunstone Ships Inc., Carnival Corporation, Hapag-Lloyd AG, Norwegian Cruise Line Holdings, these companies could be encouraged to voluntarily agree to stop using HFO in the Arctic.

## Appendix

### Summary Statistics for Cruise Ships Operating in the IMO Arctic in 2015 by Flag State and Group Beneficial Owner

Table A-1: Summary statistics for HFO-fueled cruise ships operating in the IMO Arctic in 2015, by flag state

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)	Passenger Capacity (persons)
Russia	2	3,263	20,499	3,741	2,964	38.7	2.0	326
Bahamas	18	11,634	96,394	9,671	15,376	38.5	5.2	16,117
Italy	4	478	5,700	2,042	5,926	8.3	1.1	8,956
France	3	2,872	24,082	3,896	907	7.3	2.0	792
Bermuda	2	406	4,665	1,512	2,803	5.9	0.8	3,781
Panama	2	195	2,340	1,412	3,372	5.2	0.8	5,359
Malta	4	416	5,257	1,117	4,002	4.1	0.6	6,463
Netherlands	3	279	2,672	754	4,120	3.6	0.4	4,470
Marshall Islands	2	140	1,661	384	1,097	0.9	0.2	1,526
<b>Total</b>	<b>40</b>	<b>19,683</b>	<b>163,271</b>	<b>24,528</b>	<b>40,566</b>	<b>112.5</b>	<b>13.3</b>	<b>47,790</b>

\*Ordered by distance-weighted fuel carried

Table A-2: Summary statistics for HFO-fueled cruise ships operating in the IMO Arctic in 2015, by group beneficial owner

Group Beneficial Owner	Number of Ships	Operating Hours	Distance Traveled (nm)	Fuel Consumed (t)	Fuel Carried (t)	Distance-Weighted Fuel Carried (million t-nm)*	Black Carbon (t)	Passenger Capacity (persons)
Rosmorport	1	2,603	13,704	3,485	2,689	36.8	1.9	102
Carnival Corp	8	758	8,385	2,801	11,591	11.9	1.6	16,007
Hapag-Lloyd AG	2	2,075	18,524	1,640	945	7.3	0.9	592
Amadea Shipping Company	1	415	5,004	961	1,216	6.1	0.5	604
Sunstone Ships Inc	2	3,744	25,965	2,838	570	5.9	1.5	500
Artania Shipping	1	405	4,652	1,506	1,257	5.8	0.8	1,200
Absolute Nevada LLC	1	708	5,722	961	904	5.2	0.5	613
MSC Mediterranean Shipping Co	1	179	2,128	1,378	2,337	5.0	0.8	3,959
Bridgepoint Advisers Ltd	2	1,567	13,503	2,142	604	4.1	1.1	528
Unknown	1	178	2,290	495	1,426	3.3	0.3	1,000
Ponant	1	1,305	10,579	1,754	302	3.2	0.9	264
Lindblad Expeditions LLC	1	2,024	18,344	847	141	2.6	0.5	154
Fred Olsen & Co	1	211	1,704	348	1,426	2.4	0.2	900
TUI AG	1	135	1,870	718	1,278	2.4	0.4	2,681
FleetPro Ocean Inc	1	1,823	14,013	615	166	2.3	0.3	120
Norwegian Cruise Line Holdings	4	272	2,994	640	4,068	2.2	0.3	5,484
Murmansk Shipping Co	1	660	6,795	256	275	1.9	0.1	224
Louis PLC	1	172	2,217	317	661	1.5	0.2	912
Global Maritime Corp	1	87	1,096	236	747	0.8	0.1	656
Prestige Cruise Holdings Inc	1	58	739	173	549	0.4	0.1	824
Conti Holding GmbH & Co KG	1	130	1,082	183	365	0.4	0.1	423
Silversea Cruises Ltd	1	41	410	53	655	0.3	0.0	388
FTI Cruises GmbH	1	108	1,155	73	206	0.2	0.0	420
Maritime Holdings Group Inc	1	16	212	34	1,035	0.2	0.0	1,400
Genting Hong Kong Ltd	1	7	149	54	1,291	0.2	0.0	1,010
Royal Caribbean Cruises Ltd	2	2	32	20	3,860	0.1	0.0	6,825
<b>Total</b>	<b>40</b>	<b>19,683</b>	<b>163,271</b>	<b>24,528</b>	<b>40,566</b>	<b>112.5</b>	<b>16.1</b>	<b>47,790</b>

\*Ordered by distance-weighted fuel carried