Southeast Alaska
Vessel Traffic Risk Analysis

Report to Alaska Department of Environmental Conservation
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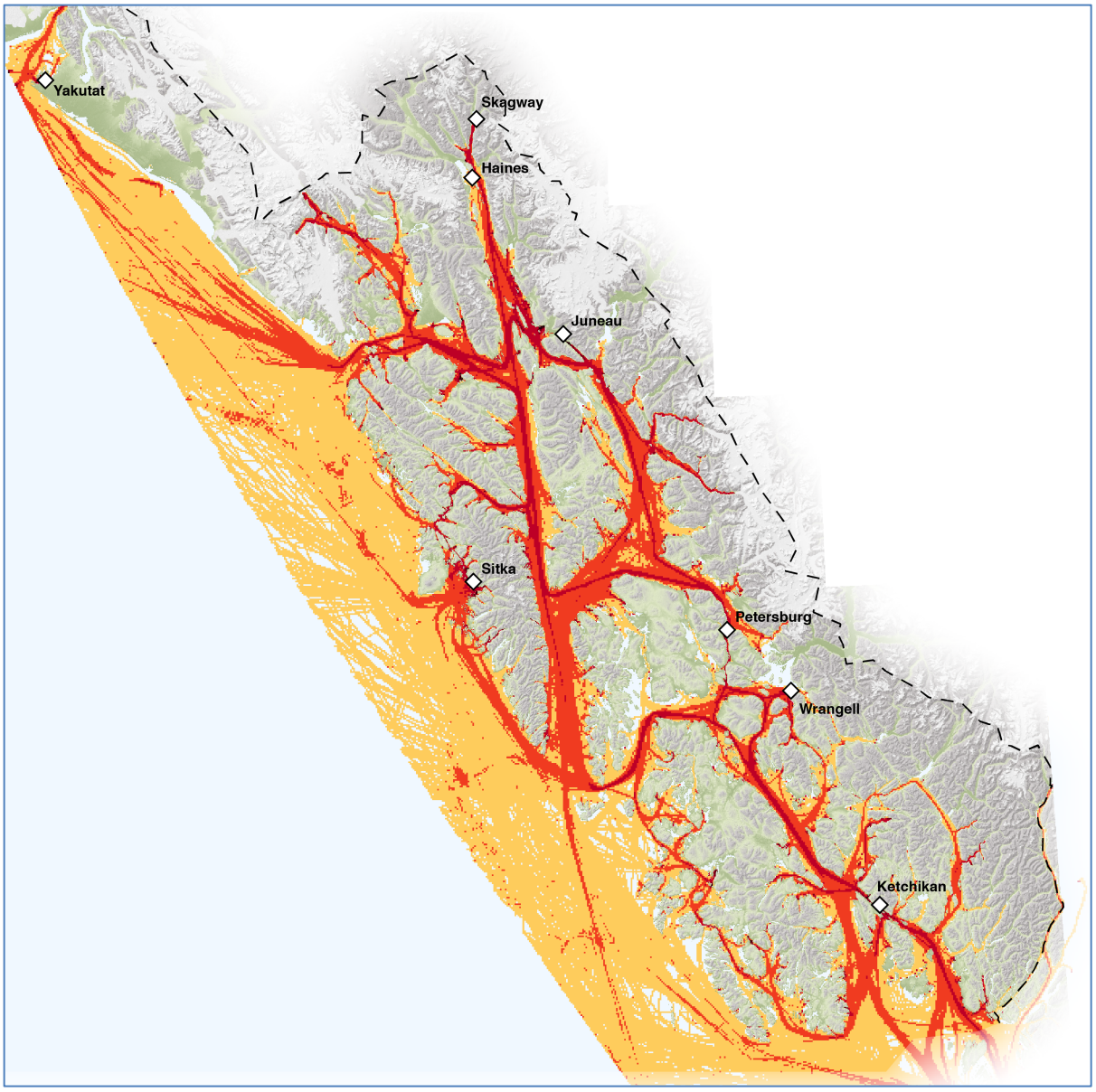

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Acronyms

ADEC	Alaska Department of Environmental Conservation
AIS	Automatic Identification System
EEZ	Exclusive Economic Zone
HFO	Heavy fuel oil
IMO	International Maritime Organization
lat/long	Latitude/longitude
MMSI	Maritime Mobile Service Identity
NM	Nautical mile
SOLAS	Safety of Life at Sea
USCG	United States Coast Guard
VTS	Vessel Traffic System

1 Introduction

Nuka Research and Planning Group, LLC (Nuka Research) developed this report for the Alaska Department of Environmental Conservation (ADEC) to support the ADEC in assessing the potential risk of an oil spill in Southeast Alaska from commercial vessel traffic. This report characterizes the movement of commercial vessels and petroleum within Southeast Alaska during 2018 using Automatic Identification System (AIS) data.

1.1 Purpose

The protected inside waters of Southeast Alaska provide an important transit route for vessels traveling from Washington or more southern ports to ports elsewhere in Alaska. Other traffic serves Southeast Alaska ports as tugs and barges, cargo and passenger ships, ferries, and fishing boats move between the many communities, lodges, mines, and logging camps in the region.

The purpose of this report is to characterize the types of vessels greater than 65 feet operating in Southeast Alaska, their typical routes and behaviors, and the quantity and types of oil they carry. The information in this report is designed to help answer the two questions of interest to ADEC for this project:

1. How much oil is transported through and within Southeast on an annual basis?
2. What areas in Southeast have a higher risk of an oil spill based on navigational risk or vessel activities?

1.2 Scope

The report describes the number and types of commercial vessels transiting Southeast Alaska during the study period (2018) and their oil-carrying capacities whether for their own propulsion or as cargo. Special areas of heighted navigational risk and higher risk activities are also identified.

The study used 2018 AIS data transmitted from commercial vessels and received by satellites and land-based stations to establish vessel movements based on tracks assembled for each vessel. Ship-specific data, such as type, size, age, and oil capacity, were associated with each vessel track. Maps showing the density of vessels and petroleum throughout the study area were produced by vessel type to depict movements through the region. Passage lines[1] were established to gauge movements either through a water body or into a port area. Vessels were counted as they crossed passage lines, and their fuel capacities were tabulated to estimate both vessel and oil movements. Summaries of the characteristics of the fleet were also provided by vessel type and ports of call. More information on the methods used in this study can be found in Section 3.

Figure 1.3-1 shows the study area, which encompassed the marine waters of Southeast Alaska including the inside passages and offshore waters. The ports shown in the figure are the primary ones at which vessels typically call. The extent of State waters is shown as a line extending three miles offshore.

1 A passage line is a geo-spatial tool that generates a record each time a vessel passes across the line.

1.3 Report Organization and Contents

This report provides brief background information in Section 2 and an overview of the methodology in Section 3. Sections 4 and 5 characterize commercial vessels within the project scope and their movements, respectively. Section 6 focuses on potentially higher-risk areas and activities. Section 7 describes petroleum movements, including both vessel fuel and, as appropriate, petroleum cargo. Section 8 includes a discussion of findings. References can be found in Section 9. Appendices provide more detailed breakdowns of vessel characteristics and movements.

Figure 1.3-1 Study Area

2 Background

2.1 Operating Area

Southeast Alaska stretches from Yakutat, Alaska, in the north to Dixon Entrance at the Canadian border in the south. This narrow slice of the North American mainland has an adjacent archipelago that includes eight large islands and hundreds, if not thousands, of smaller ones.

The general ocean coastline extends approximately 450 nautical miles (nm) north to south. Approximately 250 nm of this extent is the Alexander Archipelago, a 30-mile-wide strip of mainland bordered by an 80-mile-wide compact chain of islands between Cape Spencer and Dixon Entrance. This area has tidal shorelines totaling 11,085 nm. The topography of steep inclines and narrow gorges seen on land extends below sea level to form a system of narrow deep-water straits (National Oceanic and Atmospheric Administration, 2019). The waterways defined by these islands are the basis of marine vessel operations throughout the region.

North of Cape Spencer to Yakutat the shoreline is relatively unbroken for more than 200 nm except for Lituya and Yakutat Bays. Vessel traffic along this section of coastline is much lighter and unlikely to be congested.

2.2 Overview of Southeast Alaska Vessel Traffic

Commercial vessel traffic in Southeast Alaska is primarily comprised of three general vessel types: 1) tugs and barges, 2) deep draft vessels, including cruise ships and cargo ships, and 3) commercial fishing vessels. In addition, there are a variety of tour boats, ferries, and other commercial vessels which use the area. More information on the vessels included in this study can be found in Section 3.4 Vessel Types.

During 2018, 644 vessels of the types included in this study were observed traveling nearly 2.3 million miles in Southeast Alaska. Of these miles, about 29 percent were traveled by cruise ships, with tugs and fishing vessels being the next most active. More details on the volume of traffic and what that means in terms of petroleum products being carried in Southeast Alaska are described in the remainder of this report.

The geography of Southeast Alaska requires that vessels travel between islands through numerous straits and passages. Commercial traffic tends to use routes that are known to be of sufficient depth and width. For example, most vessels coming north through Dixon Entrance travel through Tongass Narrows and past Ketchikan before venturing to other ports. Other common routes include Cross Sound, Chatham Strait, Clarence Strait, and Stephens Passage. Because of the high volume of vessel traffic and potential congestion, these areas and others are discussed further in Section 6.1 High-Risk Areas.

In addition to common transit routes through Southeast Alaska, there are a number of ports which receive significant traffic. These ports include Ketchikan, Petersburg, Wrangell, Sitka, Juneau, Haines, Skagway, and Yakutat. The ports included in this study are shown in Figure 1.3-1. The fuel capacities of vessels calling at the ports is discussed in Section 7.2 Petroleum Movements at Ports. Ketchikan and Petersburg, in addition to being included in the sections on ports, are also included in Section 7.1 High-Risk Areas because of the high level of vessel traffic in Tongass and Wrangell Narrows.

3 Methods

3.1 Data Sources and Application

Many parameters could be considered when analyzing vessel traffic in a geographic region. The characterization in this study focuses on vessel types and attributes, ports of call, entrances to Southeast Alaska, petroleum movements, and potentially High-Risk areas and activities were of primary importance.

Data used to determine vessel attributes, characterize vessel traffic, and describe petroleum movements came from several sources including AIS data, interviews with tug/barge and fuel terminal operators, tug/barge operator websites, public databases, and data previously gathered by Nuka Research. The sections below describe what data is included and why, and how AIS, vessel movement, and vessel attribute data was collected and analyzed.

Nuka Research applied the following overall approach to compiling and processing vessel traffic data:

1. Process AIS data to remove bad data and reduce total number of points
2. Develop Vessel Attribute Database for vessels identified in AIS data
3. Develop Vessel Track Database from processed AIS data
4. Associate attribute data with track data
5. Develop vessel track and petroleum capacity density plots
6. Develop statistics for tracks that crossed passage lines, called at ports, transited High-Risk areas, or appeared to be engaging in High-Risk activities

3.2 Processing AIS Data

The AIS is an automated tracking system used on ships and by United States Coast Guard (USCG) Vessel Traffic Services (VTS) for identifying and locating vessels by electronically exchanging data with other nearby ships and VTS stations. There are two types of AIS transmitters, A and B. Type A AIS vessels report their position every 2-10 seconds dependent on the vessel's speed and/or course changes (every three minutes or less when at anchor or moored) and the vessel's static and voyage-related information every 6 minutes. Vessels with Class A AIS are also capable of text messaging safety-related information and AIS Application Specific Messages. Type B AIS vessels report every three minutes or less when at anchor or moored, but their position is reported less often and at a lower power. Likewise, they report the vessel's static data every 6 minutes, but not any voyage-related information. They can receive safety-related text and application specific messages but cannot transmit them. (USCG, 2019)

In general, federal regulations (33 CFR 164.46) and International Maritime Organization's (IMO) International Convention for the Safety of Life at Sea (SOLAS) require Type A AIS to be fitted aboard the following vessels: those weighing 1600 gross tons or more, tank ships carrying dangerous or combustible cargoes, self-propelled vessels of 65 feet or more in length engaged in commercial service, most towing vessels, some dredges, and passenger vessels certificated to carry more than 150 passengers. Type B AIS can be used in lieu of Type A for fishing industry vessels, small commercial passenger vessels, and some dredging vessels which meet the above size requirements. The USCG has the authority to require AIS systems on other vessels for mitigation of safety concerns. (USCG, 2019)

At this time, AIS stations are not required on barges, only on most of the tugs towing them. As a result, it is not readily apparent from AIS data what barge is paired with any given tug at any given time.

Nuka Research obtained an AIS dataset from exactEarth that was recorded by satellite and ground stations and included ship signals received within the study area during 2018. When an AIS signal is transmitted from the vessel to a receiver, a data point is logged identifying the position of the vessel. Each data point includes the vessel's identity, time, date, location, and limited vessel particulars. When the next signal is received, a track of the vessel's movement (track line) can be developed interpolating location between the data points. The vessel identification is then added to the project's Vessel Attribute Database.

AIS transmissions may occur as frequently as every second. Land-based stations receive signals continuously, but have a limited range and reception can be disrupted by mountains or atmospheric conditions. Satellites can receive signals from anywhere, but only when above the vessel. Thus, not every signal transmitted by a vessel is recorded. In this sampling, the data points for an individual ship maybe separated by up to 45 minutes. When a satellite is overhead, the number of data points collected is greater than necessary to accurately characterize where the vessel traveled. In some cases, AIS position data is sparse because of lack of satellite coverage and in other cases too many positions result in an unnecessarily large amount of data. The initial dataset provided by exactEarth for this project included almost 38 million individual points.

The information derived from AIS data included:

- Track lines by vessel category throughout Southeast Alaska;
- Specific events as vessels crossed a particular AIS passage line; these events were sorted and categorized by vessel type.

The fields provided in the raw AIS data included:

- Base station time stamp
- Call sign
- Vessel name
- Type of ship and cargo
- Maritime Mobile Service Identity (MMSI)[2]
- Draft
- Latitude and Longitude (lat/long)
- Destination
- Navigational status (engine, anchored, sail, fishing)
- Cargo
- Course and speed over ground
- Country or flag state
- IMO number
- Heading

While some of this information is automatically generated by the AIS transponder/receiver (e.g. lat/long, MMSI), other data require manual input by the operator (e.g. destination, cargo, vessel

[2] Maritime Mobile Service Identity (MMSI) is a series of nine digits sent in digital form over a radio frequency channel in order to uniquely identify ship stations, coast stations, coast earth stations, and group calls.

type). Data that require manual input tends to be the least reliable, particularly in determining a vessel's destination.

3.3 Vessel Movement Data

Nuka Research developed a Vessel Track Database from sequential AIS points for each individual vessel within the study area using a custom program. The program removed records that did not have valid vessel identification, time, latitude, or longitude position data. All data transmitted by vessels with mandatory (Class A) AIS transmitters were kept. Data from Class B transmitters were kept only if it could be verified that the vessel was of a type and length within the scope of the study.

Data points were grouped by vessel and ordered chronologically. One or more tracks were then built for each vessel using the following method:

1. The first and last points are always kept.

2. Beginning with the first point chronologically, each succeeding point is compared to the previous point. The successive point is excluded if it is less than three minutes since, or closer than 0.2 nm to, the previous point.

3. Tracks are then constructed from the remaining set of points for each vessel. A new track is started if a successive point is greater than 7 days or 50 nm from the previous point, the designation information provided by the vessel in the AIS signal changes, or the vessel does not move for more than four hours.

4. Tracks are stored in a geo-spatial database and spreadsheet. Each track is identified with a specific vessel based on that vessel's MMSI number and associated with vessel-specific attributes based on the same number.

The code reduces the number of data points associated with each vessel track, while retaining the information necessary to determine where the vessel traveled. The dataset was thus reduced to 6.7 million points.

3.4 Vessel Types

Vessels were categorized into several types and sub-types for the purposes of this study:

- Cargo
  - Cargo Bulk – cargo ships carrying bulk cargo other than petroleum products
  - Cargo Other – a variety of cargo-carrying vessels including landing craft, general cargo, offshore supply vessels, etc.
- Passenger
  - Cruise Ship – commercial vessels carrying passengers that stay overnight on board regardless of size (except ferries)
  - Tour Boat – commercial vessels carrying passengers for day trips regardless of size (except ferries)
  - Ferry – State of Alaska Marine Highway and Inter-Island Ferry Authority vessels
- Tugs
  - Tug – towing barges carrying cargo other than petroleum products as cargo and tugs not actively towing a barge or other vessel (such as ship-assist tugs).

    - Tug Oil Barge – towing a barge carrying petroleum products as cargo
- Fishing – commercial fishing vessels, tenders, and fish processors
- Other – a variety of vessel types including government vessels (except ferries), research vessels, yachts, etc.

All vessels under 65 feet (except tugs) were excluded from this study. While some of these vessels carry Class B AIS, tracks lines could not be considered to be representative of this size class. In addition, 473 vessels that did not enter State waters were excluded. These vessels were primarily transiting through Dixon Entrance in U.S. and Canadian waters. Tankers are not included because no tankers were identified within State waters in the study area in 2018.

3.5 Vessel Attribute Data

Once it was determined which vessels were operating in Southeast Alaska in 2018, more information was needed about them, including what kind of work they were doing, general characteristics such as length, width, and draft, fuel capacities, and, if they were tug boats, which barges they worked with and whether or not they carried petroleum products as cargo and how much. This information was obtained from a variety of sources, including Nuka Research's Vessel Attribute Database, websites, and operator interviews.

3.5.1 Nuka Research Vessel Attribute Database

Over more than a decade of work in Alaska, Nuka Research has compiled a database of information on thousands of vessels operating around the state. The database includes information such as:

- Vessel name
- Operator and/or owner
- IMO and MMSI numbers
- Flag state
- Type and subtype
- Length, width, draft
- Gross and deadweight tonnage
- Year built
- Worst case discharge
- Persistent and non-persistent fuel and cargo capacities

As vessels are encountered during different projects, this information is updated to be as accurate as possible. Based on information in this database, Nuka Research estimates oil capacities for vessels where specific data for an individual vessel is not available from other sources. In some cases, these estimates are made using a regression analysis based on other vessels of similar type and size where oil capacity is known. In other cases, general assumptions are used. In this study the following assumptions were used for Fishing Vessels, Tour Boats, and Other Cargo vessels:

• Vessels from 65 to 99 feet in length	Fuel capacity 10,000 gallons
• Vessels from 100 to 150 feet in length	Fuel capacity 20,000 gallons
• Vessel greater than 150 feet in length	Fuel capacity estimated by regression analysis

3.5.2 Tug Owner/Operator Interviews

Although data for all of the vessel types described in Section 3.3 Vessel Movement Data were included in the analyses for this report, there was particular interest in tugs as they had the potential for moving barges that were carrying petroleum products as cargo. The decision was made to contact all operators of tugs that appeared in the 2018 dataset and ask them about their tugs, barges, and cargoes. Specifically, questions were asked about tug/barge pairings, whether or not fuel was carried as cargo, fuel and cargo capacities, and whether ship-to-ship transfers were ever made. More information on the tug companies and their tugs and barges can be found in Appendix A Tug Owner/Operators.

Twenty-five tug owner/operators were initially identified. Publicly available databases were used to identify the owner/operators. All owner/operators were contacted either by email or telephone. Ultimately, positive contact was made with 13 companies, while some were determined to be incorrect or subsidiaries of another company. Telephone interviews were conducted with representatives from the 13 companies, including all companies hauling petroleum products in barges as cargo.

Information collected from these interviews was incorporated into the Vessel Attribute Database and into the results shown in Section 4 Fleet Characterization.

3.6 Fuel Terminals

While a picture can be developed of volumes of fuel moving through Southeast Alaska by examining vessel movements, the exact volumes going into and out of each port can only be estimated based on total fuel and cargo capacities of vessels and barges, although vessels are not always full. To get a more nuanced view, fuel terminal operators were contacted in communities and other ports throughout the region in an effort to determine how much fuel was delivered to each port, on what schedule, and by whom.

There are innumerable oil storage tanks and facilities in Southeast Alaska if one includes home or business heating fuel and small and large commercial storage facilities. For the purpose of this study, only commercial facilities not qualifying as Class 2 facilities were included. According to ADEC (ADEC, 2019), Class 2 facilities must meet the following criteria:

- Are onshore,
- Are not residential properties (i.e. do not include home heating oil tanks),
- Have a storage capacity equal to or greater than 1,000 gallons and less than 420,000 gallons (total storage capacity includes aboveground tanks 1,000 gallons and greater),
- Store non-crude oil (petroleum-based, motor fuels, jet fuels, heating oil, residual fuel oils, lubricants, and used oils), and
- Are not required to have a contingency plan filed with the state.

All other commercial facilities in Southeast Alaska which had fuel delivered by barge in 2018 were included in this study.

In order to make these contacts, the ports at which fuel barges called were identified from AIS track lines. Phone calls to city offices, tribal headquarters, harbor offices, and other businesses led to the development of a list of fuel terminals that accepted fuel deliveries from barges in 2018. Ultimately, 35 contacts were made in 24 ports, including 21 communities, two mines, and one National Park. There were 26 fuel terminals identified in 19 ports. Five communities reported that their fuel came overland by truck rather than by barge, and one received its fuel

from a 75-foot landing craft rather than a barge. All fuel terminals which received fuel from barges used permanently installed marine headers for the transfers.

More information on the fuel terminals interviewed can be found in Appendix B Terminal Operators. While some operators readily provided information on how often they accepted fuel deliveries and of what volumes, others were unwilling to provide this information due to concerns about their competition obtaining the information. As a result of incomplete information, Nuka Research was not able to use actual fuel deliveries to characterize petroleum movements at ports, and therefore total fuel capacities of vessels and barges was used instead.

4 Fleet Characterization

4.1 Numbers and Sizes of Vessels

The vessel types defined for this study, as well as those excluded from the study, are described in Section 3.4 Vessel Types. Table 4.1-1 displays the number of vessels of each type by length categories and the total number of vessels of each type for which 2018 AIS track lines were seen. There were 644 unique commercial vessels identified as working in or transiting Southeast Alaska in 2018. The vast majority of vessels of all types are 65 – 150 feet in length. There are more fishing vessels than any other single type, most of which fall in that that same size range. This count does not include vessels less than 65 feet operating in Southeast Alaska commercially and non-commercially as the majority of them do not carry AIS stations.

Table 4.1-1 Number of Unique Vessels by Type and Length Categories

Vessel Type	Number of Vessels by Length Category (feet)					Total
	<65	65 - 150	150 - 300	300 - 700	>700	
Cargo Bulk				34		34
Cargo Other		9	11	9		29
Cruise Ship		12	11	6	27	56
Ferry			10	4		14
Fishing		232	28	1		261
Other		91	28	4		123
Tour Boat		23				23
Tug	11	82	1			94
Tug Oil Barge		10				10
Total	**11**	**459**	**89**	**58**	**27**	**644**

Table 4.1-2 shows the relative frequency of travel by the different vessel types. The 644 vessels were observed traveling nearly 2.3 million miles in Southeast Alaska in 2018. Of these transits, about 29 percent were made by cruise ships. Tugs and fishing vessels covered the next greatest number of miles calculated from the AIS data, with 18 and 19 percent of the miles, respectively.

Table 4.1-2 Amount and Percentage of Mileage Traveled by Each Vessel Type

Vessel Type	Nautical Miles of Tracks	Percent of Total Miles
Cargo Bulk	14,756	1%
Cargo Other	30,725	1%
Cruise Ship	675,234	29%
Ferry	234,310	10%
Fishing	427,843	19%
Other	194,626	8%
Tour Boat	233,575	10%
Tug	406,432	18%
Tug Oil Barge	80,465	4%
Total	**2,297,966**	**100%**

4.2 Petroleum Capacities of Vessels

Nuka Research examined the capacity and types of petroleum fuels and cargo transported throughout Southeast Alaska in 2018. To aid in understanding petroleum movements, fuels were identified as persistent or non-persistent, and the fuel capacities of vessels (the volume they can carry for powering the vessel) was separated from cargo capacities (the volume carried for the purpose of being delivered to another facility). In all cases, the total fuel or cargo capacity of the vessels and barges was used in the analyses even if it might be assumed that the vessel or barge was not full when it was in a particular area. It was not possible to know the actual fuel or cargo volumes carried by a vessel or barge at any given time or place. Additionally, ADEC regulations governing oil spill contingency planning for marine vessels and fuel terminals are based on total capacity, not volumes transported or stored.

Non-persistent fuels include petroleum distillates that typically dissipate rapidly through evaporation when spilled in the marine environment (Anderson, 2001). For the purposes of this study, non-persistent fuels seen in Southeast Alaska include heating fuel, diesels, jet fuel, and gasoline; these fuel types were not considered separately in the analyses. Persistent fuels, in contrast, do not dissipate quickly in the marine environment (Anderson, 2001). Crude oil is a very common persistent product, but no vessels carrying crude oil transited Southeast Alaska in 2018. The typical persistent fuel used by vessels in Southeast Alaska is heavy fuel oil (HFO), the residual oil left after diesel, gasoline, and other light hydrocarbons are extracted from crude oil. HFO is frequently used to power engines in large ships, and was assumed to be used in cargo ships and cruise ships in Southeast Alaska.

Table 4.2-1 describes the non-persistent fuel capacity of the different vessel types by length. Table 4.2-2 describes the persistent fuel capacities of the different vessel types by length. Only those vessel types which carry persistent fuels are shown in the table. The volumes are averages for the vessel types in the different length categories. Not surprisingly, larger vessels have larger fuel capacities, and, as previously noted, only the larger, ocean-going ships use persistent fuels.

Table 4.2-1 Average Non-persistent Fuel Capacity (gallons) by Vessel Type and Length

Vessel Type	Average Non-persistent Fuel Capacity (gallons) by Length Category					Overall Average
	<65 feet	65 – 150 feet	150 – 300 feet	300 – 700 feet	>700 feet	
Cargo Bulk				34,606		34,606
Cargo Other		19,971	146,626	39,449		74,057
Cruise Ship		15,834	26,303	71,089	118,321	73,224
Ferry			34,094	174,116		74,100
Fishing		13,525	68,817	237,503		20,315
Other		14,278	53,559	367,640		34,711
Tour Boat		2,642				2,642
Tug	7,773	63,004	46,257			56,362
Tug Oil Barge		84,175				84,175

Table 4.2-2 Average Persistent Fuel Capacity (gallons) by Vessel Type and Length

Vessel Type	Average Persistent Fuel Capacity (gallons) by Vessel Length Category					Overall Average
	<65 feet	65 – 150 feet	150 – 300 feet	300 – 700 feet	>700 feet	
Cargo Bulk				441,693		441,693
Cargo Other				362,300		112,438
Cruise Ship				141,173	779,086	390,757

The only vessels carrying petroleum products as cargo in Southeast Alaska during 2018 were tugs towing or pushing barges. There were 9 of these combinations with an average cargo capacity of 2,604,260 gallons. The cargo capacity of articulated tug/barge combinations was roughly the same as for barges towed by tugs.

5 Vessel Traffic Characterization

5.1 Vessel Traffic Density

Data from AIS were used to create plots of vessel traffic density in Southeast Alaska. Figures 5.1-1 – 5.1-8 show the traffic density of bulk carriers, other cargo ships, fishing vessels, cruise ships, ferries, tour boats, tugs, and other vessels on separate density plots. In these maps lighter colors indicate a lower density of vessel traffic while darker colors indicate a higher density.

In general, and weather permitting, commercial vessels take the most direct route between their origin and destination. Cruise ships, tour boats, and fishing vessels are common exceptions: cruise ships and tour boats take passengers on routes to view scenery or wildlife, while fishing vessels navigate to and from fishing grounds. A review of the vessel traffic density maps shows that three commonly used routes stand out for all vessel types. One runs roughly north-south from Dixon Entrance through Revillagigedo Channel and then through Tongass Narrows past Ketchikan. Vessels following this route eventually intersect with those entering Southeast Alaska from mid-way up the archipelago at Cross Sound and then running through Icy Strait towards Juneau. Icy Strait vessels meet with those traveling through Chatham Strait to Lynn Canal and on to Juneau and Skagway.

Those primary channels aside, the density maps also show that commercial vessels travel into nearly every waterway in Southeast Alaska. Fishing vessels and tugs access the most areas, while bulk carriers access the least. Ferries and tour boats likewise have fairly consistent and limited routes.

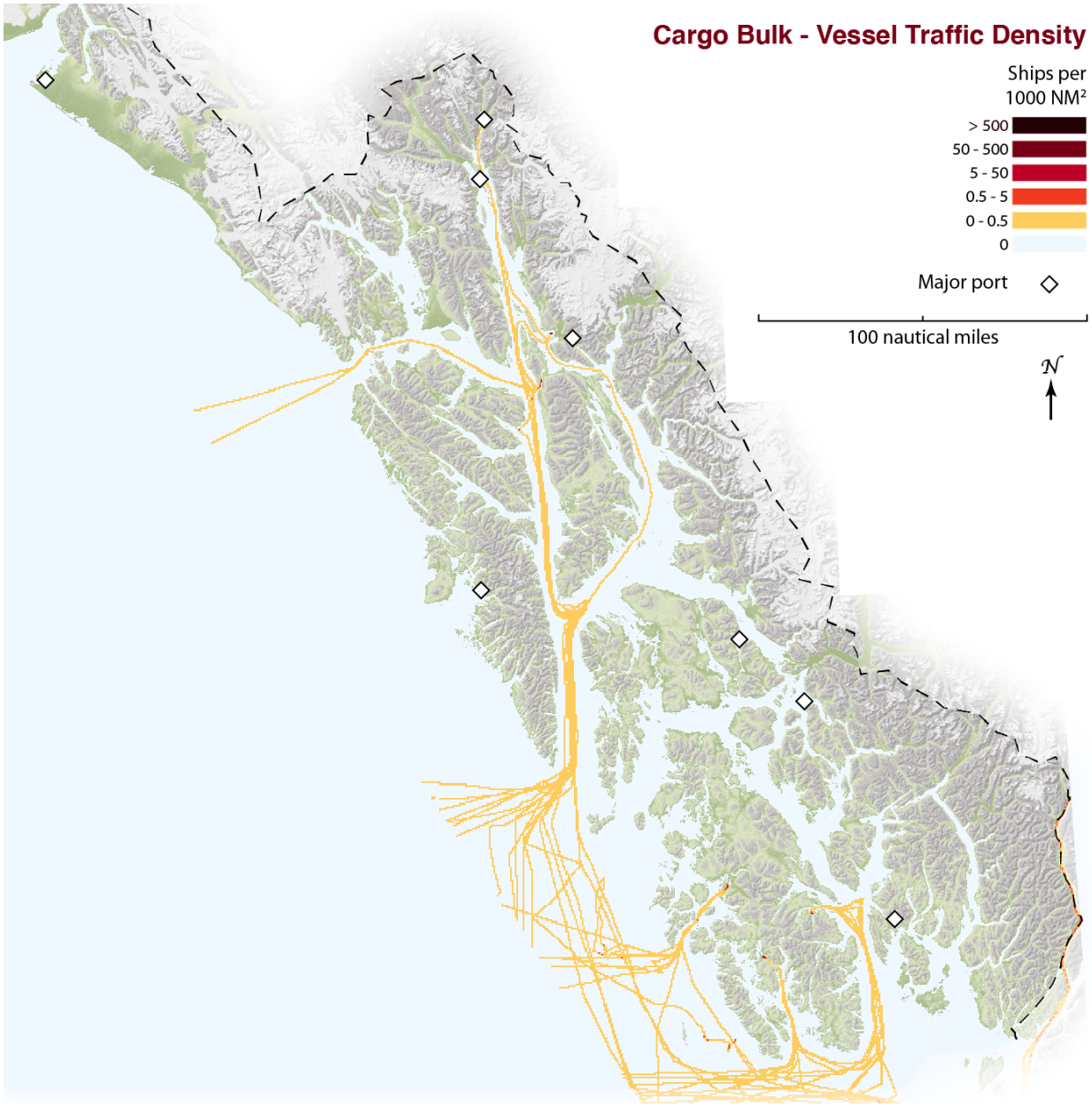

Figure 5.1-1 Cargo Bulk - Vessel Traffic Density

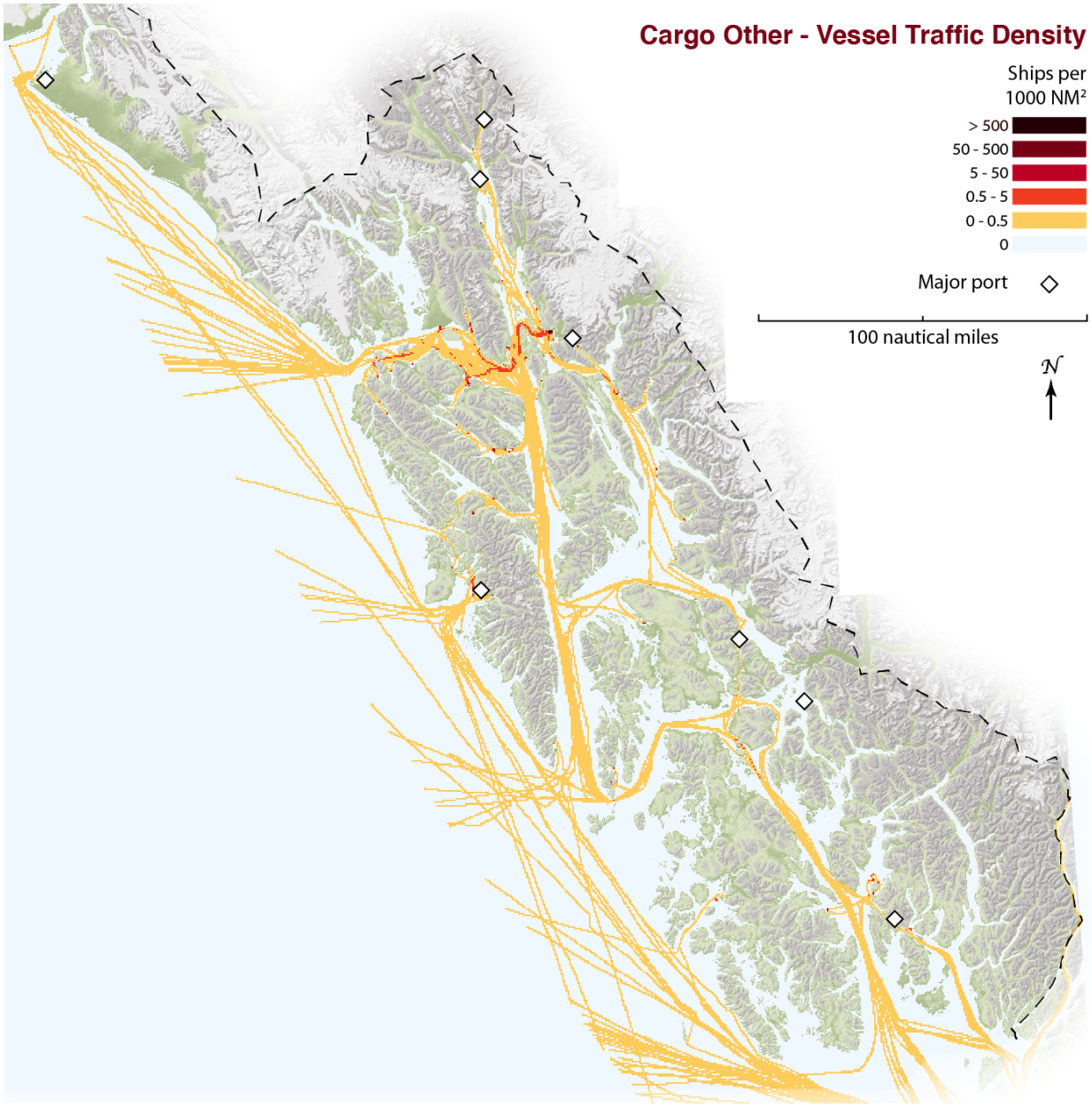

Figure 5.1-2 Cargo Other - Vessel Traffic Density

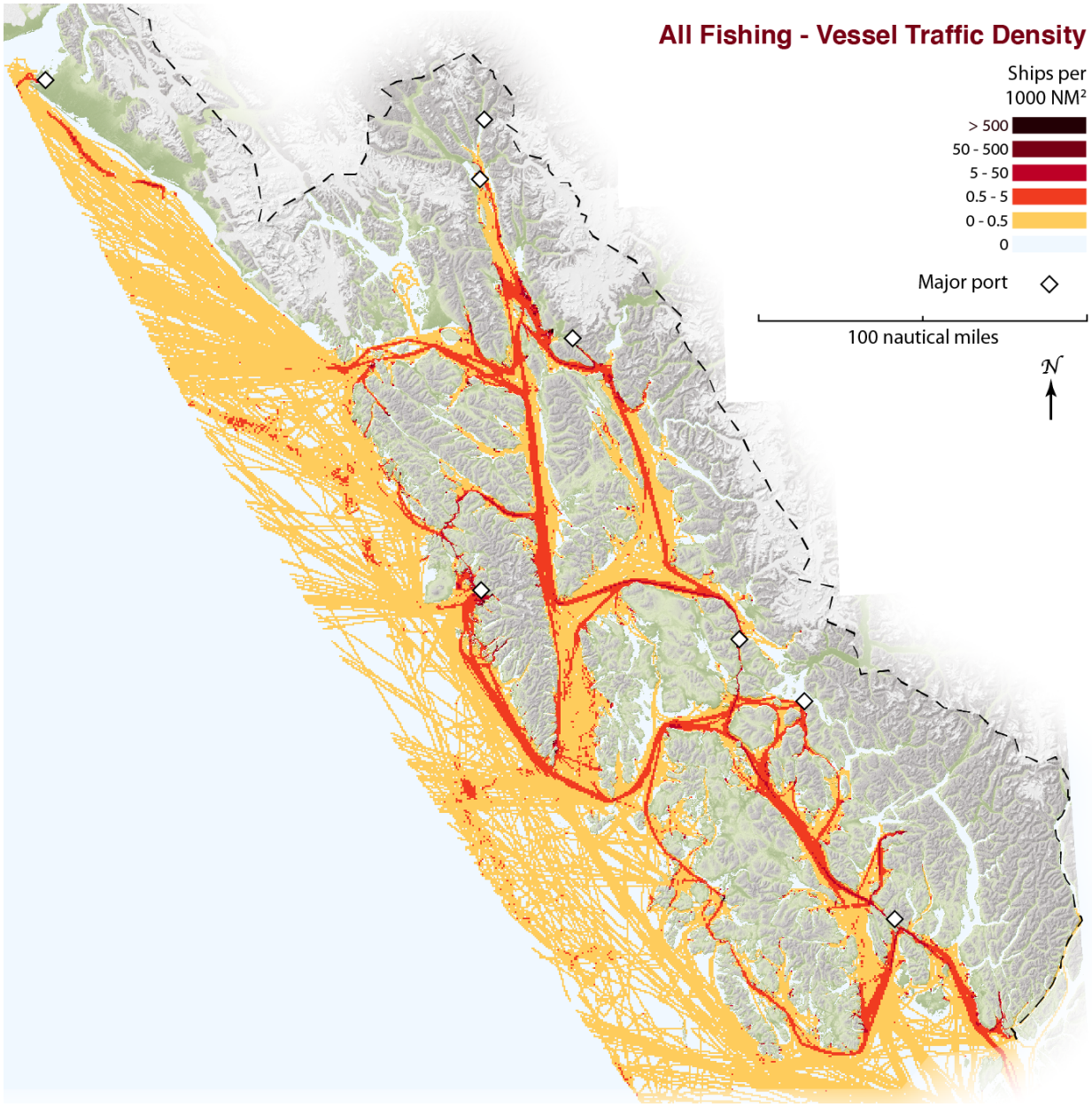

Figure 5.1-3 Fishing Vessels - Vessel Traffic Density

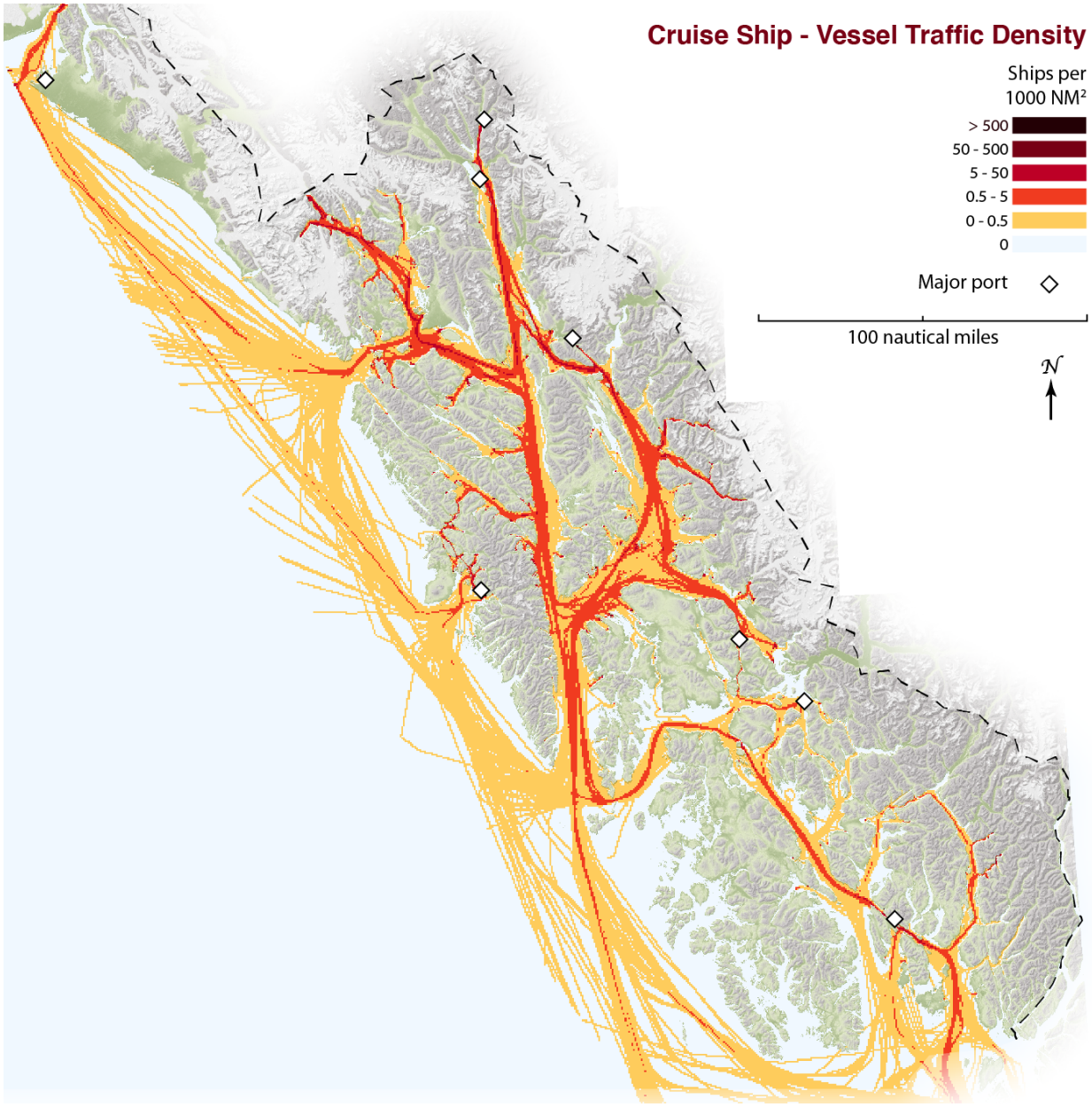

Figure 5.1-4 Cruise Ship - Vessel Traffic Density

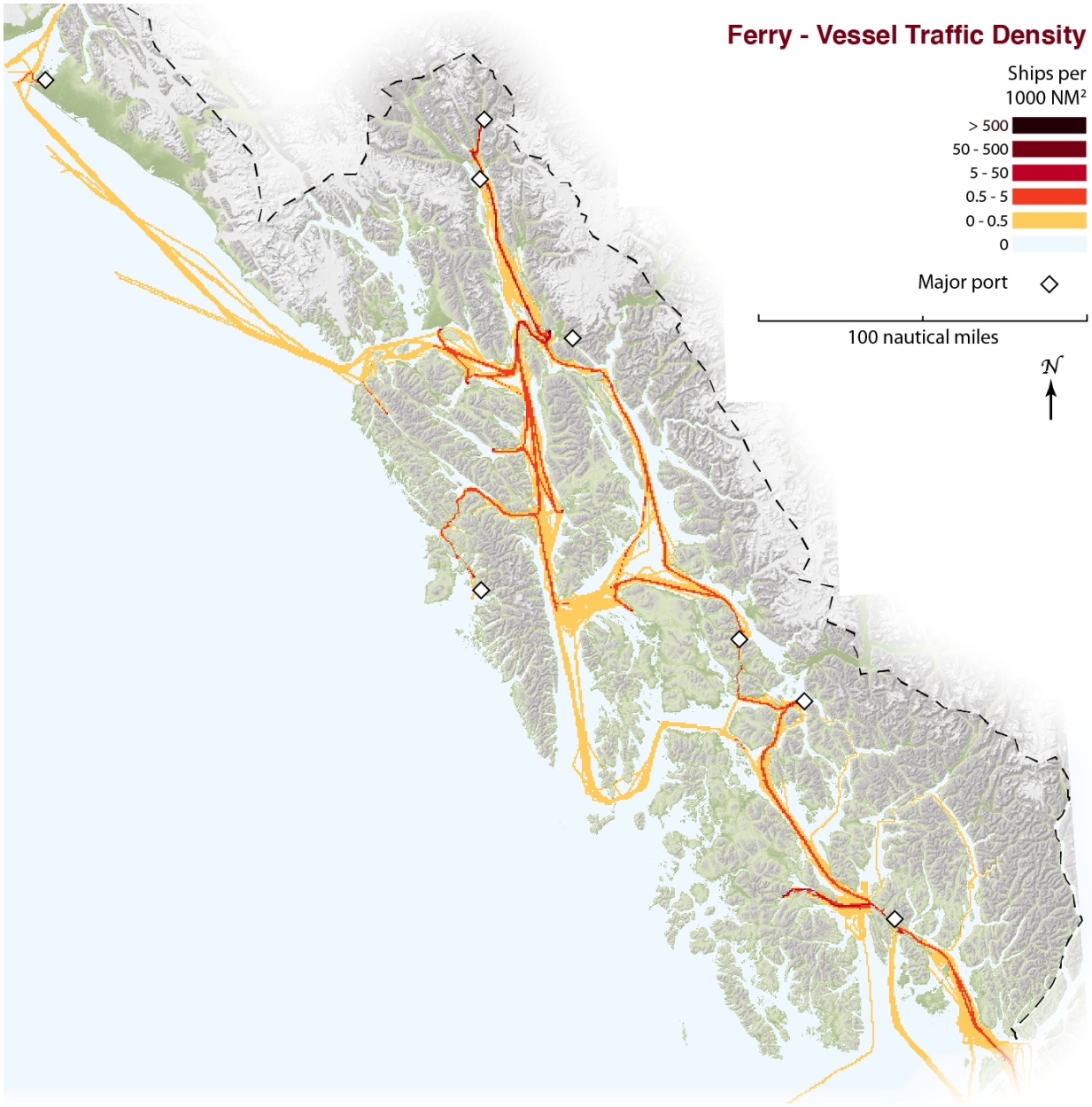

Figure 5.1-5 Ferry - Vessel Traffic Density

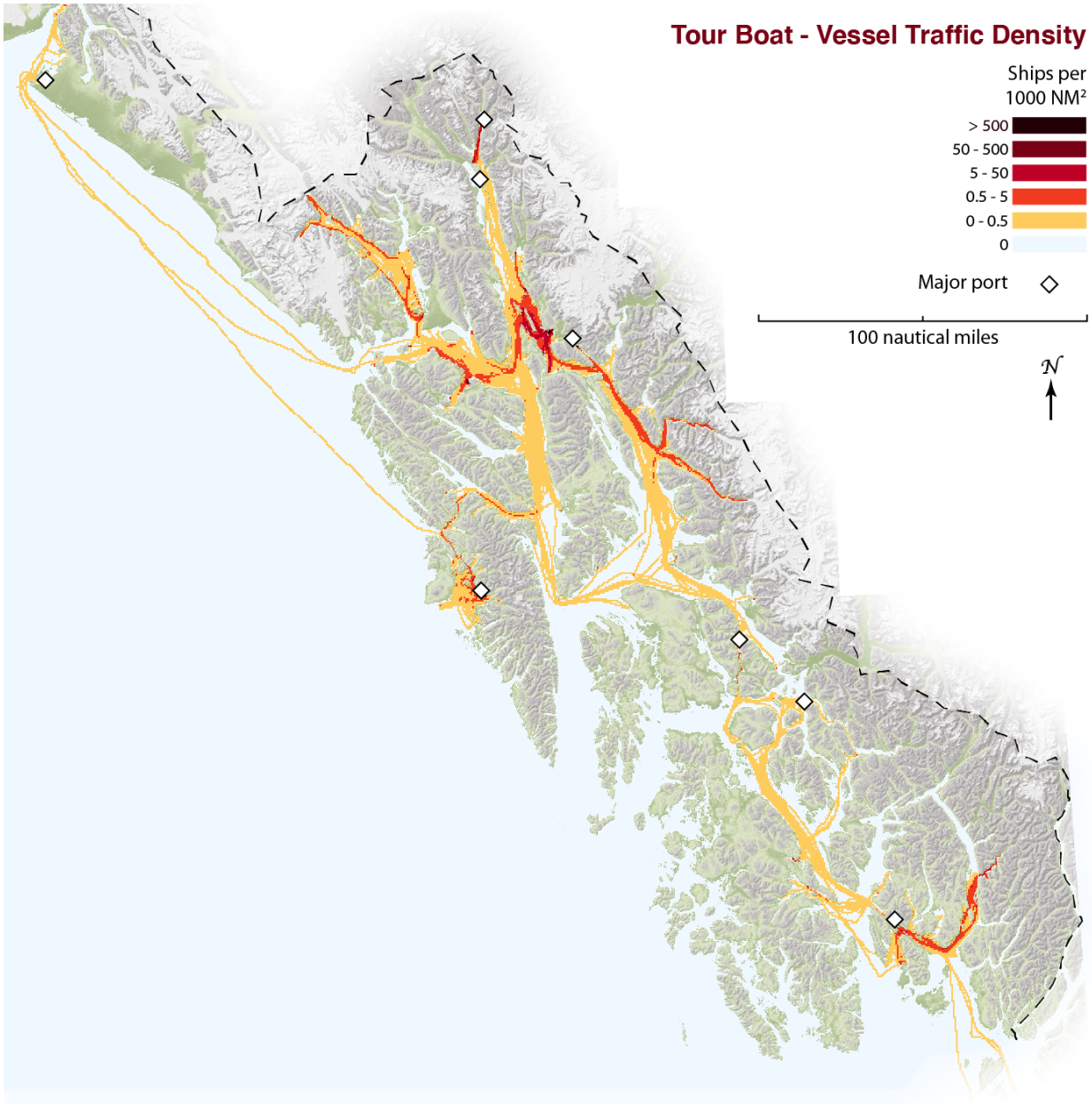

Figure 5.1-6 Tour Boat - Vessel Traffic Density

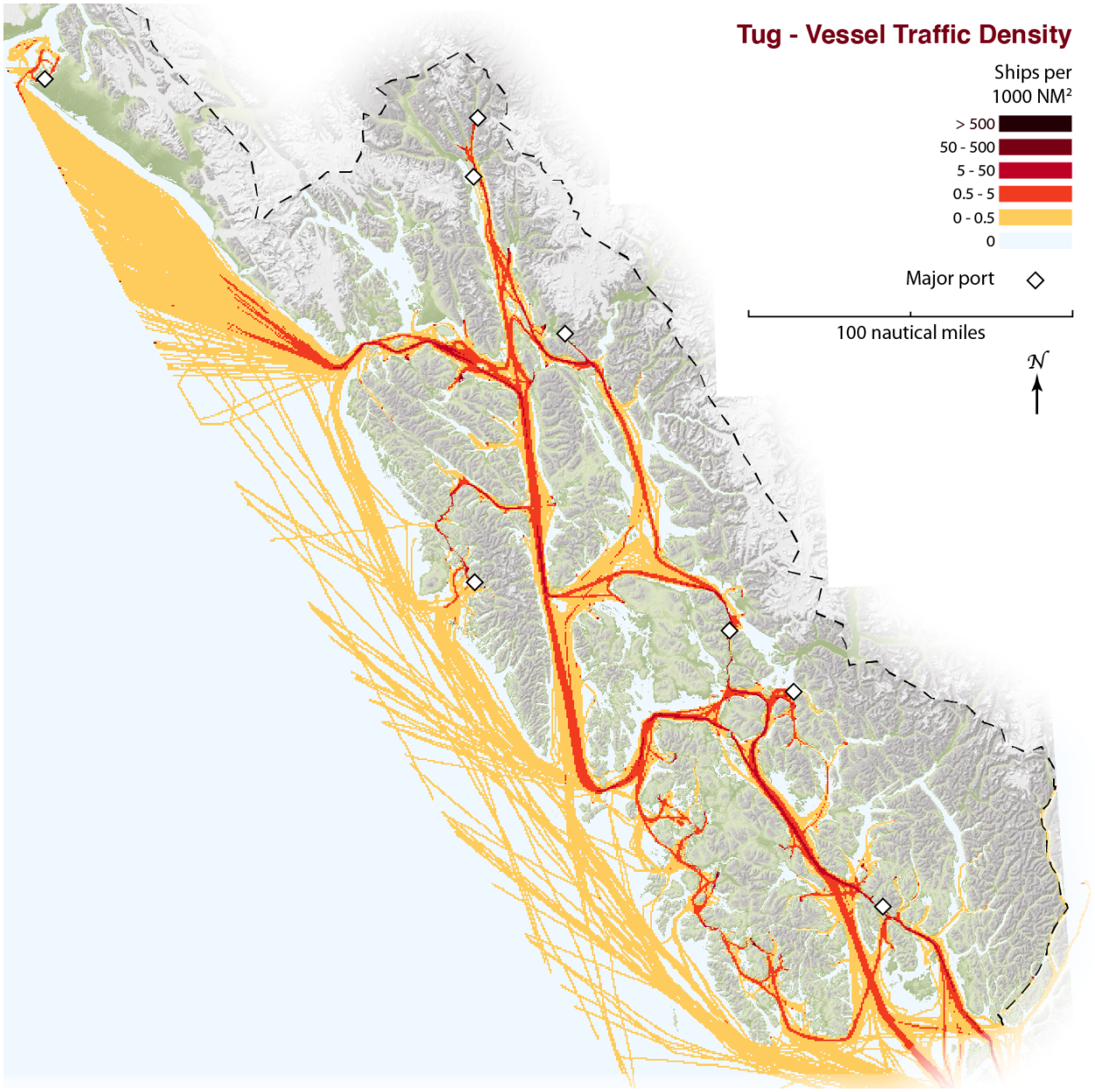

Figure 5.1-7 Tug - Vessel Traffic Density

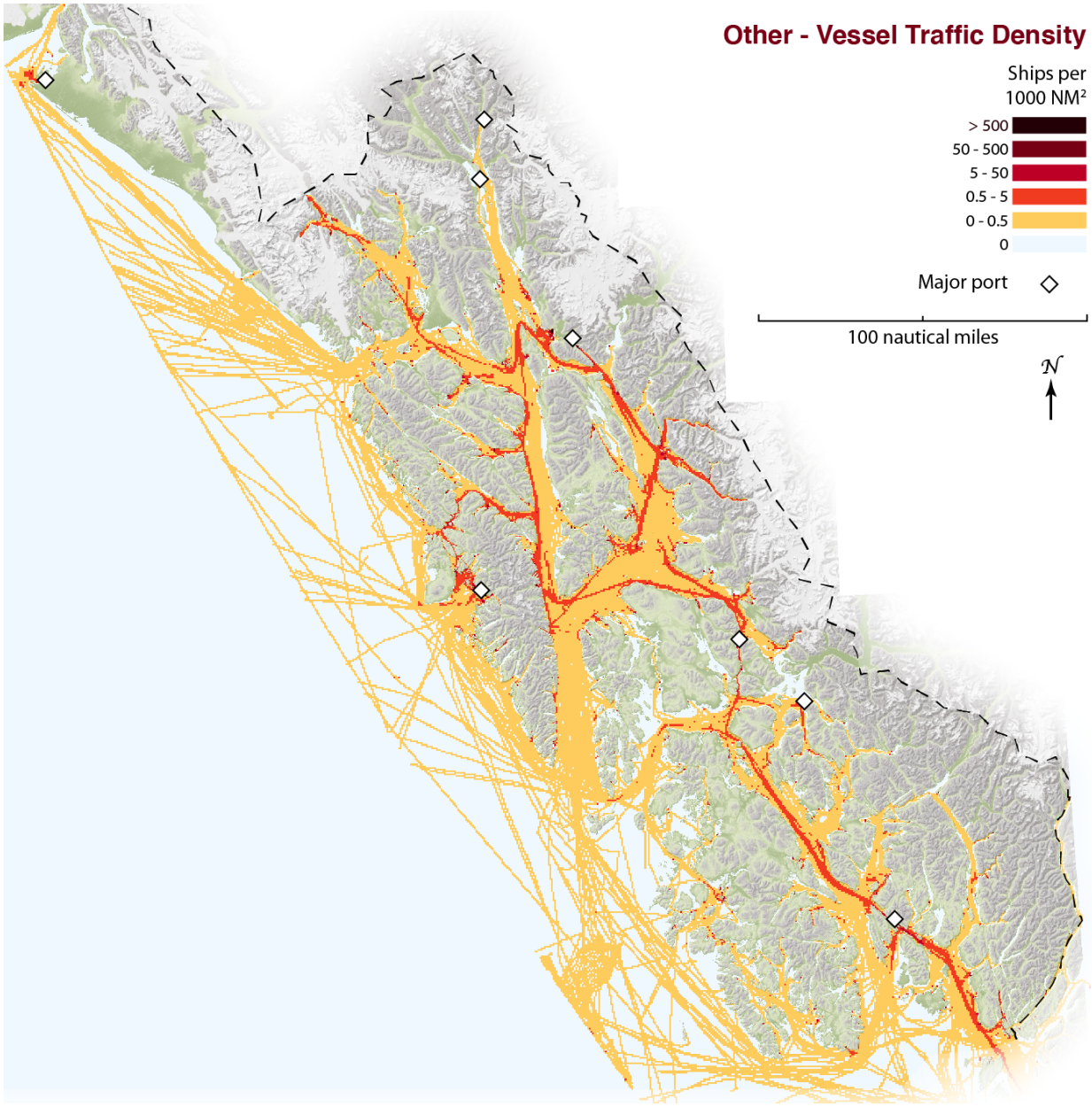

Figure 5.1-8 Other Vessels - Vessel Traffic Density

5.2 Port Calls

The number of the different vessel types calling at each port in Southeast Alaska is shown in Figure 5.2-1. Almost 5,000 commercial vessels transited through Tongass Narrows at Ketchikan. This number greatly exceeds the next highest port count at Sitka (~1,800), but it should be noted that some vessels passing through Tongass Narrows may not have made a port call in Ketchikan.[3] Petersburg is another port where vessels may have used Wrangell Narrows as a transit route without making a port call. Still, Ketchikan received at least twice as many port calls as any other port in Southeast Alaska. The next largest ports of Sitka, Petersburg, Juneau, Skagway, and Haines received between 1,300 and 1,800 ports calls each. Hoonah, Wrangell, and Glacier Bay are the only other ports that received over 500 vessel calls.

[3] The resolution of the AIS dataset makes it impossible to tell if a vessel passed through without stopping.

For some communities, such as Angoon, Gustavus, Hollis, and Tenakee Springs, the vast majority of port calls were made by ferries. The most common vessels calling in Juneau and Glacier Bay were cruise ships, while the Green's Creek Mine (in Hawk Inlet) and Kensington Mine saw a preponderance of visits from cargo tugs and barges. Appendix C Port Calls includes tables which provide more information on the number of vessels by type which called at each port in 2018.

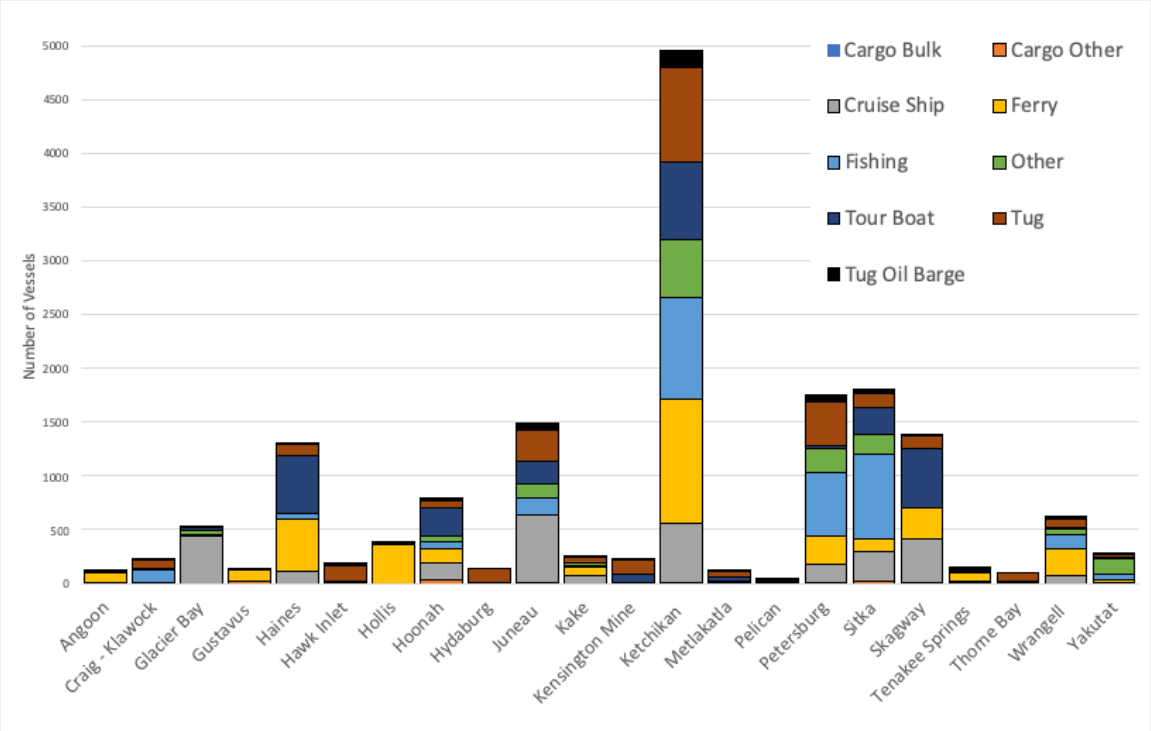

Figure 5.2-1 Port Calls by Vessel Types

5.3 Movements Between Inside and Outside Waters

Vessels going into or leaving the waters of Southeast Alaska must go through passages between islands, typically called entrances. Six entrances were the most common in 2018 according to the AIS data: Chatham Strait, Clarence Strait, Cross Sound, Peril Strait, Revillagigedo Channel, and Sumner Strait. Because vessel traffic can be more congested in entrances, they are likely to be areas of higher navigational risk and thus were of interest to ADEC for this study. Figure 1.1-1 shows the entrances on a map of Southeast Alaska.

The bar charts in Figures 5.3-1 – 5.3-9 show the movements of each type of vessel into and out of Southeast Alaska through each entrance. The colors within each bar indicate the size class of the vessels. The numbers of vessel transits are indicated on the vertical axis. The bars above the 0 horizontal axis indicate vessels moving into Southeast Alaska (e.g., using the entrance as an entrance to the area). The bars below the 0 horizontal axis indicate vessels moving out of Southeast Alaska (e.g., using the entrance as an exit from the area).

For each entrance analyzed, roughly the same number of vessels of each type use that entrance to enter Southeast Alaska as to depart from it. An exception was Cruise Ships, which made more entries into Chatham and Sumner Strait and more exits out of Clarence Strait, Cross Sound, and Revillagigedo Channel.

Most vessel types use all of the selected entrances, except bulk cargo carriers which only used Chatham Strait, Clarence Strait, and Cross Sound, and tour boats which only showed significant use of Peril Strait. The latter is likely because tour boats typically operate within the protected waters of the archipelago and do not often venture into outside waters.

More information on the numbers of vessels by size class, including the data used to create these bar charts, can be found in Appendix D Vessels Moving Through Entrances.

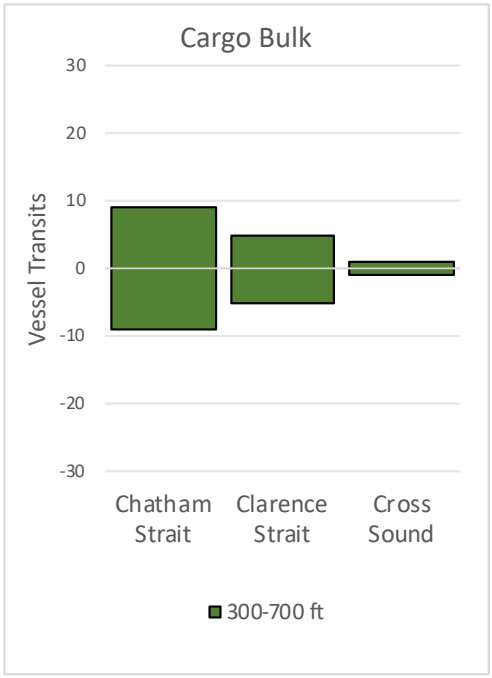

Figure 5.3-1 Cargo Bulk - Entrances/Exits

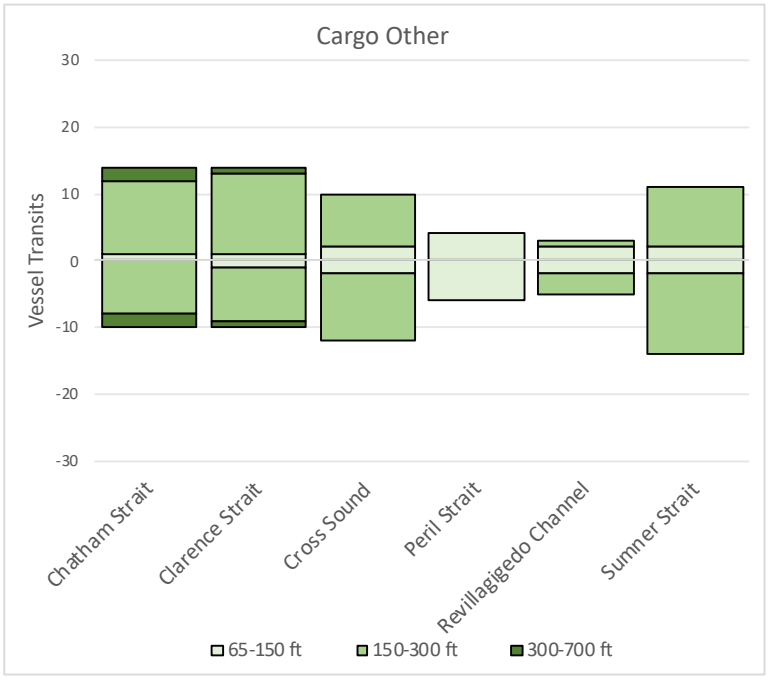

Figure 5.3-2 Cargo Other - Entrances/Exits

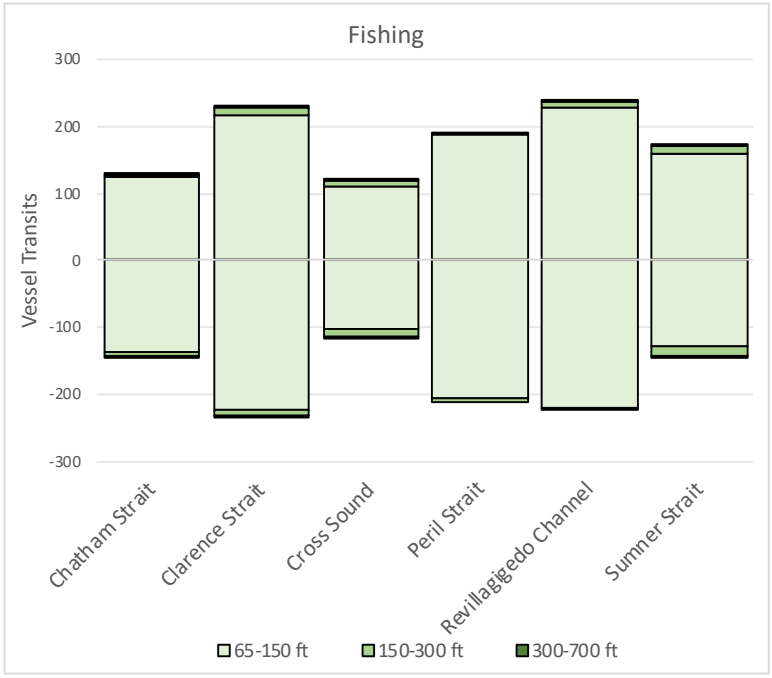

Figure 5.3-3 Fishing - Entrances/Exits

Figure 5.3-4 Cruise Ship - Entrances/Exits

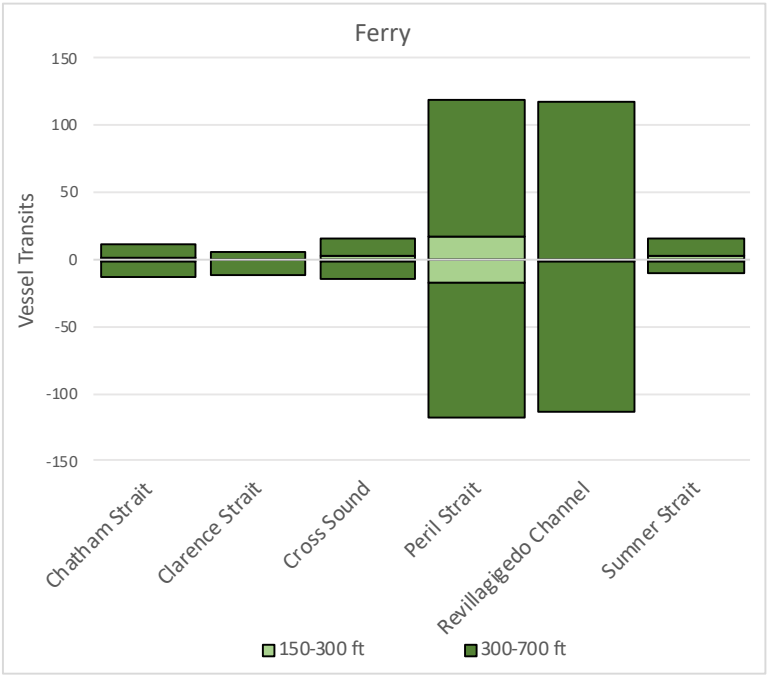

Figure 5.3-5 Ferry - Entrances/Exits

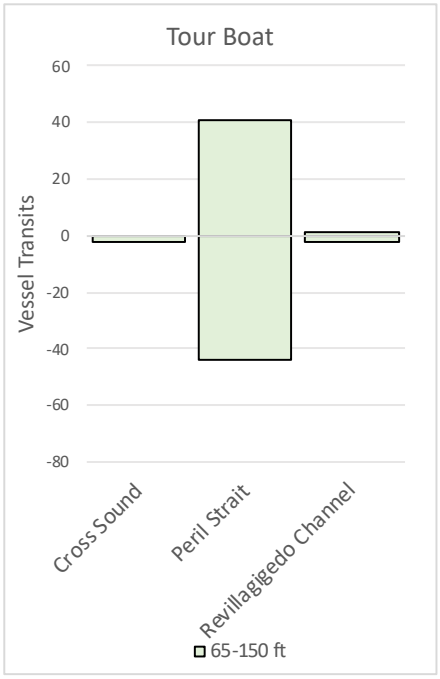

Figure 5.3-6 Tour Boats - Entrances/Exits

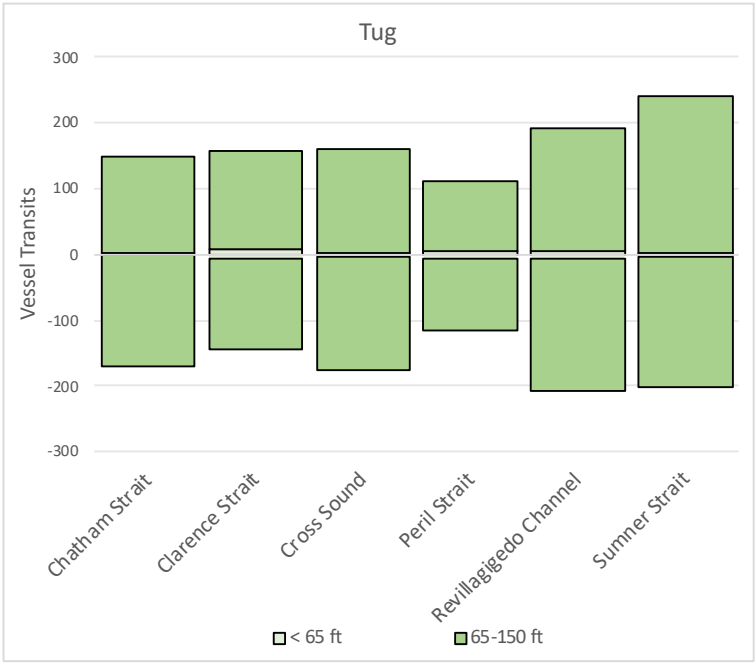

Figure 5.3-7 Tug - Entrances/Exits

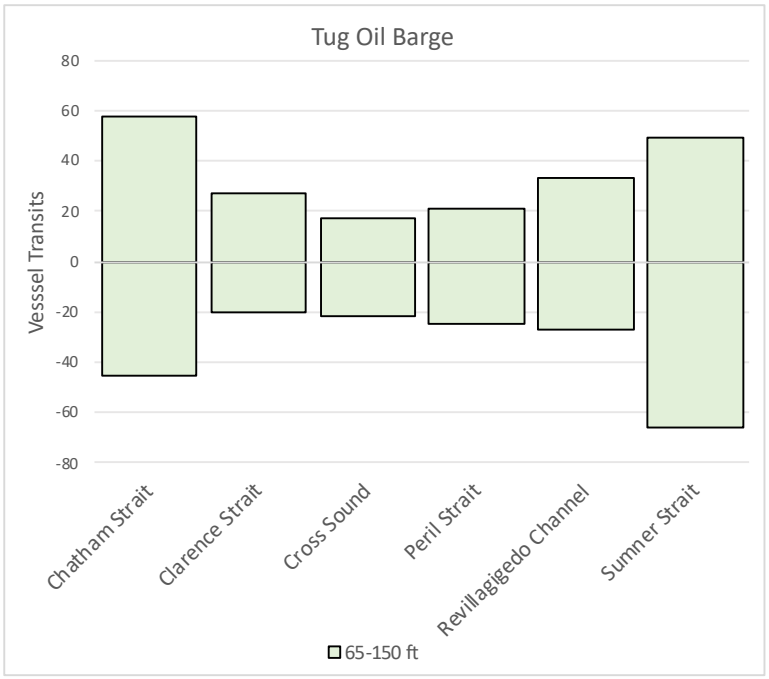

Figure 5.3-8 Tug Oil Barge - Entrances/Exits

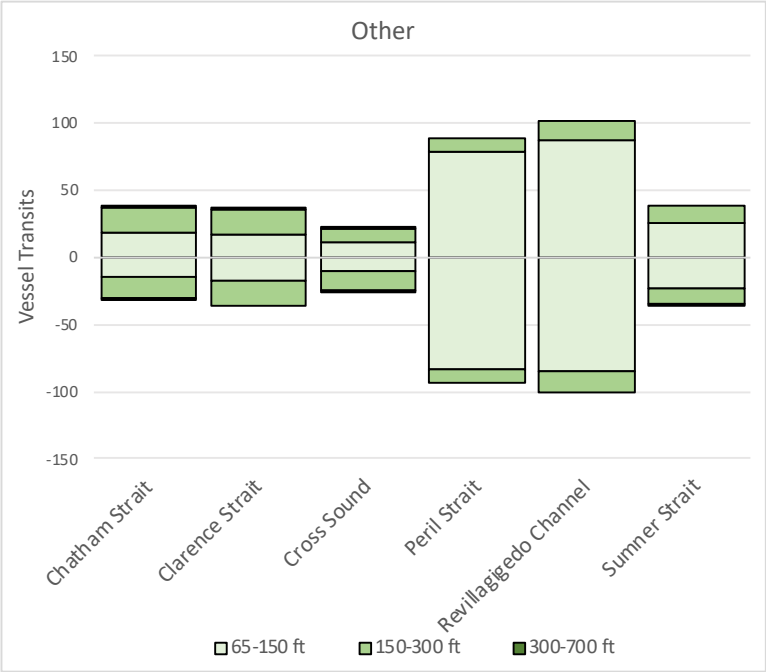

Figure 5.3-9 Other - Entrances/Exits

6 High-Risk Areas and Activities

6.1 High-Risk Areas

Some areas in Southeast Alaska were determined to be locations where the chances of an oil spill or other incident might be higher due to vessel traffic congestion or navigational hazards. (Marine Safety Task Force, 2018) For the purposes of this study, the areas identified as being potentially high risk were:

- Decision Pass
- Disenchantment Bay – Yakutat Bay
- Icy Straits/Rocky Island
- North Passage Lemesurier
- Portland Canal
- Saginaw and Favorite Channels
- South Inian Pass
- South Passage Lemesurier
- Tracy and Endicott Arms
- Snow Passage

The areas are shown on a map in Figure 6.1-1. In addition to the above, the entrances discussed in Section 5.3 may also be considered areas of increased risk but are not included in this section to avoid redundancy.

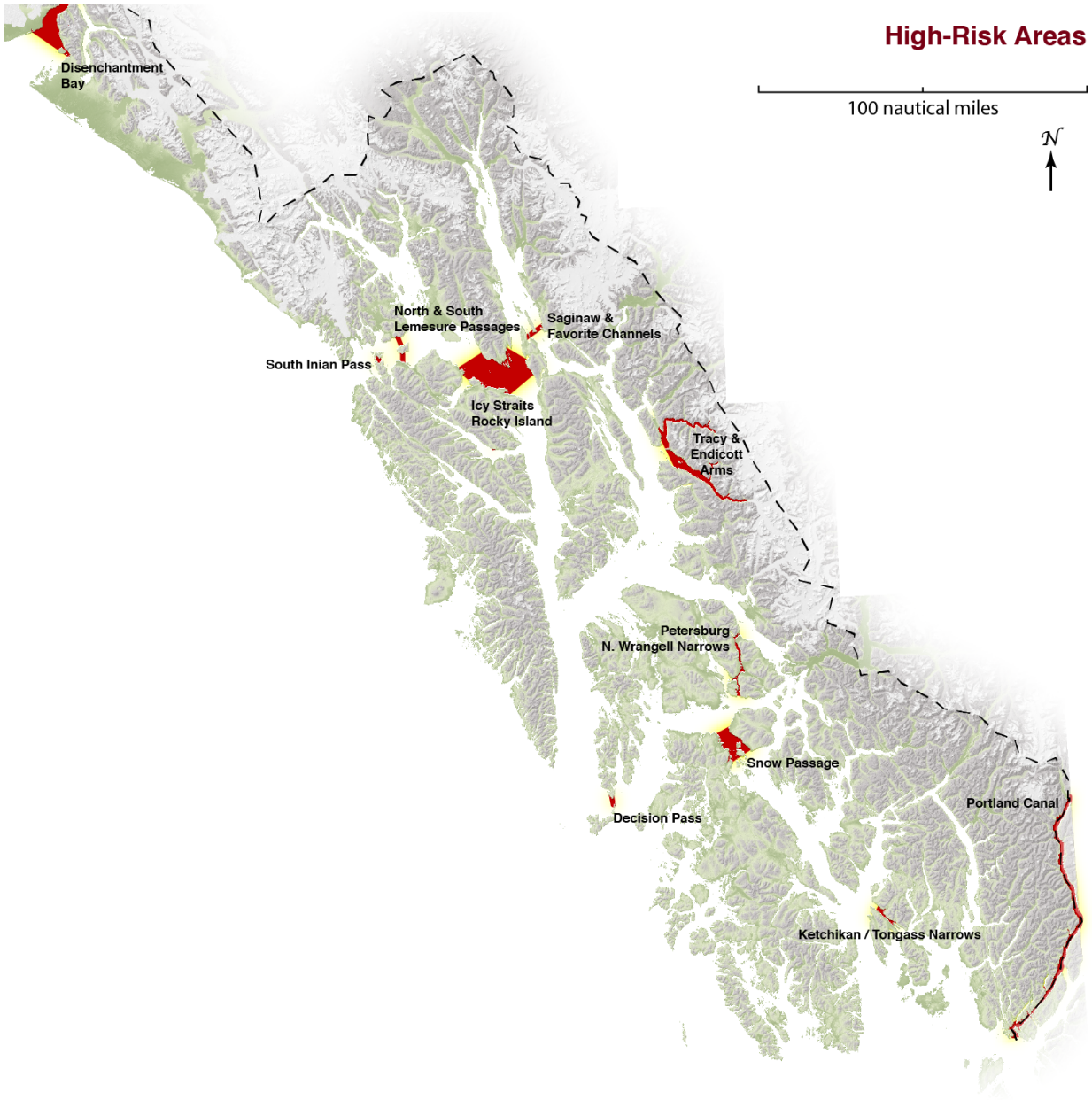

Figure 6.1-1 High-Risk Areas in Southeast Alaska

The movements of each type of vessel into and out of high-risk areas are described in the bar charts in Figures 6.1-2 – 6.1-10. The colors in each bar indicate the size classes of the vessels. The numbers of vessels are indicated on the vertical axis. The direction of travel through each area is indicated by whether the bar is above or below the 0-axis. Those above are called "entrances" and those below "exits". The direction of travel for each High-Risk area entrance or exit is described in Table 6.1-1.

Table 6.1-1 Direction of Travel for High-Risk Areas

High-Risk Area	Entrance	Exit
Decision Pass	West to East	East to West
Disenchantment Bay	South to North	North to South
Icy Straits/Rocky Island	South to North	North to South
Ketchikan	South to North	North to South
North Passage Lemesurier	West to East	East to West
Petersburg	South to North	North to South
Portland Canal	South to North	North to South
Saginaw and Favorite Channels	South to North	North to South
Snow Passage	South to North	North to South
South Inian Pass	West to East	East to West
South Passage Lemesurier	West to East	East to West
Tracy/Endicott Arms	West to East	East to West

The figures below show that, with the exception of bulk cargo carriers, all vessel types transited a large number of the high-risk areas during 2018. This is not surprising given that the high-risk areas are all passages to/from common destinations. Bulk cargo vessels had a more limited number of ports of call that the other vessel types, so it is understandable that they would have used fewer of the passages.

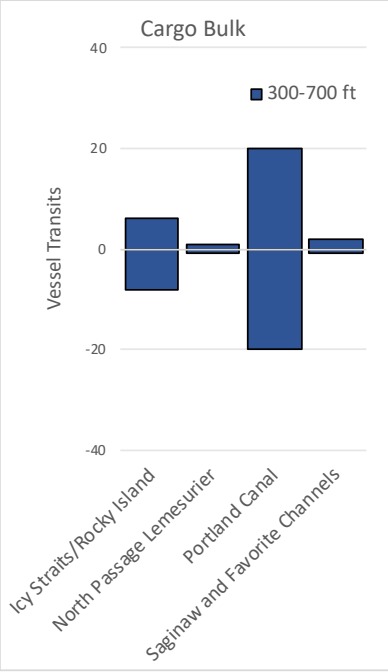

Figure 6.1-2 Cargo Bulk Movements In/Out of High-Risk Areas

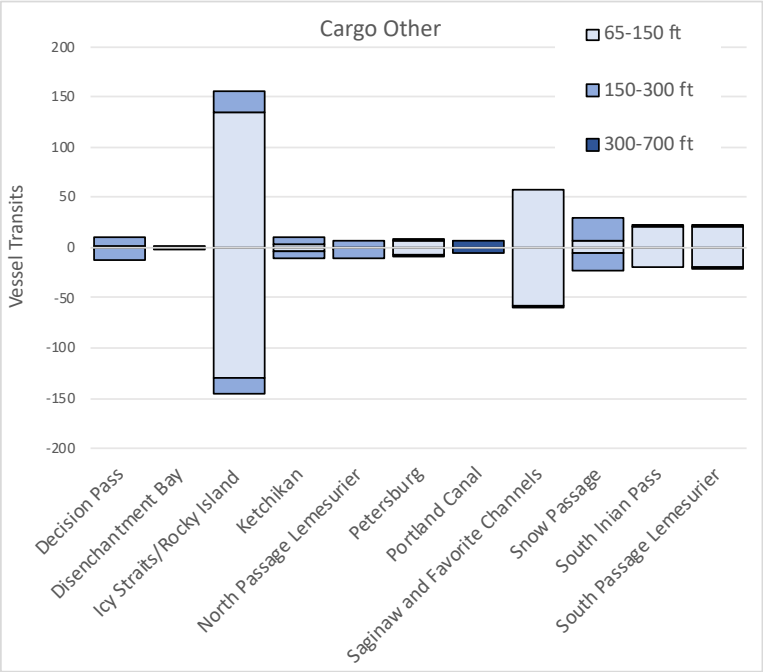

Figure 6.1-3 Cargo Other Movements In/Out of High-Risk Areas

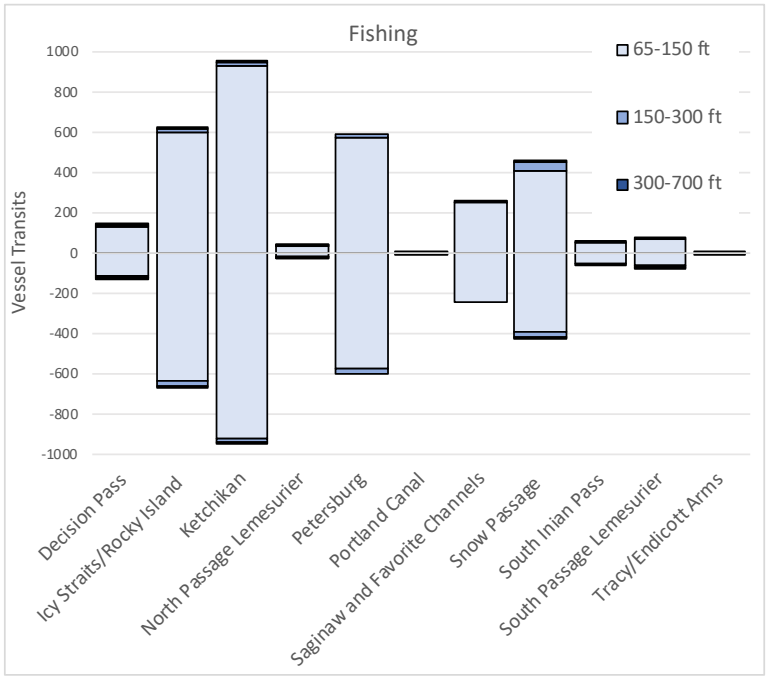

Figure 6.1-4 Fishing Vessel Movements In/Out of High-Risk Areas

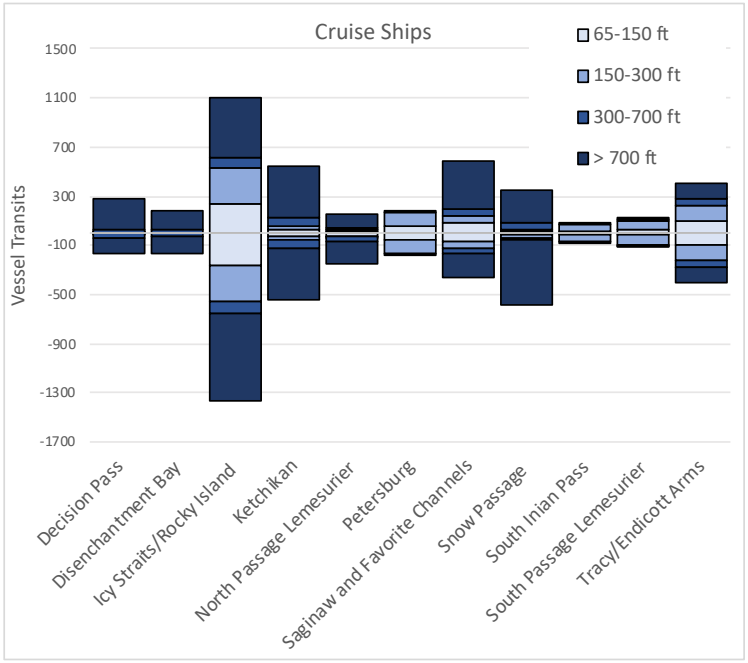

Figure 6.1-5 Cruise Ship Movements In/Out of High-Risk Areas

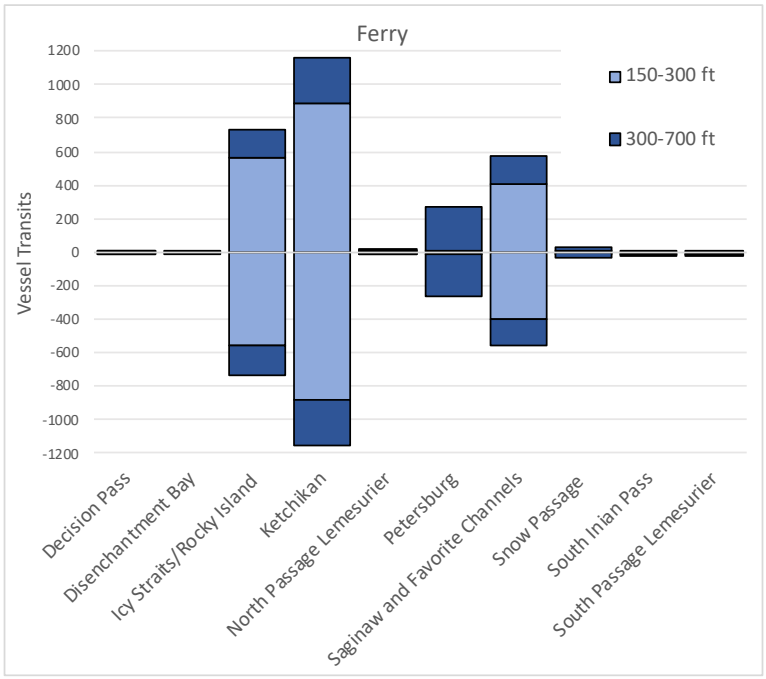

Figure 6.1-6 Ferries Movements In/Out of High-Risk Areas

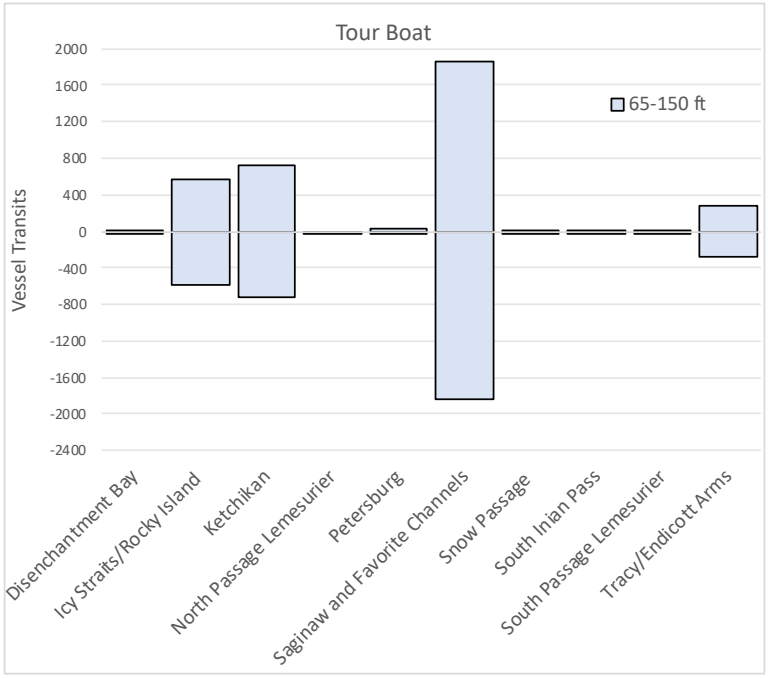

Figure 6.1-7 Tour Boats Movements In/Out of High-Risk Areas

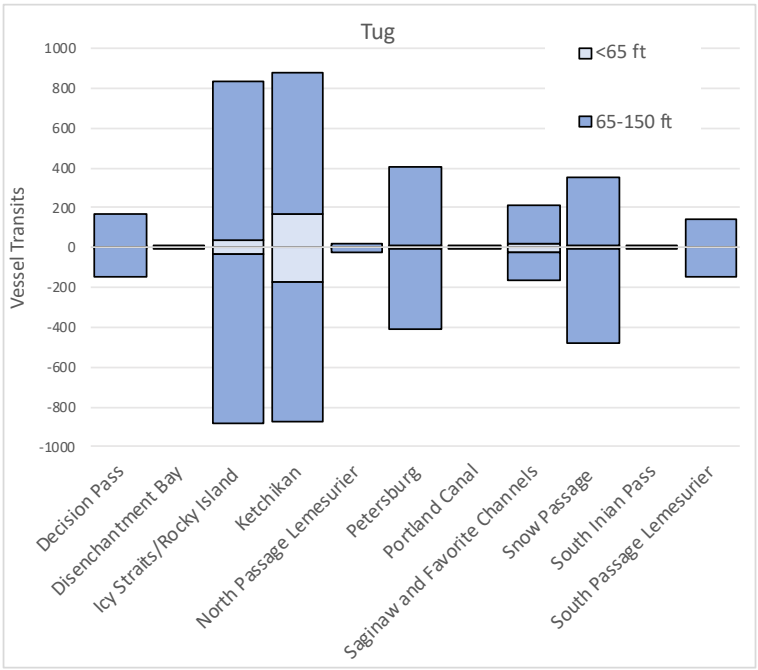

Figure 6.1-8 Tug Movements In/Out of High-Risk Areas

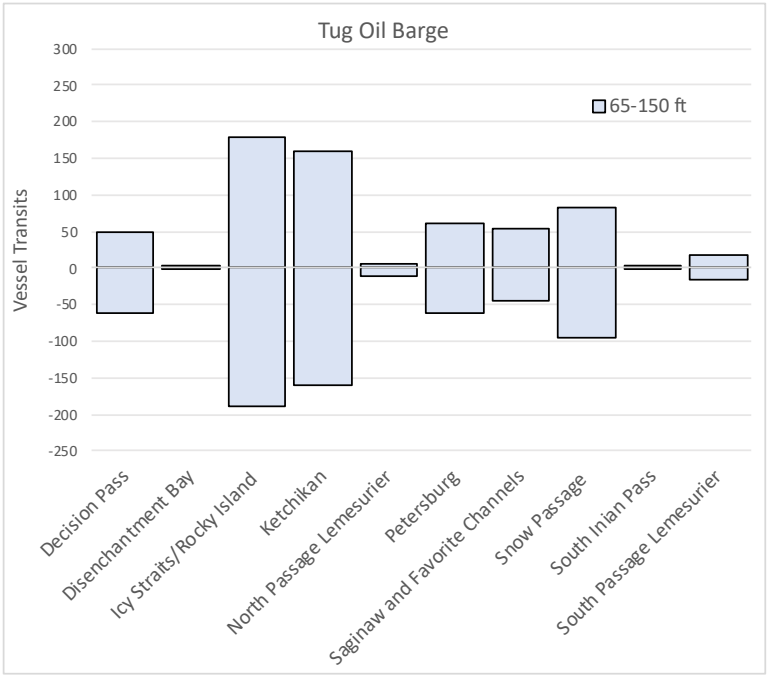

Figure 6.1-9 Tug Oil Barge Movements In/Out of High-Risk Areas

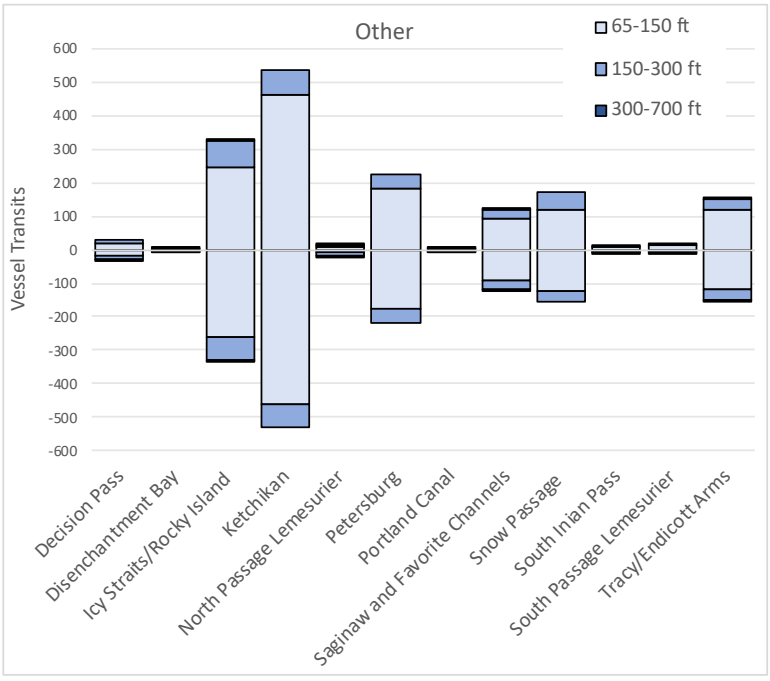

Figure 6.1-10 Other Vessels Movements In/Out of High-Risk Areas

Appendix E High-Risk Area Entrances/Exits and Appendix F Vessel Type Entrances/Exits for Each High-Risk Area contain the numerical data from which the above figures were derived as well as more information about vessels in high-risk areas.

6.2 High-Risk Activities

In addition to geographic areas considered to be of potential higher risk due to traffic density or navigational hazards, Nuka Research also considered activities that might increase risk of an oil spill and determined whether or not those activities could be pinpointed to specific geographic locations. It was decided that the activities of interest would be ship-to-ship fuel and cargo transfers and ship-to-shore fuel transfers without a marine header. Ship-to-ship fuel and cargo transfers were considered to be of two possible types: either between oil barges or between fishing vessels.

One question asked during interviews with tug operators was whether or not their vessels ever made ship-to-ship transfers within Southeast Alaska. Most companies indicated that they did not, while a few said that they did occasionally. No company indicated that they made a regular practice of doing such transfers. One company said that they carried fuel on the barge for refueling the tug while it worked in western Alaska (it only transited Southeast on its way to the west coast). The three companies that carry fuel as cargo said that they occasionally (less than five times per year) made barge-to-barge transfers of non-persistent fuel cargo. To determine when and where such transfers might have been made during 2018, the AIS data was examined to find occurrences of two tugs together in the same location at the same time for at least several hours. It was assumed that cargo may have been transferred at that time. There were four times that this occurred during 2018. Figure 6.2-1 indicates where those potential transfers took place.

A second type of ship-to-ship fuel transfer can occur within the fishing vessel fleet. It is not uncommon for fishing vessels to buy fuel from the tenders to which they deliver their fish on a daily basis. Often these fuel transfers are made with a hose and nozzle that looks much like the ones used at an automobile gas station. It was assumed that where fishing vessels were congregating in bays there were likely tenders present which could be transferring fuel. These locations are also shown in Figure 6.2-1.

There are locations throughout Southeast Alaska where ship-to-shore fuel transfers without a marine header could occur, including private homes, fish hatcheries, mines, logging operations, and lodges. Most of these locations are not regulated by ADEC as fuel terminals as they do not have large enough fuel storage capacities (see Section 3.6 Fuel Terminals for more information on regulated facilities). Not using a marine header increases the chance of a spill through operator error or equipment failure. These locations are also shown in Figure 6.2-1.

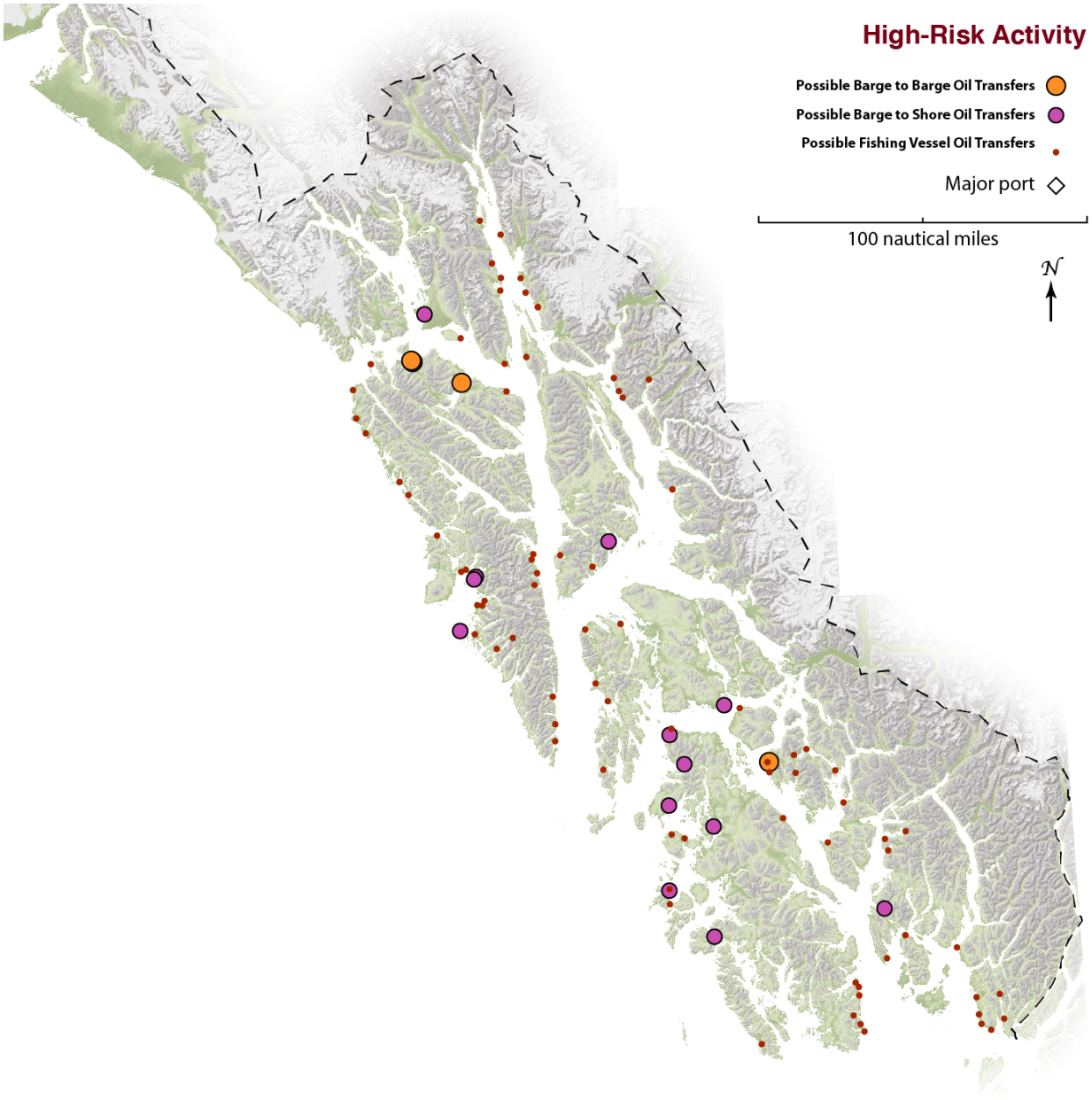

Figure 6.2-1 Locations of Potential High-Risk Activity

7 Petroleum Movement Characterization

7.1 Petroleum Movements through Passages

Nuka Research used the AIS track lines for the different vessels types and assumed total fuel capacities to develop pictures of the movement of non-persistent and persistent fuels and non-persistent cargo throughout Southeast Alaska in 2018. Figures 7.1-1 – 7.1-12 are density maps for each vessel and fuel/cargo type. In these maps, lighter colors (yellow) indicated that less oil was transported through those areas, on average, than darker colors. This difference can be correlated to vessel density in an area (see Section 5.1 Vessel Traffic Density).

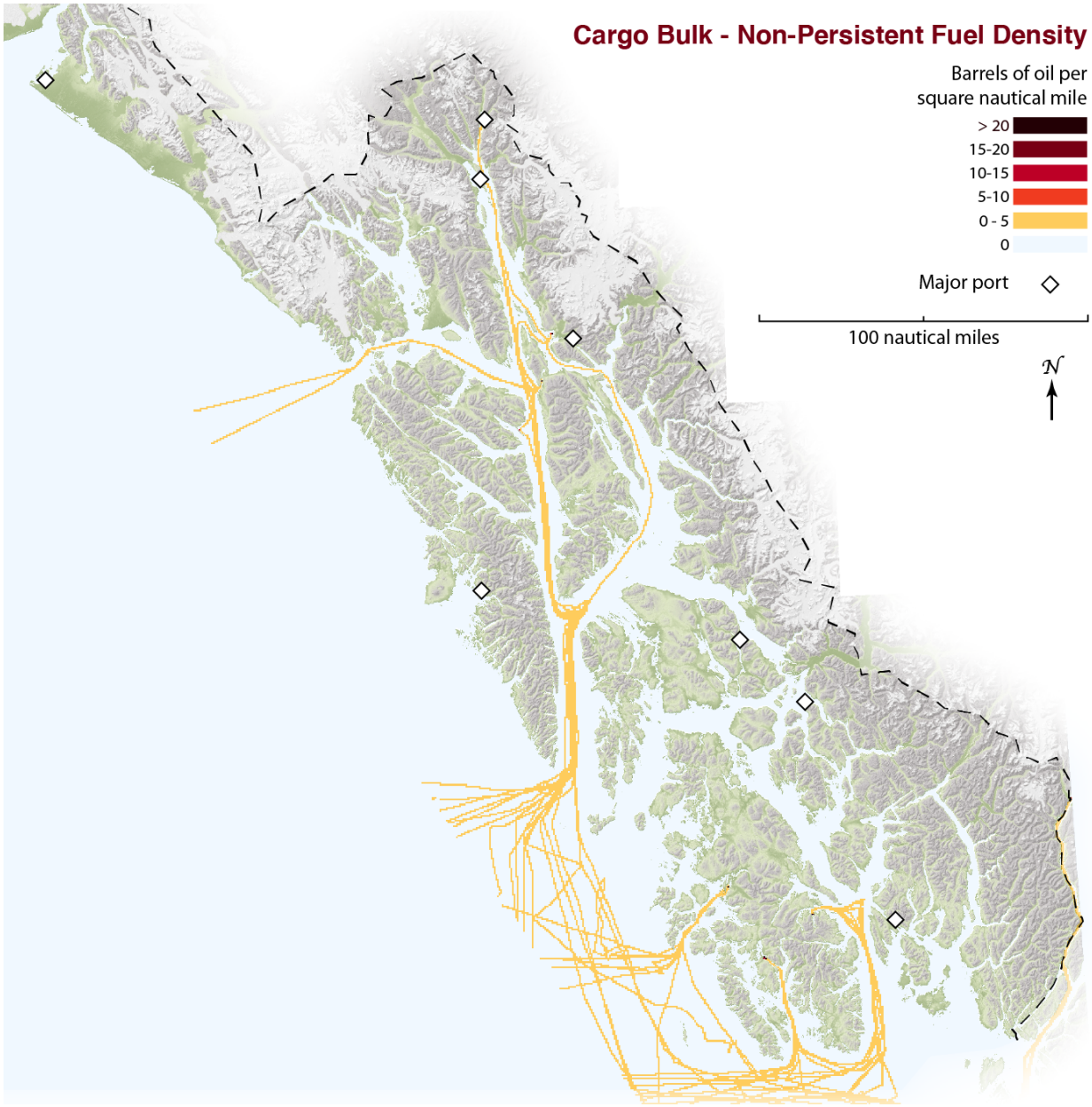

Figure 7.1-1 Cargo Bulk Non-Persistent Fuel Density

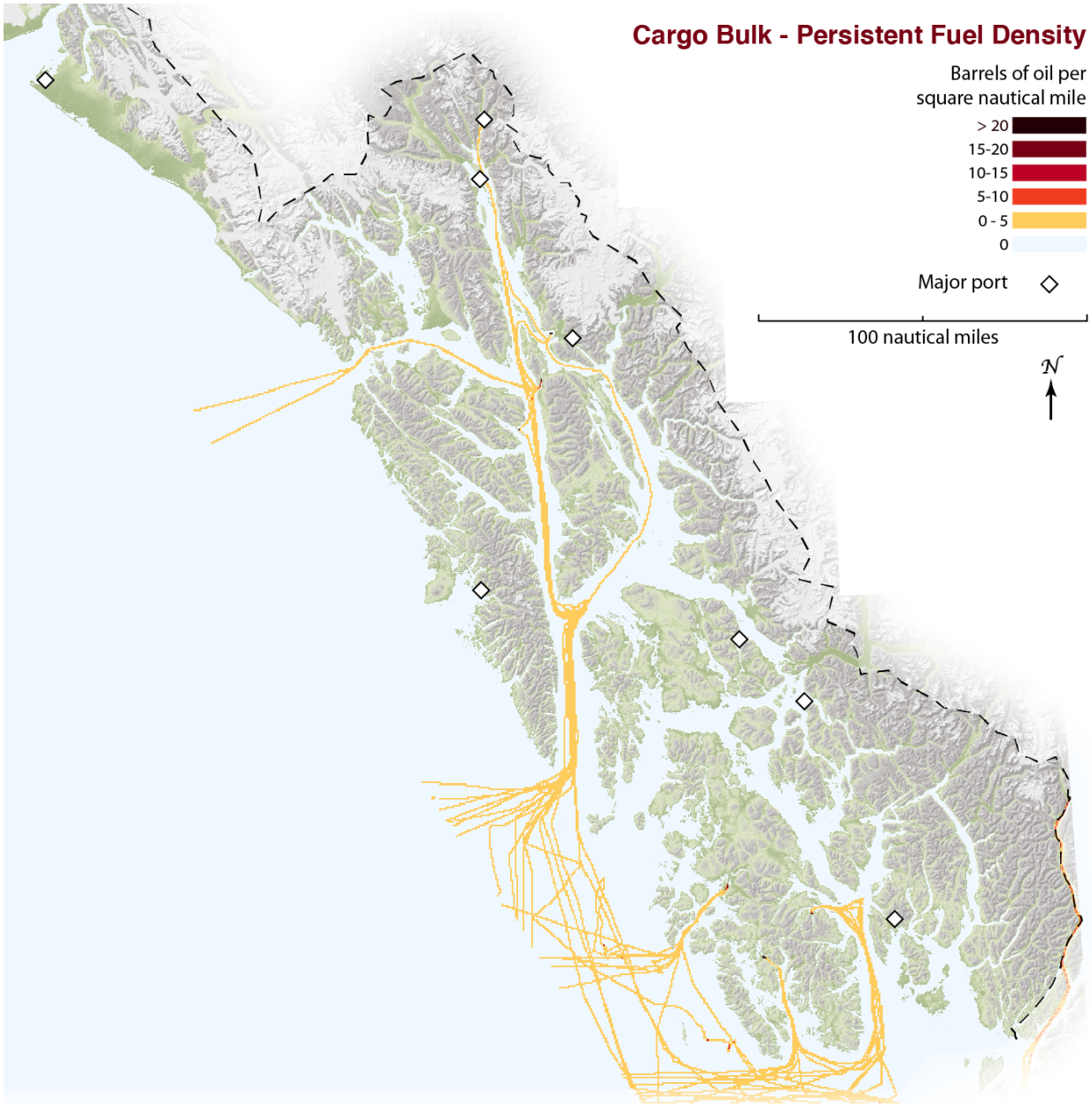

Figure 7.1-2 Cargo Bulk Persistent Fuel Density

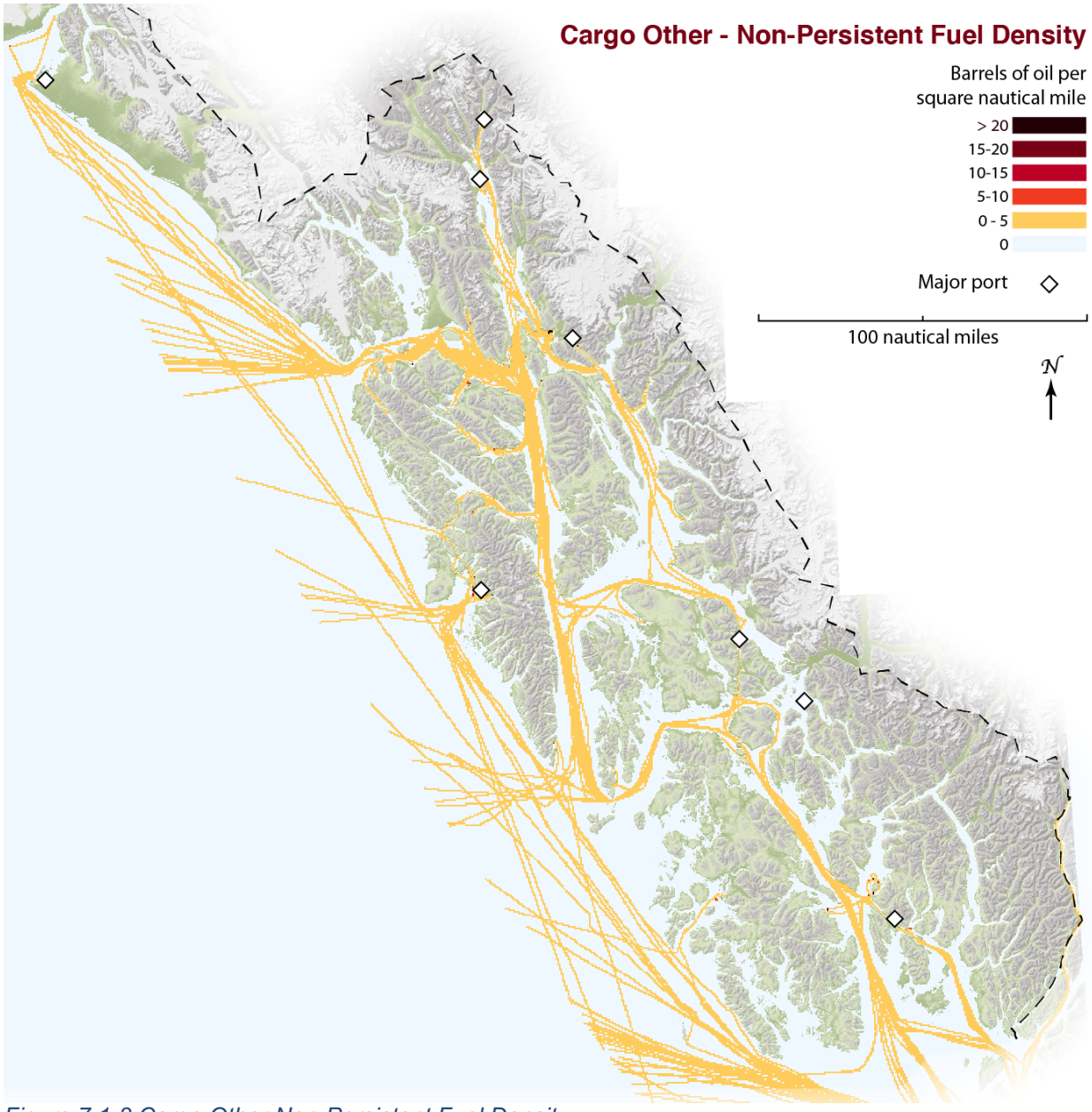

Figure 7.1-3 Cargo Other Non-Persistent Fuel Density

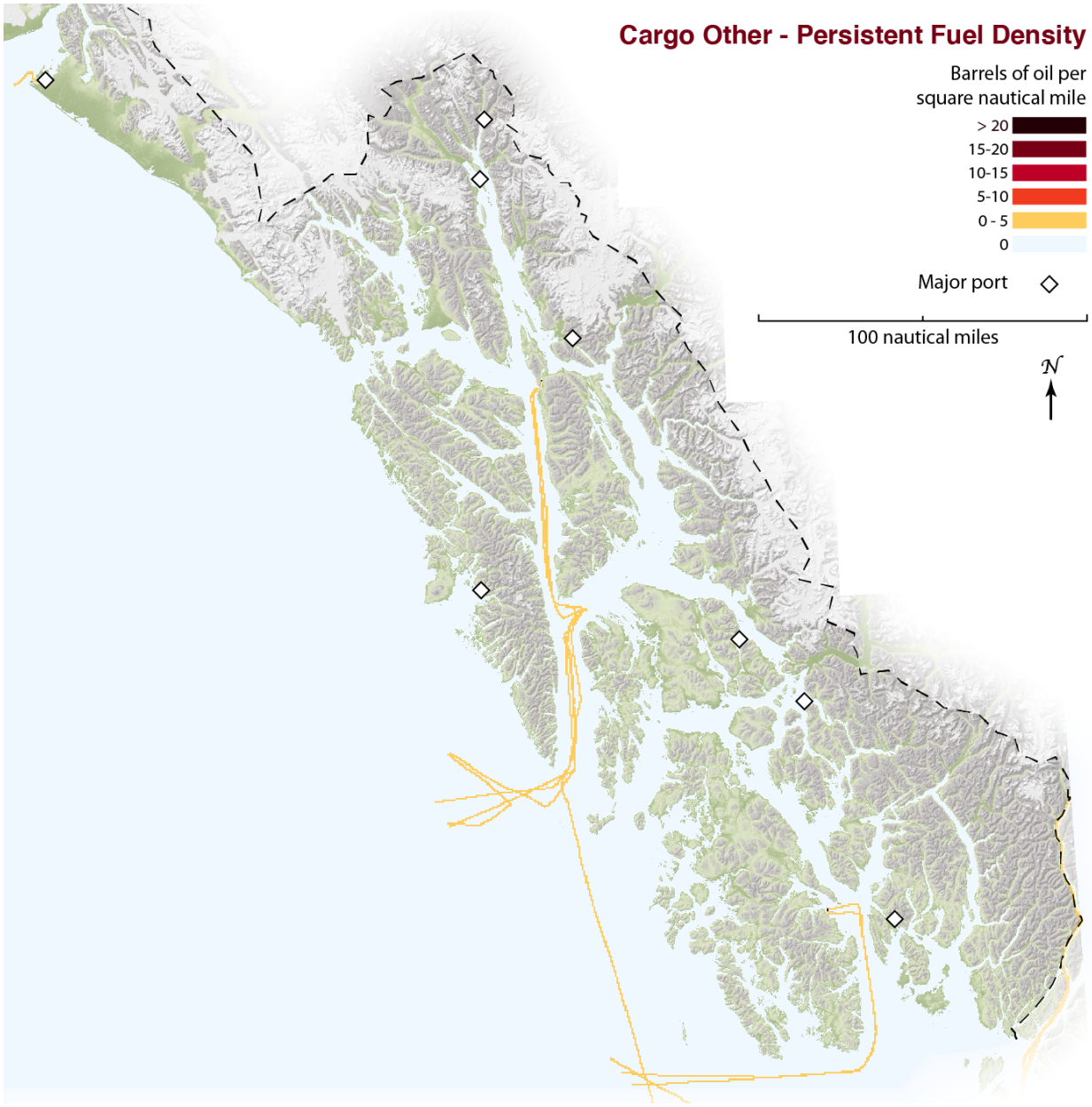

Figure 7.1-4 Cargo Other Persistent Fuel Density

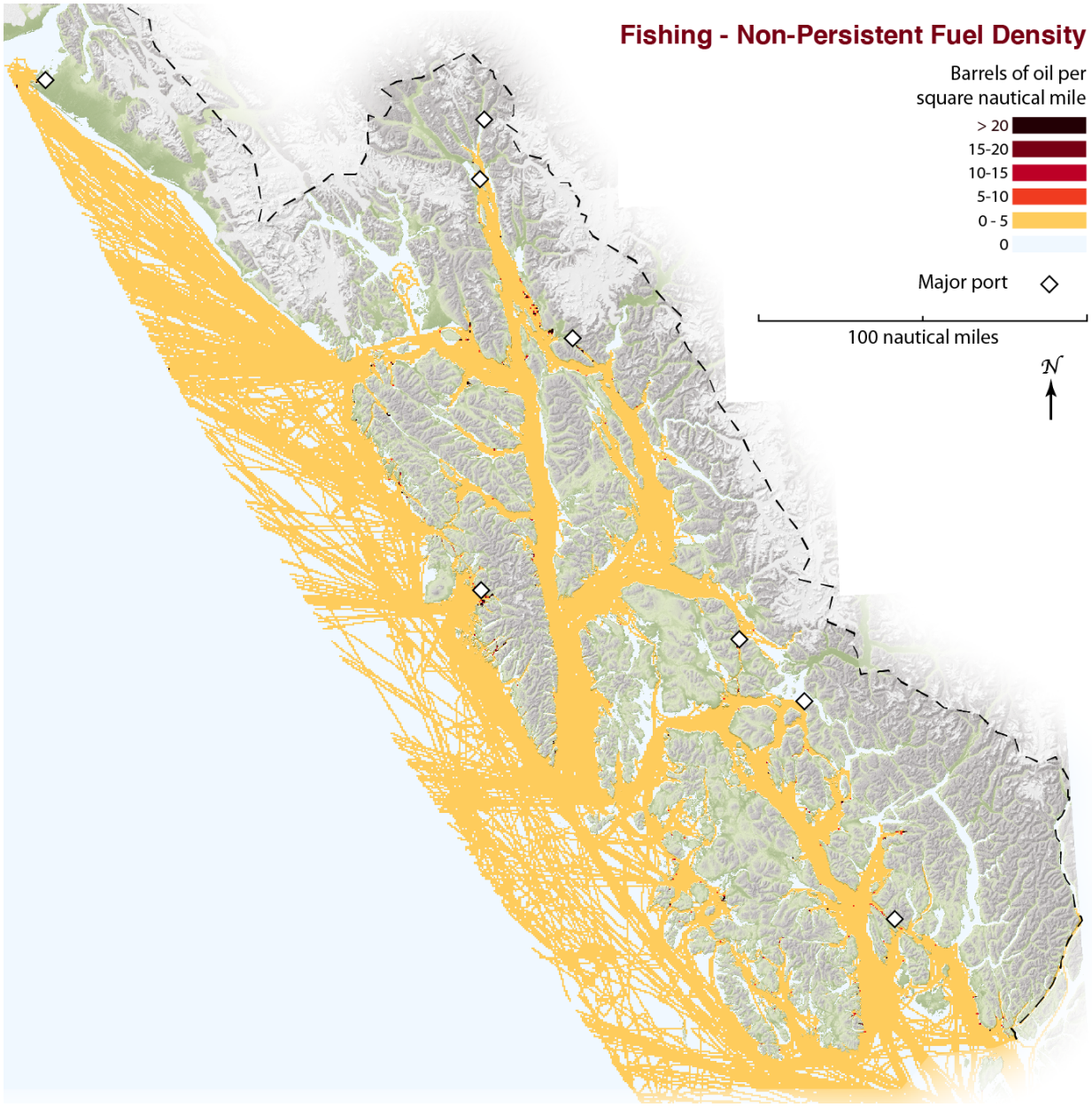

Figure 7.1-5 Fishing Vessel Non-Persistent Fuel Density

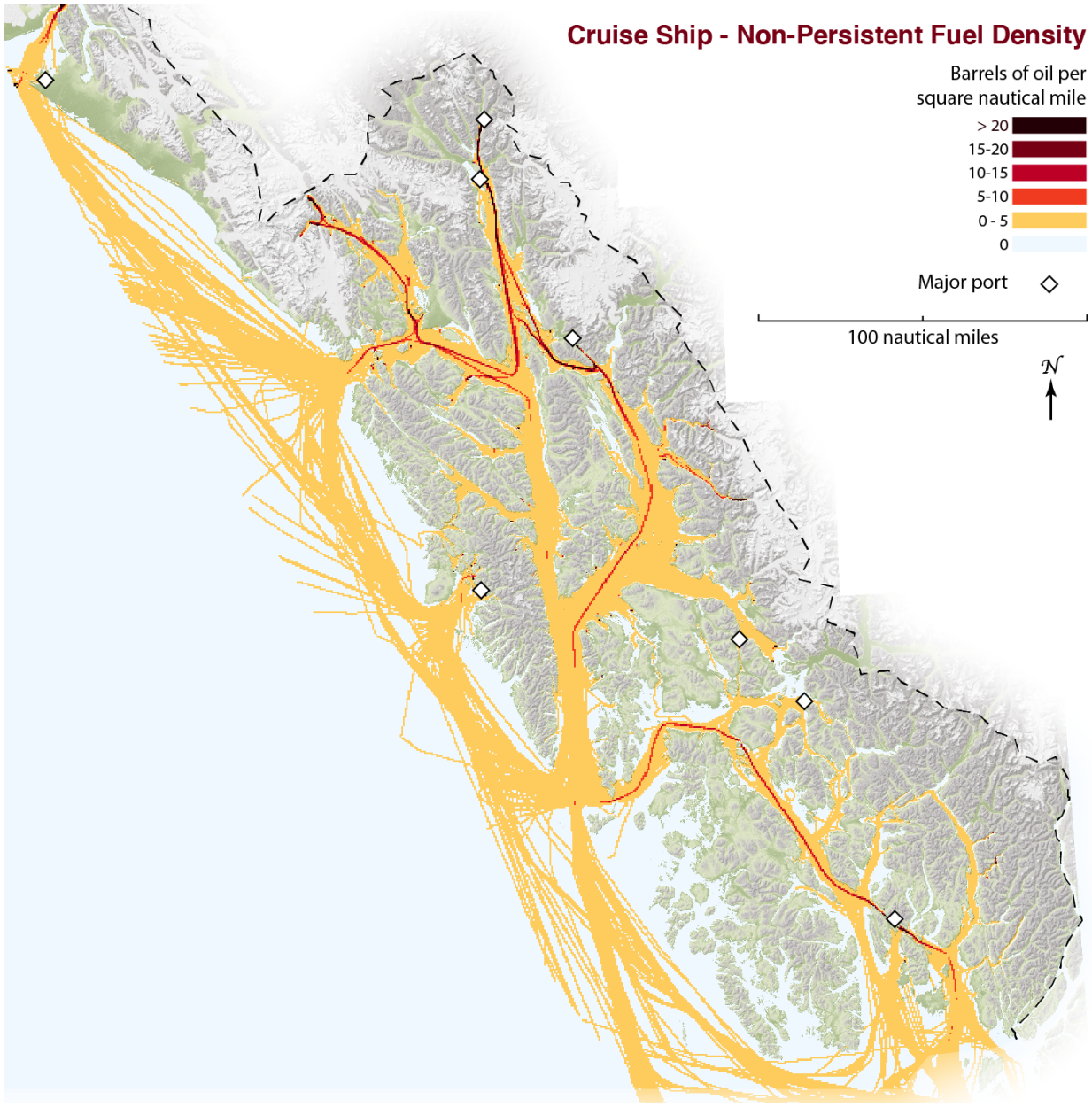

Figure 7.1-6 Cruise Ship Non-Persistent Fuel Density Map

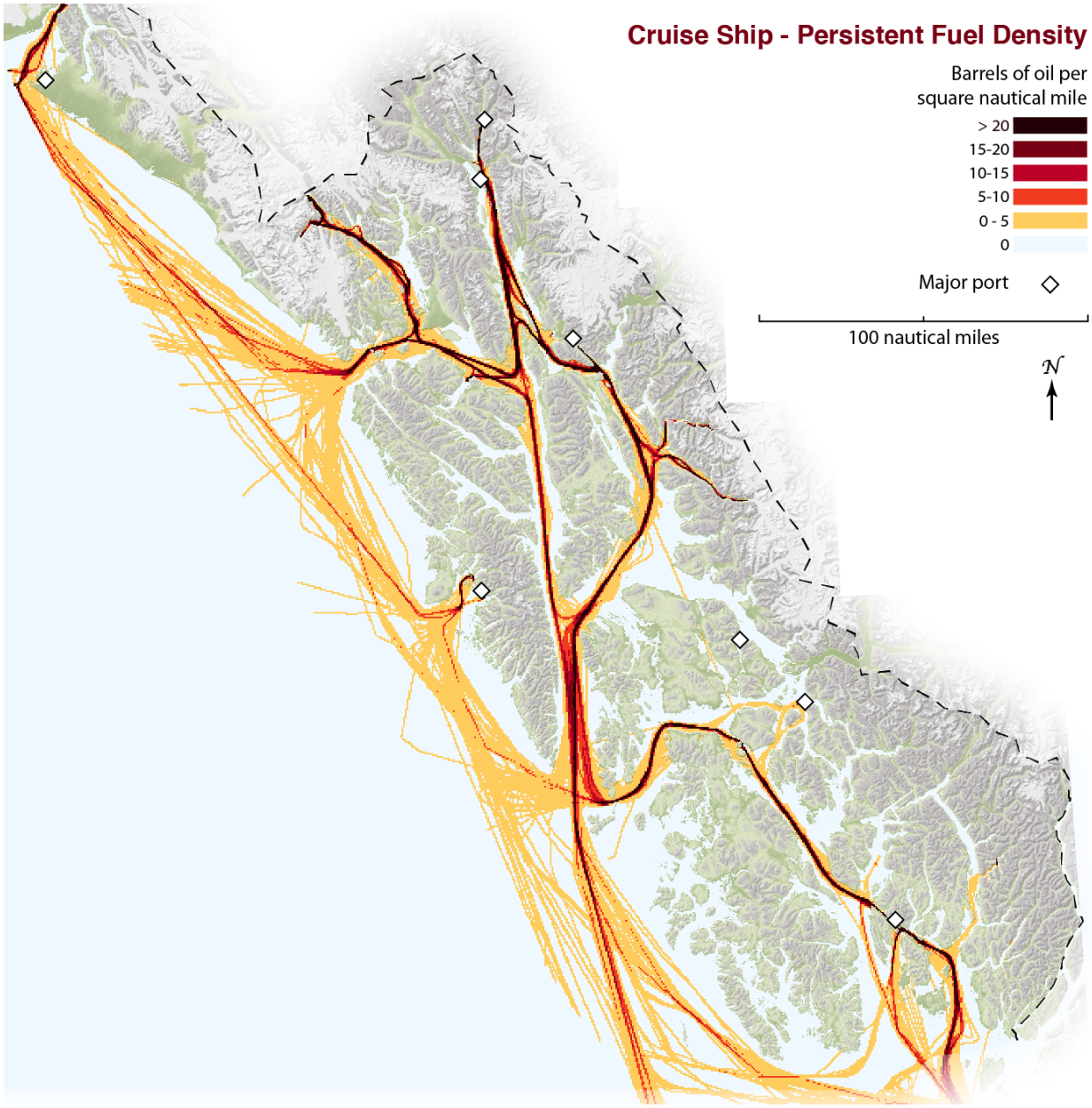

Figure 7.1-7 Cruise Ship Persistent Fuel Density

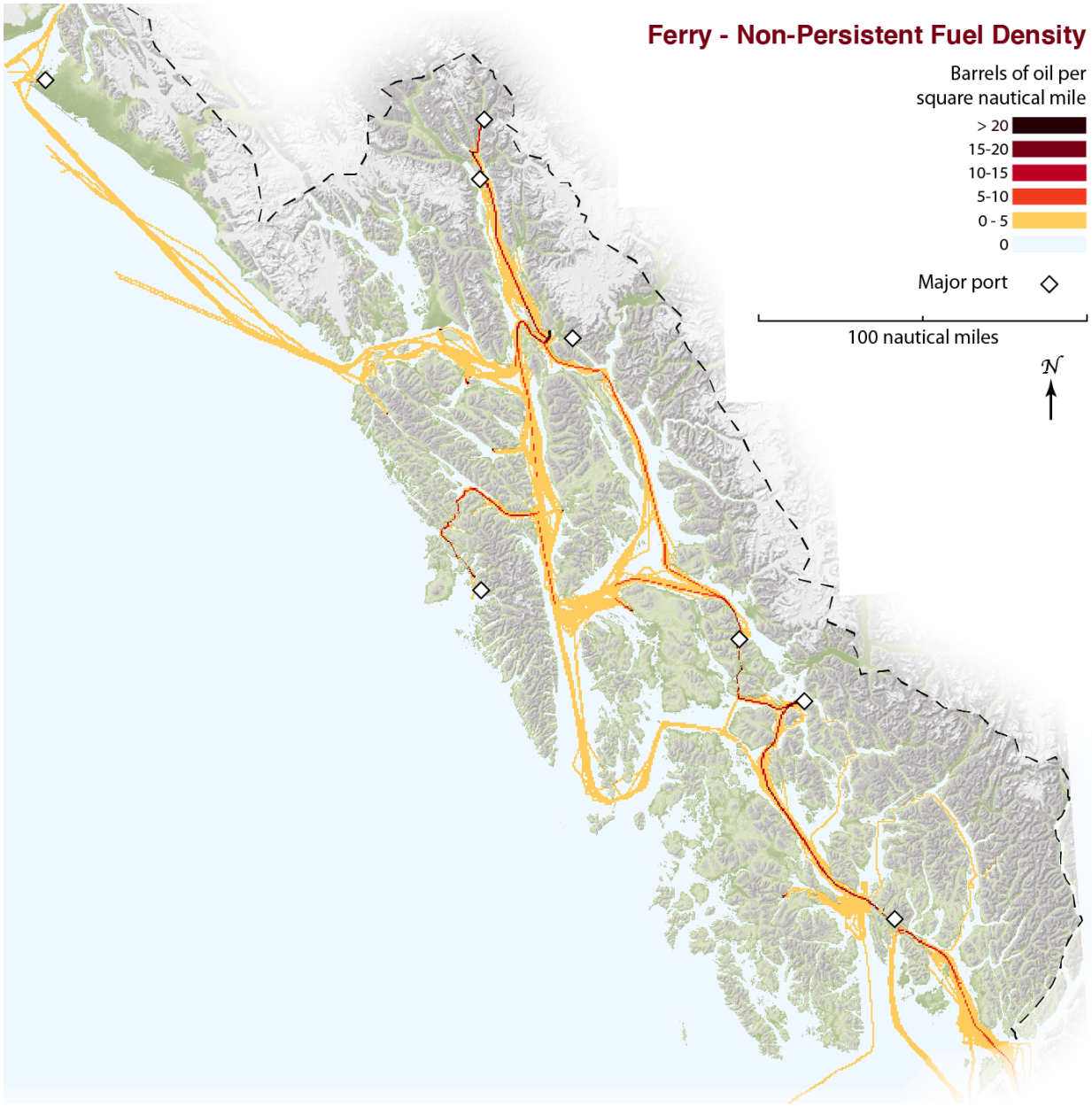

Figure 7.1-8 Ferry Non-Persistent Fuel Density

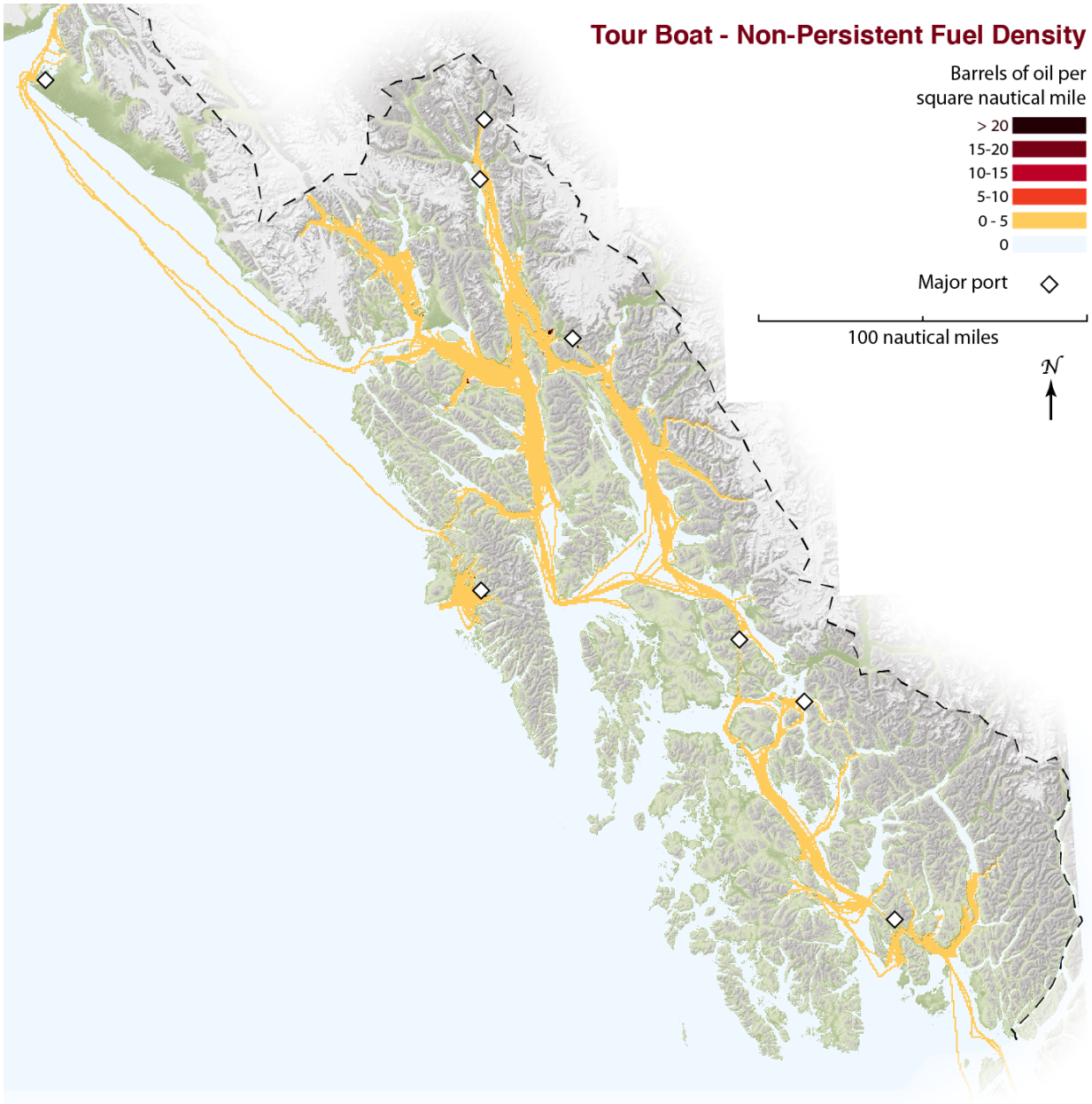

Figure 7.1-9 Tour Boat Non-Persistent Fuel Density

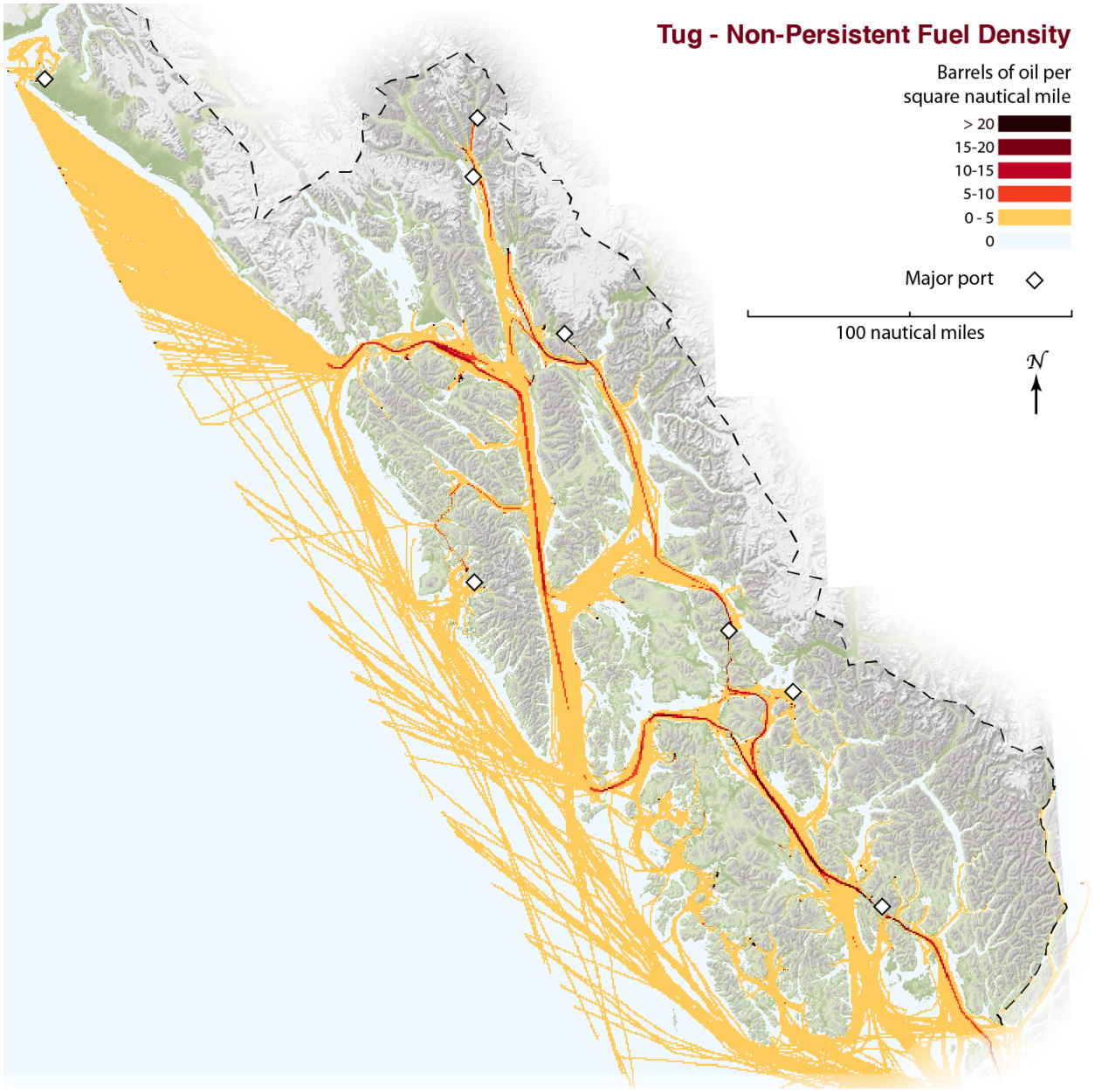

Figure 7.1-10 Tug Non-Persistent Fuel Density

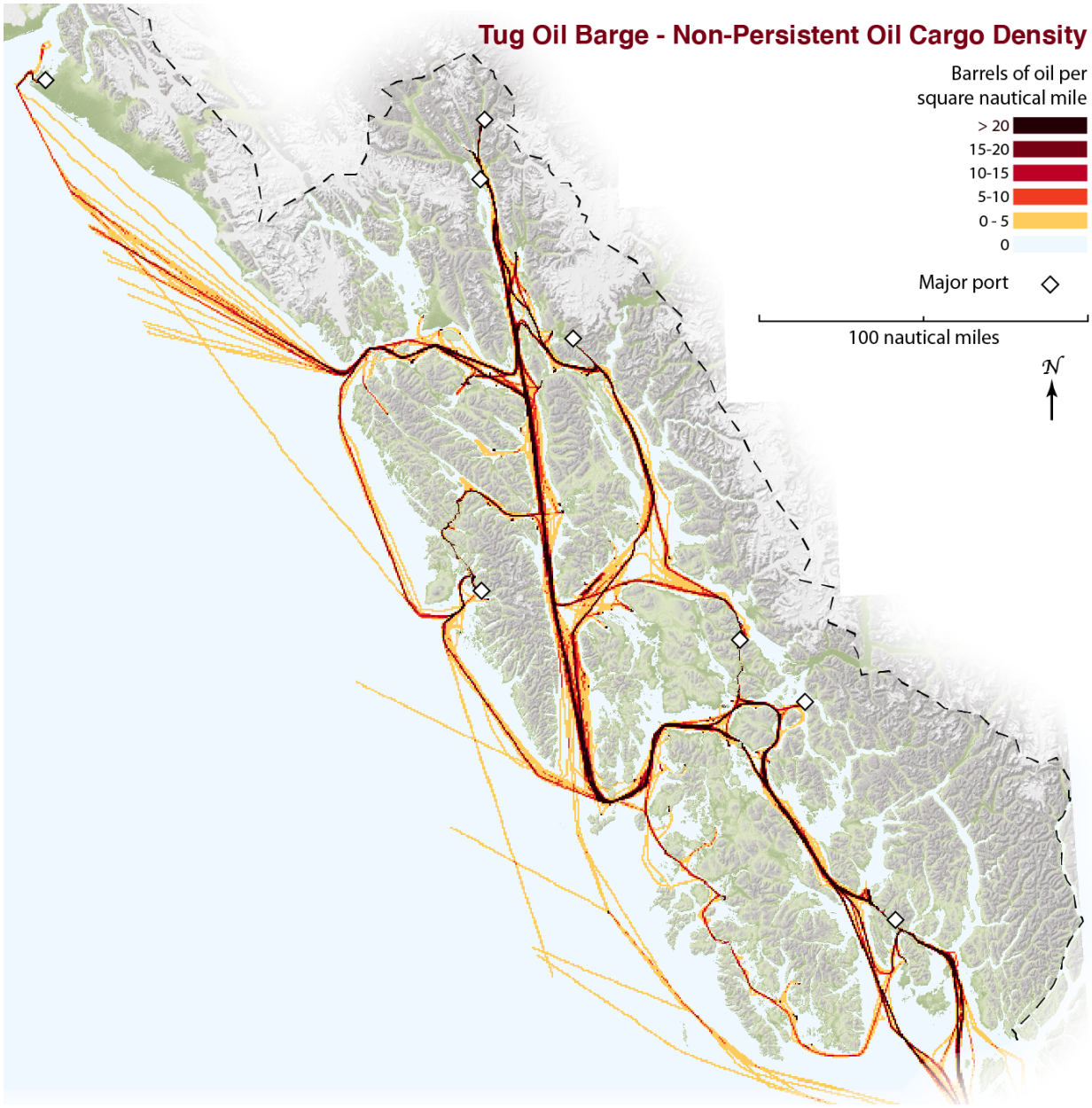

Figure 7.1-11 Tugs with Oil Barges Non-Persistent Cargo Density

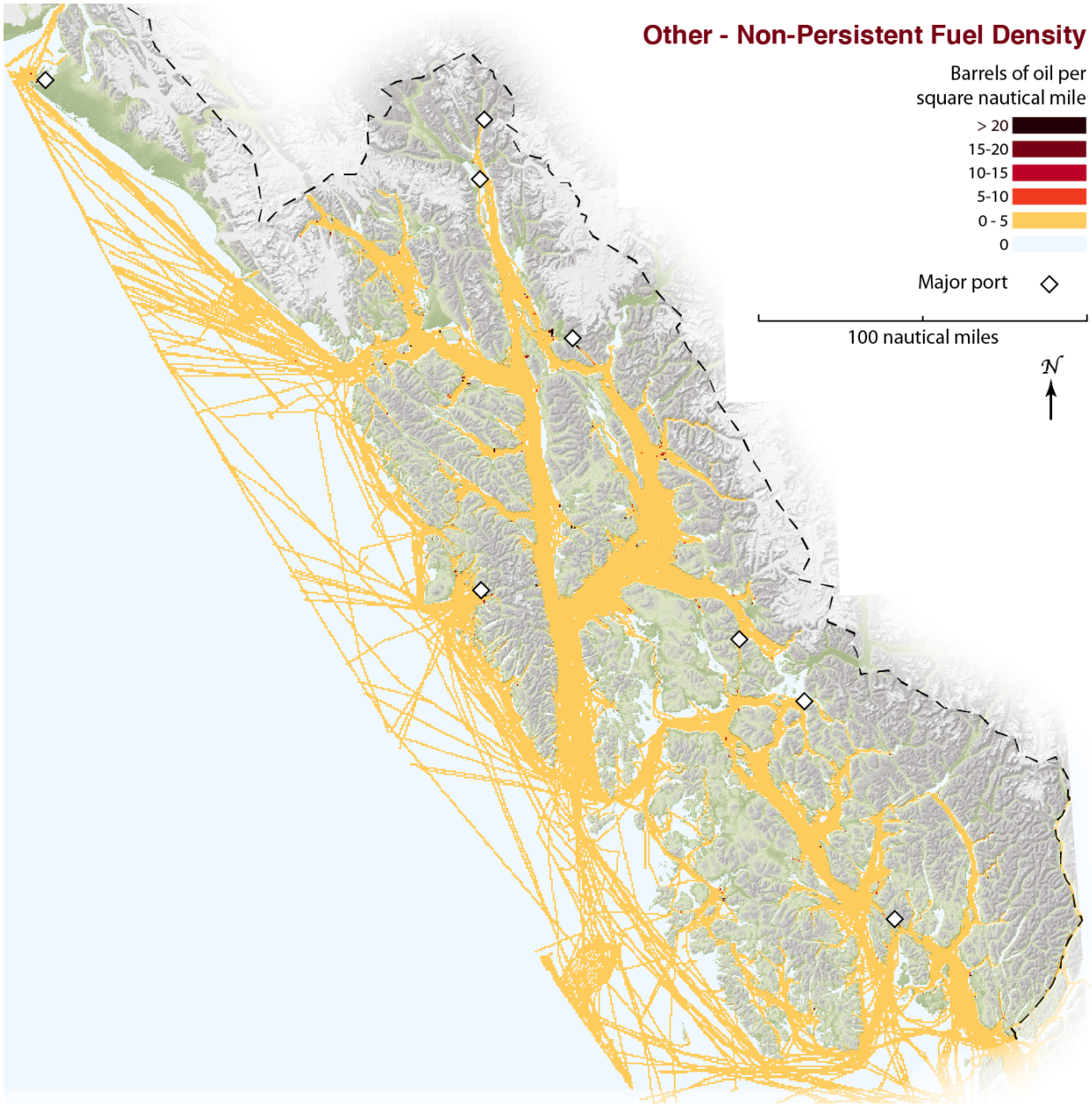

Figure 7.1-12 Other Vessels Non-Persistent Fuel Density

7.2 Petroleum Movements at Ports

As described in Section 3.6 Fuel Terminals, an attempt was made to interview all regulated fuel terminal operators in Southeast Alaska. Because not all could be contacted and some of those who were interviewed chose not to provide information, it was not possible to accurately represent the actual volumes of fuel delivered to any one port. Nevertheless, it was possible to estimate the volumes of fuel that could be entering a port based on the fuel and cargo capacities of the vessels calling at each port. It is important to note, however, that this study was not able to capture *all* fuel movements in Southeast Alaska. Many vessels were not included in the study for reasons cited previously. In addition, if a vessel transported fuel as cargo in on-deck tanks or as a roll on/roll off operation, that information would not appear in AIS data. For example, based on interviews Elfin Cove receives its fuel from a 75-foot landing craft that uses

on-deck tanks. While that vessel is large enough that its AIS data and integral fuel capacity was captured in this study, its cargo would not have estimated.

The cumulative fuel capacities of the vessel types entering each port are described in the bar charts in Figures 7.2-1 – 7.2-9. The orange bars represent persistent fuels and the blue bars represent non-persistent fuels. All quantities are in millions of gallons. In this case, cruise ships had by far the largest fuel capacity of all the vessels, both because they are often large vessels that carry a lot of fuel and because there were so many calls made to ports in 2018.

Bulk carriers typically carry persistent oil, such as bunker C or heavy fuel oil to burn at sea. They will burn non-persistent oil such a marine diesel oil while in the United States' and Canadian Exclusive Economic Zones (EEZ) to comply with emission control regulations.

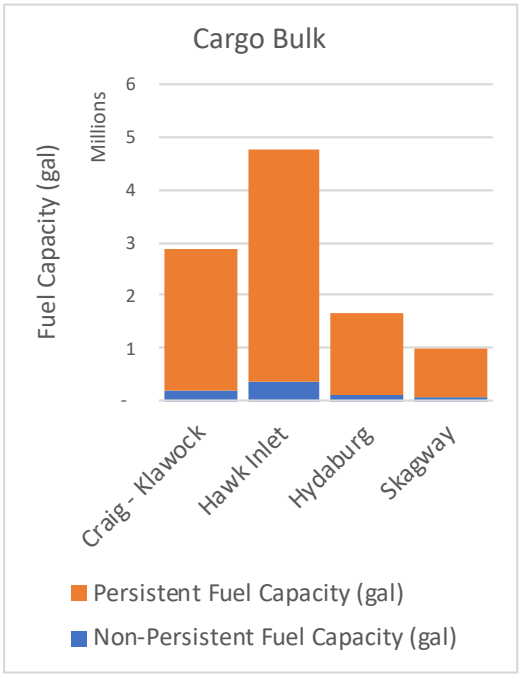

Figure 7.2-1 Cargo Bulk Fuel Capacities in Ports

Some large general cargo ships (within the Cargo Other category) also carry persistent oil to burn at sea.

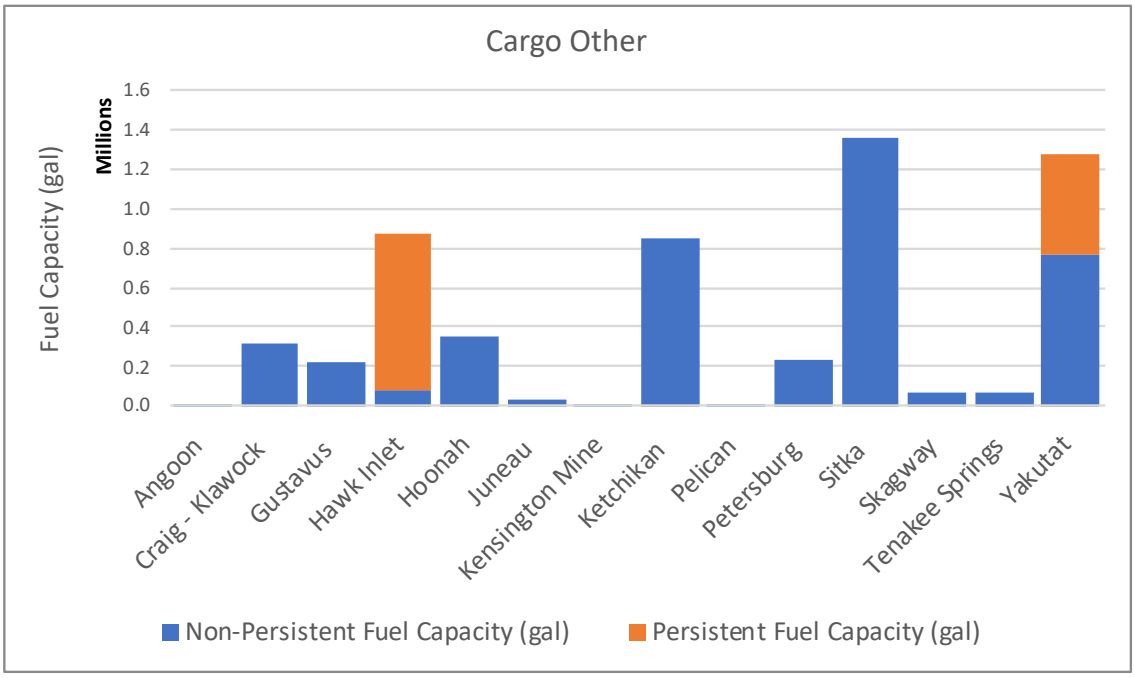

Figure 7.2-2 Cargo Other Fuel Capacities in Ports

Cruise ships have the capability to burn persistent oil, but they operate exclusively in the US and Canada EEZ during the cruise season. It is not known what fuel they carry and burn as they operate in Southeast Alaska. They might operate exclusively with non-persistent oil, such as marine diesel, or they might use heavy fuel oil and meet the emission control standards by using exhaust scrubbers or by purchasing low sulfur fuel. An inquiry to the cruise ship industry association the was not answered at the time of this report.

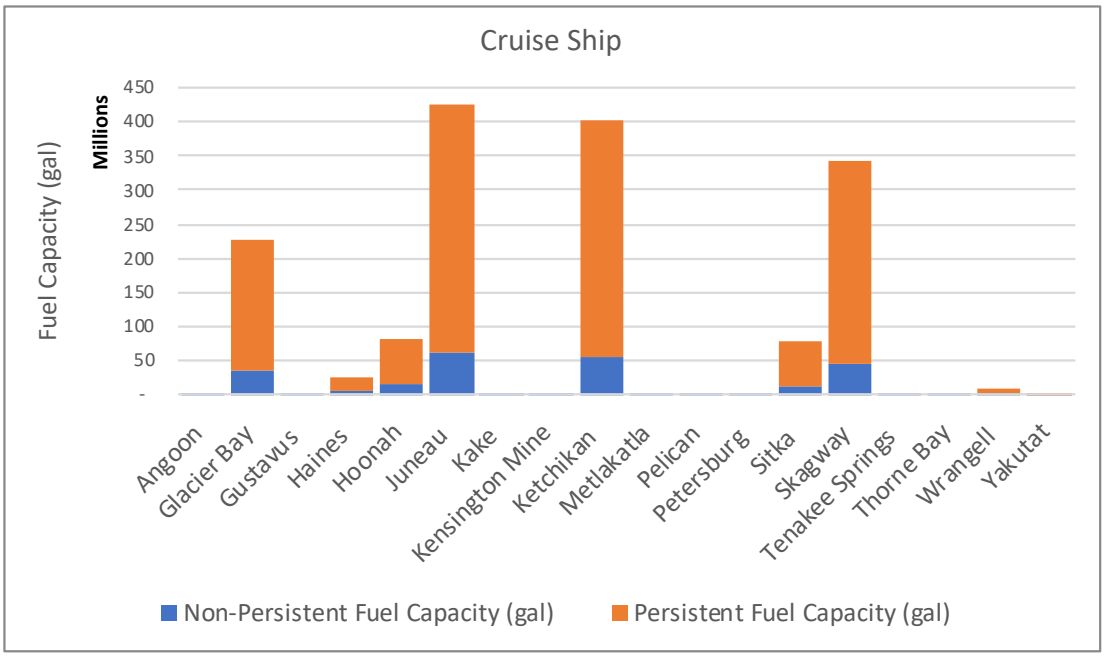

Figure 7.2-3 Cruise Ship Fuel Capacities in Ports

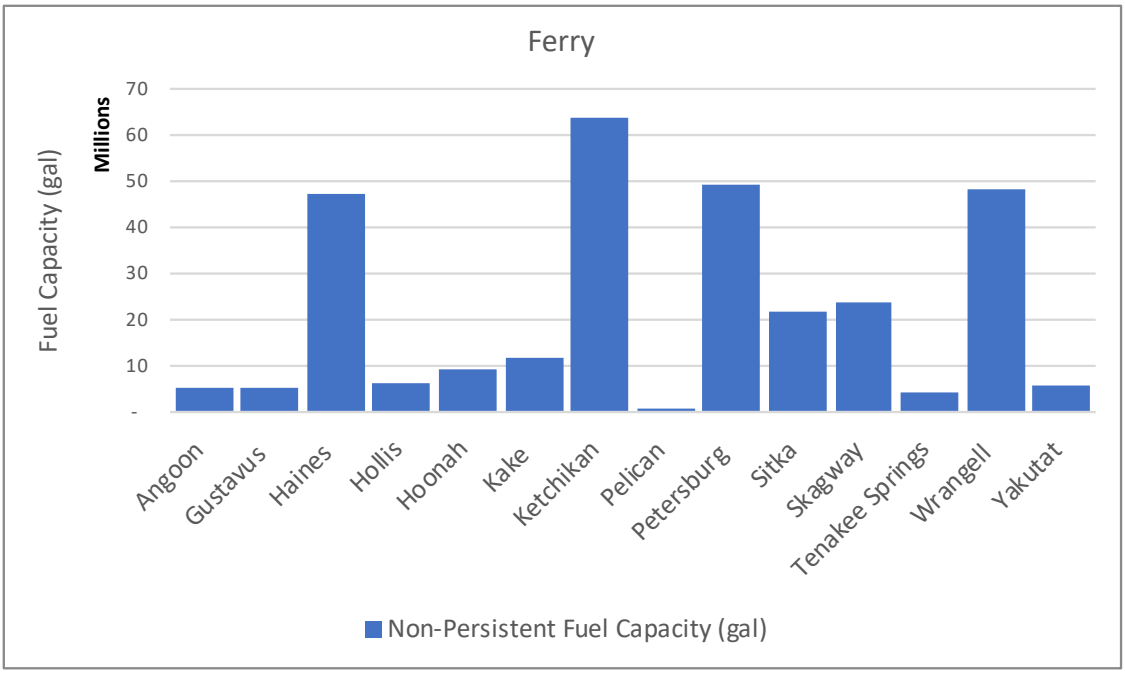

Figure 7.2-4 Ferries Fuel Capacities in Ports

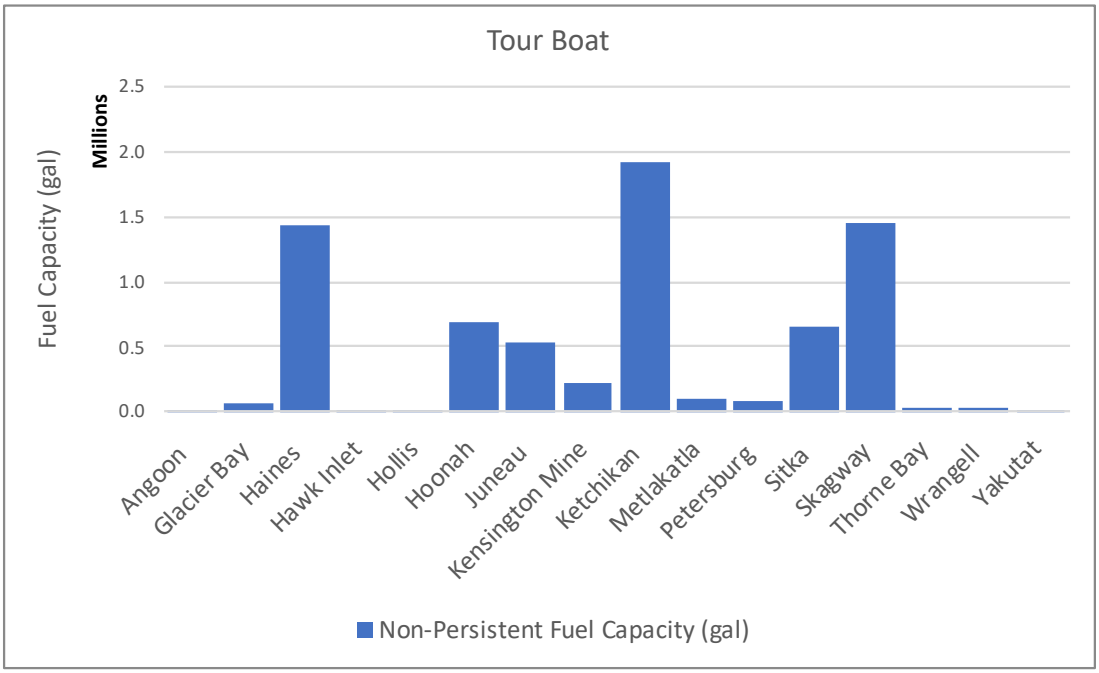

Figure 7.2-5 Tour Boats Fuel Capacities in Ports

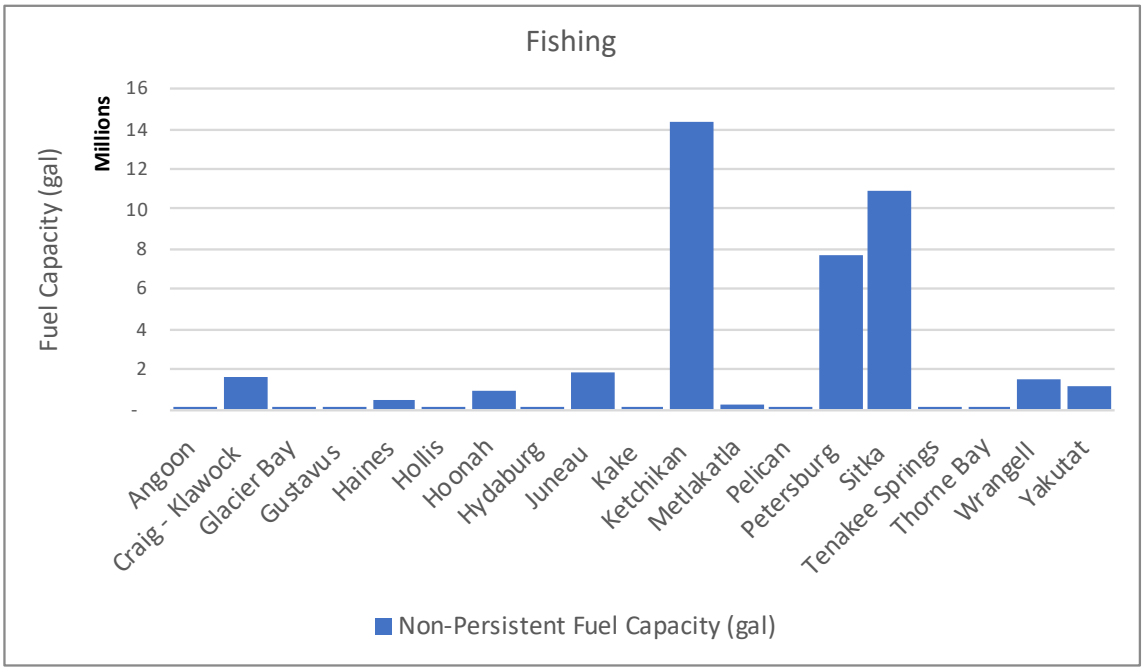

Figure 7.2-6 Fishing Vessels Fuel Capacities in Ports

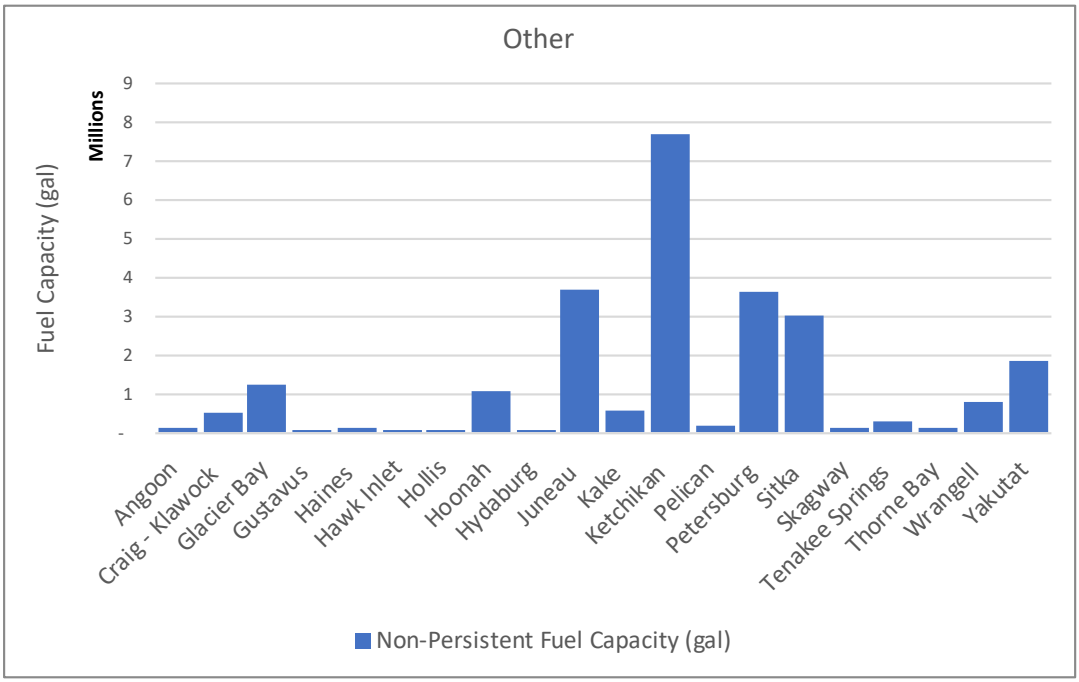

Figure 7.2-7 Other Vessels Fuel Capacities in Ports

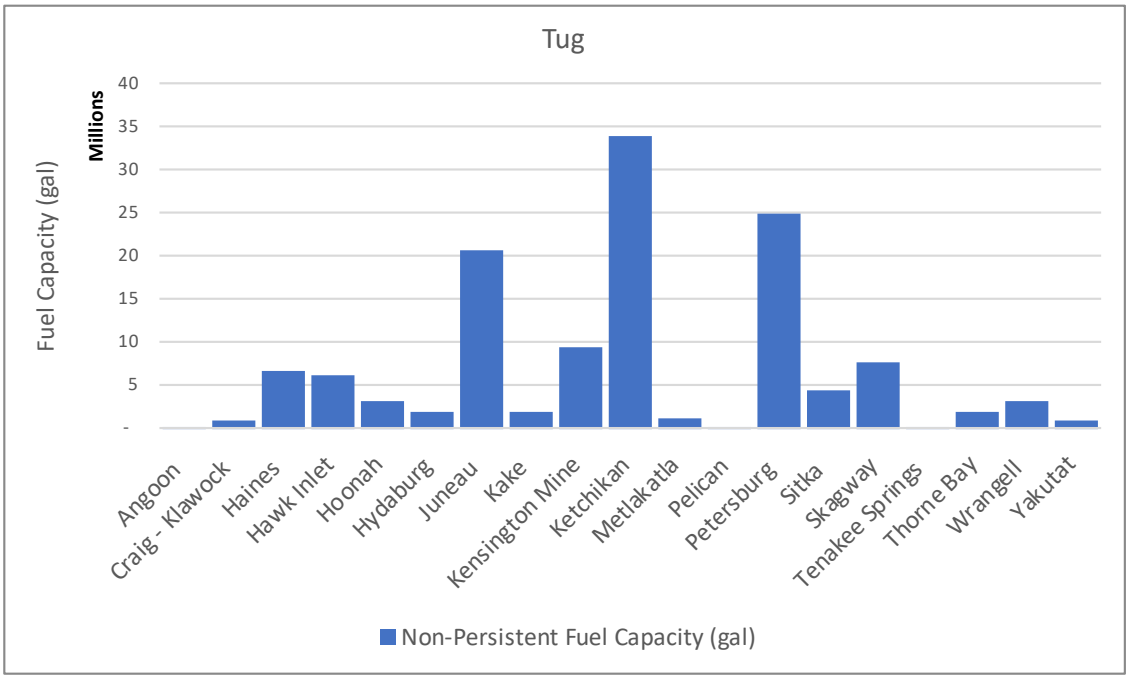

Figure 7.2-8 Tugs Fuel Capacities in Ports

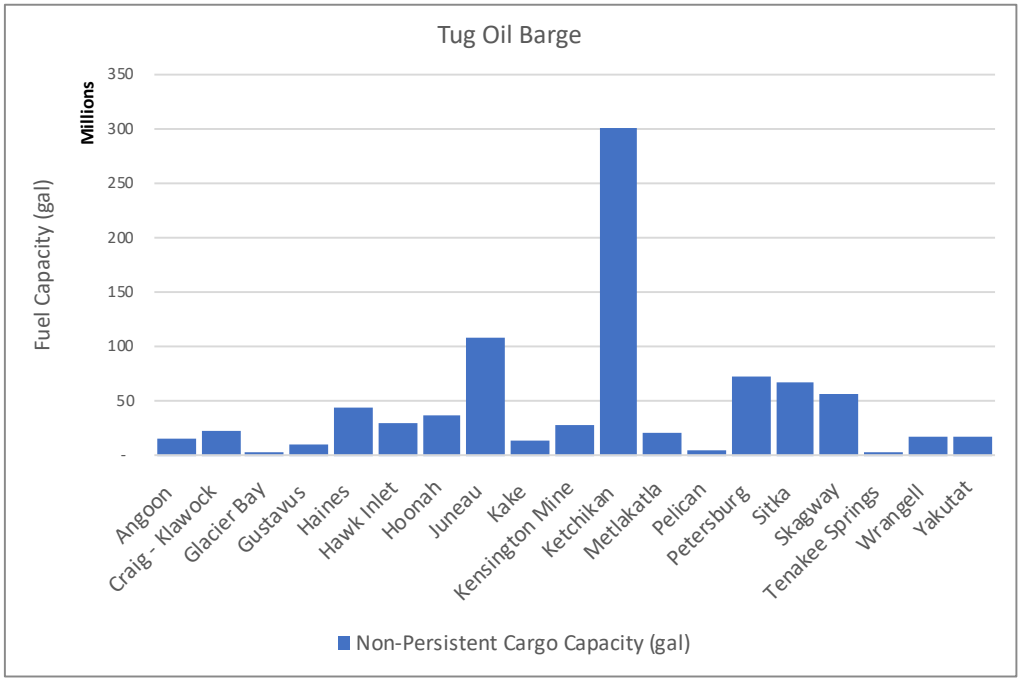

Figure 7.2-9 Tug Oil Barge Cargo Capacities in Ports

The cumulative capacities of all vessel types of non-persistent fuel, persistent fuel, and cargo for each port are shown in the bar charts in Figures 7.22 – 7.24. The ports of Juneau, Petersburg, and Ketchikan had the most non-persistent fuel entering them, while smaller communities such as Thorne Bay, Pelican, and Hydaburg had the least. Juneau, Skagway, Ketchikan, and Glacier Bay were the ports with the most vessel traffic carrying significant volumes of persistent fuels, primarily cruise ships.

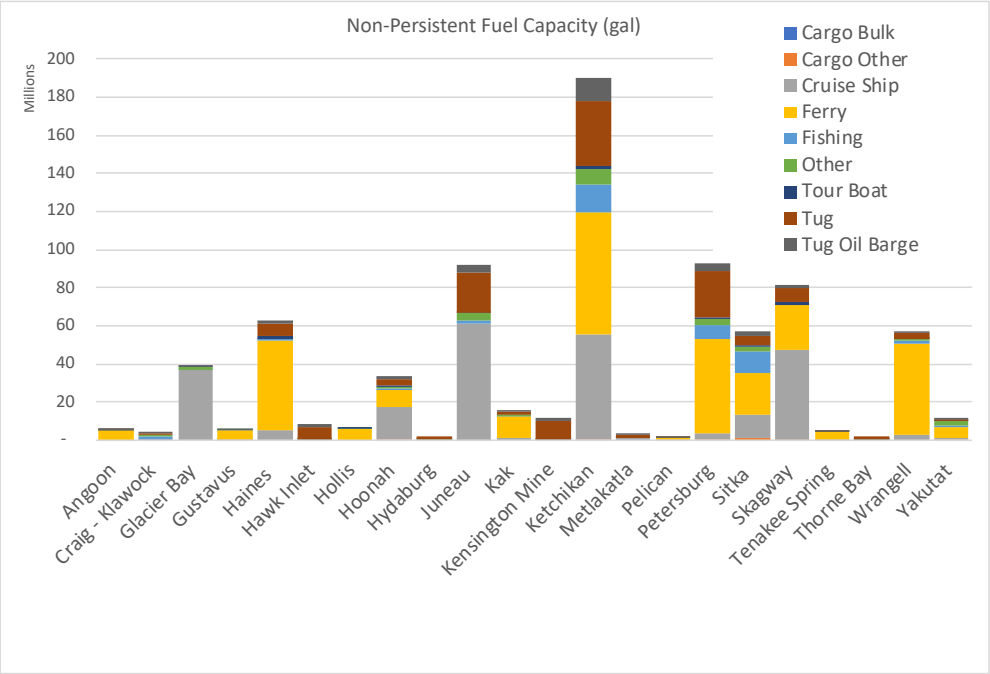

Figure 7.2-10 Non-persistent Fuel Capacity of All Vessels for Each Port

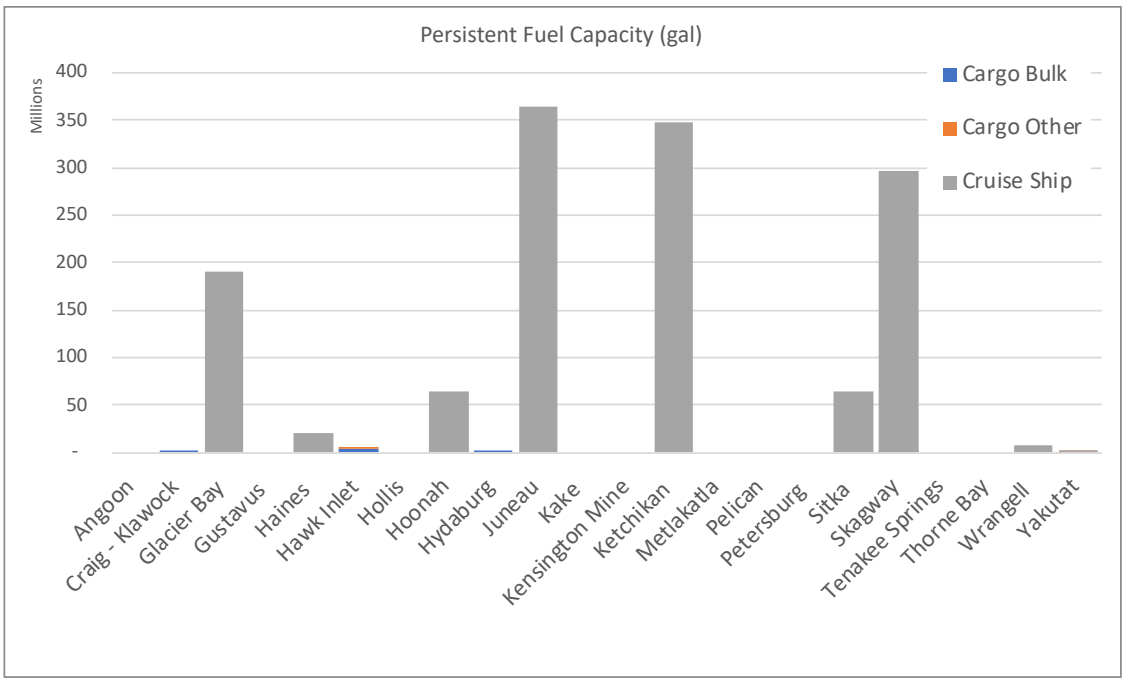

Figure 7.2-11 Persistent Fuel Capacity of All Vessels for Each Port

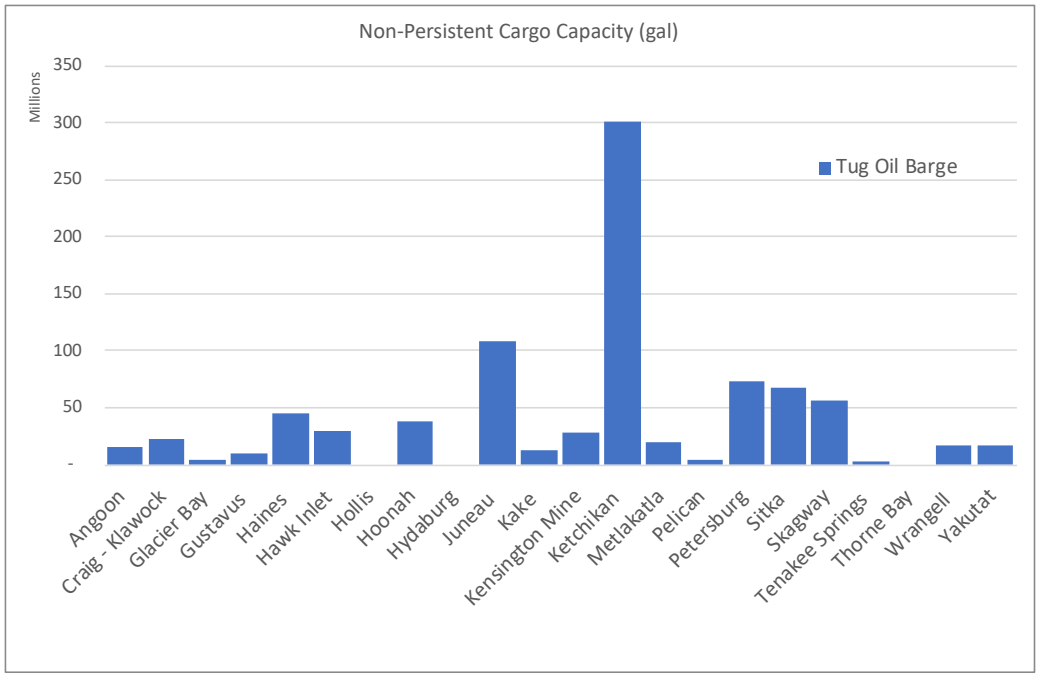

Figure 7.2-12 Cargo Capacity of All Vessels for Each Port

The following appendices contain the numeric data from which the above figures were derived as well as more information about vessels in ports:

Appendix G Fuel/Cargo Capacities of Vessels by Port
Appendix H Volume of Fuel Entering Each Port Annually
Appendix I Monthly Volume of Fuel Entering Each Port

7.3 Petroleum Movements in High-Risk Areas

The bar charts in Figures 7.3-1 – 7.3-9 describe the cumulative fuel capacities of the vessel types entering each High-Risk area. The orange bars represent persistent fuels and the blue bars represent non-persistent fuels. All quantities are in millions of gallons.

While bulk and non-bulk cargo carriers carry persistent fuels, cruise ships frequent far more high-risk areas. They also had more transits in Southeast Alaska in 2018 than any other vessel type (see Table 4.1-2).

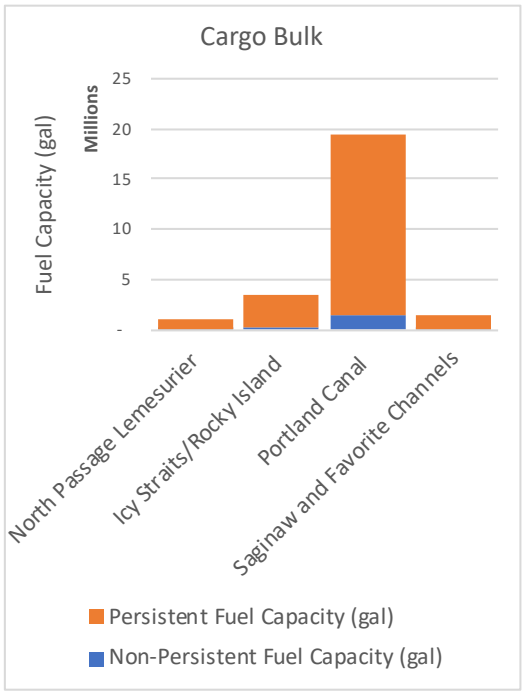

Figure 7.3-1 Cargo Bulk Fuel Capacities in High-Risk Areas

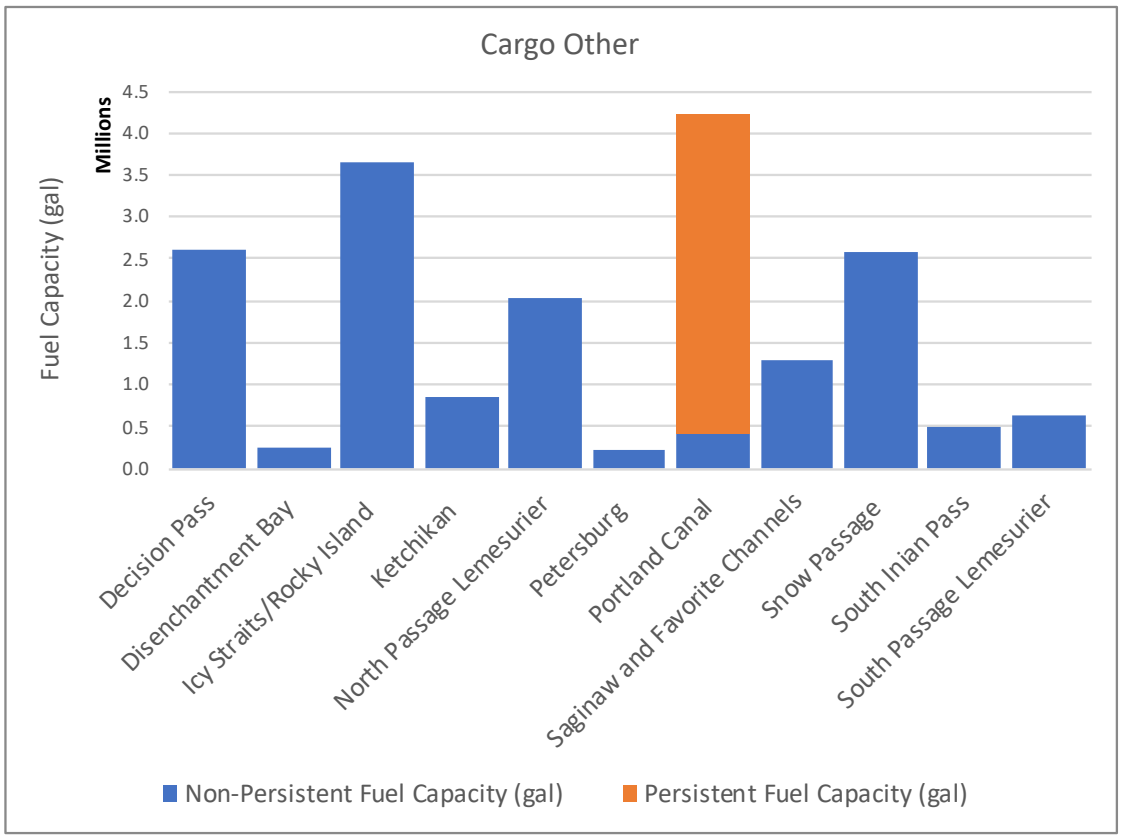

Figure 7.3-2 Cargo Other Fuel Capacities in High-Risk Areas

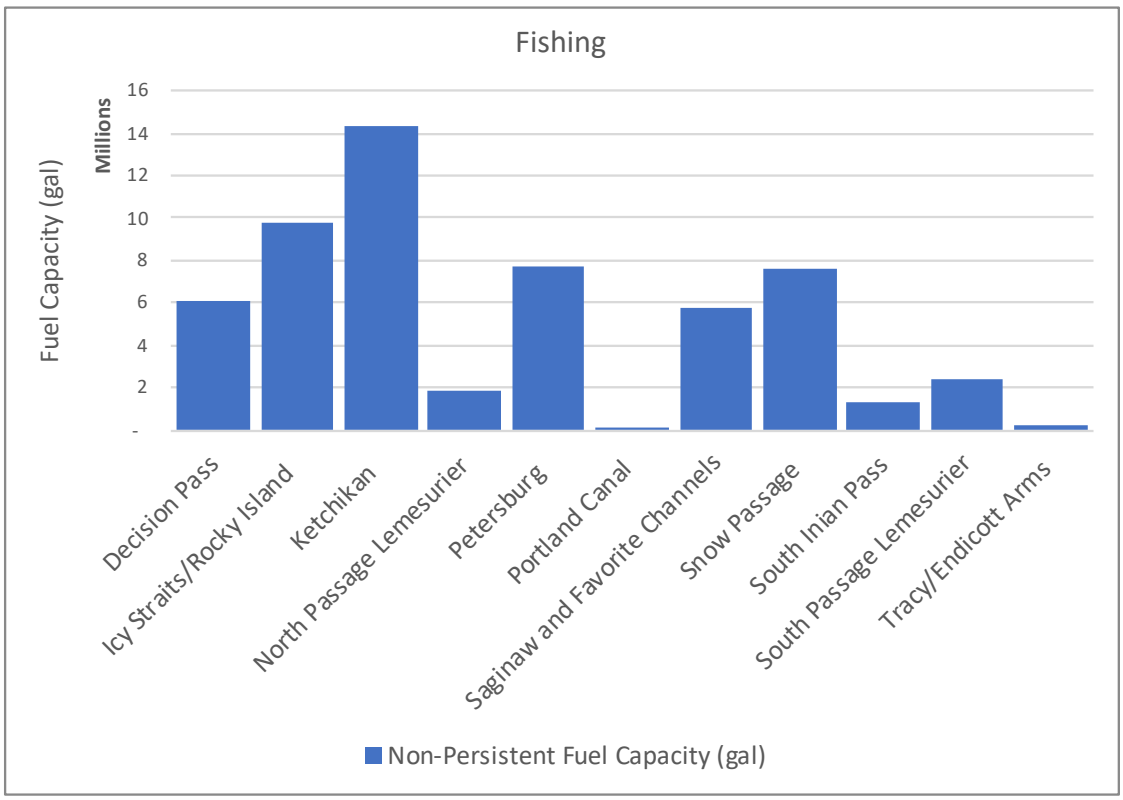

Figure 7.3-3 Fishing Vessel Fuel Capacities in High-Risk Areas

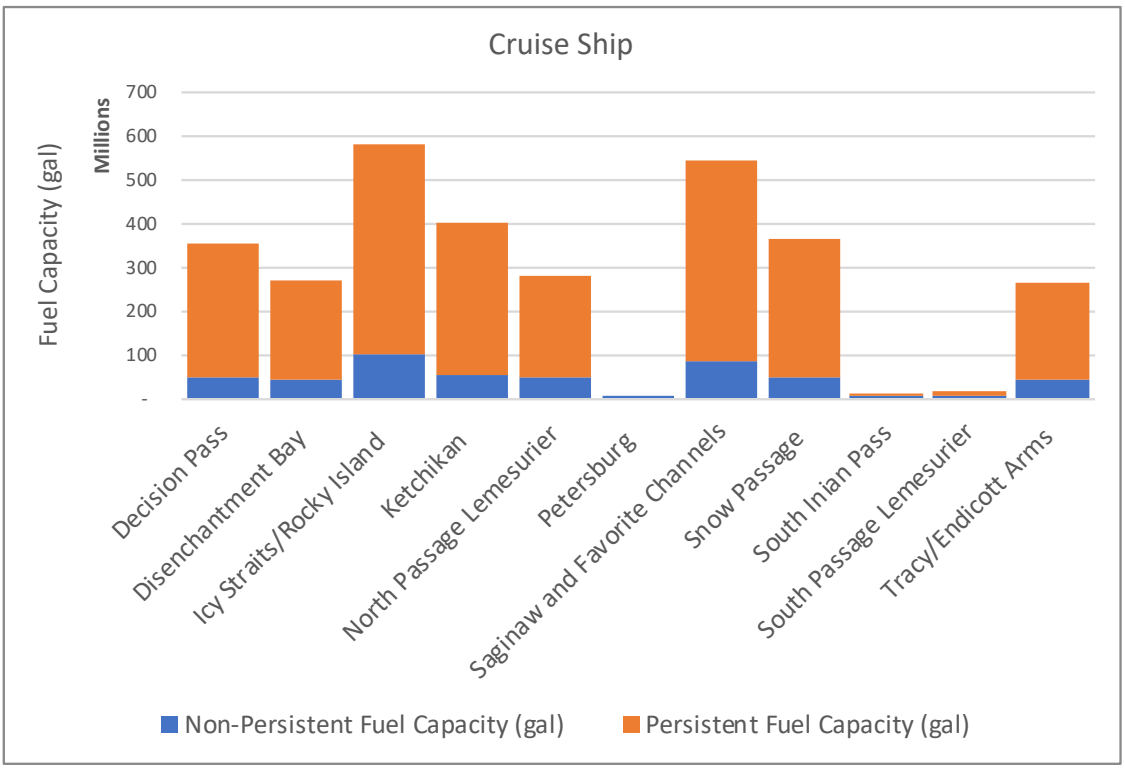

Figure 7.3-4 Cruise Ship Fuel Capacities in High-Risk Areas

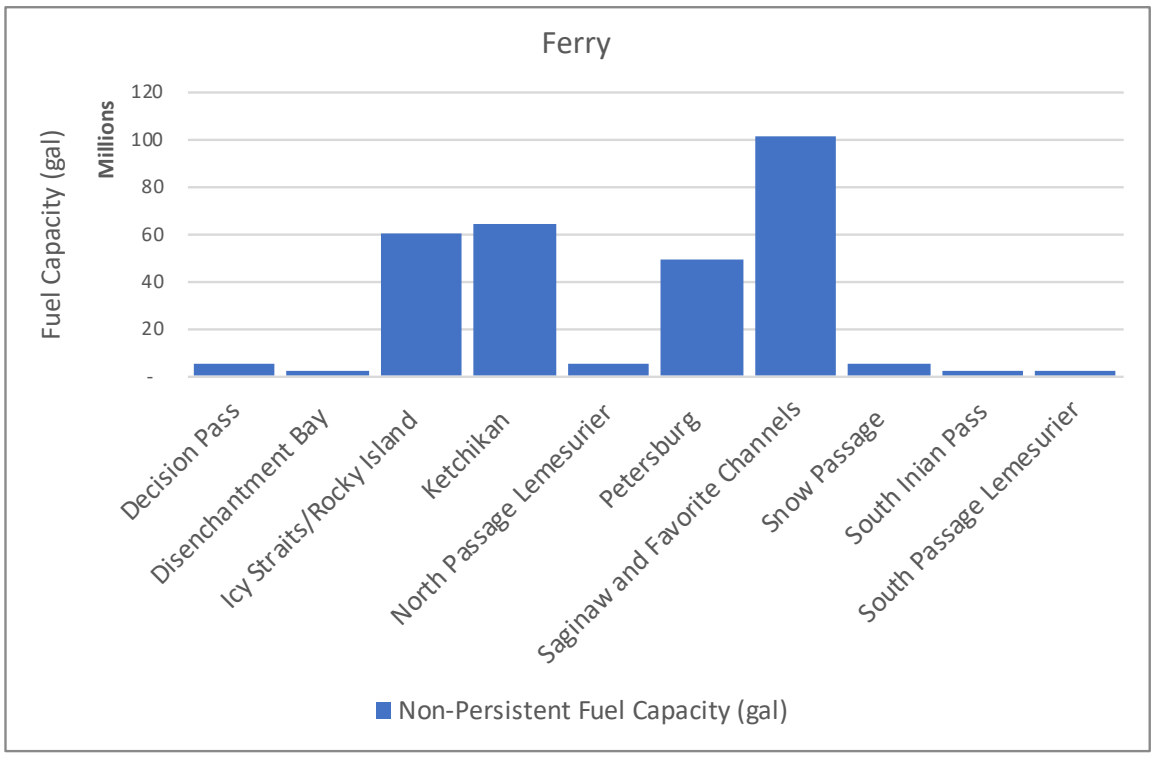

Figure 7.3-5 Ferries Fuel Capacities in High-Risk Areas

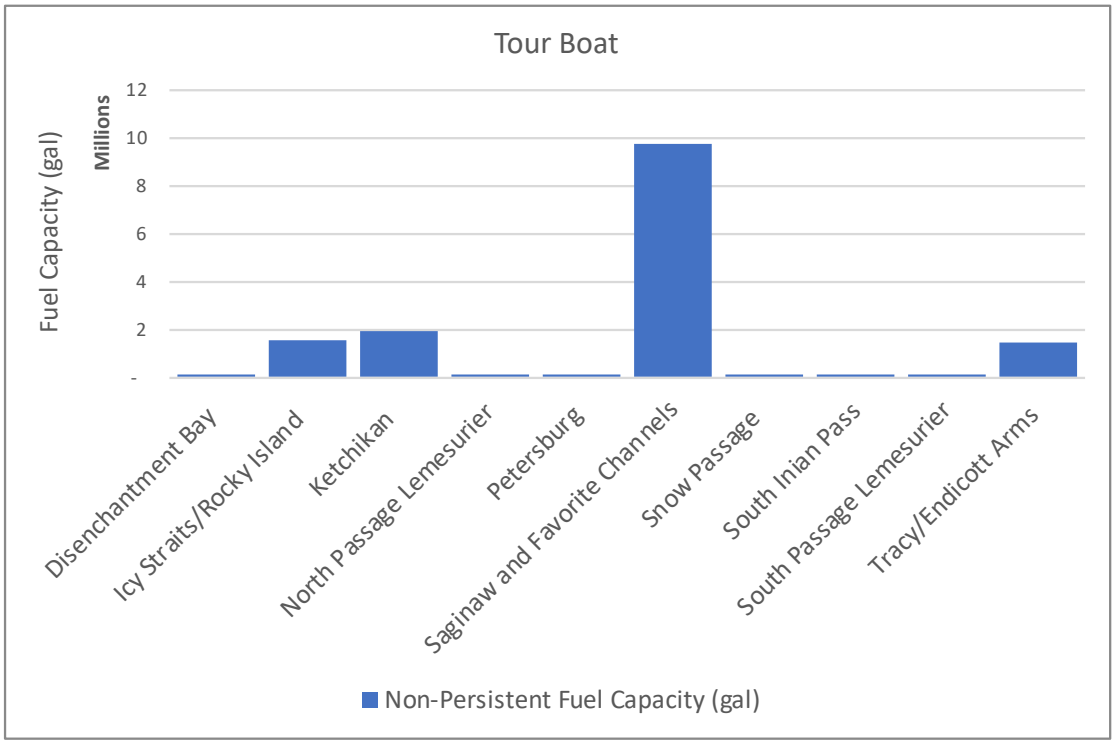

Figure 7.3-6 Tour Boats Fuel Capacities in High-Risk Areas

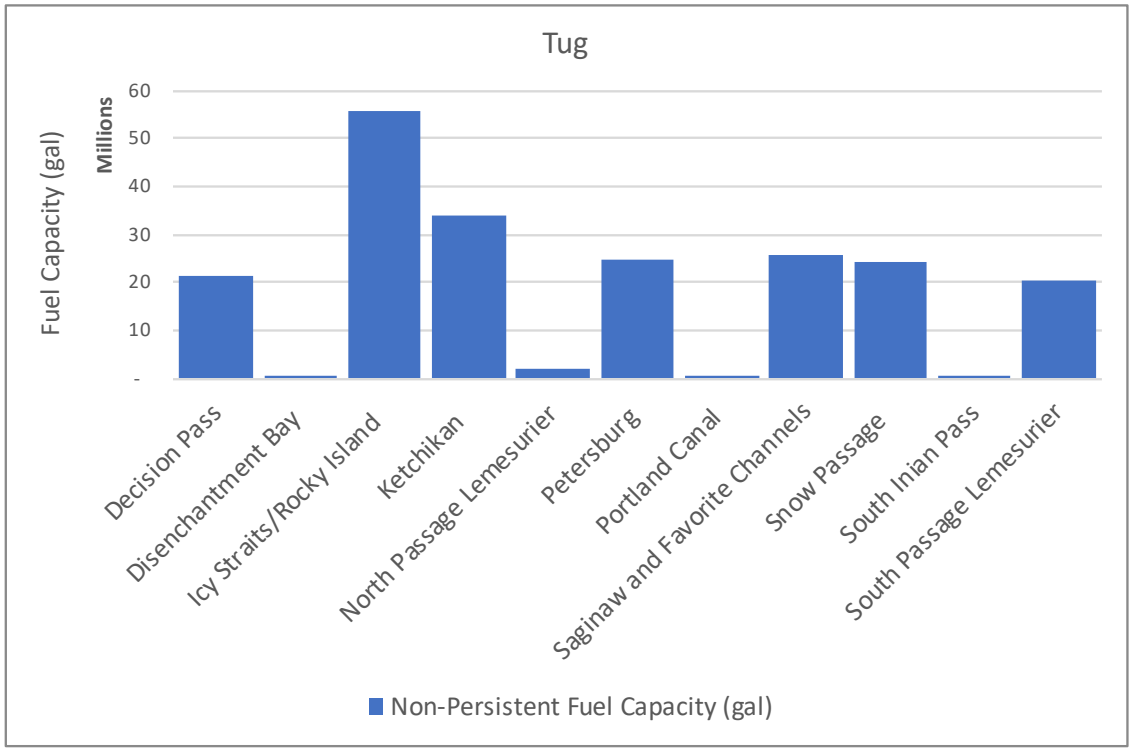

Figure 7.3-7 Tugs Fuel Capacities in High-Risk Areas

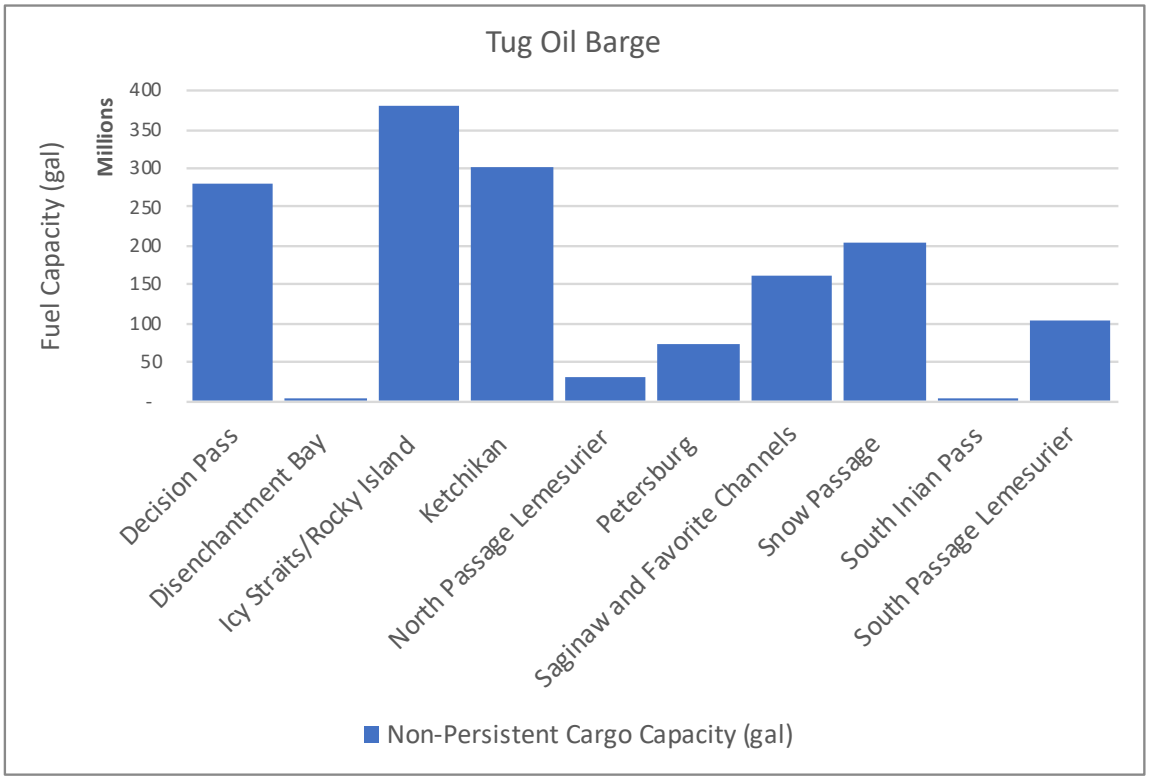

Figure 7.3-8 Tugs Oil Barge Fuel Capacities in High-Risk Areas

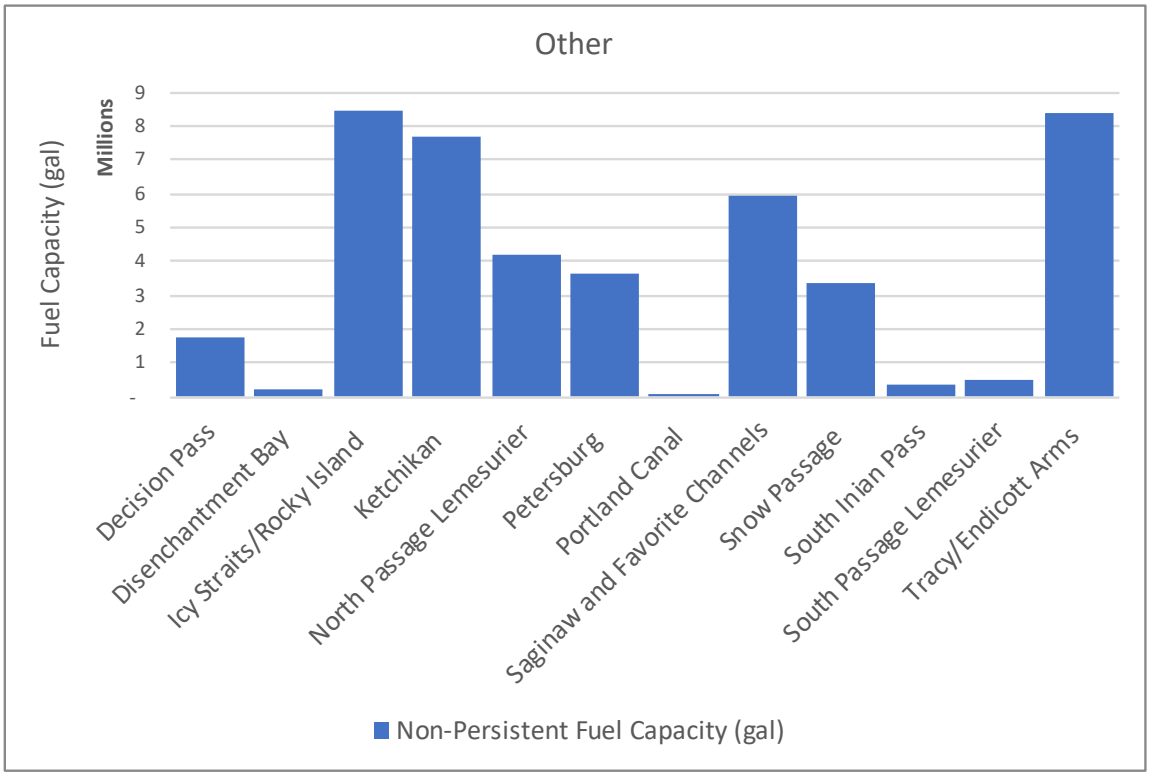

Figure 7.3-9 Other Vessels Fuel Capacities in High-Risk Areas

Figure 7.3-10 shows the capacity of all fuels in all vessel types going into High-Risk areas each week of the year. This figure is intended to show how the total movement of petroleum products varies in High-Risk areas during the year. Week 1 is the first week of January, week 53 is the last week of December, and so weeks 26 – 27 fall in the middle of summer. It is clear from the bell-shaped chart that the movement of petroleum products in High-Risk areas during 2018 was much higher during the summer months than the winter. This increase in petroleum products came from all vessel types as all segments of industry are typically busier in the summer than in the winter.

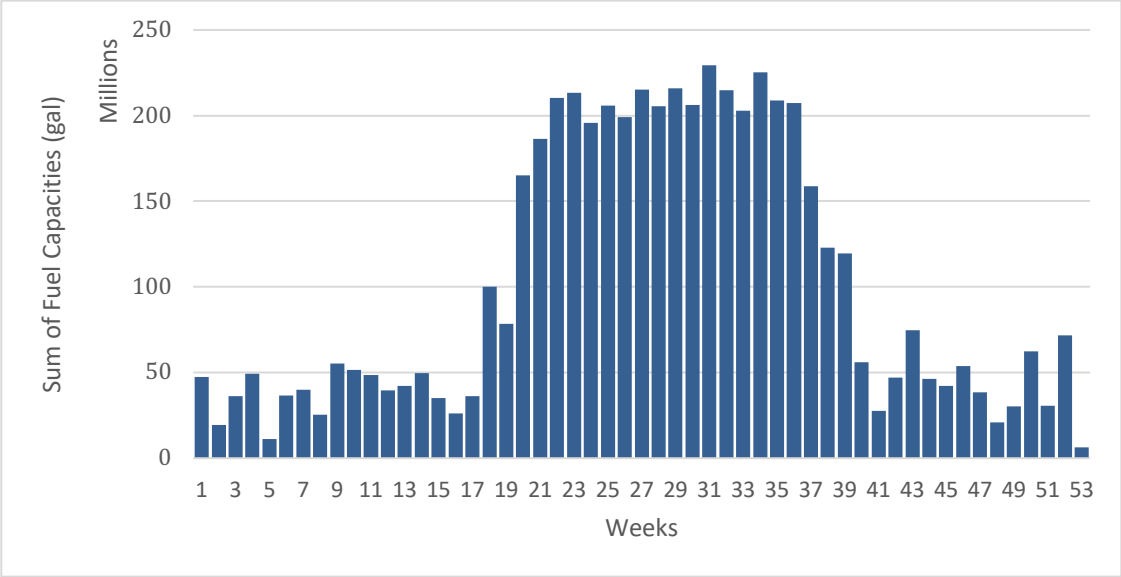

Figure 7.3-10 Total Petroleum Products in Southeast Alaska During Each Week of 2018

The following appendices contain the numeric data from which the above figures were derived as well as more information about petroleum capacities in high-risk areas:

Appendix J Fuel/Cargo Capacities of Vessels Entering High-Risk Areas
Appendix K Monthly Fuel Capacities of Vessels in High-Risk Areas

7.4 Petroleum Movements by Cruise Ships

The largest volume of oil capacity movement in Southeast Alaska is by cruise ships. Figures 7.1-6 and 7.1-7 show the density of these oil movements for the two types of fuels carried by cruise ships. As noted above, the exact nature of persistent fuel carried by cruise ships is not known. Figure 7.3-4 shows that almost 600 million gallons of capacity moved through Icy Straits and 400 million gallons of capacity moved through Tongass Narrows in 2018. Of course, the total capacity is an overstatement of the actual volume of oil moved because fuel tanks are not always full.

7.5 Petroleum Movements by Tugs with Oil Barges

The movement of oil as cargo in barges towed or pushed by tugs accounts for the second greatest volume of movement in Southeast Alaska after cruise ships. Ten tug-barge units moving oil as cargo were identified from AIS data. Three conventional tug-barges and seven articulated tug-barges operated by three companies made up the fleet of tugs moving oil as cargo. These oil barges range in size from 1.1 million gallons to 3.5 million gallons. Figure 7.1-11 shows the density of oil movements by this fleet. Figure 7.3-8 shows that approximately 375 million gallons of oil capacity moved through Icy Straits and 300 million gallons of oil capacity moved through Tongass Narrows. It should be remembered that not all of this capacity is realized, because barges are not always full.

Examination of individual vessel tracks further explains the patterns of oil movement by these tug-barge units. Some movements are transits through Southeast Alaska by tugs coming or

going in the inside waters from Dixon Entrance to Cross Sound. Some movements are oil coming into Southeast Alaska from Washington or Southcentral Alaska and being delivered to one or more major terminals in Ketchikan, Juneau, Haines, or Skagway. Some movements are redistribution of oil from the major terminals at Juneau and Ketchikan to smaller terminals and other locations. Most of this redistribution is conducted by a single articulated tug and barge with a 1.1-million-gallon capacity. Some of the 56 million gallons of oil capacity delivered to Skagway is pumped into tank cars and transported into Canada.

8 Discussion

In the request for proposal for this project, ADEC articulated two questions:

1. How much oil is transported through and within Southeast annually?
2. What areas in Southeast have a higher risk of an oil spill?

To address these questions, Nuka Research examined the following data for 2018:

- Vessel types and attributes
- Traffic density
- Ports of call
- Entrances/exits
- High-Risk areas
- High-Risk activities
- Petroleum movements

Examination of available AIS data revealed that there were eight general types of commercial vessels operating in Southeast Alaska: bulk cargo carriers, other cargo carriers, cruise ships, tour boats, ferries, fishing vessels, tugs with dry cargo barges, tugs with fuel barges. An additional, ninth, category of "other vessels" was added to capture government vessels, yachts, *et cetera*.

Once the vessel types were identified, their AIS track lines were studied to determine where vessel traffic was highest. Not surprisingly, traffic density for all vessel types was highest in the main passages between islands, through the entrances to Southeast Alaska, and at ports. The vessel traffic density maps show that commercial vessels travel into nearly every waterway in Southeast Alaska. Fishing vessels and tugs access the most areas, while bulk carriers access the least. Ferries and tour boats likewise have fairly consistent and limited routes.

Twenty-two ports were included in this study. The type of vessels which frequented each port varied depending on the size of the community at the port. For some communities, such as Angoon, Gustavus, Hollis, and Tenakee Springs, the vast majority of port calls were made by ferries. The most common vessels calling in Juneau and Glacier Bay were cruise ships, while the Green's Creek Mine (in Hawk Inlet) and Kensington Mine saw a preponderance of visits from tugs and barges moving cargo. In general, larger ports saw more vessels than smaller ports.

Six main entrances into the waters of Southeast Alaska were identified. Because vessel traffic can be more congested in entrances, these are likely to be areas of higher navigational risk and potential oil spills. The vessel traffic density maps did show higher density of most vessel types in these areas. The exception was tour boats, presumably because they work principally in inside waters and do not often venture into outside waters.

The third geographic area of interest in this study was locations where the risk of an oil spill might be higher because of vessel congestion or navigational hazards. Entrances certainly fall into this category, but since they were discussed separately, they were not also included here. Ten locations were identified as being of potentially higher risk. With the exception of bulk cargo

carriers, all vessel types encountered a large number of the High-Risk areas during 2018. This is not surprising given that the High-Risk areas are all passages to/from common destinations.

Once all of the areas of potential risk were identified and the volume of traffic moving into or through each was quantified, Nuka Research correlated vessel traffic with the movement of petroleum products. Fuels used for vessel operations were separated from oil carried as cargo, and non-persistent products were separated from persistent products. It was not possible to determine how much fuel or oil cargo individual vessels were actually carrying at any one time, and so total fuel and cargo capacities were used instead to portray how much fuel could be moving through time and space. In general, in the geographic areas where vessel traffic was highest, the potential volume of fuel being moved through the areas was also highest. Volumes of fuels being transported were higher during summer than winter.

Persistent fuels are carried by cargo ships and cruise ships in Southeast Alaska. Cruise ships created almost 30 percent of the total miles of AIS track lines in 2018 and carried persistent fuels through a much broader area in Southeast Alaska than the large cargo ships. They also frequented all of the high-risk areas.

Outside of geographic areas where vessels move, another possible area of risk is the activities which the vessel operators undertake. Two potentially higher risk activities were identified for this study: ship-to-ship fuel or cargo transfers and ship-to-shore cargo transfers without a marine header. Ship-to-ship transfers were further subdivided into two types: fuel transfers between fishing vessels and cargo transfers between barges. Three locations were identified where barge-to-barge transfers may have occurred, 81 locations were identified where fishing vessels may have transferred fuel from tenders, and 13 locations were identified where barge-to-shore may have taken place without a marine header. While transferring fuel may increase the chance of an accidental spill, transfer spills are assumed to be smaller than a catastrophic loss from a vessel grounding. Also, all transfers in the region will be of non-persistent fuels, whereas persistent fuels could be spilled from a grounding or other vessel accident.

It must be noted that the information Nuka Research was able to provide in this report was constrained by difficulty in obtaining the most accurate data, particularly with regards to the volumes of fuel and cargo being transported. It is not possible to know how full vessel fuel tanks are at any time, and so total vessel capacities were used instead. Using these capacities resulted in over-estimating the volume of fuel carried through entrances, ports, and High-Risk areas.

Perhaps more importantly, it is not possible to accurately estimate the actual volume of oil cargoes being transported at any one time or place. Tug/barge operators and fuel terminal operators were often not willing to share fuel transfer information and they are not required to report this information to the State of Alaska. Fuel is transported as cargo in barges that have an average capacity of nearly 3 million gallons. These barges represented only 4 percent of the miles traveled in the region in 2018 but had the second highest associated total fuel capacity of all vessel types. Knowing how much they are actually carrying would inform oil spill response planning.

One heavily trafficked area was not included in this study because it lies outside of State waters: Dixon Entrance. Thousands of vessels transit Dixon Entrance every year, and an oil spill in this region has the potential to immediately impact both lands and waters in the State of Alaska. A study analyzing data similar to that included in this study would help the State assess the risk of oil spills there.

Commercial vessels of all types work throughout Southeast Alaska, sometimes carrying significant volumes of non-persistent and persistent fuels. The analysis provided in this report is intended to inform the State of Alaska's efforts to ensure robust oil spill prevention and response in the region by characterizing the type, movement, and fuel capacities of the commercial fleet there.

9 References

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APPENDICES

Appendix A Tug Owner/Operators

Table A-1 includes the companies that were determined to be the owners and/or operators of the tugs and barges identified in the dataset. Interviews were only able to be conducted with ten companies. The information obtained from those interviews is included in Table A-1. The tugs listed for each company in this table are only those for which there were AIS track lines in Southeast Alaska in 2018 and may not represent all of the tugs listed for the companies. As barges are not required to have AIS systems, they are not listed in this table unless otherwise noted in the footnotes.

Table A-1 Tug Owner/Operator and Relevant Interview Information

TUG OWNER/OPERATOR	2018 TUGS	FUEL AS CARGO?
Alaska Marine Lines/ Bering Marine Corporation*[1]	Polar Wind Arctic Bear	No
Amak Tugs and Barges	Anna T Banner 670 Cape Arago Fish Hawk Taku Wind Jennie B Ardie Le Cheval Rouge Muzon Ethan B Banner 790	Unknown[#]
Boyer Towing, Inc.*	Brenda H	ISO tanks, no fuel offloaded with hoses
Brice Marine, LLC*	Sam B	No
Brusco Tug and Barge*	Heidi Brusco	No
Channel Construction Incorporated	Columbia Lane	Unknown[#]
Cook Inlet Tug and Barge*[2]	Taku Wind Bering Wind	Yes
Crowley Marine Services	Sea Prince Hunter Washington	No
DeForge Maritime Towing*	Ocean Eagle Clayton Arthur Reece Eagle Capt Cae (formerly Marine Retriever)	ISO tanks, no fuel offloaded with hoses
Dunlap Towing Company[3]	Polar Cloud Polar Ranger Polar Storm Polar King Mike O'Leary	No
Foss Marine Holdings*[2]	Justine Foss Daniel Foss Michele Foss Iver Foss Sandra Foss	No

TUG OWNER/OPERATOR	2018 TUGS	FUEL AS CARGO?
	Nicole Foss Stacey Foss	
Hamilton Marine Construction	Skookum	Unknown#
Harley Marine Services, Inc. (DBA Ocean Tug and Barge)*[4]	Bill Gobel Todd E Prophet One Cure Dale R Lindsey Emery Zidell Millenium Star Salvation Ann T Cheramie	Yes
Island Tug and Barge Company	Island Tugger Island Explorer Island Voyager	Unknown#
John Crandall	Redoubt	Unknown#
Kirby Offshore Marine, LLC*[5]	Pacific Wolf Java Sea Brooke Chapman Pacific Raven Sea Hawk	Yes
Manson Construction Company	Gladys M	Unknown#
Olson Marine Incorporated	Richard O Harriet O Avery O Wendy O	Unknown#
Sampson Tug and Barge*	Samson Mariner Gulf Cajun[6] Ocean Eagle[6] Richard Brusco[6]	No
Sause Brothers Ocean Towing Company	Henry Sr	Unknown#
Star Marine Incorporated	Glen Cove	Unknown#
Trucano Construction[7]	Otter	Unknown#
Vitus Energy[8]	American Spirit	Unknown#
Western Towboat Company, Inc.*	Ocean Navigator Gulf Titan Bering Titan Arctic Titan Ocean Mariner Ocean Titan Ocean Ranger Western Navigator Western Ranger Western Mariner Alaska Mariner Pacific Titan Western Titan Alaska Titan	No

* – interview conducted

– Unknown means that the company was not able to be reached, and Nuka Research could not verify whether or not ISO tanks were ever hauled as cargo on barges. None of these companies are known to haul fuel as cargo in integral barge tanks.

1 – Alaska Marine Lines and Bering Marine Corporation are wholly-owned subsidiaries of Lynden

2 – Cook Inlet Tug and Barge is a wholly owned subsidiary of Foss Marine. The tug *Bering Wind* was a new purchase and transited Southeast Alaska on its way to Anchorage without cargo. The tug *Taku Wind* is an ATB paired with the barge *Andril S*

3 – tugs operated by Dunlap Towing Company are owned by Alaska Marine Lines/Bering Marine
4 – Ocean Tug and Barge uses the following ATB tug/barge pairings: *Todd E Prophet/Edward Itta, One Cure/One Dream, Dale R Lindsay/PetroMariner, Bill Gobel/All Aboard for a Cure*.
5 – Kirby uses the following ATB tug/barge pairings: *Polar Cloud/Kays Pt., Pacific Wolf/DBL55, Sea Hawk/Cascade* (now retired)
6 – The three noted tugs were contracted to Sampson by Brusco and operated by Sampson during 2018
7 – AIS data indicated that the tug *Otter* was owned by ForeWest Maritime, but further research indicated the it had been sold to Trucano Construction. Trucano did not respond to messages for more information.
8 – AIS data indicated that the tug *American Spirit* was operated by American Workboat. According to their website, American Workboat merged with two other companies to form American Marine Corporation. They reported that the *American Spirit* was sold to Vitus Energy with which no contact was made.

Appendix B Terminal Operators

Table B-1 includes all of the operators in the ports of interest which were determined to accept fuel by barge. Also included is information on communities that receive fuel by other means. The number of deliveries and volumes of fuel delivered to each facility has been kept confidential at the request of the operators. PetroMarine and Delta Western Petroleum have fuel terminals in many communities. Both of these companies declined to provide any information on their facilities. It was reasonably assumed that those fuel terminals would have permanently installed marine headers for accepting fuel deliveries.

Table B-1 Fuel Terminals

PORT	COMPANY/DEPARTMENT	MARINE HEADER?
Angoon	Angoon Oil & Gas	Yes
Angoon	Inside Passage Electric Company	Yes
Coffman Cove	City office	1
Craig	PetroMarine, Craig Fuel Dock	Yes
Elfin Cove	Alaska Coastal Energy/Sea Level Transport	Yes
Glacier Bay	National Park Service	Yes
Gustavus	Gustavus Dray, Inc.	Yes
Haines	Delta Western Petroleum	Yes
Hawk Inlet	Green's Creek Mine, Hecla Mining Co.	Yes
Hollis	Community Council Pres.	1
Hoonah	Hoonah Trading	Yes
Hoonah	Inside Passage Electric Company	1
Hydaburg	Hydaburg Cooperative Assoc,	1
Juneau	PetroMarine, Juneau Plant and Marina	Yes
Juneau	Delta Western Petroleum	Yes
Juneau	Crowley Fuels	Yes
Kake	Kake Tribal Fuel	Yes
Kake	Inside Passage Electric Company	Yes
Kensington Mine	Coeur Mining Co.	Yes
Ketchikan	PetroMarine Plant and Marina	Yes
Ketchikan	Crowley Fuels	Yes
Metlakatla	Metlakatla Power and Light	Yes
Metlakatla	Anette Island Gas	2
Pelican	Pelican Fuel Distributing Co.	2
Petersburg	PetroMarine Plant and Marina	Yes
Sitka	PetroMarine Plant and Marina	Yes
Sitka	Delta Western Fuel Service and Delivery	Yes
Skagway	PetroMarine Plant and Marina	Yes
Tenakee Springs	Fuel Dock	2
Thorne Bay	Harbor Office (fuel dock)	1
Wrangell	PetroMarine Plant and Marina	Yes
Yakutat	Delta Western Petroleum	Yes

1 – These facilities receive fuel that is delivered by truck rather than barge
2 – No information was able to be obtained for these facilities

Appendix C Port Calls

Table C-1 Number of vessels entering each port by vessel type

COMMUNITY	VESSEL TYPE									
	Cargo Bulk	Cargo Other	Cruise Ship	Ferry	Fishing	Other	Tour Boat	Tug	Tug Oil Barge	Total
Angoon		1	1	103	1	5	6	2	13	132
Craig - Klawock	6	1			114	23		73	19	236
Glacier Bay			446		2	51	23		3	525
Gustavus		22	5	98	4	2			8	139
Haines			111	493	41	7	542	93	15	1302
Hawk Inlet	10	2				2	1	151	25	191
Hollis				363	8	5	1			377
Hoonah		34	152	134	67	56	262	69	23	797
Hydaburg	4				5	2		132		143
Juneau		2	641		156	132	202	293	59	1485
Kake			68	90	7	21		58	11	255
Kensington Mine		1	4				86	122	24	237
Ketchikan		11	547	1157	947	534	727	875	159	4957
Metlakatla			10		12		37	53	17	129
Pelican		1	3	14	16	4		1	4	43
Petersburg		8	168	266	592	222	29	402	61	1748
Sitka		20	277	123	776	191	246	137	38	1808
Skagway	2	3	409	287		6	552	110	20	1389
Tenakee Springs		7	12	83	5	24		3	2	136
Thorne Bay			4		1	4	12	76		97
Wrangell			67	257	130	51	15	84	14	618
Yakutat		7	4	26	47	150	7	29	6	276
Total	22	120	2929	3494	2931	1492	2748	2763	521	17020

Table C-2 Percentage of Vessels Entering Each Port by Vessel Type

COMMUNITY	VESSEL TYPE								
	Cargo Bulk	Cargo Other	Cruise Ship	Ferry	Fishing	Other	Tour Boat	Tug	Tug Oil Barge
Angoon	0%	1%	1%	78%	1%	4%	5%	2%	10%
Craig - Klawock	3%	0%	0%	0%	48%	10%	0%	31%	8%
Glacier Bay	0%	0%	85%	0%	0%	10%	4%	0%	1%
Gustavus	0%	16%	4%	71%	3%	1%	0%	0%	6%
Haines	0%	0%	9%	38%	3%	1%	42%	7%	1%
Hawk Inlet	5%	1%	0%	0%	0%	1%	1%	79%	13%
Hollis	0%	0%	0%	96%	2%	1%	0%	0%	0%
Hoonah	0%	4%	19%	17%	8%	7%	33%	9%	3%
Hydaburg	3%	0%	0%	0%	3%	1%	0%	92%	0%
Juneau	0%	0%	43%	0%	11%	9%	14%	20%	4%
Kake	0%	0%	27%	35%	3%	8%	0%	23%	4%
Kensington Mine	0%	0%	2%	0%	0%	0%	36%	51%	10%
Ketchikan	0%	0%	11%	23%	19%	11%	15%	18%	3%
Metlakatla	0%	0%	8%	0%	9%	0%	29%	41%	13%
Pelican	0%	2%	7%	33%	37%	9%	0%	2%	9%
Petersburg	0%	0%	10%	15%	34%	13%	2%	23%	3%
Sitka	0%	1%	15%	7%	43%	11%	14%	8%	2%
Skagway	0%	0%	29%	21%	0%	0%	40%	8%	1%
Tenakee Springs	0%	5%	9%	61%	4%	18%	0%	2%	1%
Thorne Bay	0%	0%	4%	0%	1%	4%	12%	78%	0%
Wrangell	0%	0%	11%	42%	21%	8%	2%	14%	2%
Yakutat	0%	3%	1%	9%	17%	54%	3%	11%	2%

Table C-3 Angoon port calls by vessel type and length category

Angoon	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cargo Other		1			
Cruise Ship		1			
Ferry			103		
Fishing		1			
Other		4	1		
Tour Boat		6			
Tug		2			
Tug Oil Barge		13			

Table C-4 Craig-Klawock port calls by vessel type and length category

Craig-Klawock	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cargo Bulk				6	
Cargo Other			1		
Fishing		111	3		
Other		19	4		
Tug	25	48			
Tug Oil Barge		19			

Table C-5 Glacier Bay port calls by vessel type and length category

Glacier Bay	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cruise Ship		90	116		240
Fishing		2			
Other		38	12	1	
Tour Boat		23			
Tug Oil Barge		3			

Table C-6 Gustavus port calls by vessel type and length category

Gustavus	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cargo Other		23			
Cruise Ship		2	3		
Ferry			95	3	
Fishing		4			
Other		2			
Tug Oil Barge		8			

Table C-7 Haines port calls by vessel type and length category

Haines	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cruise Ship		25	46	17	23
Ferry			331	162	
Fishing		41			
Other		6	1		
Tour Boat		542			
Tug	10	83			
Tug Oil Barge		15			

Table C-8 Hawk Inlet port calls by vessel type and length category

Hawk Inlet	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cargo Bulk				10	
Cargo Other				2	
Other		2			
Tour Boat		1			
Tug	40	111			
Tug Oil Barge		25			

Table C-9 Hollis port calls by vessel type and length category

Hollis	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Ferry			363		
Fishing		8			
Other		5			
Tour Boat		1			

Table C-10 Hoonah port calls by vessel type and length category

Hoonah	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cargo Other		34			
Cruise Ship		31	20	19	82
Ferry			109	25	
Fishing		65	2		
Other		47	8	1	
Tour Boat		262			
Tug	5	64			
Tug Oil Barge		23			

Table C-11 Hydaburg port calls by vessel type and length category

Hydaburg	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cargo Bulk				4	
Fishing		5			
Other		1	1		
Tug	38	94			

Table C-12 Juneau port calls by vessel type and length category

Juneau	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cargo Other		2			
Cruise Ship		63	70	56	452
Fishing		156			
Other		104	25	3	
Tour Boat		202			
Tug	30	263			
Tug Oil Barge		59			

Table C-13 Kake port calls by vessel type and length category

Kake	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cruise Ship		38	30		
Ferry			11	79	
Fishing		7			
Other		19	2		
Tug	1	57			
Tug Oil Barge		11			

Table C-14 Kensington Mine port calls by vessel type and length category

Kensington Mine	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cargo Other		1			
Cruise Ship			4		
Tour Boat		86			
Tug		122			
Tug Oil Barge		24			

Table C-15 Ketchikan port calls by vessel type and length category

Ketchikan	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cargo Other		4	7		
Cruise Ship		24	32	65	426
Ferry			886	271	
Fishing		931	15	1	
Other		461	73		
Tour Boat		727			
Tug	171	704			
Tug Oil Barge		159			

Table C-16 Metlakatla port calls by vessel type and length category

Metlakatla	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cruise Ship		3		7	
Fishing		11	1		
Tour Boat		37			
Tug	11	42			
Tug Oil Barge		17			

Table C-17 Pelican port calls by vessel type and length category

Pelican	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cargo Other		1			
Cruise Ship		1	1	1	
Ferry			14		
Fishing		16			
Other		2	2		
Tug		1			
Tug Oil Barge		4			

Table C-18 Petersburg port calls by vessel type and length category

Petersburg	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cargo Other		7	1		8
Cruise Ship		60	101	7	168
Ferry			8	258	266
Fishing		571	21		592
Other		181	41		222
Tour Boat		29			29
Tug	9	393			402
Tug Oil Barge		61			61

Table C-19 Sitka port calls by vessel type and length category

Sitka	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cargo Other		13	7		
Cruise Ship		62	82	56	77
Ferry			17	106	
Fishing		757	19		
Other		172	19		
Tour Boat		246			
Tug	15	122			
Tug Oil Barge		38			

Table C-20 Skagway port calls by vessel type and length category

Skagway	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cargo Bulk				2	
Cargo Other		3			
Cruise Ship		10	15	20	364
Ferry			210	77	
Other		3	3		
Tour Boat		552			
Tug	11	99			
Tug Oil Barge		20			

Table C-21 Tenakee Springs port calls by vessel type and length category

Tenakee Springs	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cargo Other		7			
Cruise Ship		4		8	
Ferry			83		
Fishing		5			
Other		22	2		
Tug		3			
Tug Oil Barge		2			

Table C-22 Thorne Bay port calls by vessel type and length category

Thorne Bay	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cruise Ship		4			
Fishing		1			
Other		4			
Tour Boat		12			
Tug	11	65			

Table C-23 Wrangell port calls by vessel type and length category

Wrangell	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cruise Ship		12	22	29	4
Ferry			2	255	
Fishing		130			
Other		47	4		
Tour Boat		15			
Tug	12	72			
Tug Oil Barge		14			

Table C-24 Yakutat port calls by vessel type and length category

Yakutat	< 65 ft	65 - 150 ft	150 - 300 ft	300 - 700 ft	> 700 ft
Cargo Other		1	5	1	
Cruise Ship		2		1	2
Ferry				26	
Fishing		44	4	1	
Other		145	5		
Tour Boat		7			
Tug		29			
Tug Oil Barge		6			

Appendix D Vessels Moving through Entrances

Table D-1 Cruise Ship Entrances/Exits

Cruise Ships	**65 - 150 ft**		**150 - 300 ft**		**300 - 700 ft**		**> 700 ft**	
	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance
Chatham Strait	2	1	1	1	20	30	293	356
Clarence Strait	1		1		14	7	105	27
Cross Sound	1	2			37	27	191	121
Peril Strait	47	47	65	65	5	4		
Revillagigedo Channel	7	7	8	9	20	40	183	128
Sumner Strait	2	2	1	1	36	24	130	259

Table D-2 Cargo Bulk Entrances/Exits

Cargo Bulk	**300 – 700 ft**	
	Exit	Entrance
Chatham Strait	9	9
Clarence Strait	5	5
Cross Sound	1	1

Table D-3 Cargo Other Entrances/Exits

Cargo Other	**65 – 150 ft**		**150 – 300 ft**		**300 – 700 ft**	
	Exit	Entrance	Exit	Entrance	Exit	Entrance
Chatham Strait		1	8	11	2	2
Clarence Strait	1	1	8	12	1	1
Cross Sound	2	2	10	8		
Peril Strait	6	4				
Revillagigedo Channel	2	2	3	1		
Sumner Strait	2	2	12	9		

Table D-4 Ferry Entrances/Exits

Ferry	**150 - 300 ft**		**300 - 700 ft**	
	Exit	Entrance	Exit	Entrance
Chatham Strait	2	1	11	11
Clarence Strait			11	6
Cross Sound	2	3	13	13
Peril Strait	17	17	101	102
Revillagigedo Channel	1		112	117
Sumner Strait	1	2	9	13

Table D-5 Fishing Entrances/Exits

Fishing	**65 - 150 ft**		**150 - 300 ft**		**300 - 700 ft**	
	Exit	Entrance	Exit	Entrance	Exit	Entrance
Chatham Strait	137	125	5	4	2	2
Clarence Strait	224	218	6	9	2	1
Cross Sound	103	110	10	9	2	2
Peril Strait	206	189	4	2		
Revillagigedo Channel	219	229	5	8		1

Sumner Strait	129	159	13	11	2	2

Table D-6 Other Vessels Entrances/Exits

Other	**65 - 150 ft**		**150 - 300 ft**		**300 - 700 ft**	
	Exit	Entrance	Exit	Entrance	Exit	Entrance
Chatham Strait	15	19	15	18	2	2
Clarence Strait	17	17	19	19		1
Cross Sound	10	11	14	10	2	2
Peril Strait	83	79	10	10		
Revillagigedo Channel	85	87	16	14		
Sumner Strait	23	25	11	14	1	

Table D-7 Tour Boat Entrances/Exits

Tour boat	**65 - 150 ft**	
	Exit	Entrance
Cross Sound	2	
Peril Strait	44	41
Revillagigedo Channel	2	1

Table D-8 Tug Entrances/Exits

Tug	**< 65 ft**		**65 - 150 ft**	
	Exit	Entrance	Exit	Entrance
Chatham Strait	1	2	169	148
Clarence Strait	5	7	139	150
Cross Sound	2	2	173	159
Peril Strait	6	5	108	106
Revillagigedo Channel	5	6	201	185
Sumner Strait	3	2	198	240

Table D-9 Tug Oil Barge Entrances/Exits

Tug Oil Barge	**65 - 150 ft**	
	Exit	Entrance
Chatham Strait	45	58
Clarence Strait	20	27
Cross Sound	22	17
Peril Strait	25	21
Revillagigedo Channel	27	33
Sumner Strait	66	49

Appendix E High-Risk Area Entrances/Exits by Vessel Type

Table E-1 Cargo Bulk High-Risk Area Entrances/Exits

Area	**300 - 700 ft**	
	Exit	Entrance
Icy Straits/Rocky Island	8	6
North Passage Lemesurier	1	1
Portland Canal	20	20
Saginaw and Favorite Channels	1	2

Table E-2 Cargo Other High-Risk Area Entrances/Exits

Area	**65 - 150 ft**		**150 - 300 ft**		**300 - 700 ft**	
	Exit	Entrance	Exit	Entrance	Exit	Entrance
Decision Pass	1	1	12	9		
Disenchantment Bay			1	1		
Icy Straits/Rocky Island	130	135	15	21		
Ketchikan	4	4	7	7		
North Passage Lemesurier	1		9	7		
Petersburg	8	7	1	1		
Portland Canal					6	6
Saginaw and Favorite Channels	58	57	1			
Snow Passage	5	7	18	22		
South Inian Pass	19	20		1		
South Passage Lemesurier	19	20	1	1		

Table E-3 Cruise Ship High-Risk Area Entrances/Exits

Area	**65 - 150 ft**		**150 - 300 ft**		**300 - 700 ft**		**> 700 ft**	
	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance
Decision Pass	1	2	1	1	36	24	127	253
Disenchantment Bay					27	27	139	150
Icy Straits/Rocky Island	264	236	293	291	94	90	710	481
Ketchikan	23	24	32	32	64	65	428	426
North Passage Lemesurier	23	15	8	12	42	22	183	105
Petersburg	60	60	101	101	7	7		
Saginaw and Favorite Channels	75	89	56	57	42	54	194	379
Snow Passage	16	14	22	18	20	52	528	271
South Inian Pass	13	13	60	60	2	3	0	0
South Passage Lemesurier	20	29	77	73	1	11	3	8
Tracy/Endicott Arms	94	94	133	134	45	45	136	132

Table E-4 Ferry High-Risk Area Entrances/Exits

Area	150 - 300 ft		300 - 700 ft	
	Exit	Entrance	Exit	Entrance
Decision Pass	1	2	11	11
Disenchantment Bay			6	6
Icy Straits/Rocky Island	552	564	185	167
Ketchikan	886	886	270	271
North Passage Lemesurier	2	11	7	13
Petersburg	8	8	259	258
Saginaw and Favorite Channels	400	404	155	171
Snow Passage	6	8	24	22
South Inian Pass	14	7	4	
South Passage Lemesurier	14	6	6	

Table E-5 Tour Boat High-Risk Area Entrances/Exits

Area	65 - 150 ft	
	Exit	Entrance
Disenchantment Bay	4	4
Icy Straits/Rocky Island	579	578
Ketchikan	728	727
North Passage Lemesurier	1	
Petersburg	29	29
Saginaw and Favorite Channels	1832	1860
Snow Passage	14	16
South Inian Pass	13	11
South Passage Lemesurier	14	11
Tracy/Endicott Arms	280	280

Table E-6 Fishing Vessel High-Risk Area Entrances/Exits

Area	65 - 150 ft		150 - 300 ft		300 - 700 ft	
	Exit	Entrance	Exit	Entrance	Exit	Entrance
Decision Pass	111	129	12	9	2	2
Icy Straits/Rocky Island	637	595	22	22	4	4
Ketchikan	924	931	15	15	1	1
North Passage Lemesurier	19	31	4	4	1	2
Petersburg	578	571	21	21		
Portland Canal	2	2				
Saginaw and Favorite Channels	241	251		1		
Snow Passage	395	410	26	36	4	2
South Inian Pass	52	47	1	3		
South Passage Lemesurier	64	64	6	5	1	
Tracy/Endicott Arms	6	6				

Table E-7 Other Vessels High-Risk Area Entrances/Exits

Area	65 - 150 ft		150 - 300 ft		300 - 700 ft	
	Exit	Entrance	Exit	Entrance	Exit	Entrance
Decision Pass	17	18	11	10	1	
Disenchantment Bay	1	3	2	2		
Icy Straits/Rocky Island	259	245	71	78	6	8
Ketchikan	459	461	73	73		
North Passage Lemesurier	9	8	11	7	3	3
Petersburg	177	181	39	41		
Portland Canal	2	2	1	1		
Saginaw and Favorite Channels	91	93	26	27	3	2
Snow Passage	123	121	33	50		
South Inian Pass	9	10	1	3		
South Passage Lemesurier	10	12	4	4		
Tracy/Endicott Arms	116	118	32	33	1	1

Table E-8 Tug High-Risk Area Entrances/Exits

Area	< 65 ft		65 - 150 ft	
	Exit	Entrance	Exit	Entrance
Decision Pass	1	1	143	172
Disenchantment Bay			1	9
Icy Straits/Rocky Island	36	41	848	794
Ketchikan	172	171	701	704
North Passage Lemesurier	2	2	22	21
Petersburg	9	9	397	393
Portland Canal			2	2
Saginaw and Favorite Channels	20	19	148	191
Snow Passage	10	14	474	339
South Inian Pass			2	1
South Passage Lemesurier			151	140

Table E-9 Tug Oil Barge High-Risk Area Entrances/Exits

Area	65 - 150 ft	
	Exit	Entrance
Decision Pass	62	50
Disenchantment Bay	1	1
Icy Straits/Rocky Island	190	179
Ketchikan	159	159
North Passage Lemesurier	11	5
Petersburg	61	61
Saginaw and Favorite Channels	45	54
Snow Passage	95	83
South Inian Pass	1	1
South Passage Lemesurier	17	18

Appendix F Vessel Type Entrances/Exits for Each High-Risk Area

Table F-1 Decision Pass Entrances/Exits by Vessel Type and Length

Vessel Type	Vessel Length									
	<65 ft		65 – 150 ft		150 – 300 ft		300 – 700 ft		>700 ft	
	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance
Cargo Other			1	1	12	9				
Cruise Ship			1	2	1	1	36	24	127	253
Ferry					1	2	11	11		
Fishing			111	129	12	9	2	2		
Other			17	18	11	10	1			
Tug	1	1	143	172						
Tug Oil Barge			62	50						

Table F-2 Disenchantment Bay Entrances/Exits by Vessel Type and Length

Vessel Type	**Vessel Length**							
	65 – 150 ft		150 – 300 ft		300 – 700 ft		> 700 ft	
	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance
Cargo Other			1	1				
Cruise Ship					27	27	144	145
Ferry					6	6		
Other	2	2	2	2				
Tour Boat	4	4						
Tug	5	5						
Tug Oil Barge	1	1						

Table F-3 North Passage Lemesurier Entrances/Exits by Vessel Type and Length

Vessel Type	Vessel Length									
	< 65 ft		65 – 150 ft		150 – 300 ft		300 – 700 ft		> 700 ft	
	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance
Cargo Bulk							1	1		
Cargo Other			1		9	7				
Cruise Ship			23	15	8	12	42	22	183	105
Ferry					2	11	7	13		
Fishing			19	31	4	4	1	2		
Other			9	8	11	7	3	3		
Tour Boat			1							
Tug	2	2	22	21						
Tug Oil Barge			11	5						

Table F-4 Portland Canal Entrances/Exits by Vessel Type and Length

Vessel Type	Vessel Length					
	65 - 150		150 - 300		300 - 700	
	Exit	Entrance	Exit	Entrance	Exit	Entrance
Cargo Bulk					20	20
Cargo Other					6	6
Fishing	2	2				
Other	2	2	1	1		
Tug	2	2				

Table F-5 Saginaw and Favorite Channels Entrances/Exits by Vessel Type and Length

Vessel Type	Vessel Length									
	< 65 ft		65 – 150 ft		150 – 300 ft		300 – 700 ft		> 700 ft	
	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance
Cargo Bulk							1	2		
Cargo Other			58	57	1					
Cruise Ship			75	89	56	57	42	54	194	379
Ferry					400	404	155	171		
Fishing			241	251		1				
Other			91	93	26	27	3	2		
Tour Boat			1832	1860						
Tug	20	19	148	191						
Tug Oil Barge			45	54						

Table F-6 South Inian Pass Entrances/Exits by Vessel Type and Length

Vessel Type	Vessel Length							
	65 – 150 ft		150 – 300 ft		300 – 700 ft		> 700 ft	
	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance
Cargo Other	19	20		1				
Cruise Ship	13	13	60	60	2	3		
Ferry			14	7	4			
Fishing	52	47	1	3				
Other	9	10	1	3				
Tour Boat	13	11						
Tug	2	1						
Tug Oil Barge	1	1						

Table F-7 South Passage Lemesurier Entrances/Exits by Vessel Type and Length

Vessel Type	Vessel Length							
	65 – 150 ft		150 – 300 ft		300 – 700 ft		> 700 ft	
	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance
Cargo Other	19	20	1	1				
Cruise Ship	20	29	77	73	1	11	3	8
Ferry			14	6	6			
Fishing	64	64	6	5	1			
Other	10	12	4	4				
Tour Boat	14	11						
Tug	151	140						
Tug Oil Barge	17	18						

Table F-8 Tracy and Endicott Arms Entrances/Exits by Vessel Type and Length

Vessel Type	Vessel Length							
	65 – 150 ft		150 – 300 ft		300 – 700 ft		> 700 ft	
	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance
Cruise Ship	94	94	133	134	45	45	136	132
Fishing	6	6						
Other	116	118	32	33	1	1		
Tour Boat	280	280						

Table F-9 Snow Passage Entrances/Exits by Vessel Type and Length

Vessel Type	Vessel Length									
	< 65 ft		65 – 150 ft		150 – 300 ft		300 – 700 ft		> 700 ft	
	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance
Cargo Other			6	6	20	20				
Cruise Ship			15	15	20	20	36	36	406	393
Ferry					7	7	23	23		
Fishing			404	403	31	31	3	3		
Other			122	122	41	42				
Tour Boat			15	15						
Tug	12	12	407	406						
Tug Oil Barge			89	89						

Table F-10 Icy Straits/Rocky Island Entrances/Exits by Vessel Type and Length

Vessel Type	Vessel Length									
	< 65 ft		65 – 150 ft		150 – 300 ft		300 – 700 ft		> 700 ft	
	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance
Cargo Bulk							7	7		
Cargo Other			133	132	18	18				
Cruise Ship			250	250	292	292	92	92	592	599
Ferry					550	547	177	175		
Fishing			619	613	22	22	4	4		
Other			252	252	73	76	7	7		
Tour Boat			577	580						
Tug	39	38	822	820						
Tug Oil Barge			184	185						

Table F-11 Ketchikan Entrances/Exits by Vessel Type and Length

Vessel Type	Vessel Length									
	< 65 ft		65 – 150 ft		150 – 300 ft		300 – 700 ft		> 700 ft	
	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance
Cargo Bulk										
Cargo Other			4	4	7	7				
Cruise Ship			23	24	32	32	64	65	428	426
Ferry					886	886	270	271		
Fishing			924	931	15	15	1	1		
Other			459	461	73	73				
Tour Boat			728	727						
Tug	172	171	701	704						
Tug Oil Barge			159	159						

Table F-12 Petersburg Entrances/Exits by Vessel Type and Length

Vessel Type	Vessel Length									
	< 65 ft		65 – 150 ft		150 – 300 ft		300 – 700 ft		> 700 ft	
	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance	Exit	Entrance
Cargo Bulk										
Cargo Other			8	7	1	1				
Cruise Ship			60	60	101	101	7	7		
Ferry					8	8	259	258		
Fishing			578	571	21	21				
Other			177	181	39	41				
Tour Boat			29	29						
Tug	9	9	397	393						
Tug Oil Barge			61	61						

Appendix G Fuel/Cargo Capacities of Vessels by Port

Table G-1 Cargo Bulk Fuel Capacities

Community	Non-Persistent Fuel Capacity (gal)	Persistent Fuel Capacity (gal)
Craig - Klawock	198,903	2,681,155
Hawk Inlet	365,453	4,402,243
Hydaburg	126,803	1,537,217
Skagway	73,369	905,652

Table G-2 Cargo Other Fuel Capacities

Community	Non-Persistent Fuel Capacity (gal)	Persistent Fuel Capacity (gal)
Angoon	9,999	
Craig - Klawock	320,441	
Gustavus	219,976	
Hawk Inlet	79,252	792,516
Hoonah	349,964	
Juneau	29,999	
Kensington Mine	9,999	
N Wrangell Narrows - Petersburg	850,829	
Pelican	9,999	
Sitka	234,698	
Skagway	1,356,301	
Tenakee Springs	64,907	
Tongass Narrows - Ketchikan	69,992	
Yakutat	761,618	511,796

Table G-3 Cruise Ship Fuel Capacities

Community	Non-Persistent Fuel Capacity (gal)	Persistent Fuel Capacity (gal)
Angoon	10,039	-
Glacier Bay	37,268,342	190,018,939
Gustavus	67,744	-
Haines	5,474,533	19,989,438
Hoonah	17,099,502	63,358,030
Juneau	61,024,591	364,814,748
Kake	1,041,610	-
Kensington Mine	207,977	-
Metlakatla	55,160,373	347,283,998
N Wrangell Narrows - Petersburg	1,198,479	-
Pelican	186,851	-
Sitka	3,234,249	-
Skagway	12,449,326	64,620,625
Tenakee Springs	47,032,489	295,330,359
Thorne Bay	109,896	-
Tongass Narrows - Ketchikan	16,967	
Wrangell	2,761,686	6,443,356
Yakutat	600,530	432,416

Table G-4 Ferry Fuel Capacities

Community	Non-Persistent Fuel Capacity (gal)
Angoon	5,120,895
Gustavus	5,205,768
Haines	47,270,032
Hollis	6,097,927
Hoonah	8,941,670
Kake	11,434,632
N Wrangell Narrows - Petersburg	63,961,457
Pelican	706,219
Sitka	49,314,195
Skagway	21,729,463
Tenakee Spring	23,814,197
Tongass Narrows - Ketchikan	4,187,377
Wrangell	48,328,947
Yakutat	5,460,916

Table G-5 Tour Boat Fuel Capacities

Community	Non-Persistent Fuel Capacity (gal)
Angoon	15,850
Glacier Bay	60,760
Haines	1,431,812
Hawk Inlet	2,642
Hollis	2,642
Hoonah	692,131
Juneau	533,627
Kensington Mine	227,188
Metlakatla	1,920,530
N Wrangell Narrows - Petersburg	97,744
Sitka	76,610
Skagway	649,863
Thorne Bay	1,458,229
Tongass Narrows - Ketchikan	31,701
Wrangell	39,626
Yakutat	18,492

Table G-6 Fishing Fuel Capacities

Community	Non-Persistent Fuel Capacity (gal)
Angoon	20,000
Craig - Klawock	1,564,445
Glacier Bay	29,999
Gustavus	39,996
Haines	409,955
Hollis	79,991
Hoonah	902,286
Hydaburg	90,001
Juneau	1,889,881
Kake	69,992
Metlakatla	14,318,528
N Wrangell Narrows - Petersburg	181,045
Pelican	169,984
Sitka	7,656,511
Tenakee Springs	10,847,951
Thorne Bay	59,996
Tongass Narrows - Ketchikan	9,999
Wrangell	1,532,346
Yakutat	1,185,421

Table G-7 Other Vessel Fuel Capacities

Community	Non-Persistent Fuel Capacity (gal)
Angoon	145,095
Craig - Klawock	492,021
Glacier Bay	1,259,479
Gustavus	19,999
Haines	123,760
Hawk Inlet	29,999
Hollis	49,998
Hoonah	1,072,820
Hydaburg	29,999
Juneau	3,666,963
Kake	586,419
N Wrangell Narrows - Petersburg	7,674,317
Pelican	192,030
Sitka	3,625,735
Skagway	2,993,553
Tenakee Springs	123,760
Thorne Bay	275,196
Tongass Narrows - Ketchikan	100,816
Wrangell	783,372
Yakutat	1,820,019

Table G-8 Tug Fuel Capacities

Community	Non-Persistent Fuel Capacity (gal)
Angoon	173,825
Craig - Klawock	1,010,592
Haines	6,794,868
Hawk Inlet	6,236,190
Hoonah	3,128,246
Hydaburg	1,859,993
Juneau	20,713,447
Kake	1,979,659
Kensington Mine	9,488,602
Metlakatla	33,863,665
N Wrangell Narrows - Petersburg	1,283,297
Pelican	86,913
Sitka	24,852,605
Skagway	4,508,545
Tenakee Springs	7,604,670

Thorne Bay	103,106
Tongass Narrows - Ketchikan	1,837,448
Wrangell	3,238,205
Yakutat	1,023,331

Table G-9 Tug Oil Barge Fuel/Cargo Capacities

Community	Non-Persistent Fuel Capacity (gal)	Non-Persistent Cargo Capacity (gal)
Angoon	865,427	15,533,049
Craig - Klawock	1,264,856	22,702,149
Glacier Bay	199,714	3,584,550
Gustavus	532,571	9,558,800
Haines	1,125,018	44,681,788
Hawk Inlet	1,664,284	29,871,249
Hoonah	1,648,328	37,931,665
Juneau	4,276,992	108,172,886
Kake	732,285	13,143,350
Kensington Mine	1,597,712	28,676,399
Metlakatla	12,104,461	301,675,178
N Wrangell Narrows - Petersburg	1,131,713	20,312,449
Pelican	266,285	4,779,400
Sitka	4,060,852	72,885,847
Skagway	2,632,738	67,100,216
Tenakee Springs	1,636,017	56,363,210
Tongass Narrows - Ketchikan	133,143	2,389,700
Wrangell	931,999	16,727,899
Yakutat	499,062	17,395,726

Appendix H Volume of Fuel Entering Each Port Annually

Table H-1 Non-Persistent Fuel Capacity Entering Each Port by Vessel Type

Port	Vessel Type (volumes in gallons)								
	Cargo Bulk	Cargo Other	Cruise Ship	Ferry	Fishing	Other	Tour Boat	Tug	Tug Oil Barge
Angoon		9,999	10,039	5,120,895	20,000	145,095	15,850	173,825	865,427
Craig - Klawock	198,903	320,441			1,564,445	492,021		1,010,592	1,264,856
Glacier Bay			37,268,342		29,999	1,259,479	60,760		199,714
Gustavus		219,976	67,744	5,205,768	39,996	19,999			532,571
Haines			5,474,533	47,270,032	409,955	123,760	1,431,812	6,794,868	1,125,018
Hawk Inlet	365,453	79,252				29,999	2,642	6,236,190	1,664,284
Hollis				6,097,927	79,991	49,998	2,642		
Hoonah		349,964	17,099,502	8,941,670	902,286	1,072,820	692,131	3,128,246	1,648,328
Hydaburg	126,803				90,001	29,999		1,859,993	
Juneau		29,999	61,024,591		1,889,881	3,666,963	533,627	20,713,447	4,276,992
Kak			1,041,610	11,434,632	69,992	586,419		1,979,659	732,285
Kensington Mine		9,999	207,977				227,188	9,488,602	1,597,712
Ketchikan		850,829	55,160,373	63,961,457	14,318,528	7,674,317	1,920,530	33,863,665	12,104,461
Metlakatla			1,198,479		181,045		97,744	1,283,297	1,131,713
Pelican		9,999	186,851	706,219	169,984	192,030		86,913	266,285
Petersburg		234,698	3,234,249	49,314,195	7,656,511	3,625,735	76,610	24,852,605	4,060,852
Sitka		1,356,301	12,449,326	21,729,463	10,847,951	2,993,553	649,863	4,508,545	2,632,738
Skagway	73,369	64,907	47,032,489	23,814,197		123,760	1,458,229	7,604,670	1,636,017
Tenakee Spring		69,992	109,896	4,187,377	59,996	275,196		103,106	133,143
Thorne Bay			16,967		9,999	100,816	31,701	1,837,448	
Wrangell			2,761,686	48,328,947	1,532,346	783,372	39,626	3,238,205	931,999
Yakutat		761,618	600,530	5,460,916	1,185,421	1,820,019	18,492	1,023,331	499,062

Table H-2 Persistent Fuel Capacity Entering Each Port by Vessel Type

Port	Vessel Type (volume in gallons)		
	Cargo Bulk	Cargo Other	Cruise Ship
Angoon			
Craig - Klawock	2,681,155		
Glacier Bay			190,018,939
Gustavus			
Haines			19,989,438
Hawk Inlet	4,402,243	792,516	
Hollis			
Hoonah			63,358,030
Hydaburg	1,537,217		
Juneau			364,814,748
Kake			-
Kensington Mine			
Ketchikan			347,283,998
Metlakatla			
Pelican			
Petersburg			
Sitka			64,620,625
Skagway	905,652		295,330,359
Tenakee Springs			
Thorne Bay			
Wrangell			6,443,356
Yakutat		511,796	432,416

Table H-3 Non-Persistent Cargo Capacity Entering Each Port by Vessel Type

Port	Vessel Type (volume in gallons)
	Tug Oil Barge
Angoon	15,533,049
Craig - Klawock	22,702,149
Glacier Bay	3,584,550
Gustavus	9,558,800
Haines	44,681,788
Hawk Inlet	29,871,249
Hollis	
Hoonah	37,931,665
Hydaburg	
Juneau	108,172,886
Kake	13,143,350
Kensington Mine	28,676,399
Ketchikan	301,675,178
Metlakatla	20,312,449
Pelican	4,779,400
Petersburg	72,885,847
Sitka	67,100,216
Skagway	56,363,210
Tenakee Springs	2,389,700
Thorne Bay	
Wrangell	16,727,899
Yakutat	17,395,726

Appendix I Monthly Fuel/Cargo Capacities of Vessels Entering Ports

The following tables include all fuel types (persistent, non-persistent, cargo) combined into monthly volumes transported into each port by the different vessel types during 2018. Only those vessel types actually entering a port are shown in the table.

Table I-1 Glacier Bay Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Apr	May	June	July	Aug	Sep	Oct
Cruise Ship	65 - 150			16,380	93,159	220,211	195,640	151,580	78,792	
	150 - 300			15,624	578,802	674,436	887,124	921,144	342,090	
	> 700				43,057,194	45,683,975	46,530,439	47,492,797	38,634,992	1,719,784
Fishing	65 - 150		9,999							20,001
Other	65 - 150	20,000		10,000	40,000	243,179	90,000	128,476	10,000	
	150 - 300				20,000	109,334	430,794	78,480		
	300 - 700						79,254			
Tour Boat	65 - 150				10,567	10,567	13,209	21,134	5,284	
Tug Oil Barge	65 - 150				1,261,460		1,261,460			1,261,460

Table I-2 Hawk Inlet Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Bulk	300 - 700	525,718		1,018,689	519,194		406,938		825,641	1,015,028		456,631	
Cargo Other	300 - 700					435,897							435,897
Other	65 - 150						10,000	20,000					
Tour Boat	65 - 150					2,642							
Tug	< 65			44,447	19,049	19,049	25,398		38,097	38,097		25,398	44,447
	65 - 150	372,646	208,223	359,418	548,302	633,449	652,487	680,858	1,066,620	570,797	162,806	390,014	336,774
Tug Oil Barge	65 - 150	1,261,460	2,522,919	2,522,919	1,261,460	2,522,919	1,261,460	2,522,919		1,261,460	6,307,298	5,045,838	5,045,838

Table I-3 Hollis Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Ferry	150 - 300	520,775	470,378	520,775	503,976	520,775	503,976	520,775	520,775	503,976	520,775	487,177	503,976
Fishing	65 - 150										29,998	19,998	29,998
Other	65 - 150					10,000		20,000		20,000			
Tour Boat	65 - 150								2,642				

Table I-4 Hoonah Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Other	65 - 150			9,999	39,999	49,996	39,997	59,995	29,998	59,995	9,999	9,999	
Cruise Ship	65 - 150			10,039	26,419	26,419	36,458	46,160	9,702	30,998			
	150 - 300				7,812	131,460	158,508	104,370	150,780	7,812			
	300 - 700					408,655	916,182	1,507,881	575,057	1,507,881			
	> 700					8,869,255	16,095,594	16,918,265	16,950,240	10,174,963			
Ferry	150 - 300	454,363	504,848	403,878	353,394	454,363	403,878	504,848	555,333	302,909	605,818	603,083	100,423
	300 - 700				137,717						826,302	1,101,736	964,019
Fishing	65 - 150		79,999	9,999	30,000	60,001	129,995	219,996	49,996	29,998	29,998		
	150 - 300								122,340				
Other	65 - 150	20,000	20,000			50,000	140,000	160,000	70,000	40,000			
	150 - 300						90,854	99,372		20,000			
	300 - 700												91,056
Tour Boat	65 - 150			2,642	2,642	68,687	134,732	142,657	124,165	97,747		2,642	
Tug	< 65					9,451	10,000					18,902	
	65 - 150	173,830	173,830	26,390	114,059	278,610	580,525	224,394	301,055	103,109	274,486		119,195
Tug Oil Barge	65 - 150		1,261,460	1,261,460		3,637,494	3,784,379	6,130,033	2,522,919	2,522,919	4,339,553	4,180,411	7,417,646

Table I-5 Hydaburg Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Mar	Apr	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Bulk	300 - 700					380,419	409,479	464,693		409,479	
Fishing	65 - 150								20,001	70,002	
Other	65 - 150					10,000					
	150 - 300		20,000								
Tug	< 65					79,149	56,705	60,100	56,852	31,601	12,699
	65 - 150	139,864		15,072	219,983	97,261	258,902	145,863	130,791	228,229	326,977

Table I-6 Kensington Mine Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Other	65 - 150									9,999			
Cruise Ship	150 - 300							155,988	51,996				
Tour Boat	65 - 150				66,045		31,702	2,642			126,806		
Tug	65 - 150	702,393	619,566	619,566	536,738	725,213	793,396	989,126	1,140,888	967,226	1,061,849	729,247	603,682
Tug Oil Barge	65 - 150	2,522,919	2,522,919	3,784,379	1,261,460	1,261,460	3,784,379	2,522,919	2,522,919	2,522,919	2,522,919	2,522,919	2,522,919

Table I-7 Metlakatla Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cruise Ship	65 - 150					4,242		4,242	4,242				
	300 - 700					166,402	343,292	166,402	332,804	176,890			
Fishing	65 - 150					40,002	9,999	29,998	9,999			19,998	19,998
	150 - 300								51,056				
Tour Boat	65 - 150	5,284	10,567	10,567		13,209	18,493	10,567	15,851	7,925		2,642	2,642
Tug	< 65					18,902	37,803	37,803	9,451				
	65 - 150	149,748	130,748	119,799	104,921	45,217			119,799	119,799	149,748	119,799	119,799
Tug Oil Barge	65 - 150	1,261,460		1,261,460	1,261,460	2,522,919	1,261,460	2,522,919	2,522,919	2,522,919	2,522,919	2,522,919	1,261,460

Table I-8 Petersburg Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Other	65 - 150				34,828	29,997			44,827	9,999			
	150 - 300											115,047	
Cruise Ship	65 - 150				10,039	67,829	61,696	82,905	89,080	65,142	5,460		
	150 - 300				69,634	321,963	596,299	597,810	790,794	246,407			
	300 - 700					8,718	185,602	17,435	8,718	8,718			
Ferry	150 - 300	12,683	12,683		201,933							50,483	50,483
	300 - 700	1,643,742	2,821,761	5,762,254	2,951,073	4,944,444	4,532,774	3,710,903	4,944,444	4,532,774	4,707,027	4,021,401	4,413,331
Fishing	65 - 150	69,995	169,987	339,974	349,980	399,972	661,852	1,329,879	1,866,093	829,923	229,986	109,991	79,991
	150 - 300				107,398		162,818	251,522	490,127	207,024			
Other	65 - 150	89,997	29,999	99,997	139,996	229,993	456,345	665,260	538,460	219,993	49,998	19,999	109,997
	150 - 300		79,998	39,999	159,995	58,478	90,851	59,998	249,326	137,058	59,998		39,999
Tour Boat	65 - 150	2,642	2,642		5,283	10,567	21,134	10,567	15,850	7,925			
Tug	< 65					9,219	28,120	9,219	27,658			9,219	
	65 - 150	2,003,661	1,886,285	1,971,739	1,656,156	2,635,807	2,231,392	2,072,708	2,484,823	2,448,113	2,232,581	1,661,782	1,484,123
Tug Oil Barge	65 - 150	10,091,370	1,261,421	7,568,528	6,307,107	7,568,528	6,307,107	5,045,685	3,784,264	3,784,264	7,568,528	10,091,370	7,568,528

Table I-9 Pelican Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov
Cargo Other	65 - 150					9,999						
Cruise Ship	65 - 150									10,039		
	150 - 300							10,416				
	300 - 700							166,402				
Ferry	150 - 300	50,485	50,485	50,485	50,485	50,485	100,970	100,970	100,970	50,485	50,485	49,938
Fishing	65 - 150	20,001			19,998	9,999	19,998	59,995	19,998	19,998		
Other	65 - 150							30,000				
	150 - 300						162,036					
Tug	65 - 150											86,915
Tug Oil Barge	65 - 150			1,261,460				1,261,460	1,261,460		1,261,460	

Table I-10 Skagway Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Bulk	300 - 700			511,112						467,939			
Cargo Other	65 - 150	9,999					44,911			9,999			
Cruise Ship	65 - 150						12,726	12,726	8,484	8,484			
	150 - 300						119,112	259,980	207,984	103,992			
	300 - 700					338,222	1,256,920	1,595,142	1,595,142	1,403,204			
	> 700					57,119,815	73,375,320	75,920,114	79,627,004	48,595,516	813,330		
Ferry	150 - 300	403,878	353,394	353,394	504,848	681,917	796,563	771,197	784,129	707,532	605,818	602,536	327,678
	300 - 700	821,896	1,095,861	1,789,909	1,095,861	2,332,377	1,784,446	1,372,764	1,784,446	1,784,446	1,114,132	840,166	1,105,731
Other	65 - 150						30,000	10,000					
	150 - 300						20,000	43,764	20,000				
Tour Boat	65 - 150				7,925	192,851	306,449	393,628	375,136	182,284			
Tug	< 65					27,658	27,658	9,219	18,439	9,219		9,219	
	65 - 150	547,110	464,283	570,113	524,179	699,104	585,672	573,348	1,279,023	799,756	566,387	455,197	439,314
Tug Oil Barge	65 - 150	4,801,207	3,607,114	4,868,573	3,607,114	3,607,114	3,607,114	3,607,114	8,475,687	7,214,227	7,391,492	3,607,114	3,607,114

Table I-11 Thorne Bay Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cruise Ship	65 - 150					8,484		4,242	4,242				
Fishing	65 - 150									9,999			
Other	65 - 150						53,179	47,640					
Tour Boat	65 - 150					2,642	7,925	7,925	10,567	2,642			
Tug	< 65					18,902	37,803	47,254					
	65 - 150	164,821	119,799	134,871	184,148	93,138	20,178	45,217	188,075	134,871	160,698	223,326	264,402

Table I-12 Ketchikan Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Other	65 - 150				34,828	9,999			34,828			20,000	
	150 - 300	106,725									317,006	220,716	106,725
Cruise Ship	65 - 150				10,039	74,466		43,681	34,357	56,659	5,460		
	150 - 300				69,634	192,648	85,594	25,913	92,943	189,709			
	300 - 700					921,969	3,779,004	4,348,975	4,360,198	3,627,131	341,115		
	> 700					60,490,990	86,454,575	90,471,285	88,737,099	57,217,622	813,305		
Ferry	150 - 300	921,802	895,173	1,029,399	1,018,859	890,297	908,694	899,495	971,485	1,025,994	953,088	942,378	1,055,816
	300 - 700	1,369,785	2,821,761	5,206,907	3,653,501	5,364,514	5,510,628	4,826,470	5,856,907	5,646,872	4,512,325	3,332,836	4,346,472
Fishing	65 - 150	169,997	129,988	326,205	449,988	589,981	1,439,453	3,505,226	4,038,516	1,509,018	707,608	219,981	69,992
	150 - 300		49,773		107,398		344,183		135,254	120,053	109,264		59,145
	300 - 700				237,503								
Other	65 - 150	59,998	109,997	89,997	149,995	609,982	1,140,785	1,087,607	1,039,969	859,974	189,994	79,998	39,999
	150 - 300	79,998	119,996	99,251	159,995	118,476	292,881	539,068	328,292	258,072	39,999	79,998	99,997
Tour Boat	65 - 150	15,850	7,925	21,134	23,775	356,632	478,151	396,258	330,215	272,097	7,925	2,642	7,925
Tug	< 65	88,303	72,650	47,253	91,552	119,672	205,825	255,228	169,479	119,756	116,802	154,373	47,253
	65 - 150	2,529,705	2,001,978	3,015,082	2,803,993	2,730,166	2,689,664	2,494,514	3,046,275	2,842,939	3,031,857	2,914,585	2,274,759
Tug Oil Barge	65 - 150	19,231,854	23,813,125	27,245,643	20,164,798	31,784,964	16,776,375	24,524,672	16,599,116	20,938,537	29,987,247	24,167,643	58,545,667

Table I-13 Yakutat Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Other	65 - 150					9,999							
	150 - 300				352,152	119,145	106,729			121,787			
	300 - 700							563,641					
Cruise Ship	65 - 150					10,039				10,039			
	300 - 700								176,890				
	>700									836,010			
Ferry	300 - 700				840,166	1,050,208	840,166	840,166	1,050,208	840,166			
Fishing	65 - 150			9,999	39,997	79,996	79,999	253,555	60,001	69,994	29,998	19,998	
	150 - 300						65,371	239,038					
	300 - 700												237,510
Other	65 - 150					190,000	300,000	390,000	380,000	200,000			
	150 - 300				237,762			20,000	102,312				
Tour Boat	65 - 150				2,642			15,851					
Tug	65 - 150	45,417	45,417	45,417	45,417	56,984	45,417	38,058	244,234	183,371	37,957	104,112	131,559
Tug Oil Barge	65 - 150				5,792,980		3,078,093		3,078,093		3,570,129		2,376,035

Table I-14 Angoon Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Other	65 - 150						9,999						
Cruise Ship	65 - 150								10,039				
Ferry	150 - 300	403,866	454,349	454,349	403,866	403,866	605,799	403,866	454,349	454,349	403,866	452,162	226,205
Fishing	65 - 150							20,000					
Other	65 - 150				19,999		53,178		39,999				
	150 - 300							31,919					
Tour Boat	65 - 150			2,642				5,283	7,925				
Tug	65 - 150										173,825		
Tug Oil Barge	65 - 150	2,522,843	1,261,421	1,261,421		1,261,421		1,261,421	2,522,843		3,784,264	1,261,421	1,261,421

Table I-15 Craig-Klawock Monthly Fuel Volumes (gallons)

	Length (ft)	Jan	feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Bulk	300 - 700	497,131					1,223,116			570,707			589,104
Cargo Other	150 - 300											320,441	
Fishing	65 - 150			19,998	29,997		59,996	439,981	779,955	49,997		20,000	
	150 - 300								164,521				
Other	65 - 150			19,999	149,995	49,998	10,000	49,998	10,000				
	150 - 300						182,030					19,999	
Tug	< 65	22,149	9,451				53,749	15,800	18,901	22,149	18,901		41,051
	65 - 150	109,926	35,219	15,072	78,063	36,970	113,045	56,365	110,735	62,991	58,387	68,173	63,492
Tug Oil Barge	65 - 150	1,261,421	1,261,421	2,522,843	2,522,843	2,522,843	2,522,843	1,261,421	3,784,264	1,261,421		2,522,843	2,522,843

Table I-16 Gustavus Monthly Fuel Volumes (gallons)

	Length (ft)	Jan	feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Other	65 - 150			19,998	9,999	59,993	19,998	19,998	39,996	39,996		9,999	
Cruise Ship	65 - 150						19,991		5,460				
	150 - 300					27,047		15,246					
Ferry	150 - 300	454,349	353,383	302,900	403,866	454,349	403,866	504,833	454,349	403,866	504,833	401,679	150,356
	300 - 700												413,139
Fishing	65 - 150						9,999	9,999	9,999	9,999			
Other	65 - 150					19,999							
Tug Oil Barge	65 - 150			1,261,421	1,261,421		1,261,421	2,522,843		1,261,421	1,261,421		1,261,421

Table I-17 Haines Monthly Fuel Volumes (gallons)

	Length (ft)	Jan	feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cruise Ship	65 - 150				16,380	41,831	21,840	15,162	26,669	50,903			
	150 - 300				7,812	117,387	271,396	489,789	375,973	165,769			
	300 - 700					166,397	916,154	1,440,705	848,626	848,626			
	> 700					2,440,209	4,248,897	4,248,897	6,264,341	2,440,209			
Ferry	150 - 300	807,732	706,766	706,766	1,009,665	1,275,261	1,301,620	1,314,303	1,200,654	1,262,578	1,262,082	1,205,036	528,508
	300 - 700	1,643,742	2,191,655	3,871,937	2,465,612	3,842,741	3,293,358	2,609,200	3,568,784	3,568,784	2,779,047	2,368,846	2,485,351
Fishing	65 - 150					9,999	69,992	99,989	109,988	109,988			9,999
Other	65 - 150				10,000		49,998	10,000	10,000				
	150 - 300							43,763					
Tour Boat	65 - 150					198,129	277,381	414,750	364,557	176,995			
Tug	< 65					73,753	18,901						
	65 - 150	699,820	328,505	411,330	706,146	538,250	381,283	494,155	697,956	984,583	657,010	405,875	397,301
Tug Oil Barge	65 - 150	3,078,000	6,156,000	6,156,000	5,792,805	3,078,000		3,078,000	6,156,000	3,078,000	3,078,000	3,078,000	3,078,000

Table I-18 Juneau Monthly Fuel Volumes (gallons)

	Length (ft)	Jan	feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Other	65 - 150					20,000	9,999						
Cruise Ship	65 - 150				20,958	51,240	186,058	181,399	171,990	57,330			
	150 - 300				69,634	327,800	436,871	567,823	377,653	132,464			
	300 - 700					1,105,405	3,393,612	3,210,913	3,044,913	2,021,162			
	> 700				1,109,018	64,758,161	92,836,347	98,160,648	93,707,010	58,191,197	1,719,731		
Fishing	65 - 150		39,996	69,998	29,997	19,998	319,984	789,956	299,975	179,986	69,998	49,995	20,000
Other	65 - 150	39,999			19,999	69,998	329,990	447,626	379,988	69,998	10,000		19,999
	150 - 300				39,999	81,016	182,030	146,054	319,608	51,154	59,998	19,999	
	300 - 700				79,252			79,252				1,221,003	
Tour Boat	65 - 150					71,326	137,369	137,369	137,369	50,193			
Tug	< 65		25,398	12,699	19,048	19,048	38,096		19,048	31,747	6,349	15,800	6,349
	65 - 150	1,506,611	1,476,389	1,254,283	1,835,643	1,978,853	1,970,796	1,966,897	2,040,630	1,730,108	1,925,156	1,277,731	1,556,766
Tug Oil Barge	65 - 150	8,678,843	5,600,843	9,940,264	7,942,088	10,352,769	8,678,843	17,865,820	9,238,227	12,303,969	9,385,107	5,600,843	6,862,264

Table I-19 Kake Monthly Fuel Volumes (gallons)

	Length (ft)	Jan	feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cruise Ship	65 - 150					23,519	73,581	54,768	43,174	23,519			
	150 - 300					193,824	200,418	244,853	161,275	22,679			
Ferry	150 - 300	100,967	201,933	151,450	50,483						50,483		
	300 - 700				275,426	1,239,416	1,101,703	963,990	1,239,416	1,101,703	1,652,554	1,652,554	1,652,554
Fishing	65 - 150	19,998						9,999	19,998		19,998		
Other	65 - 150	29,999	10,000	39,999	10,000		53,178		48,475			29,999	29,999
	150 - 300						31,919	302,853					
Tug	< 65						6,349						
	65 - 150	206,213	137,475	137,475	137,475	197,546	137,475	171,844	171,844	194,800	171,844	137,475	171,844
Tug Oil Barge	65 - 150	1,261,421			1,261,421		2,522,843	1,261,421	1,261,421	1,261,421	1,261,421	2,522,843	1,261,421

Table I-20 Sitka Monthly Fuel Volumes (gallons)

	Length (ft)	Jan	feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Other	65 - 150		20,000		89,657		40,001		104,485	9,999	40,001	9,999	
	150 - 300		233,000	233,000		119,142	106,725		106,725	121,783		121,783	
Cruise Ship	65 - 150		10,039	10,039	30,116	51,450	111,258	84,167	79,885	45,528	10,039	10,039	
	150 - 300				15,624	433,343	489,580	611,796	407,010	89,457			
	300 - 700					997,818	3,103,326	4,200,013	3,113,814	2,592,902	242,246		
	> 700					7,001,033	14,653,086	12,914,839	14,035,919	11,725,588			
Ferry	150 - 300		100,967				63,414	50,732	63,414	12,683			
	300 - 700	821,871	1,515,898	2,566,074	1,233,541	1,920,636	1,646,679	1,372,722	1,646,679	1,646,679	2,425,836	2,361,914	2,279,722
Fishing	65 - 150	89,990	60,001	1,348,611	99,989	179,983	539,973	1,899,933	3,739,854	1,449,887	129,986	129,986	59,993
	150 - 300				137,438		114,173	342,114	348,602	177,436			
Other	65 - 150		10,000	239,993	169,995	249,992	319,990	429,987	759,977	59,998			
	150 - 300			19,999		19,999	172,933	401,440	119,250				19,999
Tour Boat	65 - 150	5,283	5,283	18,492	36,984	63,401	50,193	140,011	155,861	116,236	26,417	26,417	5,283
Tug	< 65			9,451			37,802		27,658	28,352	18,901	18,901	
	65 - 150	309,319	309,319	274,950	366,644	410,887	450,503	413,428	472,120	333,643	343,688	259,866	423,113
Tug Oil Barge	65 - 150	6,862,264	5,600,843	4,339,421	3,784,264	5,600,843	2,522,843	6,862,264	9,940,264	5,600,843	11,756,843	1,261,421	5,600,843

Table I-21 Tenakee Springs Monthly Fuel Volumes (gallons)

	Length (ft)	Jan	feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Other	65 - 150								29,997		39,996		
Cruise Ship	65 - 150						10,039	10,039	20,077				
	300 - 700					8,718	8,718	26,153	17,435	8,718			
Ferry	150 - 300	353,383	201,933	151,450	353,383	403,866	454,349	403,866	454,349	454,349	353,383	452,162	150,903
Fishing	65 - 150						9,999			29,999		19,998	
Other	65 - 150					19,999	69,998	59,998	89,997				
	150 - 300							35,203					
Tug	65 - 150				34,369		34,369			34,369			
Tug Oil Barge	65 - 150						1,261,421					1,261,421	

Table I-22 Wrangell Monthly Fuel Volumes (gallons)

	Length (ft)	Jan	feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cruise Ship	65 - 150					38,514	4,242	8,484	18,522	10,039	5,460		
	150 - 300					23,309	98,109	38,681	38,807	59,806			
	300 - 700					175,115	1,257,269	1,688,932	1,676,399	1,440,705	583,360		
	> 700						509,822	509,822	509,822	509,822			
Ferry	150 - 300				100,967								
	300 - 700	1,643,742	2,821,761	5,762,254	2,467,081	4,806,731	4,670,487	3,436,946	4,806,731	4,806,731	4,570,783	4,021,401	4,413,331
Fishing	65 - 150		29,999	162,453	69,995	49,997	179,983	469,957	269,984	209,982	59,996	29,999	
Other	65 - 150			59,998		39,999	59,998	289,991	148,472	29,999		10,000	10,000
	150 - 300							43,763	39,999	51,154			
Tour Boat	65 - 150					5,283	10,567	10,567	7,925	5,283			
Tug	< 65					18,901	47,253	47,253					
	65 - 150	149,744	130,744	119,795	980,195	143,078	171,976	88,713	280,676	119,795	639,416	139,973	160,693
Tug Oil Barge	65 - 150	3,784,264	1,261,421	1,261,421		1,261,421	1,261,421	2,522,843	1,261,421	1,261,421	1,261,421	1,261,421	1,261,421

Appendix J Fuel/Cargo Capacities of Vessels by High-Risk Area

Table J-1 Cargo Bulk Capacities by High-Risk Areas

High-Risk Area	Non-Persistent Fuel Capacity (gal)	Persistent Fuel Capacity (gal)
North Passage Lemesurier	71,494	882,504
Icy Straits/Rocky Island	252,453	3,116,206
Portland Canal	1,412,716	18,028,682
Saginaw and Favorite Channels	104,354	1,288,113

Table J-2 Cargo Other Capacities by High-Risk Areas

High-Risk Area	Non-Persistent Fuel Capacity (gal)	Persistent Fuel Capacity (gal)
Decision Pass	2,617,285	-
Disenchantment Bay	238,283	-
Icy Straits/Rocky Island	3,657,676	-
Ketchikan	850,829	-
North Passage Lemesurier	2,044,637	-
Petersburg	234,698	-
Portland Canal	423,610	3,801,826
Saginaw and Favorite Channels	1,304,928	-
Snow Passage	2,587,798	-
South Inian Pass	491,495	-
South Passage Lemesurier	633,130	-

Table J-3 Cruise Ship Capacities by High-Risk Areas

High-Risk Area	Non-Persistent Fuel Capacity (gal)	Persistent Fuel Capacity (gal)
Decision Pass	48,970,426	306,064,350
Disenchantment Bay	44,821,084	224,560,579
Icy Straits/Rocky Island	98,002,205	479,687,388
Ketchikan	55,160,373	347,283,998
North Passage Lemesurier	45,242,499	233,884,318
Petersburg	3,234,249	-
Saginaw and Favorite Channels	83,721,966	459,345,044
Snow Passage	49,605,808	312,923,829
South Inian Pass	3,769,316	932,419
South Passage Lemesurier	6,772,180	7,259,533
Tracy/Endicott Arms	43,864,574	220,571,606

Table J-4 Ferry Capacities by High-Risk Areas

High-Risk Area	Non-Persistent Fuel Capacity (gal)
Decision Pass	4,787,761
Disenchantment Bay	2,520,423
Icy Straits/Rocky Island	59,883,648
Ketchikan	63,961,457
North Passage Lemesurier	4,834,176
Petersburg	49,314,195
Saginaw and Favorite Channels	101,261,222
Snow Passage	5,161,929
South Inian Pass	1,899,743
South Passage Lemesurier	2,231,530

Table J-5 Tour Boat Capacities by High-Risk Areas

High-Risk Area	Non-Persistent Fuel Capacity (gal)
Disenchantment Bay	21,134
Icy Straits/Rocky Island	1,532,198
Ketchikan	1,920,530
North Passage Lemesurier	2,642
Petersburg	76,610
Saginaw and Favorite Channels	9,753,230
Snow Passage	39,626
South Inian Pass	63,401
South Passage Lemesurier	66,043
Tracy/Endicott Arms	1,479,363

Table J-6 Fishing Vessel Capacities by High-Risk Areas

High-Risk Area	Non-Persistent Fuel Capacity (gal)
Decision Pass	6,062,673
Icy Straits/Rocky Island	9,775,439
Ketchikan	14,318,528
North Passage Lemesurier	1,827,347
Petersburg	7,656,511
Portland Canal	39,996
Saginaw and Favorite Channels	5,783,672
Snow Passage	7,615,887
South Inian Pass	1,330,168
South Passage Lemesurier	2,398,949
Tracy/Endicott Arms	240,006

Table J-7 Other Vessels Capacities by High-Risk Areas

High-Risk Area	Non-Persistent Fuel Capacity (gal)
Decision Pass	1,730,740
Disenchantment Bay	192,714
Icy Straits/Rocky Island	8,428,212
Ketchikan	7,674,317
North Passage Lemesurier	4,170,224
Petersburg	3,625,735
Portland Canal	99,997
Saginaw and Favorite Channels	5,917,618
Snow Passage	3,388,481
South Inian Pass	362,407
South Passage Lemesurier	516,242
Tracy/Endicott Arms	8,403,341

Table J-8 Tugs Capacities by High-Risk Areas

High-Risk Area	Non-Persistent Fuel Capacity (gal)
Decision Pass	21,552,430
Disenchantment Bay	553,144
Icy Straits/Rocky Island	55,713,930
Ketchikan	33,863,665
North Passage Lemesurier	2,179,501
Petersburg	24,852,605
Portland Canal	104,912
Saginaw and Favorite Channels	25,882,432
Snow Passage	24,117,066
South Inian Pass	142,759
South Passage Lemesurier	20,483,484

Table J-9 Tug Oil Barge Capacities by High-Risk Areas

High-Risk Area	Non-Persistent Fuel Capacity (gal)	Non-Persistent Cargo Capacity (gal)
Decision Pass	8,653,054	281,061,837
Disenchantment Bay	233,528	4,518,398
Icy Straits/Rocky Island	13,941,698	380,560,636
Ketchikan	12,104,461	301,675,178
North Passage Lemesurier	1,251,985	30,763,886
Petersburg	4,060,852	72,885,847
Saginaw and Favorite Channels	7,107,595	162,775,918
Snow Passage	6,756,199	202,876,699
South Inian Pass	133,143	2,389,700
South Passage Lemesurier	3,071,554	102,623,161

Appendix K Monthly Fuel Capacity of Vessels by High-Risk Area

The following tables include all fuel types (persistent, non-persistent, cargo) combined into monthly volumes transported into each High-Risk area by the different vessel types during 2018. Only those vessel types actually entering a High-Risk area are shown in the table.

Table K-1 Decision Pass Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Other	65 - 150					9,999					20,001		
	150 - 300	335,244	347,661		565,477	65,634			106,729		352,152	347,661	466,806
Cruise Ship	65 - 150					9,324		99,330					
	150 - 300					28,014				28,014			
	300 - 700					746,877	3,678,080	4,515,509	3,922,500	2,835,234	583,378		
	>700					57,165,666	75,571,737	80,561,760	71,417,788	53,068,987	813,330		
Ferry	150 - 300			67,115						49,938		49,938	
	300 - 700				630,125	630,125	630,125	840,166	1,050,208	840,166			
Fishing	65 - 150	130,003	30,000	239,705	49,996	39,997	296,225	499,984	1,376,217	399,982	80,002	79,999	
	150 - 300	427,821	49,775		59,147		537,882		588,520	59,147	109,268		59,147
	300 - 700			237,510	237,510				237,510				237,510
Other	65 - 150				20,000	40,000	137,640	150,000	140,000	60,000			20,000
	150 - 300		106,848	79,254	20,000	60,000	141,018	442,848	101,110	81,018	40,000		
	300 - 700												91,056
Tug	< 65						10,000		9,219				
	65 - 150	1,546,216	1,296,447	1,719,521	2,300,013	2,090,136	1,901,438	1,618,498	1,888,593	1,924,426	1,712,496	2,050,891	1,485,188
Tug Oil Barge	65 - 150	26,050,922	25,101,459	25,656,633	18,726,684	24,172,893	20,410,151	26,871,069	27,939,148	31,072,350	26,677,689	17,513,840	19,530,827

Table K-2 Disenchantment Bay Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Apr	May	June	July	Aug	Sep	Oct	Dec
Cargo Other	150 - 300	238,290							
Cruise Ship	300 - 700		1,843,201	4,028,570	2,321,901	4,564,536	2,468,185	484,506	
	> 700		30,992,024	60,360,995	68,475,827	66,417,345	27,432,732		
Ferry	300 - 700		420,083	840,166	420,083	420,083	420,083		
Other	65 - 150				20,000		40,000		
	150 - 300				30,408	102,312			
Tour Boat	65 - 150				21,134				
Tug	65 - 150					181,668			371,492
Tug Oil Barge	65 - 150								4,752,070

Table K-3 Icy Straits/Rocky Island Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Bulk	300 - 700			1,022,194			406,925			1,014,998	467,924	456,617	
Cargo Other	65 - 150	9,999	20,000	29,997	109,993	279,972	224,892	189,979	219,981	199,978	109,988	29,997	
	150 - 300	228,509	228,509		443,677	65,632			106,725		352,141	340,914	466,792
Cruise Ship	65 - 150			20,077	94,753	234,233	525,124	533,264	450,656	263,296			
	150 - 300				39,059	1,337,660	1,674,575	2,009,011	2,275,661	708,603			
	300 - 700					1,767,693	5,422,923	5,970,212	4,963,337	4,447,668	242,246		
	>700					93,430,517	114,001,054	120,229,941	126,773,648	87,741,348	2,533,037		
Ferry	150 - 300	2,170,781	2,019,331	1,632,094	2,019,331	2,271,747	2,600,509	2,625,627	2,739,276	2,321,932	2,524,163	2,473,239	852,449
	300 - 700	547,914	1,515,898	2,566,074	2,631,465	3,600,918	2,979,213	2,779,047	3,536,996	3,116,926	3,042,078	3,318,972	3,997,667
Fishing	65 - 150	20,000	229,986	99,989	329,983	339,987	1,298,057	2,749,851	1,376,143	609,941	269,979	159,988	19,998
	150 - 300	187,743	49,773	49,773	166,544		133,231	251,522	364,620	29,587	29,587		59,145
	300 - 700			237,503	237,503				237,503				237,503
Other	65 - 150	119,996	59,998	10,000	29,999	229,993	920,329	1,206,915	1,009,301	169,995	10,000		
	150 - 300		99,251	99,251	19,999	79,998	629,307	1,213,451	649,160	131,152	19,999		
	300 - 700				79,252	79,252		158,503				1,221,003	182,106
Tour Boat	65 - 150	5,283	7,925	5,283	42,268	192,846	353,990	364,557	324,932	221,904	7,925	5,283	
Tug	< 65		6,349	19,048	19,048	44,299	42,149		12,699	28,267		100,771	12,699
	65 - 150	3,471,733	2,609,435	4,708,549	5,618,879	5,053,085	4,083,919	3,521,973	4,556,399	3,052,189	3,182,423	4,569,441	11,000,577
Tug Oil Barge	65 - 150	28,017,818	23,461,379	32,491,967	19,987,538	42,359,082	23,461,379	37,490,630	44,598,177	31,777,673	44,891,937	32,709,988	33,254,764

Table K-4 North Passage Lemesurier Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Bulk	300 - 700						406,938			547,090			
Cargo Other	65 - 150					9,999							
	150 - 300	228,516	121,787		352,152	65,634			106,729		352,152	340,924	466,806
Cruise Ship	65 - 150					35,154	87,277	146,372	136,963	21,840			
	150 - 300					80,052	221,424	194,880	233,814	66,528			
	300 - 700					1,085,100	4,211,144	4,664,308	3,765,728	4,097,959	242,253		
	> 700					47,987,863	57,524,770	58,199,711	58,508,449	36,717,227	906,454		
Ferry	150 - 300	50,485		117,600	100,970	50,485	50,485	50,485	50,485	49,938		62,621	49,938
	300 - 700				630,125	840,166	630,125	630,125	630,125	840,166			
Fishing	65 - 150	20,001	30,000	19,998	79,999	19,998	111,910	19,998	169,995	69,997	29,998	49,996	9,999
	150 - 300	107,058			46,232		74,088	74,088	122,340	29,588	29,588		
	300 - 700			237,510	237,510				237,510				
Other	65 - 150	20,000				20,000	90,000	68,476	10,000	40,000			
	150 - 300		79,254	79,254		40,000	306,818	1,628,928	158,508				
	300 - 700							317,016				1,221,040	91,056
Tour Boat	65 - 150				2,642								
Tug	< 65		6,350				10,000			9,219		9,219	
	65 - 150			43,885	157,747	307,355	337,314	192,808	158,612	370,877	182,365	320,951	72,865
Tug Oil Barge	65 - 150			2,522,919	2,896,490	11,241,150		1,261,460	2,522,919		8,652,952	2,918,951	

Table K-5 Portland Canal Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Bulk	300 - 700	3,826,383	744,988	3,717,342	2,294,769			836,073	2,210,081	2,680,056	1,679,306	1,452,990
Cargo Other	300 - 700			881,304		543,154			579,262		1,350,050	871,794
Fishing	65 - 150						39,997					
Other	65 - 150	40,000			10,000	10,000						
	150 - 300				40,000							
Tug	65 - 150										40,356	64,559

Table K-6 Saginaw and Favorite Channels Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Bulk	300 - 700									935,877		456,631	
Cargo Other	65 - 150		20,001		129,990	239,984	199,987	209,983	169,989	139,989	69,994	9,999	
	150 - 300											115,050	
Cruise Ship	65 - 150				77,495	122,013	362,804	211,934	251,208	168,045			
	150 - 300				15,624	394,087	452,005	769,776	638,989	324,702			
	300 - 700					1,376,527	5,263,633	6,284,445	4,494,251	5,121,731			
	> 700					77,394,887	119,800,312	120,974,506	122,817,429	74,047,267	1,719,784		
Ferry	150 - 300	2,625,209	2,271,816	2,069,877	2,574,725	3,181,287	3,435,450	3,549,102	3,548,606	3,383,723	2,978,603	3,075,850	1,407,408
	300 - 700	2,465,687	3,917,708	7,068,331	4,959,515	7,443,884	6,272,761	5,590,051	7,105,996	6,411,947	5,408,150	5,137,123	5,381,479
Fishing	65 - 150		89,993	290,004	89,993	89,996	819,949	2,969,912	539,963	489,969	179,991	109,994	39,997
	150 - 300						74,088						
Other	65 - 150	60,000	40,000		30,000	140,000	710,357	1,026,952	596,952	70,000	10,000		
	150 - 300				40,000	60,000	356,436	538,708	569,180	71,156	60,000		
	300 - 700				79,254	79,254		158,508				1,221,040	
Tour Boat	65 - 150	10,567	13,209	10,567	132,090	1,452,990	2,110,798	2,398,754	2,353,844	1,209,944	55,478	5,284	
Tug	< 65		12,699	19,049	19,049	34,618	62,970	9,219	37,488	19,049		53,519	12,699
	65 - 150	1,574,599	1,639,314	1,265,711	2,289,030	2,385,197	2,917,825	2,685,130	2,626,585	2,049,042	2,172,632	1,631,312	2,366,479
Tug Oil Barge	65 - 150	16,247,863	16,247,863	16,803,037	10,465,247	15,105,152	9,385,391	11,710,175	19,032,188	12,304,342	16,954,148	14,431,229	11,202,025

Table K-7 Snow Passage Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Other	65 - 150				34,829	29,998			34,829		20,001		
	150 - 300	335,244	347,661		565,477	65,634			106,729		233,007	347,661	466,806
Cruise Ship	65 - 150				10,039	40,196	10,039	123,650	10,039	16,591			
	150 - 300				61,824	64,470	20,832	20,832	15,624	165,732			
	300 - 700					580,475	2,597,663	2,826,525	2,587,175	1,744,329			
	> 700					56,056,614	78,461,746	84,005,097	79,088,938	54,354,661	813,330		
Ferry	150 - 300		12,683	67,115	50,485					49,938		100,423	50,485
	300 - 700				1,050,208	420,083	630,125	840,166	1,050,208	840,166			
Fishing	65 - 150	170,002	39,999	219,985	119,996	259,987	531,887	739,976	1,862,432	829,951	139,997	39,999	9,999
	150 - 300	187,749	49,775		120,317		460,634	59,147	752,199	88,735	161,672		59,147
	300 - 700			237,510	237,510				237,510				
Other	65 - 150	40,000	30,000	20,000	40,000	200,000	400,819	347,640	460,000	230,000	10,000	40,000	40,000
	150 - 300		246,102	99,254	60,000	58,480	191,872	378,066	250,444	105,906	60,000	40,000	40,000
Tour Boat	65 - 150	2,642	2,642		5,284	2,642	13,209		7,925	5,284			
Tug	< 65	6,350				9,219	25,020	15,569	27,658			15,569	
	65 - 150	1,511,474	1,560,255	1,813,877	2,582,477	2,177,216	1,998,412	2,128,409	2,196,481	2,258,486	1,932,157	2,265,940	1,676,054
Tug Oil Barge	65 - 150	8,255,366	17,683,813	25,101,459	14,568,734	15,652,929	9,914,411	17,683,813	20,521,502	21,997,212	24,861,055	12,223,080	11,175,871

Table K-8 South Inian Pass Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Other	65 - 150				19,998	119,991	59,995	79,994	79,996	39,997			
	150 - 300				91,538								
Cruise Ship	65 - 150				10,920	40,951	21,840	44,226	74,550	26,419			
	150 - 300					465,445	786,493	746,678	891,703	218,400			
	300 - 700						176,890		1,197,362				
Ferry	150 - 300	50,485	100,970	100,970	50,485	50,485	151,454	151,454	151,454	100,970	100,970	49,938	
	300 - 700				210,042	210,042	210,042		210,042				
Fishing	65 - 150		9,999		139,997	129,995	129,990	149,988	309,989	189,985	9,999		19,998
	150 - 300				120,317				119,950				
Other	65 - 150			10,000		50,000	40,000	50,000	40,000	10,000	10,000		
	150 - 300							86,058	15,204	51,156			
Tour Boat	65 - 150						15,851	23,776	15,851	7,925			
Tug	65 - 150			65,258								20,178	57,327
Tug Oil Barge	65 - 150							2,522,919					

Table K-9 South Passage Lemesurier Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Other	65 - 150				19,998	109,991	104,906	79,994	79,996	39,997			
	150 - 300		106,729		91,538								
Cruise Ship	65 - 150				21,840	45,193	91,519	248,601	92,106	20,959			
	150 - 300					766,333	936,602	872,762	1,130,936	151,872			
	300 - 700					507,527	343,292	1,189,777	1,197,362				
	> 700						2,944,078	1,105,857	1,019,676	1,345,848			
Ferry	150 - 300	50,485	100,970	50,485		50,485	151,454	151,454	151,454	113,653	100,970	49,938	
	300 - 700				210,042	210,042	210,042	210,042	420,083				
Fishing	65 - 150		9,999		149,996	159,995	236,217	169,989	416,218	249,980	39,999	59,998	9,999
	150 - 300	80,691	49,775	49,775	120,317		59,147	59,147	181,120				59,147
	300 - 700												237,510
Other	65 - 150			10,000		40,000	50,000	70,000	50,000	30,000	10,000		
	150 - 300			20,000				149,898	35,204	51,156			
Tour Boat	65 - 150						15,851	23,776	18,493	7,925			
Tug	65 - 150	1,395,675	1,214,695	1,721,419	2,666,061	1,721,287	1,346,294	1,574,794	2,000,794	1,748,571	1,614,122	1,921,350	1,559,043
Tug Oil Barge	65 - 150	13,862,449	3,078,093	10,292,321	3,570,129	16,189,347	6,156,187	9,187,256	21,163,592	2,918,951	10,255,336	3,570,129	5,454,128

Table K-10 Tracy and Endicott Arms Monthly Fuel Volumes (gallons)

Vessel Type	Length (ft)	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cruise Ship	65 - 150	20,078	90,635	388,921	514,926	398,161	145,322			
	150 - 300	61,824	1,132,320	1,729,561	2,048,256	1,858,795	432,391			
	300 - 700		385,112	2,911,983	5,099,766	3,077,582	1,732,176	682,250		
	> 700		30,056,163	58,113,004	58,596,318	65,041,940	29,926,706			
Fishing	65 - 150							240,013		
Other	65 - 150	60,000	120,000	820,000	1,300,560	846,952	60,000			80,000
	150 - 300	20,000		1,295,632	613,952	539,796	204,624			
	300 - 700								2,442,080	
Tour Boat	65 - 150		182,284	369,852	390,986	425,330	105,672	5,284		

Table K-11 Ketchikan Monthly Fuel Volumes (gallons)

	Length (ft)	Jan	feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Other	65 - 150				34,828	9,999			34,828			20,000	
	150 - 300	106,725									317,006	220,716	106,725
Cruise Ship	65 - 150				10,039	74,466		43,681	34,357	56,659	5,460		
	150 - 300				69,634	192,648	85,594	25,913	92,943	189,709			
	300 - 700					921,969	3,779,004	4,348,975	4,360,198	3,627,131	341,115		
	> 700					60,490,990	86,454,575	90,471,285	88,737,099	57,217,622	813,305		
Ferry	150 - 300	921,802	895,173	1,029,399	1,018,859	890,297	908,694	899,495	971,485	1,025,994	953,088	942,378	1,055,816
	300 - 700	1,369,785	2,821,761	5,206,907	3,653,501	5,364,514	5,510,628	4,826,470	5,856,907	5,646,872	4,512,325	3,332,836	4,346,472
Fishing	65 - 150	169,997	129,988	326,205	449,988	589,981	1,439,453	3,505,226	4,038,516	1,509,018	707,608	219,981	69,992
	150 - 300		49,773		107,398		344,183		135,254	120,053	109,264		59,145
	300 - 700				237,503								
Other	65 - 150	59,998	109,997	89,997	149,995	609,982	1,140,785	1,087,607	1,039,969	859,974	189,994	79,998	39,999
	150 - 300	79,998	119,996	99,251	159,995	118,476	292,881	539,068	328,292	258,072	39,999	79,998	99,997
Tour Boat	65 - 150	15,850	7,925	21,134	23,775	356,632	478,151	396,258	330,215	272,097	7,925	2,642	7,925
Tug	< 65	88,303	72,650	47,253	91,552	119,672	205,825	255,228	169,479	119,756	116,802	154,373	47,253
	65 - 150	2,529,705	2,001,978	3,015,082	2,803,993	2,730,166	2,689,664	2,494,514	3,046,275	2,842,939	3,031,857	2,914,585	2,274,759
Tug Oil Barge	65 - 150	19,231,854	23,813,125	27,245,643	20,164,798	31,784,964	16,776,375	24,524,672	16,599,116	20,938,537	29,987,247	24,167,643	58,545,667

Table K-12 Petersburg Monthly Fuel Volumes (gallons)

	Length (ft)	Jan	feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Cargo Other	65 - 150				34,828	29,997			44,827	9,999			
	150 - 300											115,047	
Cruise Ship	65 - 150				10,039	67,829	61,696	82,905	89,080	65,142	5,460		
	150 - 300				69,634	321,963	596,299	597,810	790,794	246,407			
	300 - 700					8,718	185,602	17,435	8,718	8,718			
Ferry	150 - 300	12,683	12,683		201,933							50,483	50,483
	300 - 700	1,643,742	2,821,761	5,762,254	2,951,073	4,944,444	4,532,774	3,710,903	4,944,444	4,532,774	4,707,027	4,021,401	4,413,331
Fishing	65 - 150	69,995	169,987	339,974	349,980	399,972	661,852	1,329,879	1,866,093	829,923	229,986	109,991	79,991
	150 - 300				107,398		162,818	251,522	490,127	207,024			
Other	65 - 150	89,997	29,999	99,997	139,996	229,993	456,345	665,260	538,460	219,993	49,998	19,999	109,997
	150 - 300		79,998	39,999	159,995	58,478	90,851	59,998	249,326	137,058	59,998		39,999
Tour Boat	65 - 150	2,642	2,642		5,283	10,567	21,134	10,567	15,850	7,925			
Tug	< 65					9,219	28,120	9,219	27,658			9,219	
	65 - 150	2,003,661	1,886,285	1,971,739	1,656,156	2,635,807	2,231,392	2,072,708	2,484,823	2,448,113	2,232,581	1,661,782	1,484,123
Tug Oil Barge	65 - 150	10,091,370	1,261,421	7,568,528	6,307,107	7,568,528	6,307,107	5,045,685	3,784,264	3,784,264	7,568,528	10,091,370	7,568,528