



Cook Inlet Vessel Traffic 2021–2024

SEPTEMBER 2025

Sierra Fletcher, Alisha Chartier, Bretwood Higman, and Haley Griffin



Executive Summary

The Cook Inlet Regional Citizens Advisory Council (CIRCAC) commissioned this study to provide updated information about vessel traffic in Cook Inlet, with a focus on crude oil industry-related activities in the context of other vessel movements. This report follows previous studies of vessel traffic in 2010 (Cape International, Inc., 2012) and 2011 to 2020 (Nuka Research, 2021). It uses Automatic Identification System (AIS) data purchased from the Marine Exchange of Alaska to identify vessel activity in Cook Inlet.

Seven hundred forty-seven (747) vessels were identified in the 2021–2024 AIS data within the Cook Inlet study area. Fishing vessels comprised the largest portion of individual vessels identified (38%) while tugs spent the most operational time (also 38%) in the Inlet during the four years studied. Barges, which are not required to carry AIS, are not included in the study.

Vessel transits were counted across four passage lines: Cook Inlet entrance, Kachemak Bay, the Forelands, and between Tyonek and Point Possession. Crossings were highest at the Kachemak Bay passage line, which captures traffic into Homer as well as ships going to the pilot station or Kachemak Bay anchorages. Most vessel traffic moves along the east side of Cook Inlet.

More than 90 percent of petroleum that crosses the Cook Inlet passage line as either cargo or fuel is associated with tankers moving crude oil, diesel, and jet fuel among other products.

Cook Inlet has always had “frequent flier” vessels that contribute significantly to the time spent in the Inlet. These are vessels that mostly stay within the Inlet or make frequent trips. Looking back as far as a 2006 study of vessel traffic, the six ships that made the most port calls in that study are all still active in Cook Inlet today. At the same time, the future may bring changes such as the potential return of liquid natural gas (LNG) tanker shipments as well as transitions in vessel fuels.

Table of Contents

1	Introduction	1
2	Project Approach.....	3
3	Cook Inlet Vessel Traffic Overview	6
4	Cook Inlet Fleet Overview.....	9
5	Vessel Activity: Operating Days, Passage Lines, and Ports.....	12
6	Oil Movement Analysis.....	16
7	Conclusion	23
	References	24
	Appendix A – AIS Analysis Method.....	25
	Appendix B – Passage Line Crossings.....	28
	Appendix C – Port Entrances	31
	Appendix D – Passage Line Entries	35

1 Introduction

The Cook Inlet Regional Citizens Advisory Council (CIRCAC) commissioned this study to provide updated vessel traffic in Cook Inlet, with a focus on crude oil industry-related activities in the context of other vessel movements. This report follows previous studies of vessel traffic in 2010 (Cape International, Inc., 2012) and 2011 to 2020 (Nuka Research, 2021). It uses Automatic Identification System (AIS) data purchased from the Marine Exchange of Alaska to identify vessel activity in Cook Inlet (see Figure 1).

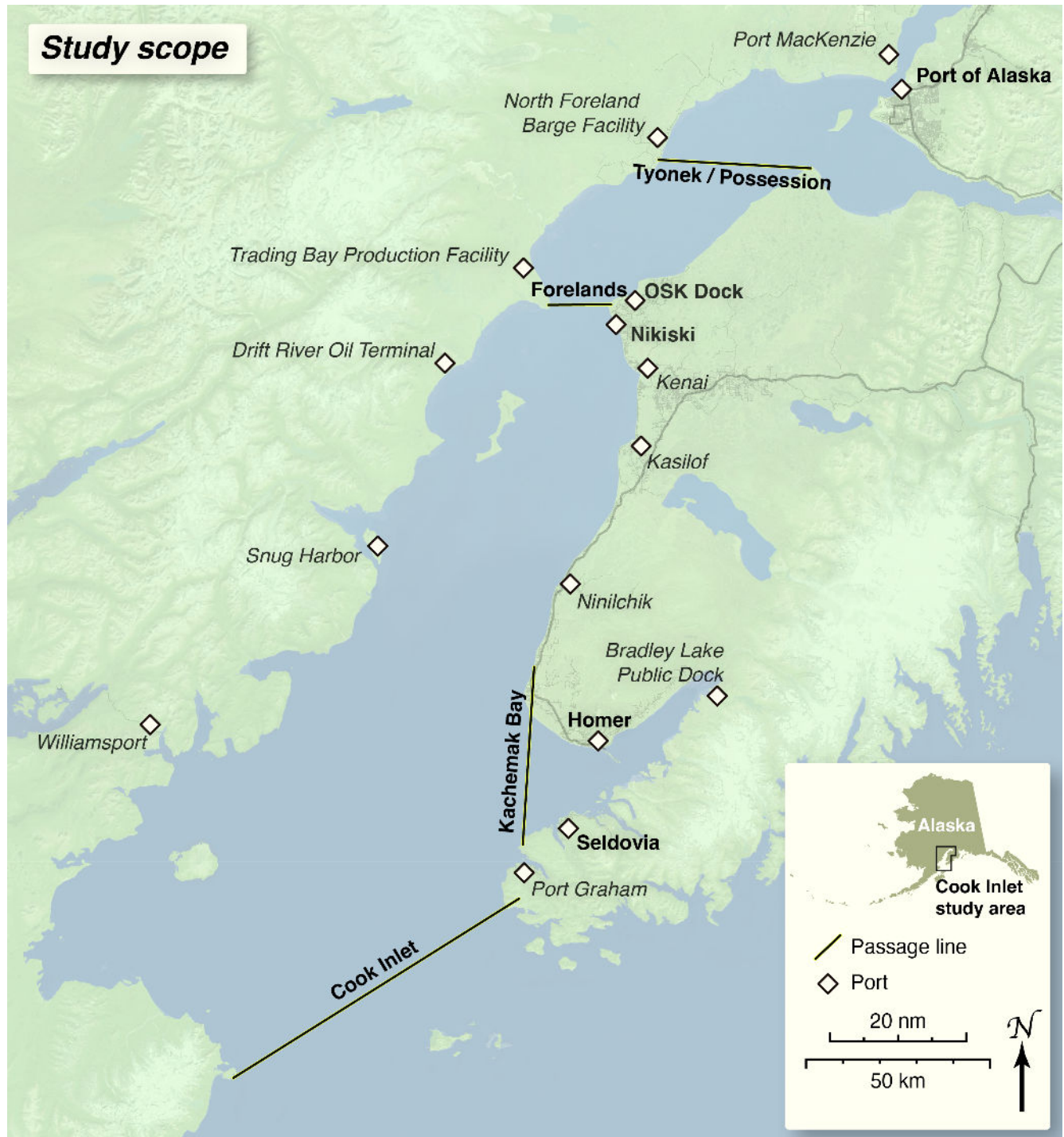


FIGURE 1.1 Study area with passage lines used for analysis

2 Project Approach

This study builds on the previous 10-year analysis of vessel traffic in Cook Inlet, capturing information over four years using AIS data records. Recorded AIS signals provide a replicable source of information about vessel location and identification which is then used to determine the vessel's type, size, and other characteristics as needed. However, the results presented in this report do not include vessels *without* AIS, nor vessel movements where there is a disruption of the AIS transmittal or reception (e.g., if AIS is turned off, AIS fails to transmit a signal, or the signal is not received due to lack of coverage by an AIS receiver for some reason). AIS requirements apply only to self-propelled vessels based on size, type, and route. Thus, barges are not required to carry AIS and are not included in the study. This is notable because barges move fuel as well as other cargo throughout Cook Inlet.

Vessels are organized into six types and 12 associated subtypes, as shown in Table 2.1. The types and subtypes from the previous 10-year study (Nuka Research, 2021) were reviewed and modified only slightly to retain as much consistency as possible. The two changes were in subtyping of tugs (tugs are now one category that includes both conventional and articulated tugs) and removal of LNG tankers since there were no LNG tankers in the Inlet during the 2021–2024 study period.

As vessel fuels change in the future, it may be appropriate to modify subtyping based on vessels using LNG or those powered by batteries, for example. At this time, while we note that two cargo ships active in the Inlet were converted to being run primarily on LNG during the study period,¹ the overall vessel typing was not modified from that used in the previous study at this time.

Raw AIS data are supplemented with information gained through online research of missing details needed to present the information in the following sections. Sources vary depending on the fields required, but include data previously researched during the 10-year study, online vessel databases such as marinetraffic.com, and, for the petroleum analysis, the U.S. Coast Guard's (USCG) Vessel Response Plan database² for fuel capacities and oil cargo capacities. Information is not always readily available for smaller vessels, so in some cases the results exclude Small Passenger, Fishing, or Other vessels. These cases are identified in the subsequent sections.

Oil volume (either fuel or fuel and oil cargo) was identified for five vessel types, as shown in Table 2.1.

¹ The vessels are the *Midnight Sun* and *NorthStar*, per communication with authors (October 24, 2024). Going forward, Nuka Research recommends that these and any other verifiable LNG-powered vessels be categorized separately in the oil exposure analysis.

² As of April 2025 this online resource is no longer publicly available.

Table 2.1 Vessel types and subtypes used in this report and vessel characteristics reported

Vessel Types	Subtypes	Examples	Size	Flag	Year Built	Oil Volume Est.
Cargo	Large Cargo	Container ships, roll-on/roll-off cargo ships, vehicle carriers, bulk carriers, general cargo, heavy lift cargo, refrigerated cargo ("reefer")	x	x	x	x
	Oil Field	Oil spill response vessels, offshore supply vessels associated with Cook Inlet oil and gas production	x		x	x
	Small Cargo	Landing craft other small cargo	x		x	
Tanker	Oil Cargo	Chemical/oil products tanker, crude oil tanker	x	x	x	x
Passenger	Alaska Marine Highway System (AMHS) Ferry	State highway system ferries	x		x	x
	Cruise Ship	Cruise ship	x	x	x	x
	Small Passenger	Small ferries (e.g., Kachemak Bay ferry), tour boats, crew boats				
Tug	Tug	Articulated and conventional tugs	x		x	
Fishing	Fishing	Crab/longliner, tender, trawler				
Other	Government	Law enforcement, military				
	Survey/ Research	Vessels identified as conducting research or surveys (for government or private sector)				
	Other	Dredging, pleasure craft, yacht, fire-fighting vessel				

There is no single metric that perfectly depicts vessel activity. In the following sections, different metrics are used to present Cook Inlet vessel activity: total number of unique vessels by subtype, time spent in Cook Inlet, passage line crossings that count the number of times vessels crossed four

imaginary lines drawn at the locations shown in Figure 1.1,³ and port entrances that count the number of times vessels enter polygons drawn around selected ports.⁴

The above information is used along with assumptions regarding vessel fuel capacity and oil cargo to estimate overall petroleum movements as well. Those assumptions are discussed in Section 6 along with results. Appendix A provides further details on the processing of AIS data.

³ Passage lines were added from the previous 10-year study to better capture movements into Upper Cook Inlet; this was done based on information requests and to offset the reduction in the number of ports at which vessels were counted.

⁴ In this case, ports were included based on whether they hosted more than 5 Oil Cargo or Oil Field vessels during 2011–2020 based on the previous 10-year study (Nuka Research, 2021). Those ports are: Port of Alaska (Anchorage), Nikiski, OSK Dock, Homer, and Seldovia.

3 Cook Inlet Vessel Traffic Overview

This section presents an overview of vessel activity before further details are examined of the fleet (Section 4) and vessel movements (Section 5). Figure 3.1 shows vessel activity by subtype for 2021–2024 based on the processed AIS signals.

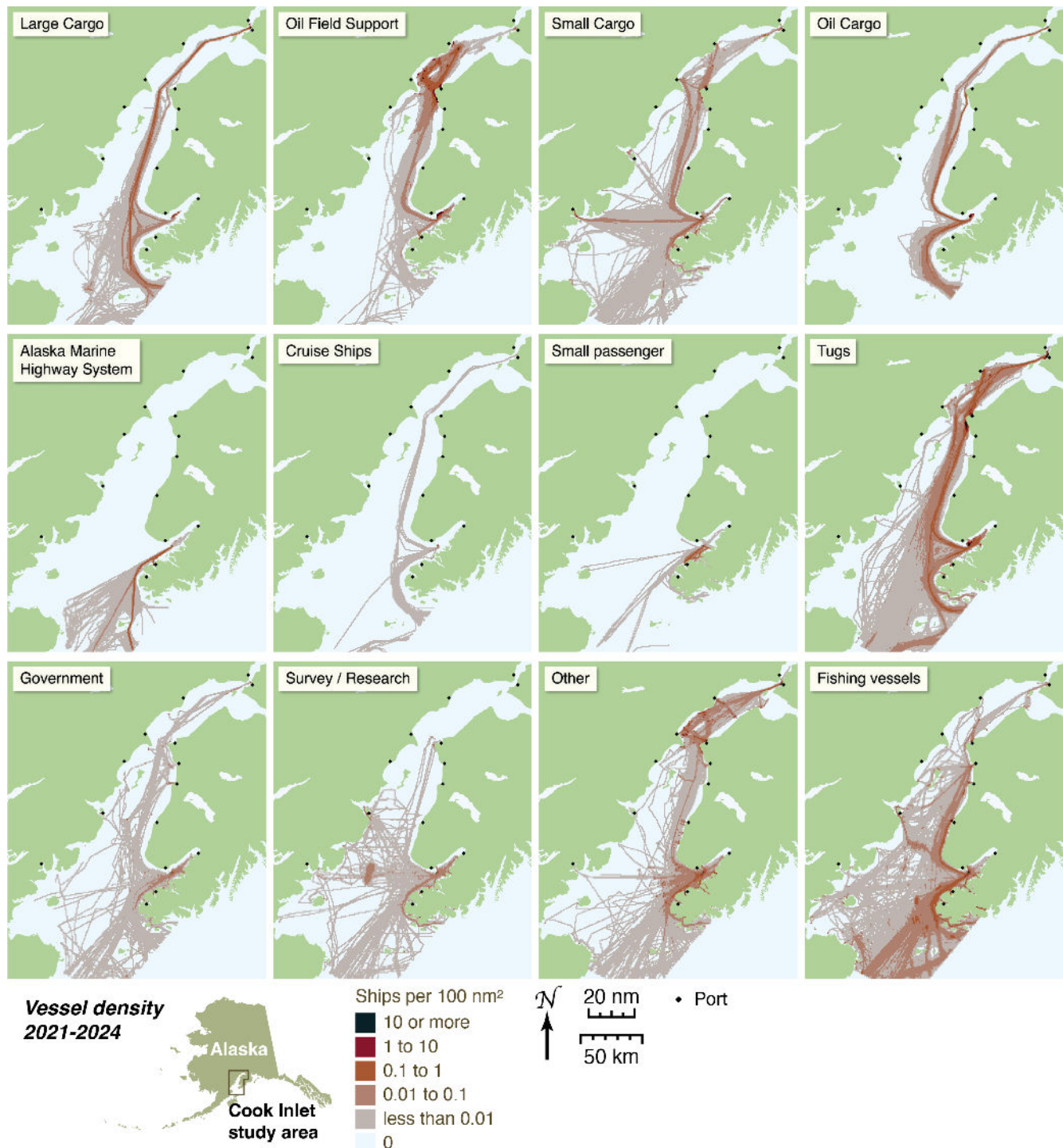
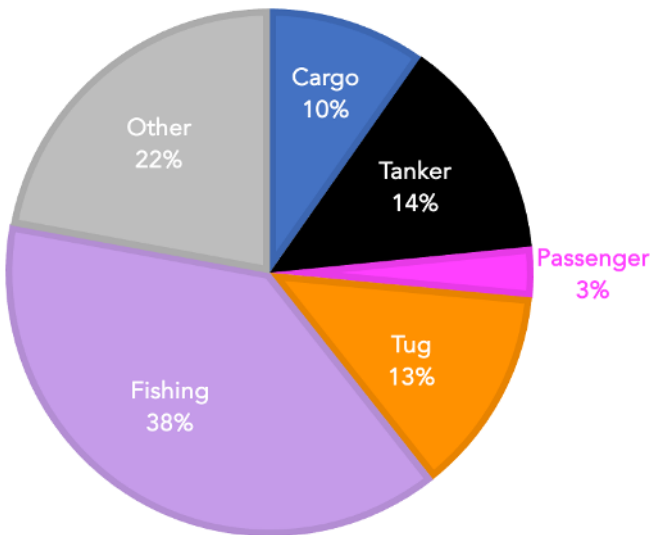


FIGURE 3.1 Vessel movements by subtype (Cook Inlet AIS dataset, 2021–2024)

Seven hundred forty-seven (747) vessels were identified in the 2021–2024 AIS data within the Cook Inlet study area. Fishing vessels comprised the largest portion of individual vessels identified (38%), followed by Other vessels, Oil Cargo (tank ships), and Tugs. Tugs, however, spent the most operational time in the Inlet during the study period (3,855 days) followed by Cargo vessels. More than half of the 2,666 Cargo vessel operating days were Oil Field vessels. Nine (9) Oil Field vessels accounted for those 1,491 operating days over the four-year period.

Figure 3.2 shows the percentage breakdown of unique vessels and operating days by vessel type for the four-year study period. Table 3.1 provides the total number of vessels and total operational days (over the study period) by subtype.⁵ (In addition to the vessels below, there were 10 vessels for which the type was not identified.)

Percent of Unique Vessels (2021–2024)



Percent of Operational Days (2021–2024)

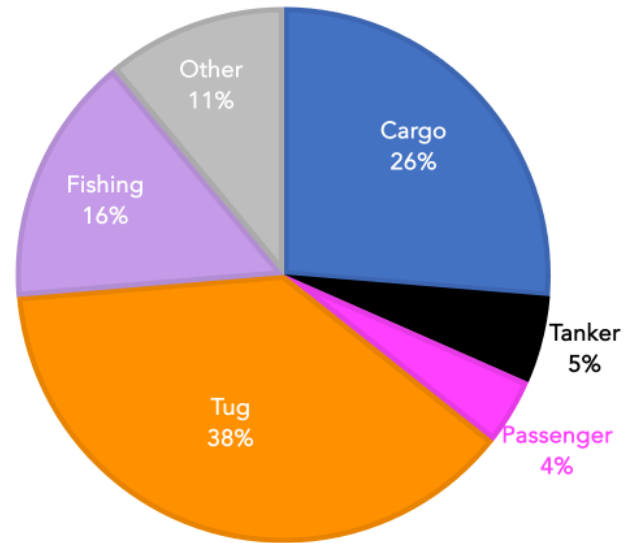


FIGURE 3.2 Percent of unique vessels (left) and operating days (right) by vessel type for 2021–2024 Cook Inlet AIS data, combined

⁵ Operational days are used here as the primary metric for indicating vessel activity in Cook Inlet. Operational days by year are shown in Section 5.1 and used to consider changes over time. These data are also used in the oil cargo/fuel analysis.

TABLE 3.1 Total unique vessels and total operational days in the Cook Inlet AIS dataset, 2021–2024

Vessel Type	Vessel Subtype	Unique Vessels	Total Operational Days
Cargo	Large Cargo	49	737
	Oil Field	9	1,491
	Small Cargo	15	438
<i>Subtotal Cargo</i>		73	2,666
Tanker	Oil Cargo	102	534
Passenger	AMHS	2	231
	Cruise Ship	14	15
	Small Passenger	7	170
<i>Subtotal Passenger</i>		23	416
Tug	Tug	96	3,855
Fishing	Fishing	288	1,552
Other	Government	27	120
	Other	129	852
	Survey / Research	9	144
<i>Subtotal Other</i>		165	1,116
Total		747	10,140

4 Cook Inlet Fleet Overview

This section presents the results of the AIS analysis focused on the vessel fleet, including vessel sizes, year of construction, and flag state.

4.1 Vessel size

Table 4.1 shows the number of vessels in the dataset by size category using gross tonnage (GT). These include the Large Cargo, Oil Field, AMHS, Cruise Ship, and Tug subtypes.⁶ The most operating time in Cook Inlet is spent by vessels that are less than 10,000 GT. Most Tugs are smaller than 500 GT (all are less than 1,000 GT). Tanker sizes are measured in deadweight tonnage (DWT) and shown in Figure 4.1 in comparison to the Large Cargo ships sizes for reference.

TABLE 4.1 Vessel sizes in Cook Inlet AIS dataset 2021–2024

Vessel Type	<100	100-499	500-999	1,000-9,999	10,000-24,999	25,000-49,999	50,000-99,999	Unknown	Total
Large Cargo	-	-	-	8	22	16	3	-	49
Oil Field	-	2	4	3	-	-	-	-	9
AMHS	-	-	-	1	1	-	-	-	2
Cruise Ship	-	-	-	-	8	2	4	-	14
Tug	14	74	6	-	-	-	-	2	96
Total	14	76	10	12	31	18	7	2	170

Large Cargo vessels appear in both the table above (in GT) and the figure below (DWT) to show the sizes of tankers and cargo vessels in comparison to each other. While they are in the middle-to-smaller size class compared to tankers, Large Cargo vessels are among the larger vessels, along with Cruise Ships, compared to other vessel subtypes examined. This relates to size only, not the carriage of fuel or oil cargo.

⁶ Sizes were not reliably available for Small Passenger, and Other vessels and those types/subtypes are not included here.

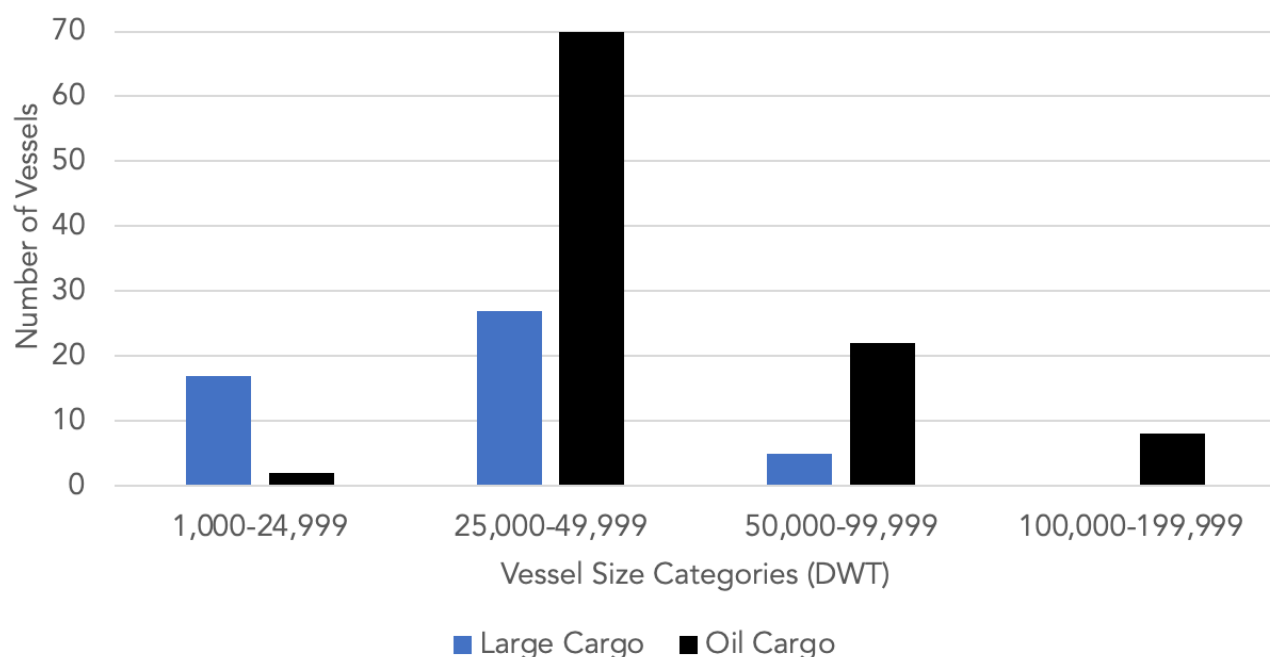


FIGURE 4.1 Comparison of Large Cargo and Tankers in Cook Inlet AIS dataset, 2021–2024

4.2 Year of construction

Table 4.2 shows the decade vessels were constructed based on vessel research (excluding Small Passenger, Fishing, and Other for which data are not reliably available, along with 10 vessels in the categories below).

TABLE 4.2 Decade of vessel construction by type (and as available) in Cook Inlet AIS dataset, 2021–2024

Vessel Type	1940s	1950s	1960s	1970s	1980s	1990s	2000s	2010s	2020s
Cargo	-	1	1	7	8	10	12	21	5
Tanker	-	-	-	-	-	1	34	55	12
Passenger	-	-	1	-	1	3	3	7	1
Tug	1	1	10	28	11	15	6	19	3
Total	1	2	12	35	20	29	55	102	21

4.3 Flag state

Table 4.3 shows the flag states for Large Cargo, Cruise Ships, and Tankers. Other vessel types are assumed to be flagged to the U.S. as they are engaged solely in domestic trade or activities (either

within Cook Inlet or in “Jones Act” service between U.S. ports in Cook Inlet and elsewhere in Alaska or the Lower 48).⁷ The U.S.-flagged Oil Cargo tankers and Large Cargo ships shown in the table are similarly engaged, including moving oil cargo from Valdez and to other U.S. ports. The U.S.-flagged Large Cargo ships are primarily trading between Anchorage and Puget Sound.

TABLE 4.3 Flag state for Large Cargo, Cruise Ships, and Tankers in Cook Inlet AIS dataset, 2021–2024

Flag State	Cruise Ship	Large Cargo	Tankers	Total
Antigua Barbuda	-	2	-	2
Bahamas	4	2	-	6
Canada	-	1	-	1
China	-	-	2	2
Denmark	-	1	6	7
France	1	-	-	1
Greece	-	-	2	2
Hong Kong	-	9	15	24
Indonesia	-	-	1	1
Italy	-	-	2	2
Korea	-	-	1	1
Liberia	-	1	8	9
Malta	2	-	1	3
Marshall Islands	2	3	36	41
Netherlands	3	-	-	3
Norway	2	1	3	6
Panama	-	9	10	19
Singapore	-	3	6	9
USA	-	17	9	26
Total	14	49	102	165

⁷ “Other” vessels could be foreign-flagged pleasure craft for example but were not researched.

5 Vessel Activity: Operating Days, Passage Lines, and Ports

This section presents results related to vessel activity, including operating days (by year), passage line crossings, and port entrances.

5.1 Operating days

While Section 3.1 presented total operating days by vessel type and subtype, Figure 5.1 shows the operational days by type for each year in the dataset. This illustrates a slight increase in 2023 and 2024 compared to 2021 and 2022, but there is no consistent increase across subtypes (details by subtype are shown in Table 5.1).

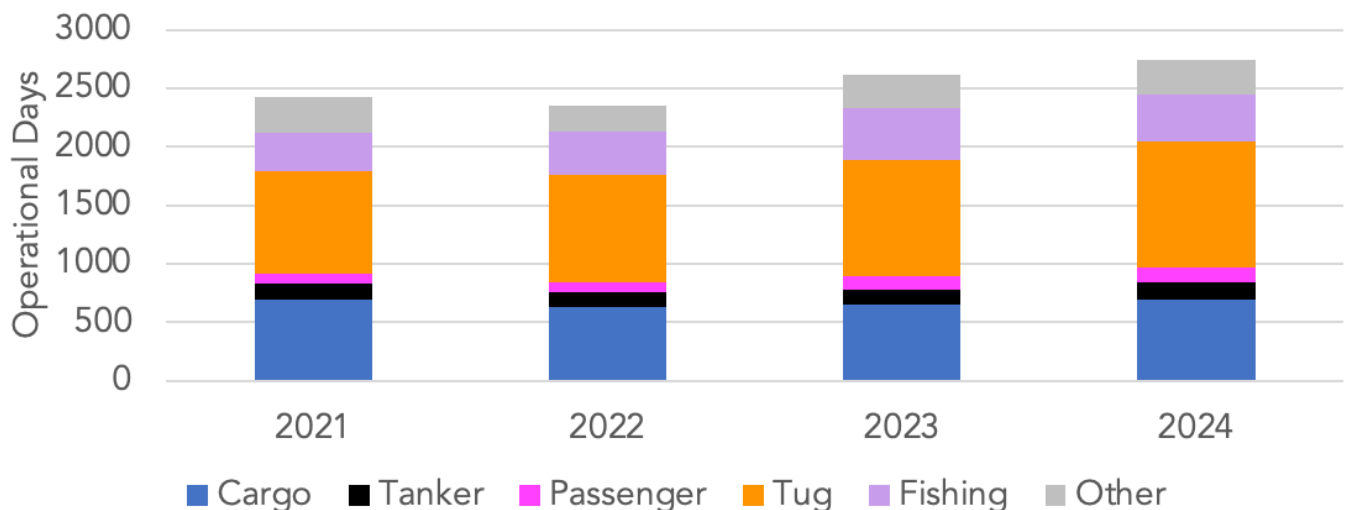


FIGURE 5.1 Operating days by year for each vessel type in Cook Inlet AIS dataset, 2021–2024

TABLE 5.1 Operating days by year for each vessel type and subtype in Cook Inlet AIS dataset, 2021–2024. Average total operating days per vessel for the four years is also shown by subtype

Vessel Type	2021	2022	2023	2024	Avg Total Operating Days/Vessel
Cargo					
Large Cargo	180	176	181	199	15
Oil Field	400	352	345	393	166
Small Cargo	107	100	128	103	29
Subtotal Cargo	687	629	654	696	
Tanker	139	126	125	144	5
Passenger					
AMHS	52	41	72	66	115
Cruise Ship	-	2	6	7	1
Small Passenger	32	46	39	52	24
Subtotal Passenger	84	89	117	126	
Tug	879	917	985	1075	40
Fishing	328	365	452	407	5
Other					
Government	38	25	24	33	4
Other	212	170	237	232	16
Survey / Research	62	25	23	33	16
Subtotal Other	312	220	285	299	
Total	2,429	2,346	2,619	2,745	

5.2 Passage lines

Figure 5.2 shows the number of vessel transits across each of four passage lines (for each year). These are counts of vessel crossings in one direction, either south-to-north, or, for Kachemak Bay, west-to-east. Transits are counted one-way because these numbers become the basis for estimating oil cargo movements across passage lines in Section 6 (a tanker is assumed to have oil cargo in one direction only).

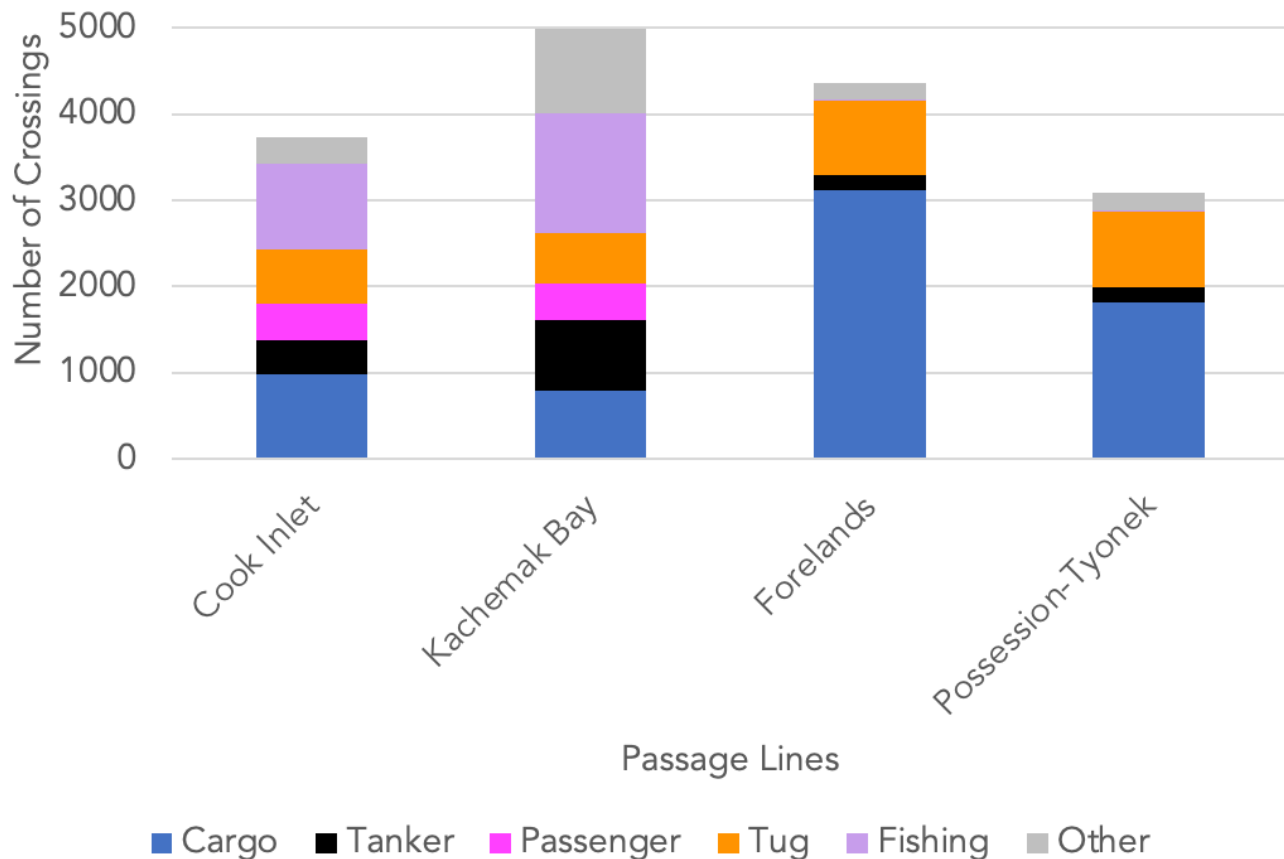


FIGURE 5.2 One-way passage line crossings at each of four passage lines, showing the activity by vessel type at those lines (Kachemak Bay passage line counts crossings west-to-east; at other passage lines the crossings are counted south-to-north)

Passage line counts quantify differences in the type of vessels active in different parts of the Inlet (see Figure 3.1 which shows vessel tracks by subtype). Figure 5.2 shows the amount of fishing activity in southern Cook Inlet area (Cook Inlet and Kachemak Bay passage lines) as compared to the north (to the extent fishing activity is captured in AIS data; not all fishing vessels use AIS). Tanker entrances to the Homer pilot station are also reflected, showing a larger number of tanker movements into Kachemak Bay than entering the Inlet overall. Some tankers go to the pilot station more than once during a Cook Inlet visit. The AMHS ferry crossings at the Cook Inlet and Kachemak Bay passage lines also show a higher level of Passenger vessel activity there as compared to the Forelands and Possession-Tyonek passage line with otherwise just a few Cruise Ship crossings at those lines.

See Appendix B for passage line crossings by vessel subtype and year.

5.3 Ports

Entrances to the following ports were counted: Port of Alaska (Anchorage), OSK Dock, Nikiski, Homer, and Seldovia. The ports included all had at least 5 entrances of Oil Cargo Tankers or Oil Field vessels in 2016–2020 in the previous 10-year study.

Port entrances were counted based on vessel crossings into a polygon around each port. The polygons were intended to capture vessels entering the port and not just passing by or maneuvering at the dock, but the AIS data may differ from port data if vessels are maneuvering in the area in a way that means they go in and out of the polygon used. See Figure 5.3.

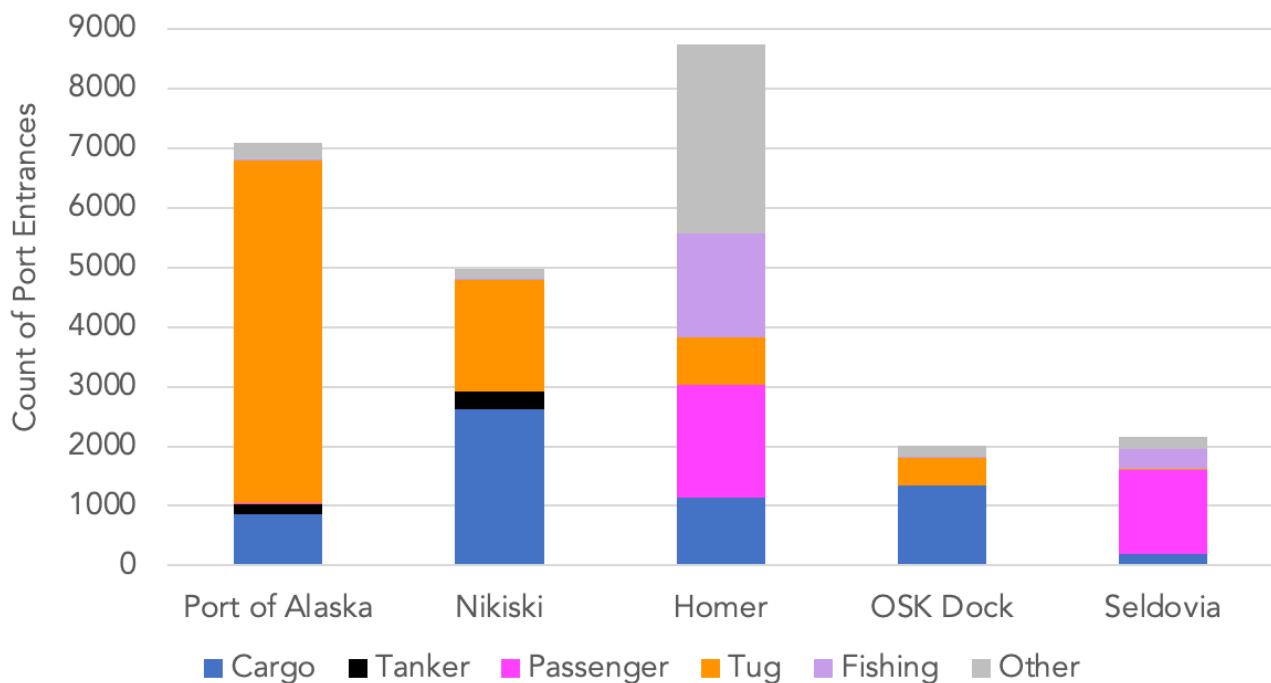


FIGURE 5.3 Total entrances to selected ports in Cook Inlet AIS dataset by vessel type, 2021–2024.

See Appendix C for detailed tables of entrances for each port.

6 Petroleum Movement Analysis

Petroleum movements are estimated for both vessel fuels and petroleum cargo for Large Cargo, Oil Field, AMHS, Cruise Ship. The results do not include oil moved on barges. While oil barges are used in Cook Inlet, barges are not required to carry AIS.

The analysis uses two categories for the type of petroleum used. The National Oceanic and Atmospheric Administration describes the spill response considerations and environmental impacts associated with five groups of oil from federal regulations (see Table 6.1). For the analysis and outputs in this report, we combine Groups 1 and 2 oils into one category and Groups 3, 4, and 5 in another.⁸

TABLE 6.1 Overview of oil groups as applied in this report

Oil Group & Characteristics Related to Response (based on NOAA, 2025)	Examples Relevant to Cook Inlet	Category Used in this Report
Group 1 Non-persistent Light Oils • Volatile and flammable • No residue • High concentrations of toxic compounds • Localized, severe impacts possible	Gasoline Aviation Fuels LNG (for this study only)	Groups 1–2
Group 2 Persistent Light Oils • Moderately volatile • Will leave residue • Moderate concentrations of toxic compounds • Potential long-term contamination of intertidal resources	Diesel Marine Diesel No. 2 Fuel Oil	
Group 3 Medium Oils • Some evaporation • Potential long-term contamination of intertidal areas • Potential severe impacts to waterfowl and fur-bearing mammals	Crude Oil (most) IFO 380	Groups 3–5
Group 4 Heavy Oils • Little or no evaporation or dissolution • Heavy contamination of intertidal areas likely • Severe impacts to waterfowl and fur-bearing mammals • Weathers slowly	Crude Oil (some) No. 6 Bunker Fuel Bunker C	
Group 5 Sinking Oils • Sinks quickly • Long-term contamination of sediments and benthic species	Residual Oils	

⁸ In the previous 10-year study, the terminology used for the petroleum categories was different: in that study, the Groups 1–2 oils were called “non-persistent” while the Groups 3–5 oils were called “persistent.”

6.1 Vessel fuels

Fuel volumes used in the analysis are assumed to be 70% of a vessel's fuel capacity.⁹ Vessel fuel capacities were researched.¹⁰ Where information on fuel capacity was not found, fuel capacity was estimated using a regression analysis based on the vessel, length, and tonnage (depending on the vessel type).

The type of fuel used (whether Groups 1–2 or Groups 3–5) was determined based on vessel subtype. The assumptions in the previous 10-year study were applied unless there was reason to consider whether emerging air emissions-related requirements may have led to a change in the fuels carried.

As of 2020, a global cap of 0.5% sulfur emissions took effect for vessels worldwide (IMO, 2021). Sulfur emissions restrictions impacting the Cook Inlet area were not new: since 2012, vessels from Cook Inlet to southern California have had to comply with a more stringent 0.1% cap on sulfur emissions while in coastal waters (IMO, 2010). Many vessels voyaging across the Pacific or going outside the 0.1% "Emissions Control Area" would use a less expensive heavy fuel oil on the longer part of their voyage and burn a distillate fuel when within the Emissions Control Area.

Of interest in this study, the 2020 0.5% sulfur cap meant that some larger ships calling in Cook Inlet from the Lower 48 or Asia may have chosen to switch to using a Group 2 oil as fuel and stopped using Groups 3–5 entirely. Alternatively, they may continue using a fuel oil (Groups 3–5) that has been modified to comply with the sulfur cap or use exhaust gas scrubbers to meet air emissions requirements.¹¹

For the purposes of this study, we are focused on oil exposure regarding potential spills, based on the volumes and types of fuel a vessel is carrying, not which fuel it is burning in Cook Inlet specifically. For example, a tanker on a trans-Pacific voyage may have low sulfur (heavy) fuel for the longer part of the route as the lowest cost option for complying with the 0.5% global sulfur cap, then use a more expensive marine gas or diesel to comply with the 0.1% sulfur cap in Cook Inlet. Broad assumptions

⁹ A single percentage is used even though the volume will change as fuel is burned throughout a voyage or if engines are run while the vessel is at berth or mooring.

¹⁰ Sources include drawing on previous studies for which fuel data had been obtained, oil discharge prevention and contingency plans required by the State of Alaska, and the U.S. Coast Guard Vessel Response Plan database. (The latter is no longer available as of April 2025).

¹¹ In future, there are also emerging requirements and targets from the International Maritime Organization (IMO) that may drive some vessels to change fuels as one way to reduce their greenhouse gas emissions (IMO, 2025).

were applied to fit the purpose of this study, though we acknowledge that there may be individual vessels or voyages among foreign-flagged Large Cargo, Cruise Ships, or Tankers that use a lighter product.

Considering the changing air emissions requirements discussed above, Nuka Research reached out to some of the frequent operators and ships' agents of vessels for the Large Cargo, Cruise Ships, and Tankers identified in the AIS data.¹² See Table 6.2.

TABLE 6.2 Assumptions applied for oil type used as fuel for vessel subtypes studied

Vessel Subtype	Oil Types Applied for Vessel Fuels in Analysis	Comments
Large Cargo	Groups 1–2 and Groups 3–5	Note that two Large Cargo vessels that frequently call in Cook Inlet began using LNG <i>during</i> the study period which is included for now as a Group 1–2 oil type for the purpose of this study.
Oil Field	Groups 1–2	It was assumed that these vessels used a Group 1–2 oil as fuel in the previous study, and that this did not change due to new air emissions requirements.
Tanker	See Comments column.	Assumed U.S.-flagged tankers carry only Groups 1–2 oils as fuel and foreign-flagged tankers carry a combination of Groups 1–2 and Groups 3–5 oils as fuel.
Cruise Ship	Groups 1–2 and Groups 3–5	Same as for previous study based on input received.
AMHS	Groups 1–2	Same as for Oil Field.

Vessel fuel usage is also changing. Within the study period, two of the U.S.-flagged Large Cargo ships that frequently call in Cook Inlet began using LNG as their primary fuel, with some diesel. Further changes in vessel fuels are expected as vessel operators comply not only with air quality emissions standards and also with emerging greenhouse gas emissions reduction goals.

¹² Thanks to the following Cook Inlet Harbor Safety Committee (CIHSC) members for providing information to inform these assumptions: Captain Paul Mehler, Marathon (CIHSC Chair); Vicente “Ben” Cruz, Matson; Andrew Mew, Alaska Maritime Agencies; and Frank Smith, TOTE Maritime.

6.2 Oil cargoes

For oil cargo, Alaska Department of Environmental Conservation (ADEC)-approved contingency plans were reviewed to determine whether the vessel was likely to be a crude oil or a lighter product categorized as Groups 1–2. Where available on ADEC’s website, information about the cargo and voyage was used.

U.S.-flagged tankers in Cook Inlet are calling at Nikiski and assumed to be moving crude oil. Of the 571 tanker entrances counted at the Cook Inlet passage line over the four years, 415 of these were U.S.-flagged crude oil tankers.

Foreign-flagged tankers (156 of 571 entries at the Cook Inlet passage line) called at Nikiski and the Port of Anchorage and were assumed to be moving a product in Groups 1–2. However, if a foreign flagged tanker was identified as a crude oil tanker in its AIS transmittal and on [marinetraffic.com](https://www.marinetraffic.com) and it went *only* to Nikiski, it was counted as a crude oil tanker.¹³

Oil cargo volumes were either as identified in the documentation associated with ADEC’s approval of a vessel charter or, if that was not available, assumed to be the maximum cargo according to either ADEC-approved plan documents or the U.S. Coast Guard’s Vessel Response Plan database. Unless different information was provided in the charter documentation, vessels with more than 300,000 bbl oil capacity were assumed to carry a maximum of 300,000 bbl based on input CIRCAC received from operators at the time of the last 10-year vessel traffic study. (As discussed in that study, the maximum oil cargo volume allowed in Cook Inlet per compliance with state regulations is 499,999 bbl.)

Cargo capacity is assumed to be 100% of the volume established using the methods above for the density maps and overall exposure calculation. At passage line crossings, 100% of cargo is assumed since we present results based on one direction only. Whether bringing oil cargo into or out of the Inlet, tankers are assumed to be in ballast when going in the opposite direction.

Figures 6.1 and 6.2 show the density of Group 1–2 and Groups 3–5 petroleum movements in the combined four years. Note that this does not include fuel barges.

¹³ During the study period, the first transit of a tanker bringing crude oil from the Transmountain Pipeline expansion in southern British Columbia to Alaska was reported (Chamber of Shipping, 2024). This was an example of a foreign-flagged crude oil tanker calling at Nikiski, whereas most crude oil tankers calling there are U.S.-flagged ships.

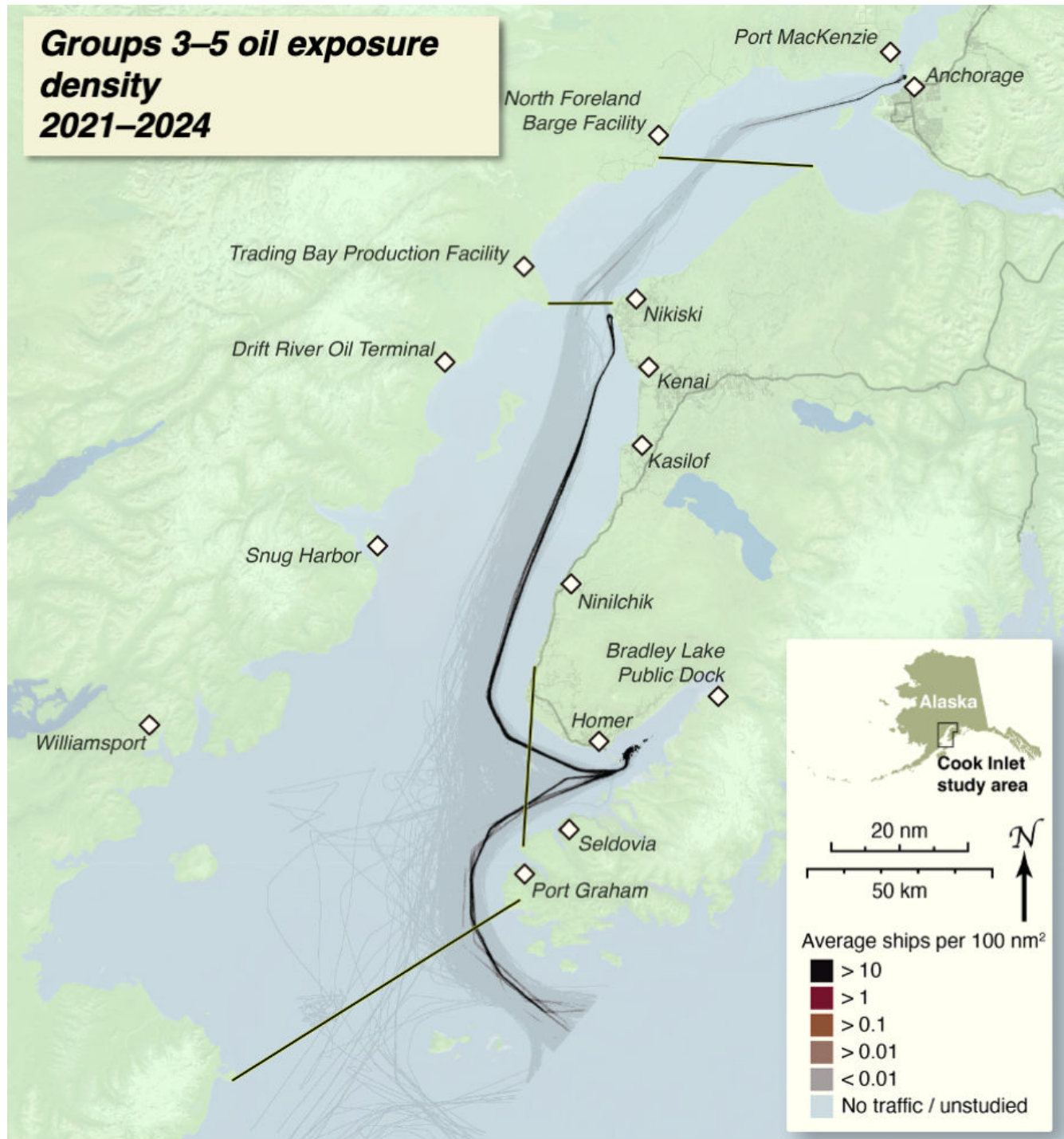


FIGURE 6.1 Density of Groups 3–5 oil exposure based on vessel fuels and, for tankers, vessel cargoes for the Large Cargo, Oil Field, AMHS, Cruise Ship, and Oil Cargo Tanker (2021–2024 Cook Inlet AIS dataset)

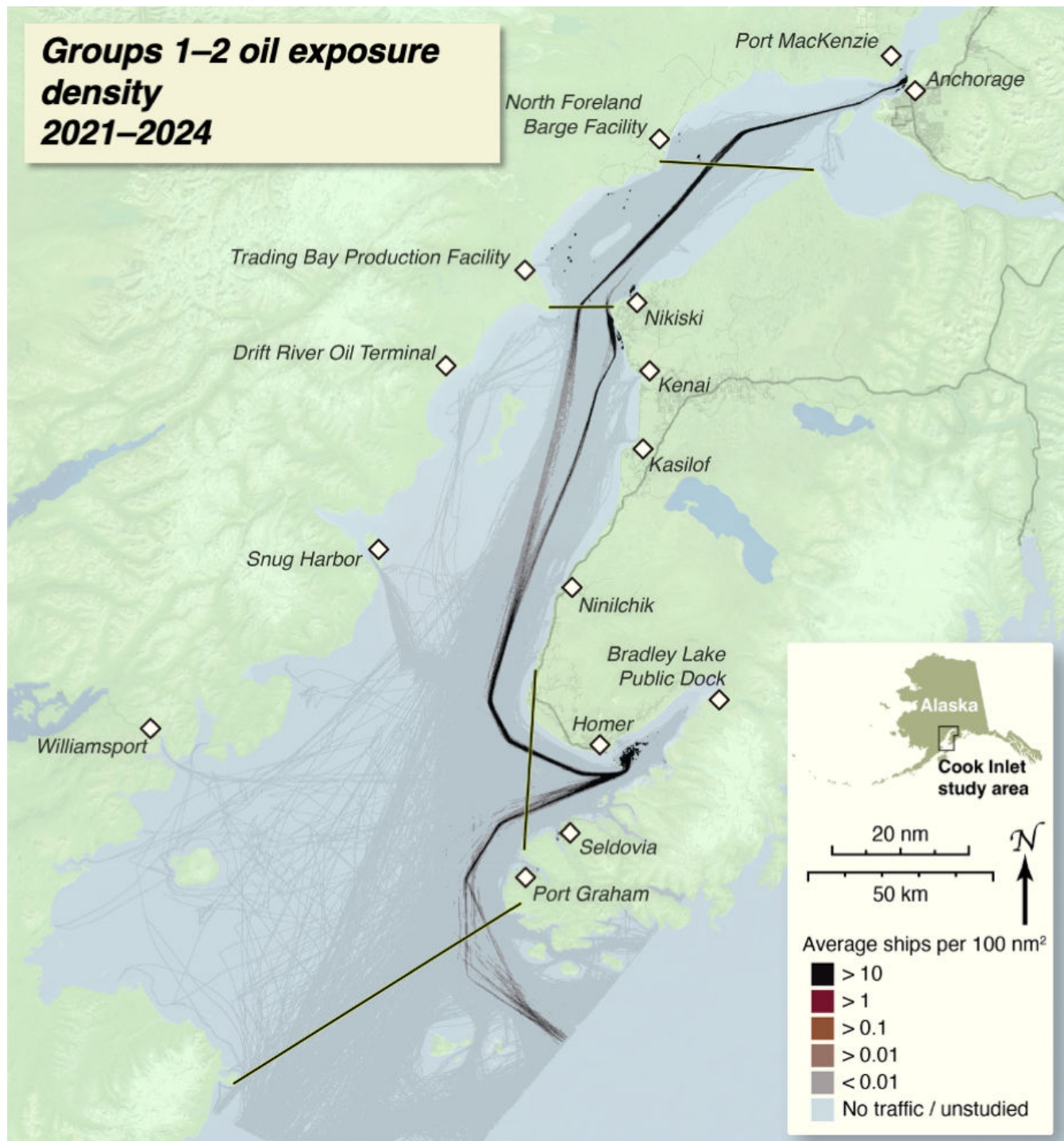


FIGURE 6.2 Density of Groups 1–2 oil exposure based on vessel fuels and, for tankers, vessel cargoes for the Large Cargo, Oil Field, AMHS, Cruise Ship, and Oil Cargo Tanker (2021–2024 Cook Inlet AIS dataset). Barges also move fuels in groups 1–2 but are not included in the study.

Table 6.3 shows the estimated total petroleum volume to move through Kennedy Entrance (at the Cook Inlet passage line). These are one-way crossings, so oil cargo, which dominates the total estimated petroleum volume, is the total cargo in one direction regardless of in which direction the tanker would be assumed to be “full” (or at its maximum Cook Inlet cargo volume). Tankers represent 92 percent of Groups 1–2 and 93 percent of Groups 3–5 oil volume at the Cook Inlet passage line during the study period.

TABLE 6.3 Estimated total petroleum carried one-way at Cook Inlet Passage Line for analyzed vessel subtypes, 2021–2024 (barrels)

Vessel Type	Groups 1–2 Oil	Groups 3–5 Oil
Large Cargo*	4,717,161 (7%)	4,910,138 (7%)
Oil Field	56,863 (0%)	-
Tanker	59,110,807 (92%)	63,925,456 (93%)
AMHS	520,144 (1%)	-
Cruise Ship	31,044 (0%)	132,467 (0%)
Total	64,436,019	68,968,060

*This is an overestimate as noted above. Percentages are rounded to nearest whole number.

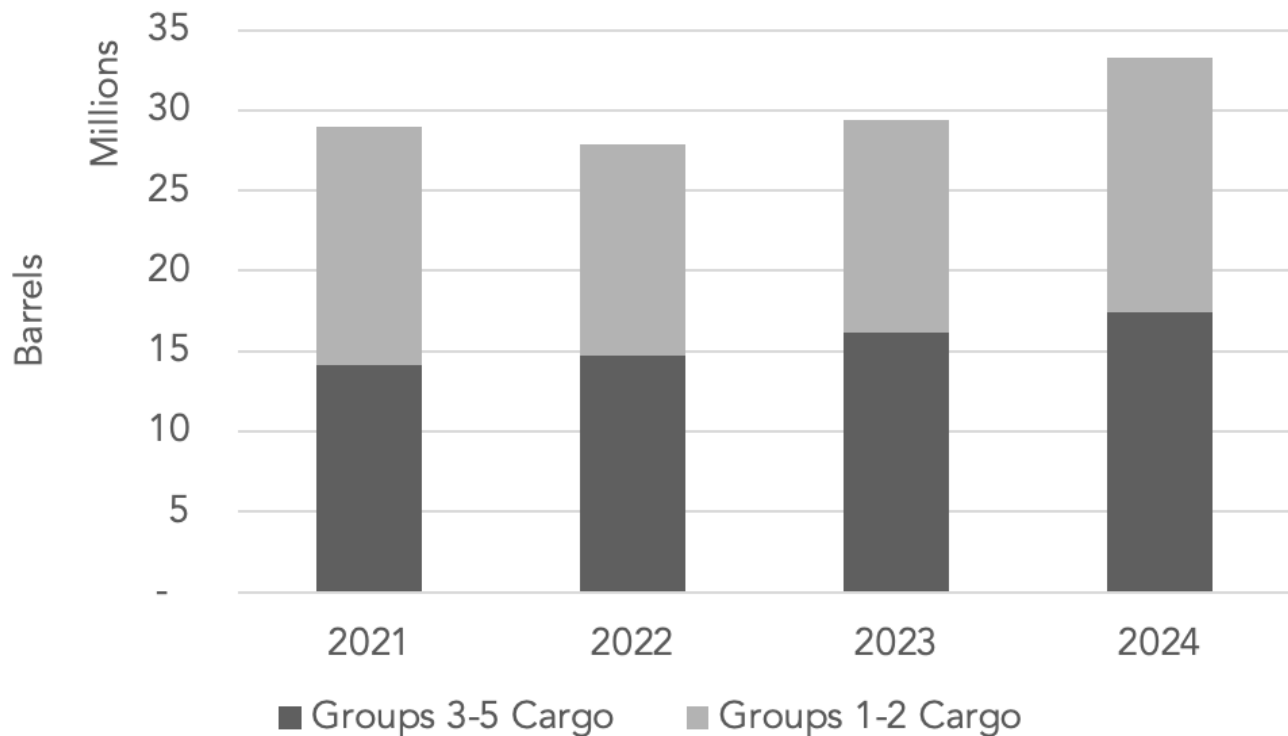


FIGURE 6.3 Estimated Oil Cargo at Cook Inlet Passage Line each year, 2021–2024 (not including barges)

7 Conclusion

The slight increase in operating days between 2021 and 2024 in this study can be seen as modest overall when considered in the context of the previous 10-year study in Figure 7.1.

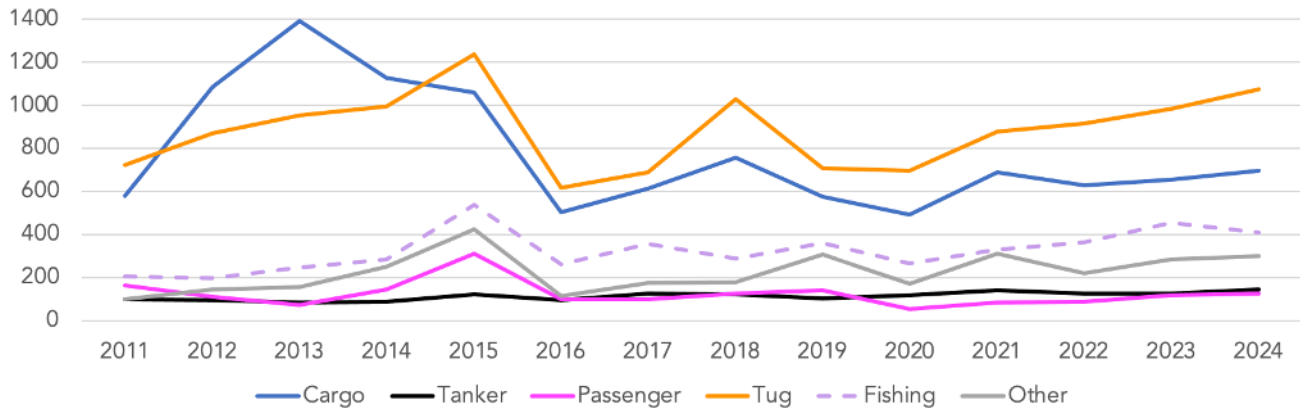


FIGURE 7.1 Operating days by vessel type over time, 2011–2024

Tanker operating hours have generally remained steady since 2015. As discussed in the previous 10-year study,¹⁴ tanker operating days in Cook Inlet that were reduced by the closure of the Christy Lee Platform have essentially been replaced by the delivery of Groups 1–2 oil products to Anchorage from outside Alaska (Nuka Research, 2021).

Cook Inlet has always had “frequent flier” vessels that contribute significantly to the time spent in the Inlet. Looking back as far as a 2006 study of vessel traffic, the top six deep draft vessels identified in that study using port calls (the primary analysis approach prior to the expanded use and coverage of AIS data) are all still active in Cook Inlet: the *Tustumena* ferry, two TOTE Maritime cargo ships, and three Matson cargo ships (owned by Horizon Lines at the time of the 2006 previous study) (Cape International, Inc. and Nuka Research, 2006). At the same time, future changes may bring the return of LNG tanker shipments (ADGC, 2025) and further transitions in vessel fuels.

¹⁴ Oil is now moved via subsea pipeline from the west side of the Inlet to Nikiski.

References

Alaska Gasline Development Corporation (ADGC). (2025). Alaska LNG: Project overview. Retrieved from: <https://alaska-lng.com/project-overview/>

Cape International, Inc. and Nuka Research. (2006). Cook Inlet vessel traffic study. Report to Cook Inlet Regional Citizens Advisory Council. Retrieved from: https://www.circac.org/wp-content/uploads/CI_VesselTrafficStudy_Final_Mar07.pdf

Cape International, Inc. (2012). Cook Inlet vessel traffic study. Report to the Cook Inlet Risk Assessment. January.

Chamber of Shipping. (2024, October 25). “Canada ships crude oil to Alaska via expanded Transmountain Pipeline after over a decade”. Retrieved from: <https://shippingmatters.ca/canada-ships-crude-oil-to-alaska-via-expanded-transmountain-pipeline-after-over-a-decade/>

International Maritime Organization (IMO). (2021). IMO2020 fuel oil sulphur limit – cleaner air, healthier planet. International Maritime Organization. Retrieved from: <https://www.imo.org/en/MediaCentre/PressBriefings/pages/02-IMO-2020.aspx>

International Maritime Organization (IMO). (2010). Information on North American Emission Control Area (ECA) Under MARPOL Annex vi, MEPC.1/Circ.723. Retrieved from: <https://www.epa.gov/sites/default/files/2016-09/documents/mepc1-circ-re-na-eca.pdf>

National Oceanic and Atmospheric Administration (NOAA). (2025). Oil types. Retrieved from: <https://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/oil-types.html>

Nuka Research. (2021). Cook Inlet vessel traffic 2011–2021. Submitted to the Cook Inlet Regional Citizens Advisory Council. Retrieved from: <https://www.circac.org/wp-content/uploads/220307-CI-Traffic-Report-Fnl.pdf>

Appendix A – AIS Analysis Method

Data used to determine vessel attributes, characterize vessel traffic, and describe how petroleum movements came from several sources, including: Automatic Identification System (AIS) data, a download from Marine Traffic, public databases, and data previously gathered by Nuka Research. Data are combined to develop maps and statistics characterizing vessel traffic in Cook Inlet for 2021–2024.

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

1. Obtain and process AIS data
2. Develop Vessel Track Database from processed AIS data
3. Develop Vessel Attribute Database for vessels identified in AIS data
4. Develop report outputs based on combining vessel track and attribute data

AIS is an automated tracking system used to identify and locate vessels using electronic signals sent from the vessel and received by other ships and receiver stations (on land or satellites). When AIS signals are compiled, data can be used to understand vessel movements in a particular area. Although the AIS requirements have been in force since 2004, receivers have become more widespread since that time, increasing the viability of using AIS data to research or characterize vessel traffic.

There are two types of AIS transmitters: AIS-A and AIS-B. AIS-A transmitters 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 AIS-A are also capable of text messaging safety-related information and AIS Application Specific Messages. AIS-B transmitters report every three minutes or less when at anchor or moored, but their position is reported less often and at a lower power compared to the AIS-A signals. Voyage-related information is not transmitted from AIS-A. 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 the International Maritime Organization's (IMO) International Convention for the Safety of Life at Sea (SOLAS) require AIS-A transmitters on the following self-propelled vessels: vessels in commercial service that are 65-feet long or more, towing vessels of 26-feet long or more (also in commercial service), any vessel allowed to carry 150 passengers, or any vessel moving certain dangerous, flammable, or liquid oil cargo in bulk (33 CFR 164.01).

AIS-B can be used in lieu of AIS-A for fishing industry vessels, small passenger vessels, and some dredging vessels. The USCG has the authority to require AIS systems on other vessels for mitigation of safety concerns (USCG, 2019). Other vessels use AIS-B voluntarily. AIS transmitters 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.

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. AIS transmissions may occur as frequently as every second. The number of data points collected is greater than necessary to accurately characterize where a 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.

For this project, Nuka Research obtained data compiled by shore receivers and satellite-based AIS from the Marine Exchange of Alaska.

Vessel tracks are compiled of sequential AIS points for each individual vessel within the study area. Records are removed that do 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 within the scope of the study. The following method is used to build vessel tracks while reducing unnecessary points:

- Data points were grouped by vessel and ordered chronologically.
- The first and last points are always kept.
- 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.
- 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 2 hours or 20 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.
- Tracks are stored in a geo-spatial database and spreadsheet. Each track is identified with a specific vessel based on its MMSI number. This number is used to associate the track with the vessel-specific attributes.

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)
- 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 (e.g., location, MMSI), other data require manual input by the operator (e.g., destination, cargo, vessel type). Data that require manual input may be entered inconsistently, intermittently, or not at all. In these cases, research and assumptions are applied as described in the report to complete the dataset.

Appendix B – Passage Line Crossings

TABLE B-1 Cook Inlet passage line crossings (south-to-north) each year by vessel type/subtype in Cook Inlet dataset, 2021–2024

Vessel Type	2021	2022	2023	2024	Total
Cargo	250	231	241	260	982
Large Cargo	209	207	212	221	849
Oil Field	9	6	8	8	31
Small Cargo	32	18	21	31	102
Tanker	102	91	99	109	401
Passenger	97	84	129	116	426
AMHS	95	77	121	106	399
Cruise Ship	-	3	8	10	21
Small Passenger	2	4	-	-	6
Tug	154	154	158	163	629
Fishing	222	223	309	240	994
Other	69	73	78	80	300
Government	19	25	18	17	79
Other	31	33	45	46	155
Survey / Research	19	15	15	17	66
Total	894	856	1014	968	3732

TABLE B-2 Kachemak Bay entrances (west-to-east crossings) each year by vessel type/subtype in Cook Inlet dataset, 2021–2024

Vessel Type	2021	2022	2023	2024	Total
Cargo	180	187	190	231	788
Large Cargo	27	39	40	80	186
Oil Field	66	56	42	51	215
Small Cargo	87	92	108	100	387
Tanker	207	192	202	224	825
Passenger	98	83	131	114	426
AMHS	95	77	121	106	399
Cruise Ship	-	2	9	8	19
Small Passenger	3	4	1	-	8
Tug	145	126	176	140	587
Fishing	297	339	386	356	1378
Other	198	234	296	260	988

Vessel Type	2021	2022	2023	2024	Total
Government	26	20	24	42	112
Other	135	193	251	191	770
Survey / Research	37	21	21	27	106
Total	1125	1161	1381	1325	4992

TABLE B-3 Forelands passage line crossings (south-to-north) each year by vessel type/subtype in Cook Inlet dataset, 2021–2024

Vessel Type	2021	2022	2023	2024	Total
Cargo	590	805	834	888	3117
Large Cargo	206	200	209	216	831
Oil Field	358	567	542	640	2107
Small Cargo	26	38	83	32	179
Tanker	45	38	43	51	177
Passenger		1	3	3	7
AMHS	-	-	-	-	-
Cruise Ship		1	3	3	7
Small Passenger	-	-	-	-	-
Tug	165	192	238	255	850
Fishing	-	2	19	1	22
Other	104	20	48	15	187
Government	6	2	6	3	17
Other	75	18	42	12	147
Survey / Research	23	-	-	-	23
Total	904	1058	1185	1213	4360

TABLE B-4 Possession-Tyonek passage line crossings (south-to-north) each year by vessel type/subtype in Cook Inlet dataset, 2021–2024

Vessel Type	2021	2022	2023	2024	Total
Cargo	497	400	422	493	1812
Large Cargo	206	200	209	216	831
Oil Field	275	176	194	265	910
Small Cargo	16	24	19	12	71
Tanker	44	38	42	51	175
Passenger	44	38	42	51	175
AMHS	-	-	-	-	-
Cruise Ship	-	1	3	3	7

Vessel Type	2021	2022	2023	2024	Total
Small Passenger	-	-	-	-	-
Tug	-	1	3	3	7
Fishing	-	-	-	-	-
Other	199	234	201	240	874
Government	-	12	1	1	14
Other	66	47	51	49	213
Survey / Research	5	4	6	2	17
Total	61	43	45	47	196
Cargo	-	-	-	-	-
Large Cargo	806	732	720	837	3095

Appendix C – Port Entrances

TABLE C-1 Port of Alaska entrances each year by vessel type/subtype in Cook Inlet dataset, 2021–2024

Vessel Type	2021	2022	2023	2024	Total
Cargo	214	208	219	219	860
Large Cargo	206	201	209	214	830
Oil Field	2	-	1	2	5
Small Cargo	6	7	9	3	25
Tanker	44	39	42	51	176
Passenger	-	1	3	3	7
AMHS	-	-	-	-	-
Cruise Ship	-	1	3	3	7
Small Passenger	-	-	-	-	-
Tug	1378	1524	1051	1793	5746
Fishing	-	25	-	-	25
Other	51	97	53	71	272
Government	2	-	4		6
Other	49	97	49	71	266
Survey / Research	-	-	-	-	-
Total	1687	1894	1368	2137	7086

TABLE C-2 Nikiski entrances each year by vessel type/subtype in Cook Inlet dataset, 2021–2024

Vessel Type	2021	2022	2023	2024	Total
Cargo	307	756	772	793	2628
Large Cargo	-	-	-	-	-
Oil Field	301	730	733	770	2534
Small Cargo	6	26	39	23	94
Tanker	70	71	71	72	284
Passenger	-	-	-	-	-
AMHS	-	-	-	-	-
Cruise Ship	-	-	-	-	-
Small Passenger	-	-	-	-	-
Tug	518	478	395	486	1877
Fishing	-	-	17	-	17
Other	89	14	47	15	165
Government	-	-	-	-	-

Vessel Type	2021	2022	2023	2024	Total
Other	86	14	47	15	162
Survey / Research	3	-	-	-	3
Total	984	1319	1302	1366	4971

TABLE C-3 OSK Dock entrances each year by vessel type/subtype in Cook Inlet dataset, 2021–2024

Vessel Type	2021	2022	2023	2024	Total
Cargo	542	379	291	133	1345
Large Cargo	-	-	-	-	-
Oil Field	500	345	235	133	1213
Small Cargo	42	34	56		132
Tanker	-	-	-	-	-
Passenger	-	-	-	-	-
AMHS	-	-	-	-	-
Cruise Ship	-	-	-	-	-
Small Passenger	-	-	-	-	-
Tug	126	256	72	-	454
Fishing	-	22	4	-	26
Other	71	40	56	18	185
Government	-	-	-	-	-
Other	69	40	56	18	183
Survey / Research	2	-	-	-	2
Total	739	697	423	151	2010

TABLE C-4 Homer entrances each year by vessel type/subtype in Cook Inlet dataset, 2021–2024

Vessel Type	2021	2022	2023	2024	Total
Cargo	285	302	257	293	1137
Large Cargo	3	4	-	3	10
Oil Field	136	126	85	115	462
Small Cargo	146	172	172	175	665
Tanker	-	-	-	-	-
Passenger	416	435	522	521	1894
AMHS	175	147	229	197	748
Cruise Ship	-	2	6	8	16
Small Passenger	241	286	287	316	1130
Tug	175	180	236	202	793
Fishing	364	413	521	452	1750
Other	648	743	908	869	3168
Government	40	43	30	56	169
Other	552	664	849	783	2848
Survey / Research	56	36	29	30	151

Total	1888	2073	2444	2337	8742
--------------	-------------	-------------	-------------	-------------	-------------

TABLE C-5 Seldovia entrances each year by vessel type/ subtype in Cook Inlet dataset, 2021–2024

Vessel Type	2021	2022	2023	2024	Total
Cargo	72	43	33	38	186
Large Cargo	-	-	-	-	-
Oil Field	52	29	20	24	125
Small Cargo	20	14	13	14	61
Tanker	-	-	-	-	-
Passenger	318	338	387	364	1407
AMHS	78	69	108	88	343
Cruise Ship	-	-	-	-	-
Small Passenger	240	269	279	276	1064
Tug	3	2	7	16	28
Fishing	67	86	79	92	324
Other	21	39	68	79	207
Government	2	-	1	5	8
Other	18	39	66	72	195
Survey / Research	1	-	1	2	4
Total	481	508	574	589	2152

Appendix D – Passage Line Entries

TABLE D-1 Cook Inlet passage line crossings (South-to-North) each year

Vessel Type	2021	2022	2023	2024	Total
Cargo	250	231	241	260	982
Large Cargo	209	207	212	221	849
Oil Field	9	6	8	8	31
Small Cargo	32	18	21	31	102
Tanker	102	91	99	109	401
Passenger	97	84	129	116	426
AMHS	95	77	121	106	399
Cruise Ship	-	3	8	10	21
Small Passenger	2	4	-	-	6
Tug	154	154	158	163	629
Fishing	222	223	309	240	994
Other	69	73	78	80	300
Government	19	25	18	17	79
Other	31	33	45	46	155
Survey / Research	19	15	15	17	66
Total	894	856	1014	968	3732

TABLE D-2 Kachemak Bay passage line crossings (West-to-East) each year

Vessel Type	2021	2022	2023	2024	Total
Cargo	180	187	190	231	788
Large Cargo	27	39	40	80	186
Oil Field	66	56	42	51	215
Small Cargo	87	92	108	100	387
Tanker	207	192	202	224	825
Passenger	98	83	131	114	426
AMHS	95	77	121	106	399
Cruise Ship	-	2	9	8	19
Small Passenger	3	4	1	-	8
Tug	145	126	176	140	587
Fishing	297	339	386	356	1378
Other	198	234	296	260	988
Government	26	20	24	42	112
Other	135	193	251	191	770

Vessel Type	2021	2022	2023	2024	Total
Survey / Research	37	21	21	27	106
Total	1125	1161	1381	1325	4992

TABLE D-3 Forelands passage line crossings (South-to-North) each year

Vessel Type	2021	2022	2023	2024	Total
Cargo	590	805	834	888	3117
Large Cargo	206	200	209	216	831
Oil Field	358	567	542	640	2107
Small Cargo	26	38	83	32	179
Tanker	45	38	43	51	177
Passenger		1	3	3	7
AMHS	-	-	-	-	-
Cruise Ship		1	3	3	7
Small Passenger	-	-	-	-	-
Tug	165	192	238	255	850
Fishing	-	2	19	1	22
Other	104	20	48	15	187
Government	6	2	6	3	17
Other	75	18	42	12	147
Survey / Research	23	-	-	-	23
Total	904	1058	1185	1213	4360

TABLE D-4 Tyonek-Possession passage line crossings (South-to-North) each year

Vessel Type	2021	2022	2023	2024	Total
Cargo	497	400	422	493	1812
Large Cargo	206	200	209	216	831
Oil Field	275	176	194	265	910
Small Cargo	16	24	19	12	71
Tanker	44	38	42	51	175
Passenger	-	1	3	3	7
AMHS	-	-	-	-	-
Cruise Ship	-	1	3	3	7
Small Passenger	-	-	-	-	-
Tug	199	234	201	240	874
Fishing	-	12	1	1	14
Other	66	47	51	49	213
Government	5	4	6	2	17
Other	61	43	45	47	196
Survey / Research	-	-	-	-	-
Total	806	732	720	837	3095

