

# COAST GUARD: Improved Reporting on Domestic Icebreaking Performance Could Clarify Resource Needs and Tradeoffs

GAO-24-106619 (Accessible Version)  
Q&A Report to Congressional Committees

January 16, 2024

## Why This Matters

The U.S. Coast Guard maintains and operates icebreaking vessels to promote safety in U.S. waters, along with its other missions. The Coast Guard breaks ice to help keep channels and harbors open to navigation and facilitate “the reasonable demands of commerce” pursuant to an executive order. This assistance includes establishing and maintaining open tracks in critical waterways, assisting and escorting vessels stuck in ice, and removing hazards created by ice, according to the Coast Guard. The Coast Guard conducts domestic icebreaking operations in three of its nine districts—the Great Lakes, New England, and the Mid-Atlantic.

In the Great Lakes, 55 percent of the regional economy is dependent on key shipping channels, according to the Coast Guard. In 2020, industries shipped 100 million tons of iron ore, limestone, coal, and other commodities through the Great Lakes, according to data from the Army Corps of Engineers Waterborne Commerce Statistics Center. Some industry stakeholders who rely on these shipping channels have raised questions about whether the Coast Guard has adequate icebreaking resources available to facilitate commerce.

Section 11212 of the James M. Inhofe National Defense Authorization Act for Fiscal Year 2023 includes a provision for GAO to review Coast Guard icebreaking operations in the Great Lakes and examine proposed performance standards for the Coast Guard’s Great Lakes icebreaking program. This report discusses the associations between ice coverage on the Great Lakes and effects on certain economic indicators, the Coast Guard’s icebreaking resource needs, and the potential effects of the proposed standards on the Coast Guard’s icebreaking efforts.

## Key Takeaways

- Great Lakes vessel-based commerce declines during the winter, primarily due to lock closures and weather conditions. We found that the amount of ice coverage on the Great Lakes was generally not associated with selected economic indicators we examined, such as regional unemployment rates and unfilled orders for steel production. Industries may mitigate the effects of delays caused by ice coverage, such as stockpiling iron ore inventory to maintain steel production throughout the winter.
- The Coast Guard identified heavy icebreaking capability gaps and its reliance on an aging fleet as risks to its ability to conduct its domestic icebreaking mission. As a result, the Coast Guard anticipates needing at least \$3 billion in lifecycle costs to replace and acquire new vessels for domestic icebreaking.

- The proposed standards for the Coast Guard’s domestic icebreaking program will largely not have an operational impact. The proposed standards may lead to improvements in data collection and reporting, which could help the Coast Guard better communicate its resource needs and tradeoffs. However, the data collection efforts may increase operating costs and information sharing needs with industry, according to the Coast Guard.
- We recommend that the Coast Guard, using data it already collects, report more complete information on its icebreaking performance to better articulate its resource needs and tradeoffs.

### What is the nature of winter commerce in the Great Lakes?

Vessel-based commerce on the Great Lakes declines during the winter when the locks connecting them are closed for maintenance and from other factors. Seasonal lock closures prevent ships from moving out of the Great Lakes through the St. Lawrence Seaway (Seaway) and between Lake Superior and the lower Great Lakes through the Soo Locks (fig. 1).

**Figure 1: Great Lakes Shipping Routes by Commodity**



Sources: Map Resources, University of Wisconsin-Superior. | GAO-24-106619

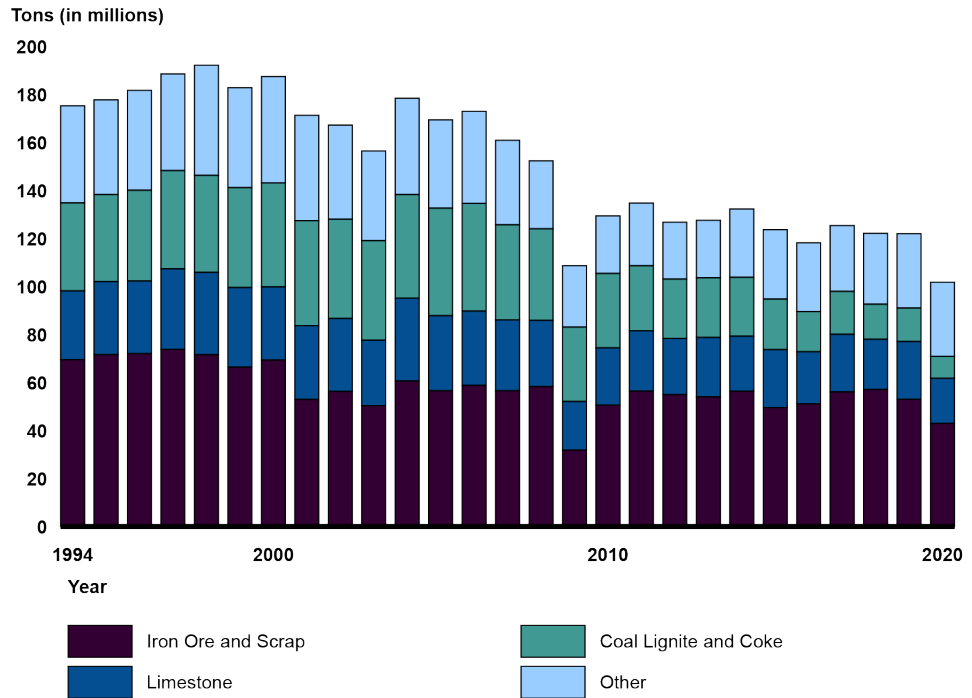
### Accessible Text for Figure 1: Great Lakes Shipping Routes by Commodity

Great Lakes	Locks	Ports	Commodities
• Lake Superior	• St. Lawrence Seaway Locks	Selected U.S. ports	• Iron ore
• Lake Michigan	• Soo Locks		• Coal
• Lake Huron			• Limestone
• Lake Erie			• Grain
• Lake Ontario			

Sources: Map Resources, University of Wisconsin-Superior. | GAO-24-106619

Great Lakes commerce supports industries within and outside the Great Lakes region. For example, according to an iron and steel association, 90 percent of U.S.-sourced iron ore moves through the Soo Locks. Due to certain industry and energy trends, such as reduced reliance on iron ore and coal in steel and power generation, respectively, total cargo volumes transiting the Great Lakes have generally declined in recent decades (fig. 2).

**Figure 2: Trends in U.S. Commodities Shipped on the Great Lakes, 1994-2020**



Source: GAO analysis of Army Corp Waterborne Commerce Statistics data. | GAO-24-106619

**Accessible Data for Figure 2: Trends in U.S. Commodities Shipped on the Great Lakes, 1994-2020**

Year	Iron Ore and Scrap	Limestone	Coal Lignite and Coke	OTHER
1994	69.519	28.621	36.705	40.43
1994	71.632	30.396	36.277	39.445
1994	72.051	30.237	37.82	41.665
1994	73.828	33.523	40.92	40.308
1994	71.574	34.356	40.393	45.909
1994	66.428	33.144	41.57	41.72
2000	69.381	30.451	43.317	44.341
2000	52.947	30.733	43.76	43.919
2000	56.268	30.409	41.357	39.192
2000	50.398	27.205	41.495	37.386
2000	60.645	34.553	43.095	40.141
2000	56.591	31.263	44.773	36.784
2000	58.848	30.908	44.896	38.361
2000	56.574	29.521	39.572	35.292
2000	58.296	27.624	38.116	28.345
2000	31.829	20.243	31.019	25.598
2010	50.615	23.833	30.955	24.052
2010	56.461	25.133	27.042	26.1
2010	54.932	23.441	24.729	23.723
2010	54.016	24.756	24.846	24.014
2010	56.352	22.942	24.535	28.464
2010	49.588	24.119	21.081	28.917

Year	Iron Ore and Scrap	Limestone	Coal Lignite and Coke	OTHER
2010	51.122	21.721	16.71	28.689
2010	56.119	23.985	17.886	27.441
2010	57.123	20.885	14.647	29.529
2010	53.059	24.065	13.939	30.952
2020	42.967	18.822	9.086	30.928

Source: GAO analysis of Army Corp Waterborne Commerce Statistics data. | GAO-24-106619

Note: These timeframes represent the most recent data available by commodity.

### What is the relationship between Great Lakes ice coverage and economic indicators?

We found largely no association between Great Lakes ice coverage and selected economic indicators, such as regional unemployment rates, unfilled orders for steel production, and operating revenues for iron and steel companies.<sup>1</sup> Specifically, we conducted a regression analysis and found that ice coverage was not associated with nine of 12 economic indicators to a level of statistical significance (i.e., any results indicating a relationship were likely due to chance only), and was associated with three indicators.<sup>2</sup>

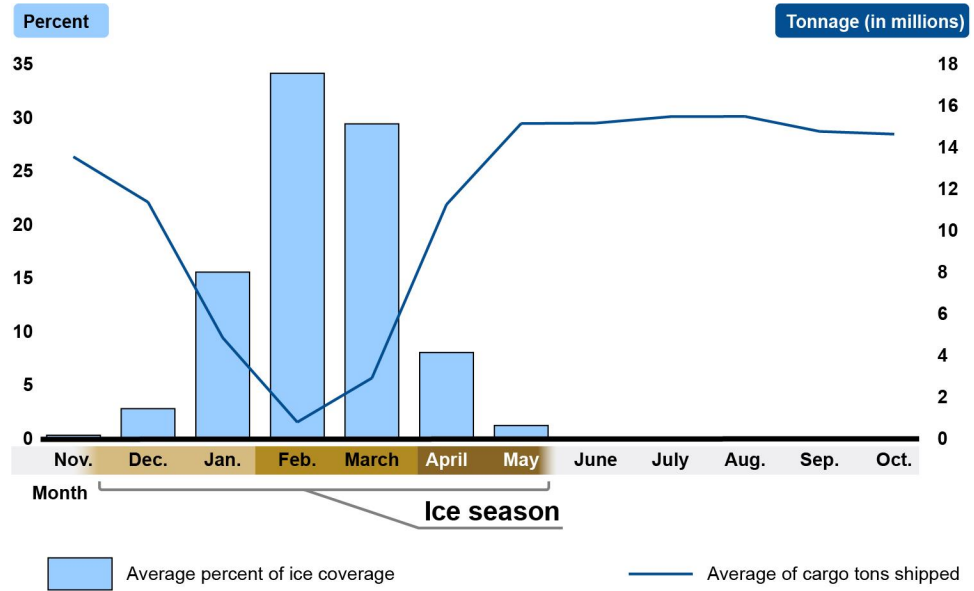
For example, we did find an association between ice coverage and Great Lakes cargo volume, where we found a negative relationship. On average, for every 1 percent increase in the average ice coverage in the Great Lakes region there was an associated 1 percent decrease in total Great Lakes cargo volume.

However, data limitations and some factors for which we were unable to control could have affected our analysis of average ice coverage and economic indicators.<sup>3</sup> For example, our interviews with industry stakeholders illustrate additional ways that companies could be affected by ice conditions that are not captured by the selected indicators.

Representatives from some commercial vessel companies we spoke with told us that they may not be able to fulfill existing orders or receive new orders if they experience individual delays due to ice. According to representatives of Great Lakes port authorities, delays due to ice can cause lost revenue from decreased traffic and fewer vessels able to berth at shipyards after the lock closure.

Some industry stakeholders told us that they mitigate the effects of delays due to ice in their pre-ice season operational planning. For example, two major Great Lakes steel producers told us they stockpile an average of 90-100 days of iron ore inventory provisions. According to stakeholders we interviewed, examples of other redundancies could include switching modes of transportation to trucking or rail, and front-loading deliveries to customers ahead of the ice season. Figure 3 shows trends in Great Lakes ice and lake-based cargo volume by phase of the ice season and Figure 4 shows Coast Guard domestic icebreaking vessel hours by phase of the ice season.

**Figure 3: Trends in Percent of Great Lakes Ice Coverage and Cargo Volume, 2005-2019**



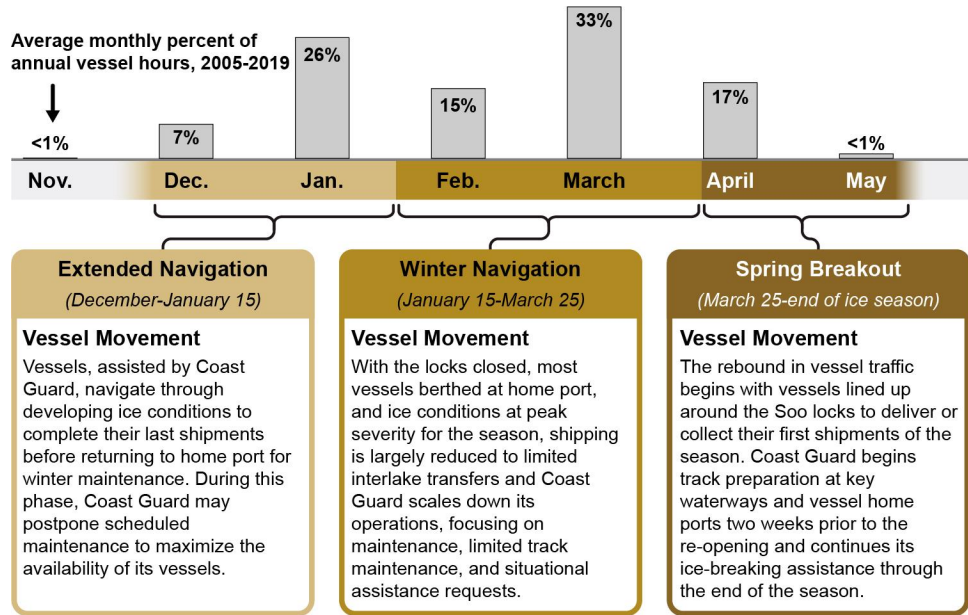
Source: GAO analysis of Coast Guard information and Army Corp-provided data. | GAO-24-106619

**Accessible Data for Figure 3: Trends in Percent of Great Lakes Ice Coverage and Cargo Volume, 2005-2019**

Month	Percent	Ice tonnage (in millions)	Percent of Vessel Hours
Nov.	0.331888	13.55	0.045373
Dec.	2.82183	11.37	7.45007
Jan.	15.58	4.86	26.4408
Feb.	34.1557	0.8	15.291
March	29.4191	2.92	33.2018
April	8.06436	11.26	16.5965
May	1.25004	15.15	0.974414
June		15.17	
July		15.48	
Aug.		15.49	
Sep.		14.77	
Oct.		14.64	

Source: GAO Analysis of Coast Guard information and Army Corp-provided data. | GAO-24-106619  
 Note: These timeframes represent the most recent data available.

**Figure 4: Coast Guard Domestic Icebreaking Vessel Hours by Phase of Ice Season, 2005-2019**



Source: GAO analysis of Coast Guard information. | GAO-24-106619

**Accessible Data for Figure 4: Coast Guard Domestic Icebreaking Vessel Hours by Phase of Ice Season, 2005-2019**

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Category	Time period	Vessel movement
Extended navigation	December through January 15 <sup>th</sup>	Vessels, assisted by Coast Guard, navigate through developing ice conditions to complete their last shipments before returning to home port for winter maintenance. During this phase, Coast Guard may postpone scheduled maintenance to maximize the availability of its vessels.
Winter navigation	January 15 <sup>th</sup> through March 25 <sup>th</sup>	With the locks closed, most vessels berthed at home port, and ice conditions at peak severity for the season, shipping is largely reduced to limited interlake transfers and Coast Guard scales down its operations, focusing on maintenance, limited track maintenance, and situational assistance requests.
Spring breakout	March 25 <sup>th</sup> through end of ice season	The rebound in vessel traffic begins with vessels lined up around the Soo locks to deliver or collect their first shipments of the season. Coast Guard begins track preparation at key waterways and vessel home ports two weeks prior to the re-opening and continues its ice-breaking assistance through the end of the season.

Source: GAO analysis of Coast Guard information. | GAO-24-106619

Note: These timeframes represent the most recent data available.

## How does the Coast Guard prioritize its domestic icebreaking mission?

The Coast Guard applies a risk-based approach to prioritize its domestic icebreaking operations based on anticipated resource availability and other factors, such as safety.

**Resource availability.** The Coast Guard designates waterways by tiers to prioritize its resources.

- **Tier one** waterways are those determined to be the highest-priority due to their geographical location, such as waterways that connect the Great Lakes to one another, or the importance of cargo to public health and safety (e.g. fuel and food).
- **Tier two** waterways are those that connect tier one to tier three waterways.
- **Tier three** waterways are federally maintained channels connecting tier two waterways to various commercial ports.
- **Tier four** waterways are comprised of docks, shipyards, and wholly private areas.

According to the Coast Guard, 81 percent of its icebreaking in the Great Lakes takes place in tiers one and two, and 19 percent takes place in tier three waterways. The Coast Guard will also refer icebreaking requests from commercial vessels to commercial icebreaking services, particularly in tier three and four waterways.<sup>4</sup> According to Coast Guard officials, its referrals of

icebreaking requests to commercial icebreaking services is one way that it facilitates commerce.

**Safety.** The Coast Guard manages risks to its fleet and personnel by limiting its Great Lakes icebreaking during the winter navigation season to only where and when vessel traffic is moving. The Coast Guard takes this approach because excessive icebreaking may create harsher ice conditions later. This happens when floating pieces of ice created from icebreaking are blown by the wind, pile up, and refreeze into thicker sheets of ice. Those conditions can cause more wear and tear on vessels, according to Coast Guard officials. Also, the Coast Guard generally does not conduct night ice operations due to visibility and crew fatigue concerns but may do so in emergent situations at the discretion of the Coast Guard icebreaker's Commanding Officer.

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## What are some unique attributes of the Coast Guard icebreaking in the Great Lakes?

### Icebreaking Convoy Between U.S. and Canadian Coast Guards



Source: GAO. | GAO-24-106619

The icebreaking mission in the Great Lakes has some unique attributes that set it apart from the other two districts where the Coast Guard conducts domestic icebreaking, such as coordination with the Canadian Coast Guard and managing vessel traffic.<sup>5</sup>

**Coordination with the Canadian Coast Guard.** In the Great Lakes, the Coast Guard manages its icebreaking mission in coordination with the Canadian Coast Guard because of the shared waterways in the region. This coordination is governed by a Memorandum of Understanding between the two Coast Guards that includes sharing information and conducting joint icebreaking operations. U.S. and Canadian Coast Guard officials also conduct daily calls with industry to share information on weather conditions and vessel locations and understand the nature of commercial activity taking place that day.

**Managing Vessel Traffic.** In the Great Lakes, the Coast Guard manages vessel traffic differently than in the other districts because the lock closures create a closed environment where the commercial vessels remain the same and the Coast Guard is familiar with the vessels and their capabilities. The Coast Guard has the authority to impose regulated navigation areas that establish performance and speed requirements for vessels to move in ice.<sup>6</sup> However, according to Coast Guard officials, while it will use these authorities in the Great Lakes, if necessary, their established rapport with the vessels in the Great Lakes makes such restrictions generally unnecessary. This is different than the other two districts where there is open ocean with many unfamiliar vessels transiting the area.








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## **What is the current fleet for the Coast Guard's domestic icebreaking mission?**

The Coast Guard has a fleet of 33 vessels comprised of heavy, medium, and light domestic icebreakers as well as two types of ice-capable buoy tender vessels to conduct its domestic icebreaking mission (fig. 5).<sup>7</sup>

**Figure 5: Attributes of the Coast Guard's Domestic Icebreaking Fleet**

	<p><b>240' Heavy Icebreaker</b></p> <p><b>Age</b> 17 years</p> <p><b>Icebreaking capability</b> Breaks ice greater than 32 inches thick. Effective in breaking ice jams and establishing tracks.</p> <p><b>Limitations</b> Control of motion in high winds</p> <p>1 in current fleet</p>	<p><b>Locations where used</b> Great Lakes</p>
	<p><b>140' Bay Class Medium Icebreaking Tug</b></p> <p><b>Average age</b> 39 years</p> <p><b>Icebreaking capability</b> Breaks ice up to 30 inches thick. Can operate effectively in smaller channels.</p> <p><b>Limitations</b> Limited seaworthiness in open water and ice conditions</p> <p>9 in current fleet</p>	<p><b>Locations where used</b> Great Lakes New England</p>
	<p><b>65' Small Harbor Light Icebreaking Tugs</b></p> <p><b>Average age</b> 57 years</p> <p><b>Icebreaking capability</b> Breaks ice up to 12 inches thick. Can operate effectively in smaller channels and harbors.</p> <p><b>Limitations</b> Limited capability in ice greater than 12 inches thick</p> <p>11 in current fleet</p>	<p><b>Locations where used</b> New England Mid-Atlantic</p>
	<p><b>225' Juniper Class Seagoing Buoy Tenders</b></p> <p><b>Average age</b> 19 years</p> <p><b>Icebreaking capability</b> Though icebreaking is not its primary mission, the ice-capable vessel can break ice up to 14 inches thick.</p> <p><b>Limitations</b> Poor backing capability in ice leaves it vulnerable to ridges and ice under pressure.</p> <p>5 in current domestic icebreaking fleet</p>	<p><b>Locations where used</b> Great Lakes New England Mid-Atlantic</p>
	<p><b>175' Keeper Class Coastal Buoy Tenders</b></p> <p><b>Average age</b> 22 years</p> <p><b>Icebreaking capability</b> Though icebreaking is not its primary mission, the ice-capable vessel can break ice up to 9 inches thick.</p> <p><b>Limitations</b> Lacks the maneuverability to provide direct vessel assistance, especially if ice is greater than 6 inches.</p> <p>7 in current domestic icebreaking fleet</p>	<p><b>Locations where used</b> New England Mid-Atlantic</p>

Source: GAO analysis of U.S. Coast Guard information; Photos (from top to bottom) U.S. Coast Guard photos by Daniel R. Michelson; Daniel R. Michelson; Petty Officer 3rd Class Steve Strohmaier; Petty Officer 1st Class Thomas Johnson; Petty Officer 3rd Class Hunter Medley. | GAO-24-106619

**Accessible Data for Figure 5: Attributes of the Coast Guard's Domestic Icebreaking Fleet**

Vessel type	Locations where used	Age (years)	Icebreaking capability	Limitations	Number in current fleet
240 foot Heavy Icebreaker	Great Lakes	17	Breaks ice greater than 32 inches thick. Effective in breaking ice jams and establishing tracks.	Control of motion in high winds	1
140 foot Bay Class Medium Icebreaking Tug	<ul style="list-style-type: none"> <li>Great Lakes</li> <li>New England</li> </ul>	39 (average age)	Breaks ice up to 30 inches thick. Can operate effectively in smaller channels.	Limited seaworthiness in open water and ice conditions	9

Vessel type	Locations where used	Age (years)	Icebreaking capability	Limitations	Number in current fleet
65 foot Small Harbor Light Icebreaking Tugs	<ul style="list-style-type: none"> <li>New England</li> <li>Mid-Atlantic</li> </ul>	57 (average age)	Breaks ice up to 12 inches thick. Can operate effectively in smaller channels and harbors.	Limited capability in ice greater than 12 inches thick	11
225 foot Juniper Class Seagoing Buoy Tenders	<ul style="list-style-type: none"> <li>Great Lakes</li> <li>New England</li> <li>Mid-Atlantic</li> </ul>	19 (average age)	Though icebreaking is not its primary mission, the ice-capable vessel can break ice up to 14 inches thick.	Poor backing capability in ice leaves it vulnerable to ridges and ice under pressure	5 (domestic icebreaking fleet)
175 foot Keeper Class Coastal Buoy Tenders	<ul style="list-style-type: none"> <li>New England</li> <li>Mid-Atlantic</li> </ul>	22 (average age)	Though icebreaking is not its primary mission, the ice-capable vessel can break ice up to 9 inches thick.	Lacks the maneuverability to provide direct vessel assistance, especially if ice is greater than six inches.	7 (domestic icebreaking fleet)

Source: GAO analysis of U.S. Coast Guard information; Photos (from top to bottom) U.S. Coast Guard photos by Daniel R. Michelson; Daniel R. Michelson; Petty Officer 3rd Class Steve Strohmaier; Petty Officer 1st Class Thomas Johnson; Petty Officer 3rd Class Hunter Medley. | GAO-24-106619

### What icebreaking fleet does the Coast Guard project that it needs and how much will it cost to acquire?

The Coast Guard determined it will need 2 heavy, 11 medium, and 7 light icebreakers for its future domestic icebreaking fleet. The Coast Guard projects that it will cost at least \$3 billion in lifecycle costs to replace the aging medium and light icebreakers and to acquire a second heavy icebreaker, according to its analyses (Table 1).<sup>8</sup> However, the costs are likely to be higher because the estimates do not include other costs, such as shore infrastructure costs at port locations that the Coast Guard has not yet determined.

**Table 1. Acquisition/Replacement Lifecycle Cost for Each Vessel Type for Domestic Icebreaking, as of 2020 (dollars in millions)**

Domestic Icebreaking Vessel Type	Heavy (1)	Medium (11)	Light (7)	Total (19)
Procurement	216.3	778.1	39.8	1,034.2
Maintenance	115.8	512	65.8	693.6
Operating	73.9	171.5	7.7	253.1
Personnel	177	762.7	152.8	1,092.4
Disposal	1.2	9.5	2.3	13
Total 30-year Lifecycle Cost (\$2020)	584.2	2,233.8	268.4	3,086.4

Source: U.S. Coast Guard's 2022 Mission Need Statement for Domestic Icebreaking. | GAO-24-106619

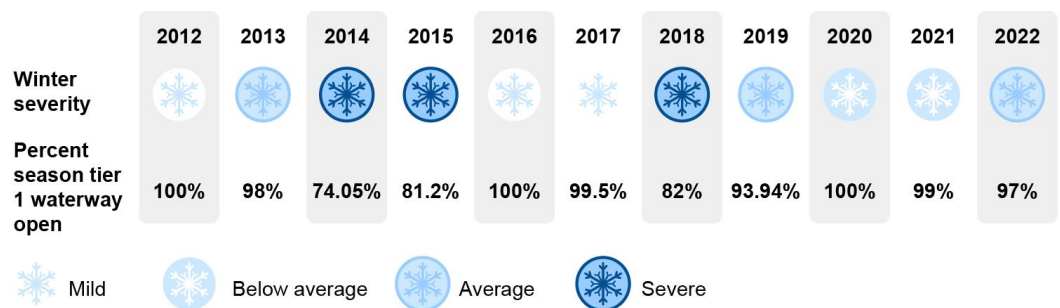
Note: The actual costs are likely to be higher than reported because the estimates do not include other costs, such as shore infrastructure costs at port locations that the Coast Guard has not yet determined.

The Coast Guard projects its future mission needs by conducting a fleet mix analysis to determine the type and number of assets needed to meet forecasted demands. The Coast Guard analyzes mission needs, data on ice and weather condition forecasts, and icebreaking resource hours. According to Coast Guard data, from 2010-2019, it conducted 62.8 percent of its average annual domestic ice breaking hours in the Great Lakes, 35.1 percent in New England and 2.1 percent in the Mid-Atlantic. The Coast Guard's April 2023 fleet mix analysis identified its reliance on an aging fleet and the need for additional heavy and medium capabilities as risks to its ability to conduct its domestic icebreaking mission in the future.

### How is the Coast Guard measuring its Great Lakes icebreaking performance?

The Coast Guard measures and reports the performance of its icebreaking operations in the Great Lakes as the percentage of time during the ice season that tier one waterways are available for transit, with a target of 95 percent. The Coast Guard has generally met this goal except during severe winters. Coast Guard officials explained that it did not meet its performance goal in 2019—an average season—due to planned and unplanned vessel maintenance that resulted in the loss of two of its medium icebreakers for the season.<sup>9</sup> Figure 6 illustrates the Coast Guard's reported performance for the Great Lakes domestic icebreaking mission from 2012-2022.

**Figure 6: The Coast Guard's Great Lakes Domestic Icebreaking Performance, 2012-2022**



Source: GAO analysis of Coast Guard information; GAO (illustrations). | GAO-24-106619

**Accessible Data for Figure 6: The Coast Guard’s Great Lakes Domestic Icebreaking Performance, 2012-2022**

Year	Winter severity	Percent season tier one waterway open
2012	Mild	100
2013	Average	98
2014	Severe	74.05
2015	Severe	81.2
2016	Mild	100
2017	Mild	99.5
2018	Severe	82
2019	Average	93.94
2020	Below average	100
2021	Below average	99
2022	Average	97

Source: GAO analysis of Coast Guard information; GAO (illustrations). | GAO-24-106619

### How can the Coast Guard better communicate about its domestic icebreaking efforts?

The Coast Guard could communicate information it already collects to improve the transparency of its icebreaking performance. For example, the Coast Guard collects data on icebreaking operation hours and the availability of waterways by phases of the ice season (i.e., extended navigation, winter navigation, and spring breakout) in its end-of-season ice reports. However, it only reports the total tier one waterway availability for the ice season to stakeholders, such as industry associations, vessel operators, and Congress. As a result, this key performance metric for the Coast Guard does not provide a full picture of its icebreaking performance, including successes and challenges that occur during certain portions of the ice season. Coast Guard officials acknowledged that the service could improve its reporting on icebreaking performance with information it already collects. According to Coast Guard officials, this includes potential improvements to its program reporting across all domestic icebreaking regions in order to maintain consistency in mission reporting.

The Coast Guard communicates its resource needs to Congress, in part through its fleet mix analysis. However, the fleet mix analysis does not reflect the full scope of the assets required to fulfill the mission, as it excludes many assets, both Coast Guard and commercial, that contribute to the icebreaking mission. Further, while the Coast Guard uses vessels that are designed to conduct multiple missions, the fleet mix analysis is limited to assets where icebreaking is its primary mission. This omits the multi-mission vessels that are used to achieve the icebreaking mission.

For example, the Coast Guard uses two 225’ ice-capable buoy tenders in the Great Lakes whose primary mission is aids-to-navigation (e.g., buoy tending), rather than icebreaking. Although these vessels are not icebreakers, Coast Guard’s end-of-season ice reports show that these vessels are a critical part of the Coast Guard’s current fleet to accomplish the icebreaking mission, accounting for 4 to 29 percent of icebreaking operation hours from 2012-2022.

Further, these vessels serve as a stopgap for the other aging icebreaking vessels in the fleet when they are not available due to scheduled or unscheduled maintenance. Coast Guard officials said that the 225’ vessels are not included in the fleet mix analysis for the domestic icebreaking mission because the vessels’

primary mission is not icebreaking. The Coast Guard's ideal future fleet mix for domestic icebreaking therefore relies only on icebreaking vessels.

The conclusions in the Coast Guard's fleet mix analysis are based on other underlying analyses that are completed as part of its acquisition processes. These analyses communicate the Coast Guard's icebreaking capabilities, gaps and risks. However, because these underlying analyses are part of its internal acquisition process, this information is not proactively shared with decision makers, such as Congress, though Coast Guard officials noted that they can provide them upon request.

Further, the fleet mix analysis is focused on articulating the ideal future fleet mix. For the domestic icebreaking mission, the mix does not include the ice-capable buoy tenders that the Coast Guard currently relies upon to help meet mission needs. As a result, stakeholders are not fully informed regarding resource needs and tradeoffs across missions.

Given the multi-mission nature of the Coast Guard, omitting key details of how it makes tradeoffs to conduct its domestic icebreaking operations, such as by using non-icebreaker vessels to break ice, has the potential to obfuscate the resource requirements for such missions. For example, although the Coast Guard prioritizes its domestic icebreaking operations by using a tiered waterway system, officials said that it approaches the icebreaking mission as a system inclusive of all waterways.

Further, its key analysis for establishing its operating resource needs does not acknowledge the role of commercial icebreaking in lower-priority tier three and four waterways. While these are private icebreaking services and not Coast Guard vessels, Coast Guard policy states that it is to promote both a robust commercial icebreaking industry and facilitate the reasonable demands of commerce in the region.<sup>10</sup> Therefore, if commercial icebreaking assistance is available, the Coast Guard will not interfere, particularly in tier three and tier four waterways where most commercial icebreaking assistance is conducted.

The Coast Guard's 2011 Domestic Icebreaking Operations Policy provides factors the Coast Guard should consider in developing measures that capture the performance of the domestic icebreaking mission. For example, it states that the Coast Guard's performance measures should be expandable to reflect icebreaking by assets assigned outside of their normal area of responsibility.<sup>11</sup> In addition, *Standards for Internal Control in the Federal Government* call for management to communicate the necessary quality information (internally and externally) to achieve the agency's objectives.<sup>12</sup>

By more transparently communicating its performance with information it already collects, including the actual extent of vessel utilization and resource-based prioritization the Coast Guard has identified through various analyses, the Coast Guard could provide stakeholders with better information on operational gaps, risks, and resource needs. Providing this information to Congress would also better position the Coast Guard to articulate tradeoffs and resource decisions.

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### **What standards have been proposed for the Coast Guard's Great Lakes icebreaking?**

The James M. Inhofe National Defense Authorization Act for Fiscal Year 2023 provides proposed standards for performance specific to Great Lakes icebreaking operations.<sup>13</sup> Specifically, these proposed standards state that:

*The Commandant shall keep ice-covered waterways in the Great Lakes open to navigation during not less than 90 percent of the hours that commercial vessels*

*and ferries attempt to transit ice-covered waterways. In a year in which the Great Lakes are not open to navigation because of an ice of a thickness that occurs on average once every 10-years, the Commandant shall keep ice-covered waterways in the Great Lakes open to navigation during not less than 70 percent of the hours that commercial vessels and ferries attempt to transit ice-covered waterways.*

Under the act, the Coast Guard is required to submit a report to certain committees in Congress that includes any proposed modifications to these proposed standards for icebreaking operations in the Great Lakes.

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### **What are the potential impacts of the proposed performance standards?**

The proposed performance standards for Great Lakes icebreaking would largely have no operational impact, according to Coast Guard officials. Specifically, implementing the proposed standards will not change how the Coast Guard conducts icebreaking operations.

**Anticipated impacts on inland waterways.** With respect to inland waterways, the Coast Guard does not plan to change its approach to prioritizing icebreaking through the use of the tiered waterway system.<sup>14</sup> Under this system, inland waterways are typically characterized as tier three and four waterways. According to Coast Guard officials, the tiered system continues to be a useful way to prioritize its resources. Further, the Coast Guard's policy is to support commercial icebreaking. Therefore, inland waterways that are deemed tiers three and four will continue to be serviced by commercial icebreaking services.

**Anticipated impacts on other domestic icebreaking regions.** According to Coast Guard officials in New England, the proposed standards would not impact its operations unless the Coast Guard reassigns assets to the Great Lakes. However, based on the Coast Guard's proposed fleet mix, existing assets will not be reassigned to other districts. Coast Guard officials in the Mid-Atlantic said that the proposed standards will not have an impact on them.

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### **What potential impact will the proposed standards have on the Coast Guard?**

Implementing the proposed performance standards may provide more detailed information about certain characteristics of the Coast Guard's icebreaking performance, but potentially at a significant cost to the Coast Guard. This is particularly true given that the proposed standards will not change how the Coast Guard executes its domestic icebreaking mission.

Coast Guard officials said they understand the benefit in using data to better communicate tradeoffs between missions at existing resource levels. However, Coast Guard officials told us that the proposed performance standards are ambiguous in parts and pose data collection, regulatory, and resource challenges. For example, Coast Guard officials noted that the wording of the proposed standard requires the ability to track a commercial vessel throughout its entire voyage and know the ice conditions that the vessel is moving in at any given time.

Specifically, to track when a commercial vessel is attempting to transit ice, the Coast Guard would require resources to acquire more robust vessel tracking technology than it currently has available, as well as require commercial vessels to provide regular, standardized vessel movement data. In addition, the Coast

Guard would have to hire additional personnel to analyze the data. According to Coast Guard officials, such resource outlays could be significant and result in tradeoffs that could affect other mission needs.<sup>15</sup> Coast Guard is therefore trying to leverage other data it collects but has not used for reporting purposes to provide a more nuanced picture of its performance without needing to invest the additional resources that would be required to implement the proposed standards.

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### **What impact will the proposed standards have on industry?**

Implementing the proposed performance standards may provide certain stakeholders with more information about certain characteristics of the Coast Guard's icebreaking performance, but potentially at a cost that industry may find prohibitive. For example, one industry association and some vessel operators told us they anticipate benefits from the proposed standards, such as having measures they believe would better illustrate that the Coast Guard has deployed fewer resources to domestic icebreaking than they believe are necessary.

However, industry may incur costs associated with Coast Guard data collection. For example, representatives from one large commercial vessel company told us they have an automated system for tracking vessel movement but that smaller companies may not. Therefore, smaller companies operating vessels on the Great Lakes that do not already possess digital real-time ship log reporting capability would incur costs installing it, and costs to report the information in a standardized manner, according to Coast Guard specifications.

### **Conclusions**

Along with the Coast Guard's other missions, it maintains an icebreaking capability to help keep channels and harbors open to navigation to facilitate "the reasonable demands of commerce." Commercial activity on the Great Lakes supports industries within and outside the Great Lakes region, such as steel production and agriculture.

The Coast Guard reports some information on its icebreaking performance but has additional data that it could use to improve the transparency of its icebreaking performance. Communicating additional information that it is already collecting would provide a fuller picture of its performance, including the extent of vessel utilization and resource-based prioritization the Coast Guard has identified through various analyses. Such reporting would provide stakeholders with better information on operational gaps, risks, and resource needs. Further, providing this information to Congress would better position the Coast Guard to articulate tradeoffs and resource decisions.

### **Recommendation for Executive Action**

The Commandant of the Coast Guard should, using data the Coast Guard already collects, report more complete performance information to Congress on its domestic icebreaking operations to better articulate resource needs and tradeoffs. (Recommendation 1)

### **Agency Comments**

We provided a draft of this report to the Coast Guard through the Department of Homeland Security for review and comment. In its comments, reproduced in appendix I, the Department of Homeland Security concurred with our recommendation, stating that the Coast Guard intends to update current performance measures and formalize new ones, as applicable, using data already being internally collected. It noted that initial data collection efforts are in



place for the 2023-2024 ice season. The Coast Guard also provided technical comments, which we incorporated as appropriate.

### **How GAO Did This Study**

To inform all our work, we reviewed relevant laws and Coast Guard policies, guidance, and analyses. We also interviewed Coast Guard officials to understand domestic icebreaking operations and priorities and conducted a site visit to Sault St. Marie, Michigan to observe Coast Guard icebreaking operations.

To examine the potential economic impact of ice coverage on the Great Lakes, we conducted regression analyses to examine the relationship between the average monthly Great Lakes ice coverage using data from the U.S. National Oceanic and Atmospheric Administration and a variety of relevant regional and industry-specific economic indicators.<sup>16</sup> These indicators were average unemployment rates for Great Lakes counties where iron and steel producers are concentrated, unfilled iron and steel orders, revenues for iron and steel companies, mining and manufacturing Gross Domestic Product (GDP) for Great Lakes states, vessel-based exports and imports to the top Great Lakes ports (by tonnage), and Great Lakes cargo tonnage.<sup>17</sup>

We selected these indicators based on our review and analysis of various relevant government, academic and industry analyses. Our analysis considered the locations and economic contributions of identified major economic stakeholders in terms of output, contribution to local and national GDP, and employment in the Great Lakes maritime industry.

We sourced our data from U.S. government sources, specifically, the Army Corps of Engineers, the Federal Reserve Board, the Bureau of Labor Statistics, the Census Bureau, and the Bureau of Economic Analysis. To assess the reliability of the data, we interviewed knowledgeable officials, reviewed documentation about each system, and conducted electronic testing of the data to check for missing values, calculation errors, and outliers. We determined the data were sufficiently reliable to use in our regression.

Our regression analysis controlled for the potential confounding factors of seasonal, pre-existing, and national economic trends. However, our results are limited by several factors. First, some of our indicators are aggregated by broad geographic or industrial levels such as Great Lakes region and all steel and iron firms. Second, our indicators are aggregated by either month or quarter. For these reasons, our regression may not capture more localized potential relationships such as between ice coverage and one plant's production or those occurring at shorter time intervals, such as the impact of ice coverage on steel or iron production over days and weeks. Third, some of the indicators are estimates of economic activity rather than reflections of actual activity. Finally, we examined data for 2005-2019 since some data were not available for earlier or later periods. Thus, we were limited by the number of observations, which decreases the likelihood of observing a statistically significant relationship even if one is present.

To supplement our regression analysis, we also considered the economic impact of ice through industry interviews. We selected the industry stakeholders by first reviewing industry and academic studies to determine the most important sectors in the Great Lakes. We narrowed down our selected industry stakeholders for outreach to the maritime transportation sector, which includes commercial vessels and ports, the automotive industry, and iron and steel production.

We ultimately interviewed representatives from the two largest Great Lakes-based iron and steel producers, two of the largest Great Lakes commercial vessel fleets, one Great Lakes cement-mixing company that has a small commercial vessel fleet, one Great Lakes port authority, the largest Great Lakes

commercial icebreaking and towing services provider, and four industry associations representing Great Lakes stakeholders. From these interviews, we extracted illustrative examples of the economic impact of ice and ways selected stakeholders mitigate the impact of ice.

To evaluate the Coast Guard's current and future mission needs for domestic icebreaking, we reviewed key documents, such as its April 2023 Fleet Mix analysis and underlying analyses, such as the 2022 Mission Need Statement and 2021 Capability Analysis Report. In addition, we reviewed and analyzed the Coast Guard's end-of season ice reports from 2000-2022 to understand domestic icebreaking operational trends.

We also spoke with Coast Guard officials in the domestic icebreaking program office, as well as officials in each of the three districts where domestic icebreaking operations take place – the Great Lakes (District 9), New England (District 1) and the Mid-Atlantic (District 5). In addition, we spoke with officials from the Canadian Coast Guard to gather perspectives on their coordination with the U.S. Coast Guard in the Great Lakes. Further, we spoke with Coast Guard headquarters officials from the Office of Cutter Forces and the Office of Requirements and Analysis to understand the analyses and underlying assumptions in their fleet mix analysis.

To describe the potential effect of the proposed standards on Coast Guard's domestic icebreaking operations, we reviewed the proposed standards from the James M. Inhofe National Defense Authorization Act for Fiscal Year 2023 as well as the performance measures that the Coast Guard currently uses to assess its domestic icebreaking mission.

In addition, we interviewed Coast Guard officials from the domestic icebreaking program office, as well as officials in each of the three domestic icebreaking districts to understand the impacts that the proposed standards would have on their operations as well as any predicted benefits, costs, and tradeoffs. Further, we interviewed two of the largest commercial vessel companies operating on the Great Lakes to understand what information each collects and their willingness to share such information with the Coast Guard, if needed.

We conducted this performance audit from February 2023 to January 2024 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

### **List of Addressees**

The Honorable Maria Cantwell  
Chair  
The Honorable Ted Cruz  
Ranking Member  
Committee on Commerce, Science, and Transportation  
United States Senate

The Honorable Sam Graves  
Chairman  
The Honorable Rick Larsen  
Ranking Member  
Committee on Transportation and Infrastructure  
House of Representatives

## Appendix I: Comments from the Department of Homeland Security

U.S. Department of Homeland Security  
Washington, DC 20528



**Homeland  
Security**

December 15, 2023

Heather MacLeod  
Director, Homeland Security and Justice  
U.S. Government Accountability Office  
441 G Street, NW  
Washington, DC 20548-0001

Re: Management Response to Draft Report GAO-24-106619, "COAST GUARD:  
Improved Reporting on Domestic Icebreaking Performance Could Clarify  
Resource Needs and Tradeoffs"

Dear Ms. MacLeod:

Thank you for the opportunity to comment on this draft report. The U.S. Department of Homeland Security (DHS or the Department) appreciates the U.S. Government Accountability Office's (GAO) work in planning and conducting its review and issuing this report.

DHS leadership is pleased to note GAO's recognition that the U.S. Coast Guard (Coast Guard) applies a risk-based approach to prioritize its domestic icebreaking operations based on anticipated resource availability and other factors, such as safety. The Coast Guard will continue to provide icebreaking services to assist vessels in emergency or urgent situations and to assist communities in exigent need.

The draft report contained one recommendation with which the Department concurs. Enclosed find our detailed response to the recommendation. DHS previously submitted technical comments addressing several accuracy, contextual, and other issues under a separate cover for GAO's consideration.

Again, thank you for the opportunity to review and comment on this draft report. Please feel free to contact me if you have any questions. We look forward to working with you again in the future.

Sincerely,

JIM H CRUMPACKER

Digitally signed by JIM H  
CRUMPACKER  
Date: 2023.12.15 12:38:31 -05'00'

JIM H. CRUMPACKER, CIA, CFE  
Director  
Departmental GAO-OIG Liaison Office

Enclosure

**Enclosure: Management Response to Recommendation  
Contained in GAO-24-106619**

GAO recommended that the Commandant of the Coast Guard:

**Recommendation 1:** Using data the Coast Guard already collects, report more complete performance information to Congress on its domestic icebreaking operations to better articulate resource needs and tradeoffs.

**Response:** Concur. The Coast Guard's domestic icebreaking program intends to update current performance measures and formalize new ones, as applicable, using data already being internally collected. Potential measures include: (1) expanded reporting on the current tiered waterway system; (2) response rates to icebreaking assistance requests; (3) impact of commercial icebreaking provider contributions; and (4) impact of unplanned icebreaker maintenance. The Coast Guard's Office of Waterways and Ocean Policy (CG-WWM) will lead this effort in coordination with the First, Fifth, and Ninth Coast Guard Districts. Initial data collection efforts are in place for the 2023-2024 ice season and development of new performance measures will be completed by July 31, 2024, during the 2024 off-season. Evaluation of new performance measures will be implemented by December 31, 2024, for the 2024-2025 ice season. Results will be codified in the next version of Commandant Instruction 16151.1D, "Domestic Icebreaking Operations Policy," dated December 21, 2011.<sup>1</sup> Estimated Completion Date: June 30, 2025.

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<sup>1</sup> [https://media.defense.gov/2017/Mar/15/2001716998/-1/-1/0/CI\\_16151\\_1D.PDF](https://media.defense.gov/2017/Mar/15/2001716998/-1/-1/0/CI_16151_1D.PDF)

**Accessible Text for Appendix I: Comments from the Department of  
Homeland Security**

December 15, 2023

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Director, Homeland Security and Justice  
U.S. Government Accountability Office  
441 G Street, NW  
Washington, DC 20548-0001

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JIM H CRUMPACKER

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JIM H. CRUMPACKER, CIA, CFE  
Director  
Departmental GAO-OIG Liaison Office

Enclosure

**Enclosure: Management Response to Recommendation Contained in GAO-24-106619**

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## GAO Contact Information

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**Staff Acknowledgments:** Andrew Curry (Assistant Director), Julia Vieweg (Analyst-in-Charge), Sean Worobec, Nasreen Badat, Ben Crossley, Lilia Chaidez, Elizabeth Dretsch, Billy Commons, and Janet Temko-Blinder.

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## Endnotes

<sup>1</sup> Specifically, we examined the relationship between the average ice coverage in the Great Lakes and a variety of economic indicators after controlling for seasonal changes and pre-existing trends. We selected these economic indicators because they represent commodities and industries that make up the largest share of the regional economic activity and contribution to national economic output.

<sup>2</sup> The other two variables that we found a statistically significant association with ice coverage were U.S. domestic capacity utilization for steel and iron products, a measure of actual production output relative to maximum potential output, and U.S. domestic production of iron and steel products. For both of these variables, we found a negative relationship.

<sup>3</sup> There may be some factors we did not control for that could be impacting the results of the limited association we found between economic indicators and average ice coverage in the Great Lakes. Furthermore, some indicators we used are (1) only estimates of economic activity rather than actual activity, (2) aggregated to a monthly or quarterly frequency which would not capture activity occurring at shorter time intervals (e.g., days or weeks), and (3) have broad geographic coverage (e.g., national vs the Great Lakes region), and thus would not capture more localized potential relationships.

<sup>4</sup> Under Coast Guard's commercial ice breaking policy in the Great Lakes, Coast Guard will break ice, establish and maintain tracks, and conduct escorts and direct assistance to vessels in Tier One waterways. In Tier Two waterways, Coast Guard will only break ice to establish and maintain tracks in shipping lanes within the waterway. Vessel escorts and direct assistance are left to commercial ice breaking providers if they are available. See, United States Coast Guard, *Great Lakes Domestic Icebreaking Framework* (November 2016) as well as United States Coast Guard, *Domestic Icebreaking Operations Policy*, Commandant Instruction 16151.1D (December 21, 2011).

<sup>5</sup> The Coast Guard's other six districts are: (1) the Southeast, (2) the Heartland, (3) the Pacific Southwest, (4) the Pacific Northwest, (5) Hawaii and the Pacific, and (6) Alaska.

<sup>6</sup> 33 C.F.R. pt. 165

<sup>7</sup> See 14 U.S.C. §§ 102, 504.

<sup>8</sup> We have previously reported that agencies, such as the Coast Guard, should base major ship acquisitions on a good business case, which includes setting firm requirements, and ensuring that technologies are fully developed and the design is stabilized before construction to avoid delays. See GAO, *Coast Guard Recapitalization: Actions Needed to Better Manage Acquisition Programs and Address Affordability Concerns*, [GAO-23-106948](#) (Washington, D.C.: July 27, 2023).

<sup>9</sup> The planned maintenance was for large-scale mid-life and service-life extension projects, not routine unit-level maintenance. The Coast Guard generally plans its winter vessel maintenance while the locks are closed to minimize impact on operations and availability.

<sup>10</sup> See Exec. Order No. 7,521, *Use of Vessels for Icebreaking Operations in Channels and Harbors*, 1 Fed. Reg. 2527 (Dec. 21, 1936).

<sup>11</sup> United States Coast Guard, *Domestic Icebreaking Operations Policy*, Commandant Instruction 16151.1D (December 21, 2011), page 7.

<sup>12</sup> *Standards for Internal Control in the Federal Government* directs managers to use quality information to achieve program objectives, where "quality" means, among other characteristics, current, complete, and accurate. GAO, *Standards for Internal Control in the Federal Government*, [GAO-14-704G](#) (Washington, D.C.: Sept. 2014).

<sup>13</sup> Pub. L. No. 117-263, § 11212, 136 Stat. 2395, 4013-15.

<sup>14</sup> Pursuant to 33 C.F.R. § 2.26, "inland waters" means "the waters shoreward of the territorial sea baseline." According to Coast Guard officials, "inland waters" include the entirety of the Great Lakes and they apply this definition specifically to tier three and four waterways for the domestic icebreaking mission within the Great Lakes. For clarity, we refer to "inland waters" as "inland waterways" in this report.

<sup>15</sup> The Coast Guard's 11 statutory missions are (1) aids to navigation, (2) defense readiness, (3) drug interdiction, (4) ice operations, (5) living marine resources, (6) marine environmental protection, (7) marine safety, (8) migrant interdiction, (9) other law enforcement, (10) ports, waterways, and coastal security, (11) search and rescue. 6 U.S.C. § 468(a).

<sup>16</sup> The U.S. National Oceanic and Atmospheric Administration's Great Lakes Environmental Research Laboratory conducts scientific research on the Great Lakes and coastal ecosystems; develops products and services; and shares knowledge and information to advance science, service and stewardship.

<sup>17</sup> For the purpose of our analysis, we included Illinois, Indiana, Michigan, Ohio, Wisconsin, and Minnesota as Great Lakes states. Pennsylvania and New York were not included because data sources such as the U.S. Bureau of Economic Analysis excludes these states from its Great Lakes regional data.