A Ten-Year Projection of Maritime Activity in the U.S. Arctic Region, 2020-2030*

UPDATE TO THE CMTS 2015 PROJECTIONS REPORT

*Final edits pending; numbers subject to change

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ARCTIC COUNCIL PAME - SEG PRE-MEETING

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REYKJAVIK, ICELAND

Overview

- Recap of our 2015 approach
- Ways we didn't quite predict the future
- New approaches to improve our clairvoyance
- Updated projections
- Future considerations

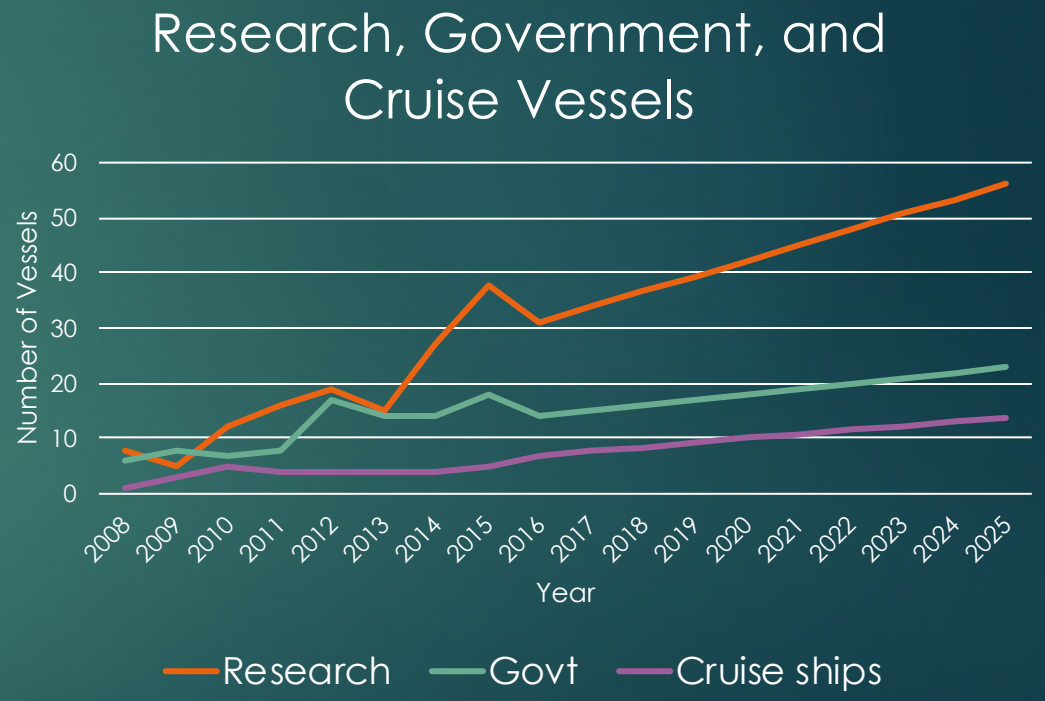
Recap of 2015 approach

- Based on specific assumptions:
  1) US Arctic traffic would grow at a similar rate to global growth.
  2) Oil and gas development would be a major driver.
  3) Vessels would diverge from traditional shipping routes at measurable levels.
  4) Tourism, research, government, and unknown activity would remain generally consistent.

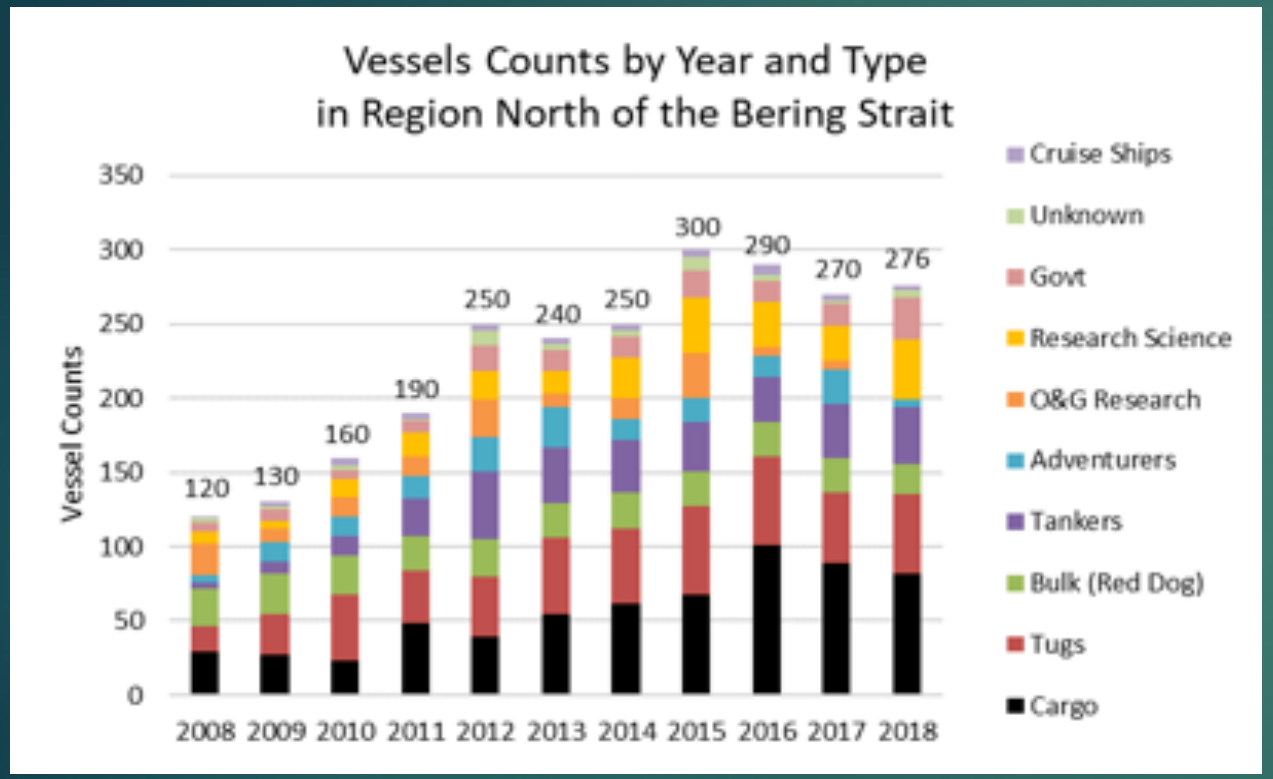
- We found that while the conservative projections for about 420 vessels by 2025 aligned well with the extrapolated data from 2008-2018, the underlying assumptions were no longer accurate.

Assumptions that didn't quite work

- Sectors like tug and cargo traffic grew at a rate of about 17%; not 3%.
- Shell pulled out of their Arctic exploration and development plans in late 2015.
- Research, cruise, and government traffic all increased.
  - Cruise traffic reached our anticipated 2025 high by 2016.
  - Research vessels nearly doubled.



Where are we now?



- Continue to see increases in vessel numbers.
- Rethinking study area – expanded to use Polar Code.

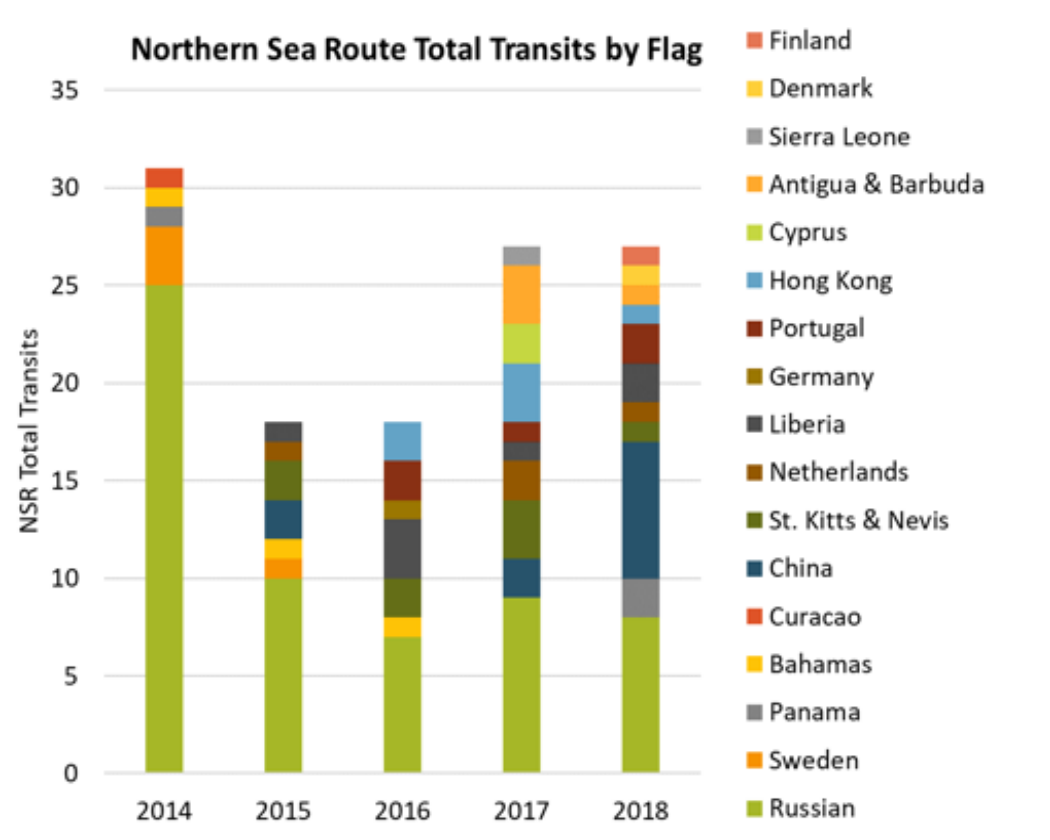
Improving our Clairvoyance

- Expert workshop in November 2018.
- Identify drivers of vessel activity.
- Rank drivers based on potential impact and likelihood of happening.
- 41 experts from industry, academia, government, and the Arctic region.
- Participants identified and ranked over 70 different drivers of vessel activity, across nine different categories, including:

- Natural Resources
- The Global Economy
- Changing Geopolitics
- Regulatory Changes
- Infrastructure
- Improved Technology and Operations
- Environmental Change
- The Human Element
- Changing Fuel Landscape

Improving our Clairvoyance

Understanding trends



Understanding context

- Analysis of ASTD traffic data found that a total of 2,043 unique vessels transmitted AIS in the Polar Code region of Arctic in 2017
- 1,584 of those vessels registered to Arctic States (77.5%).
- Only 11.5% of the total number of unique ships operating in the Polar Code definition of the Arctic region transited through this study's area of interest.

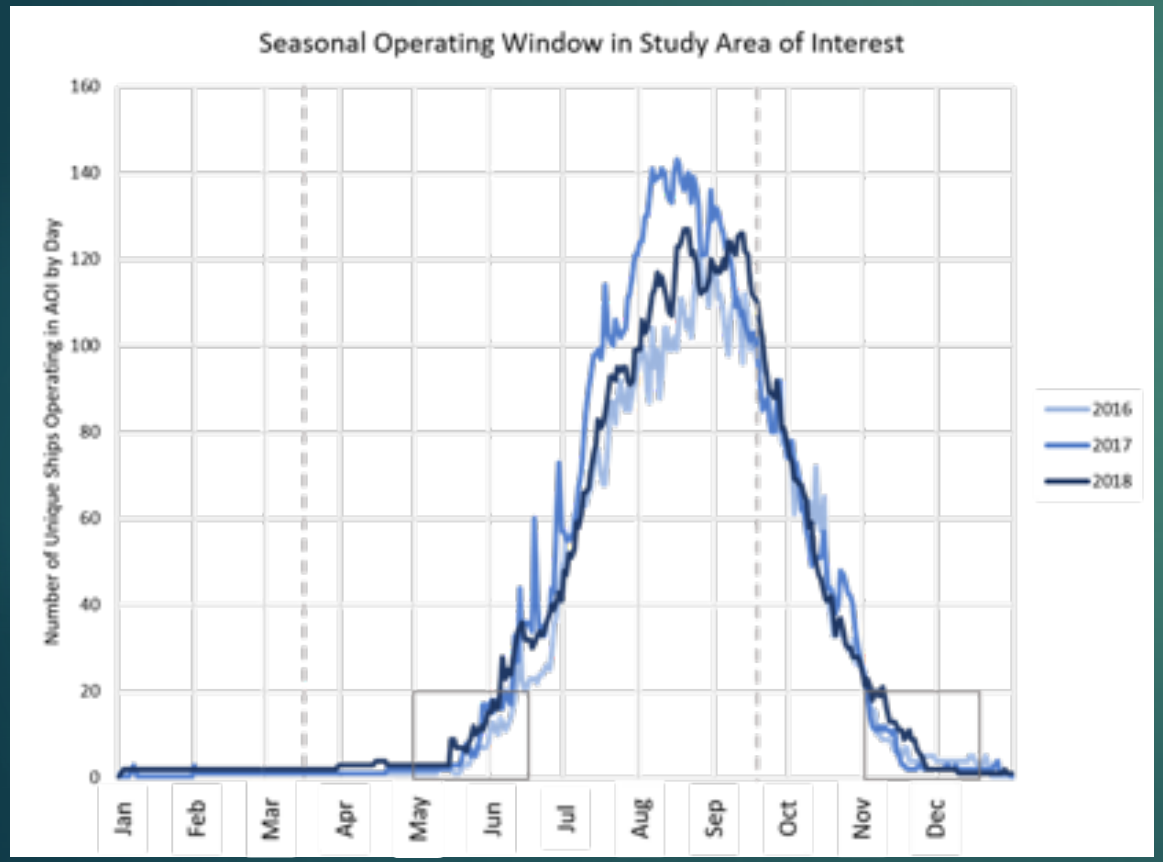
Improving our Clairvoyance

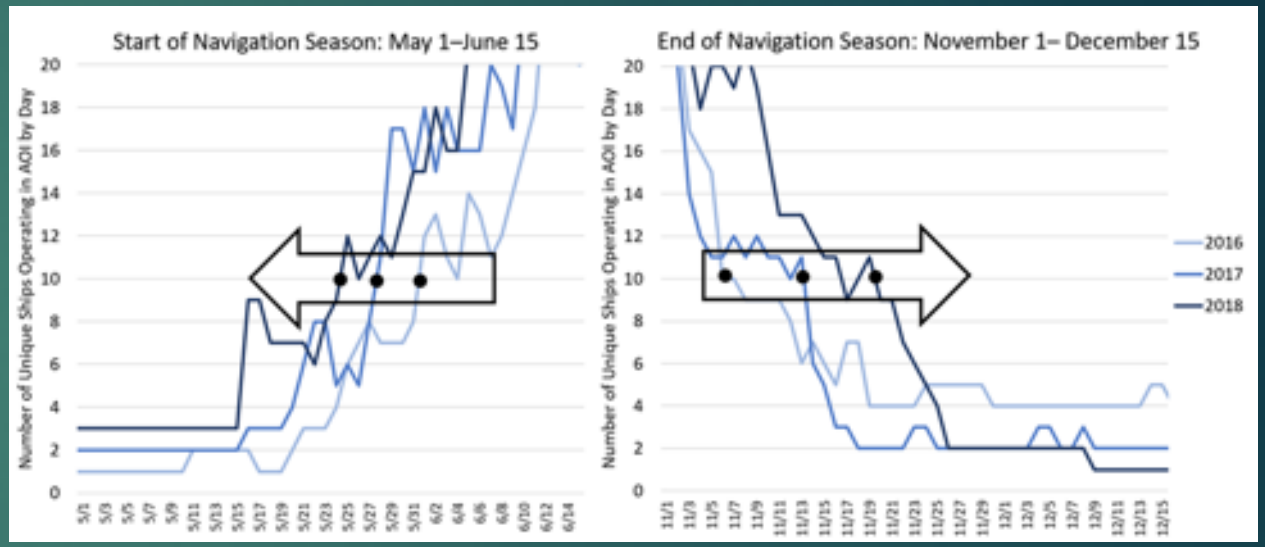
Understanding drivers

Type of Growth	Sources of Growth
Natural Resource Development	Offshore Geological and Geophysical Research (US)
	Liberty Hilcorp Development Project (US)
	Eni's Beaufort Sea Exploration from Spy Island Drillsite (US)
	Oil and Gas Activities in the Willow Prospect within the National Petroleum Reserve (US)
	Oil and Gas Activities in the Arctic National Wildlife Refuge (US)
	LNG Production on the North Slope (US)
	Yamal LNG Project (Russia)
	Arctic LNG 2 Project (Russia)
	Ob LNG Project (Russia)
	Transshipment Facilities at Kamchatka and Murmansk (Russia)
	China's Icebreaking LNG Tankers
	Expansion of the Red Dog Mine (US)
	Graphite One Project in Nome (US)
	Hope Bay Gold Mine (Canada)
	Back River Gold Mine (Canada)
	Mary River Mine (Canada)
	Offshore Geological and Geophysical Research for Offshore Wind Development (US)
Infrastructure Development	Relocation of Kivalina, AK
	Relocation/Protection-in-Place of Shishmaref, AK
	Relocation of Newtok, AK
	Modification of the Port of Nome
	Lower Yukon River Regional Port and Road Project in Emmonak, AK
	Construction of the Kotzebue to Cape Blossom Road
	Road Improvements in Utqiagvik, AK
	Road Improvements in Nome, AK
	Road Improvements in Selawik, AK
	Airport Repair in Alaska
	Onshore Renewable Wind Development Projects
	Expanded Services for Community Resupply and Waste Removal
Expansion of the Arctic Fleet	USCG Polar Security Cutters
	Russian Icebreakers
	Canadian Icebreakers
	Chinese Icebreakers
	Expansion of Polar Class Cruise and Adventure Ships
Seasonally Rerouted Shipping	A Panamax-sized Fleet of Select Vessel Types

Improving our Clairvoyance

Exploring navigation season





- The navigation season grew from 159 days in 2016, to 171 in 2017, and 180 in 2018;
- An average 10-day increase each year.

Building our Scenarios

- The Reduced Activity Scenario assumes that the high risks of operating in the region are not able to be mitigated over the next decade, and this uncertainty limits the volume of growth in the region.

- The Optimized Growth Scenario assumes that much of the risk for operating in the region will be mitigated over the next decade. This scenario incorporates the upper end of growth rates.

- The Most Plausible Scenario assumes that some of the risks for operating in the region will be mitigated. This scenario incorporates the most reasonable estimates of traffic growth and vessel counts into a single scenario.

- The Accelerated, but Unlikely Scenario assumes that the risks of operating in the region are completely mitigated and incorporates all sources of growth for the region, including components which may be unlikely according to best available data. This scenario is meant to act as a ceiling for the projections in this study

Table 1: Summary of additional vessels anticipated from expanded adventure fleet

		Total number of additional adventure ships per year in study AOI											
	Scenario Assumption	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Reduced Activity Scenario	0 additional vessels added each year	0											
Most Plausible Scenario	1 vessel added every 2 years until 7 vessels in AOI	2		3		4		5		6		7	
Optimized Growth Scenario	2 vessels added every 2 years until 14 vessels in AOI	4		6		8		10		12		14	
Accelerated, but Unlikely Scenario	All of planned ships sail within study AOI as soon as they are delivered	7	10	12	14		20	25	28				

Table 1: Summary of Vessels Associated with the Mary River Mine Anticipated to Pass Through Study Area of Interest by Scenario

		Total number of vessels servicing the Mary River Mine via study AOI per year											
	Scenario Assumption	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Reduced Activity Scenario	All vessels approach site from the east	0											
Most Plausible Scenario	Gradually increase from 1 to 2 vessels/year	1			1--2				2				
Optimized Growth Scenario	Adds 2 vessels every 3 years until 8 vessels/year	2			4			6			8		
Accelerated, but Unlikely Scenario	Adds 2 vessel every 2 years until 12 vessels/year	2		4		6		8		10		12	

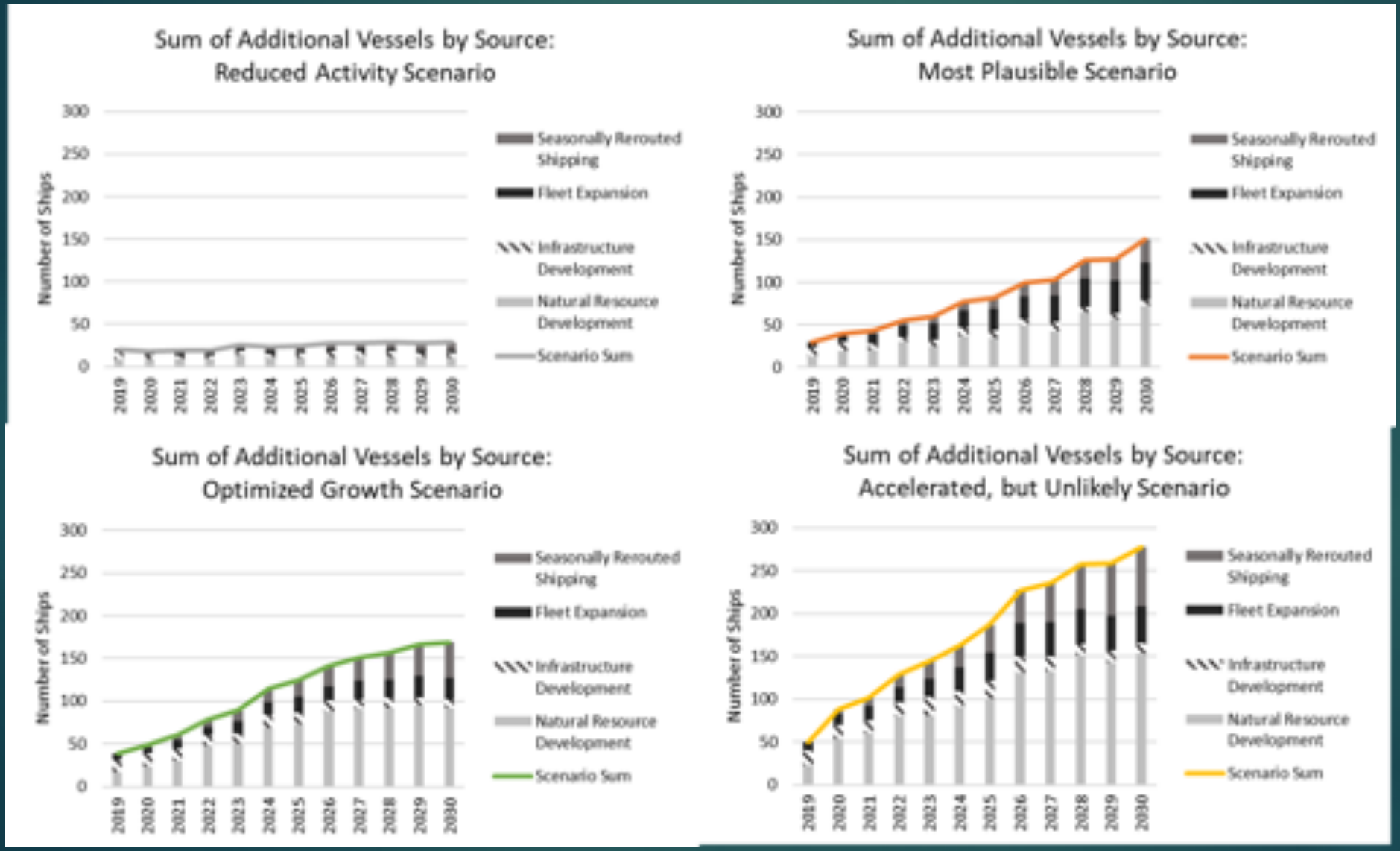
Table 1: Expected sealift requirements for the Relocation of Kivalina

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Reduced Activity Scenario	Construction	Additional Funding is Not Secured										
	2 vessels/yr	*0 vessels/yr*										
Most Plausible Scenario	Construction					Surge			Surge			Surge
	1-2 vessels/yr					*3 vessels*			*2 vessels*			*3 vessels*
Optimized Growth Scenario	Construction	Relocation/Protect-in-Place Activities										
	2-3 vessels/yr	*1-2 vessels/yr*										
Accelerated, but Unlikely Scenario	Construction	Relocation/Protect-in-Place Activities										
	2-3 vessels/yr	*2-3 vessels/yr*										

Example scenario tables

- Top: increases from ecotourism based on estimated delivery of new polar capable vessels
- Middle: Increases from the Mary River Mine based on proposed operations and expansions
- Bottom: Increases based on local infrastructure and climate related projects, specifically, the relocation of Kivalina, AK.

Building our Scenarios

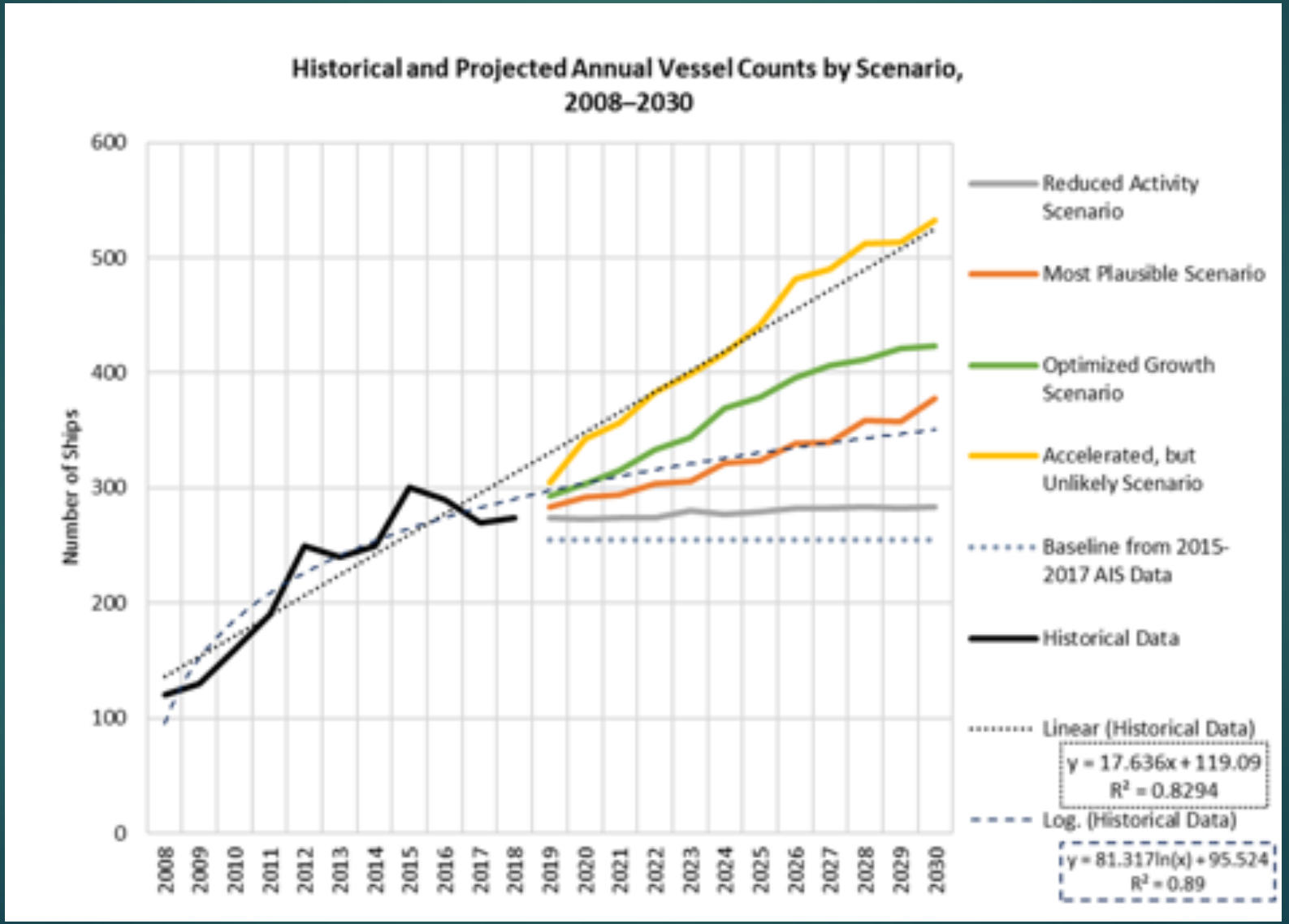


- Each scenario is based on a combination of the vessel activities for each of the categories and the individual projects within.

2030 Scenario Projections

Scenario	Additional Vessels in 2030	Total Vessels in 2030	Projected Average Annual Growth Rate	Change from 2008 Baseline Level	Change from Current (2015—2017) Baseline
Reduced Activity Scenario	29	284	0.30%	136%	11%
Most Plausible Scenario	124	379	2.58%	215%	48%
Optimized Growth Scenario	171	425	3.31%	255%	67%
Accelerated, but Unlikely Scenario	281	535	4.93%	346%	110%

Projections compared with historic data



Analysis of Results

- Comparing the projected data with the historical data from this area reveals that three highest growth scenarios are in close agreement with mathematical regressions of the available historical data
- The Accelerated, but Unlikely Scenario vessel projection values are in very close agreement with the linear regression from the USCG data set.
- The Most Plausible Scenario vessel projection values are in close agreement with the logarithmic regression of the same historical data set. The historical data has a slightly better fit to the logarithmic regression (R2 = 0.89) compared to the linear regression (R2= 0.83)
- Most Plausible Scenario has the best agreement with the historical data available.
- This suggests that the region may enter a period of slower growth over the next decade than what was observed in the past decade.

Future Considerations

- The logarithmic fit to the data, maturing from relatively fast-paced growth and approaching little to no growth, or equilibrium, suggests that the system is approaching a carrying capacity, or the point at which the environment, market, or system is unable to continue to grow because of one or more limiting factors.
  - In biology, the carrying capacity is the maximum population a given environment may support indefinitely.
- To understand why this may be occurring, we need a better understanding of what the limiting factors are in a system.
- There are a number of possible factors that meet this description for the Arctic: infrastructure, investment, and regulatory and operational certainty, among them.

Future Considerations

- Several areas of the report require more granular analysis:
  1. Better understanding subsistence users in the region.
     - Among the 11 whaling communities in the northern Bering Sea and Alaskan Arctic, there are 165 registered whaling captains.
     - Assuming each captain uses a single unique vessel, the total number of vessels based on AIS alone may underrepresent actual vessels by 40% by excluding subsistence activities
  2. The Arctic as a system.
     - This report examines vessel operations on a vessel-by-vessel basis – it does not attempt to calculate a system or approximate trips, voyages, or other metrics.
  3. The Arctic and its mariners
     - This report does not examine the people involved in Arctic shipping. While it incorporates elements of business risk, financial risk, and environmental risk, it does not examine the number of mariners at risk in the Arctic.

Questions?

- Follow up or for a copy of the report once available:
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  - https://www.cmts.gov/topics/arctic