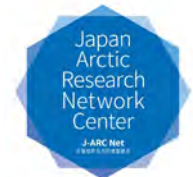


PICES W2

@Yokohama, Japan, Oct 25-Nov 4, 2018

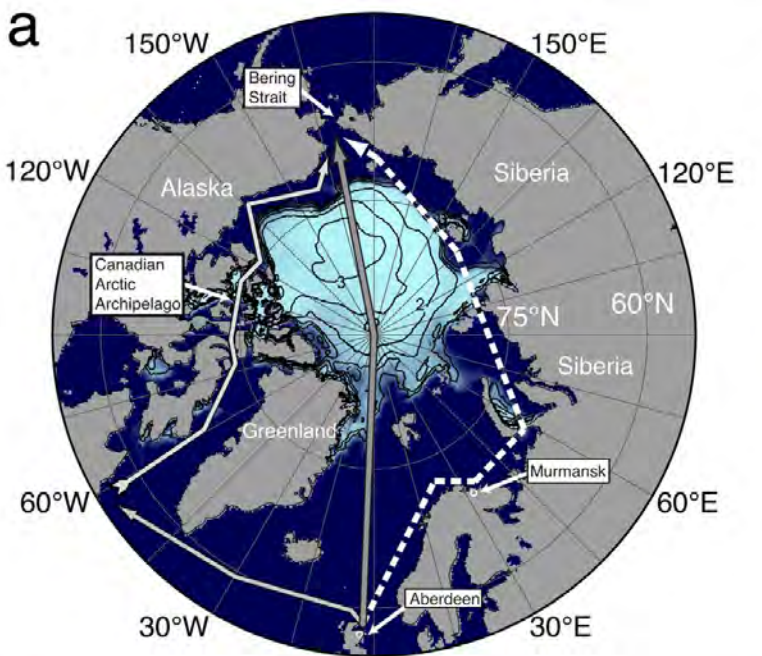
Characteristics of environmental risks caused by navigation in the Central Arctic Ocean

Natsuhiko Otsuka, Xiaoyang Li and Sei-Ichi Saitoh

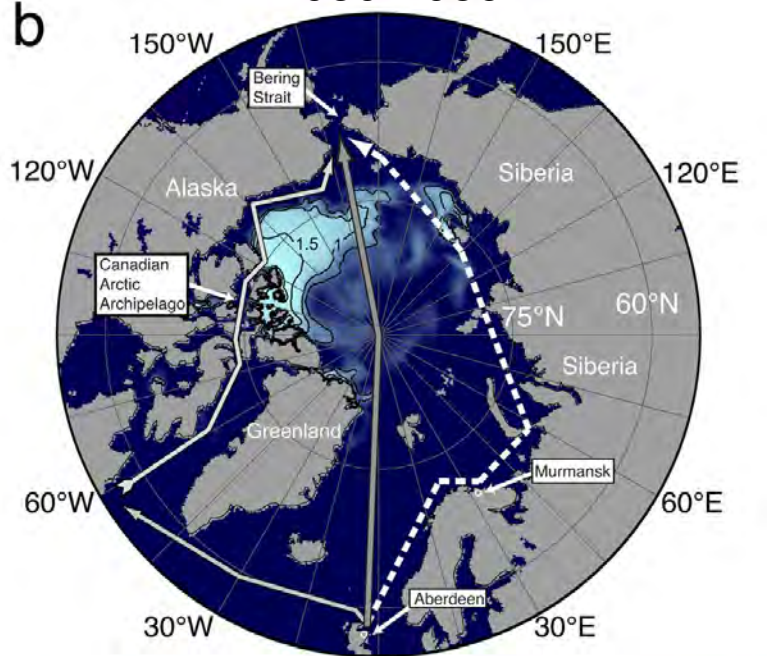


Sea ice retreat in Arctic

2010-2019



2030-2039

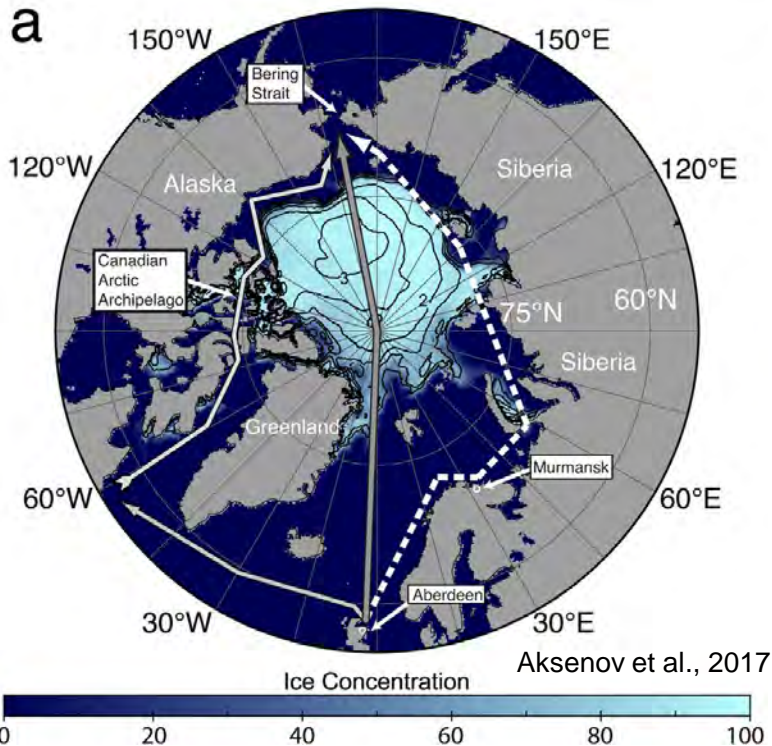


Smith and Stephenson, 2013; Aksenov et al., 2017

Central Arctic Ocean (CAO) is projected to become seasonally ice-free by midcentury.

Introduction:

Arctic shipping routes



a) Northern Sea Route (NSR)

b) Northwest Passage (NWP)

c) North Pole Route (NPR)

The NSR is the most feasible Arctic shipping route.

Introduction:

Sea ice retreat



ice-strengthened ships to navigate into the CAO



environmental risks to marine ecosystem in the CAO

The objectives of this study:

- Investigation of current status and future trend of Arctic shipping
- Identification of possible environmental risks caused by ship navigation in the CAO
- Comparison of current regulations with these risks for future environmental protection in the CAO

Method:

➤ Data sources:

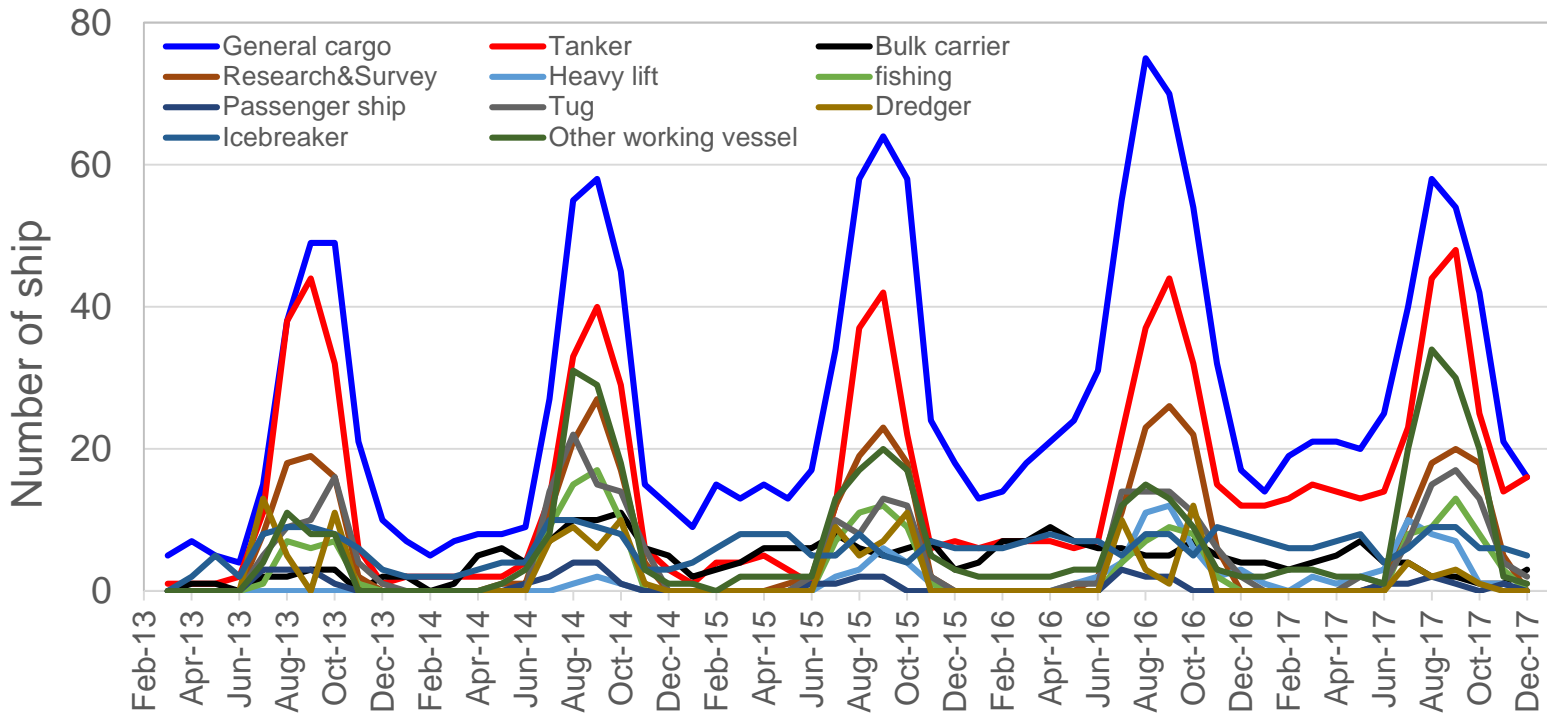
- Daily data of IMO number, ice class from NSRA
- Ship type from “MarineTraffic”
- Period: March of 2013 to December of 2017

➤ Ship separation:

- Ships grouped according to their ship types:
general cargo, tanker, bulk carrier, and so on
- Ships classified based on their ice classes:
 - ✓ High ice class (PC 2 – 4): year-round operation in thick first-year ice (120-200 cm) with old ice inclusions
 - ✓ Middle ice class (PC 5 – 7): summer/autumn operation in thin first-year ice (30-70 cm) with old ice inclusions
 - ✓ Low ice class (non – 1B): operation in open water area

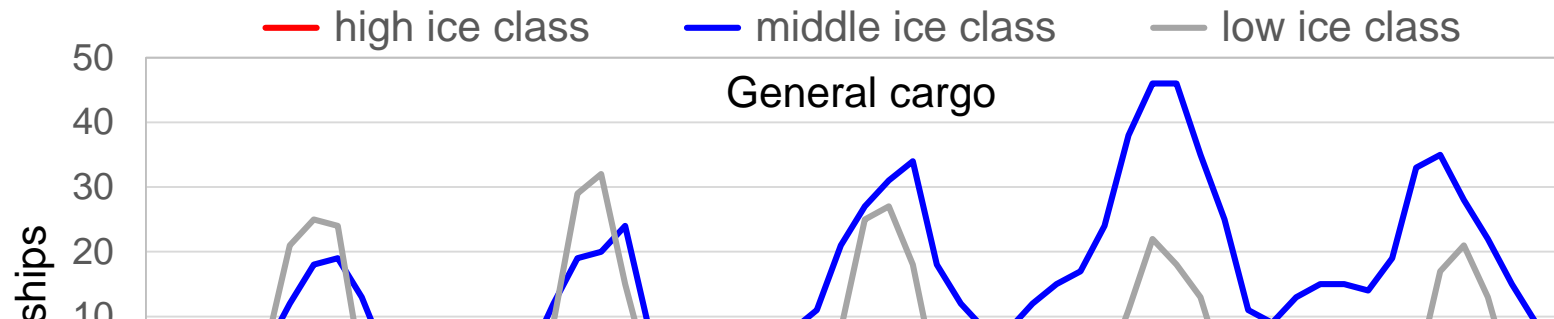
Results 1

Monthly ship number in NSR



- Ship number:
 - high in summer for most ship types
- General cargo and tanker:
 - predominant and increased

Monthly ship number in NSR



The increased ships in NSR:

Tanker with middle and high ice class

General cargo with middle ice class

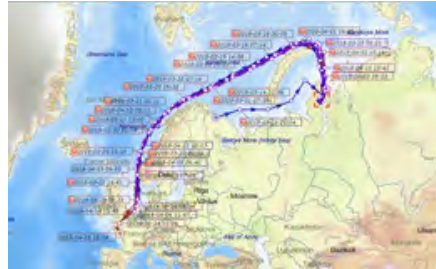
Feb. Apr. Jun. Aug. Oct. Dec. Feb. Apr. Jun. Aug. Oct. Dec. Feb. Apr. Jun. Aug. Oct. Dec. Feb. Apr. Jun. Aug. Oct. Dec.

- General cargo: increased in middle ice class
- Tanker: increased in middle and high ice class

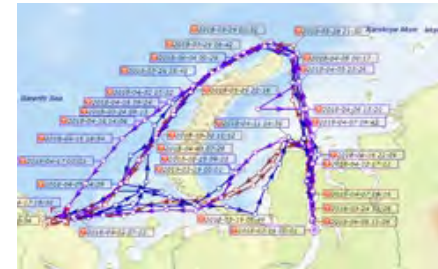
Current Arctic shipping

❖ Increased tankers with middle and high ice class

Caused by year-round navigation of LNG and crude oil transport from Kara Sea



LNG transport (Mar.~Apr. 2018)



Crude oil transport (Mar.~Apr. 2018)

❖ Increased general cargo with middle ice class

Due to destination shipping to and from Russian Arctic coast for natural resource exploration

❖ Transit shipping of bulk cargo has carried out

❖ North Pole and the CAO cruise has already been carried out annually.

❖ Economic feasibility of the NSR and NWP increase

Future Arctic shipping

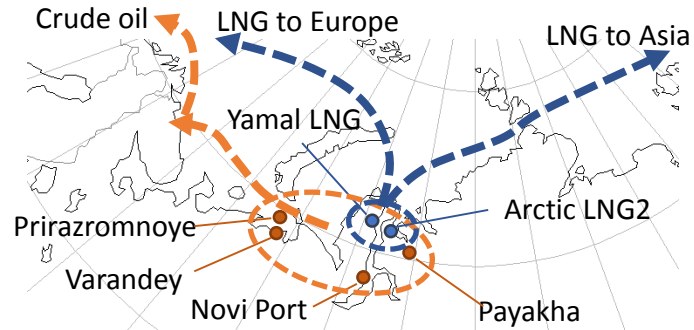
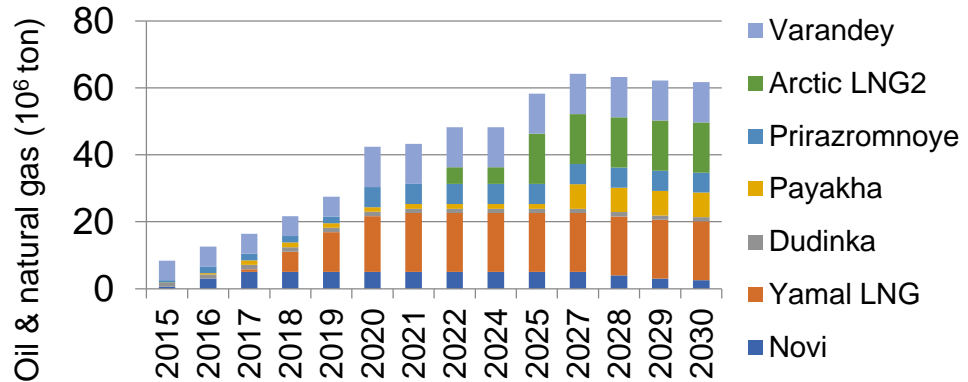
❖ Tanker

Shipping activity
will increase

LNG: dominant
cargo in NSR

- ✓ International transit shipping will increase in bulk cargoes
- ✓ Container: pilot voyage by MAERSK in 2018
- ✓ Tourism activity in CAO will increase

Planned oil and natural gas production from Russian Arctic coast



Environmental risks in CAO

CAO will be ice-free in summer



More ice-strengthened ships will navigate into the CAO



Environmental risks to marine ecosystem in the CAO:

➤ Cargo released by accident:

Crude oil, condensate, HFO, LNG, and chemicals

➤ Discharge:

Garbage, Sewage, Ballast water and oils

➤ Exhaust emissions:

CO₂, BC, NO_x, PM, SO_x, and CO

➤ Noise and wave by ship operation:

Protection of ocean environment by IMO Polar Code

➤ Cargo released by accident:

Double hull and bottom required for all oil tankers

➤ Discharge:

- Discharge of oil or oily mixtures from any ship is prohibited
- Disposal of plastics and animal carcasses are prohibited
- Treated Sewage and food waste can be discharged into water area farther than 12 nm from nearest land, ice shelf and fast ice
- Ships required to carry out ballast water management procedures to a given standard

➤ Exhaust emissions: ships encouraged not to use HFO in Arctic

➤ Noise: ships encouraged to reduce underwater noise

Protection of ocean environment by IMO Polar Code

Shipping activity has risks for ocean pollution

- IMO has been tackling with and implementing many regulations.
- Polar Code has realized some regulations for Polar waters.

Countermeasures against released hazardous materials are undeveloped



We need to achieve technologies and risk analysis further in order to prepare coming new era.

Environmental risks caused by navigation were investigated in CAO.

- ❑ The Arctic shipping activity will increase in CAO.
- ❑ The major risks in CAO are cargo release, discharge, exhaust emissions and noise from ship.
- ❑ Preparation against new environmental risks by navigation in CAO will be required.

Thank you very much
for your attention!