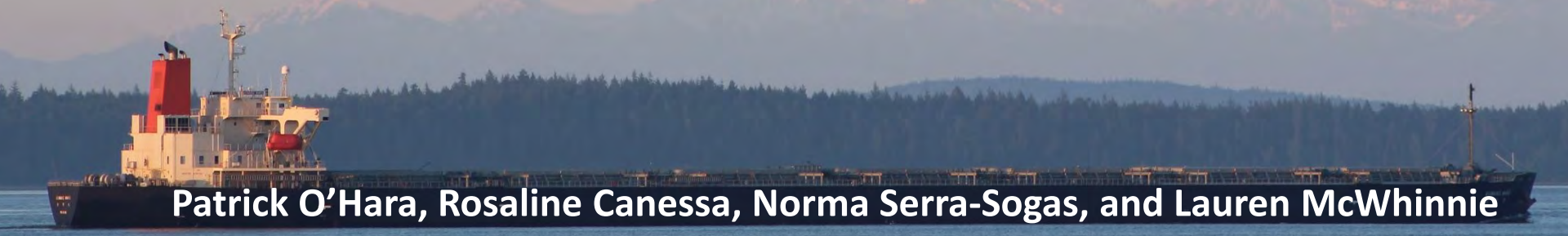
Noise Exposure to the Marine Environment from Ships

Challenges and Opportunities for Capturing and Monitoring Spatial Data on Small Vessels to Address Associated Threats to Marine Life.



Patrick O'Hara, Rosaline Canessa, Norma Serra-Sogas, and Lauren McWhinnie

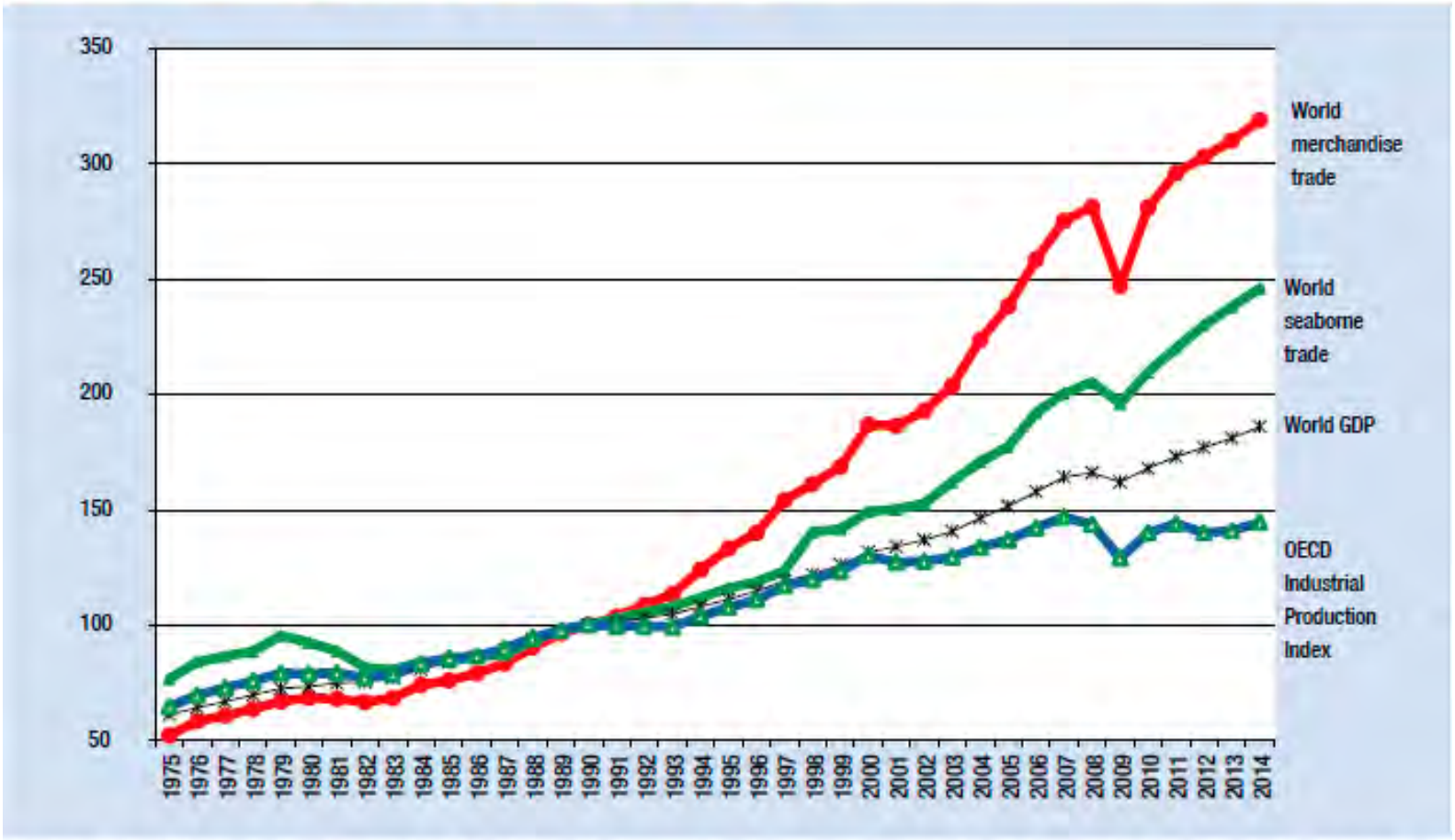
CORAL Group,

Department of Geography, University of Victoria

PICES, Vladivostok, 2017

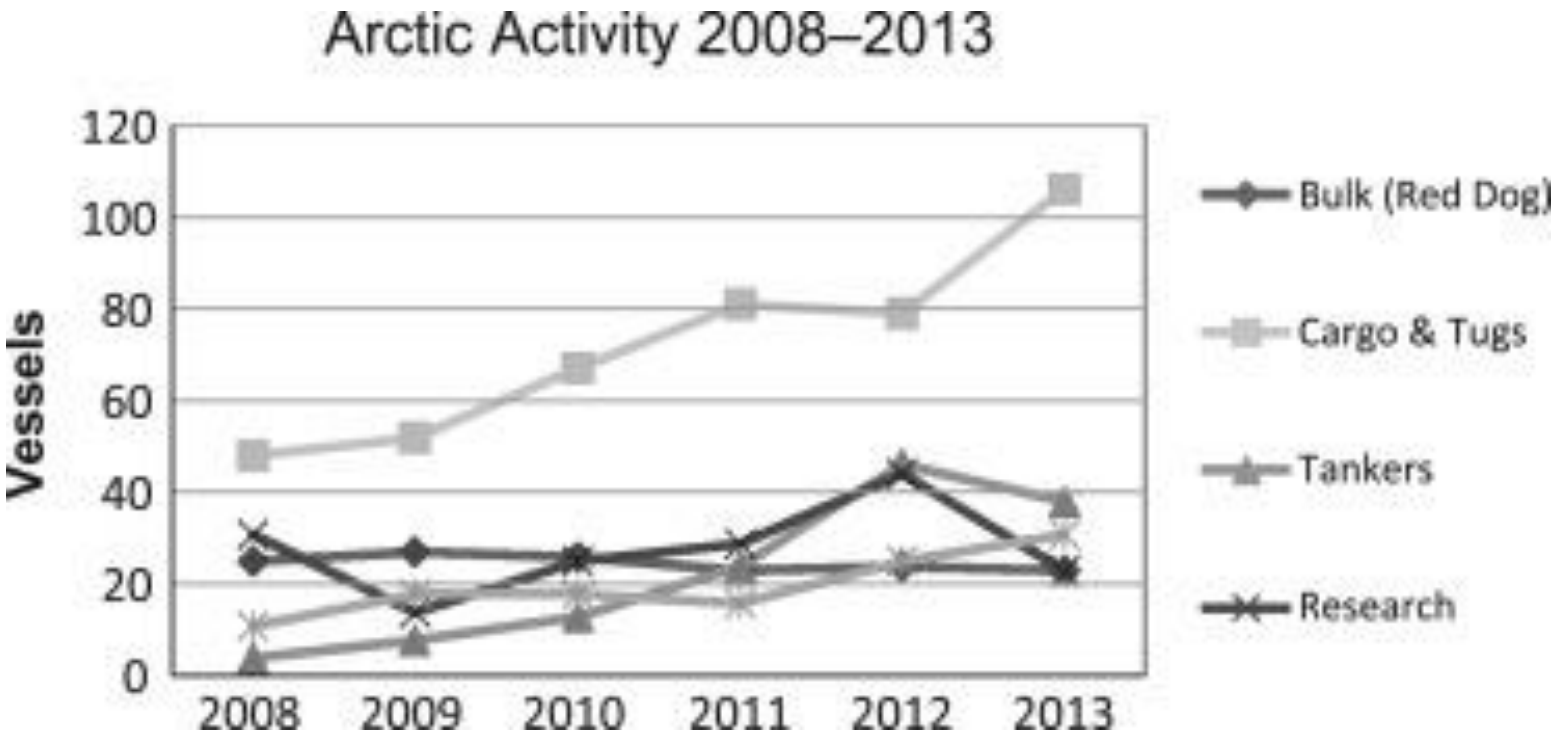
Marine Vessel Traffic

Figure 1.1. The OECD Industrial Production Index and indices for world GDP, merchandise trade and seaborne shipments (1975–2014) (base year 1990 = 100)



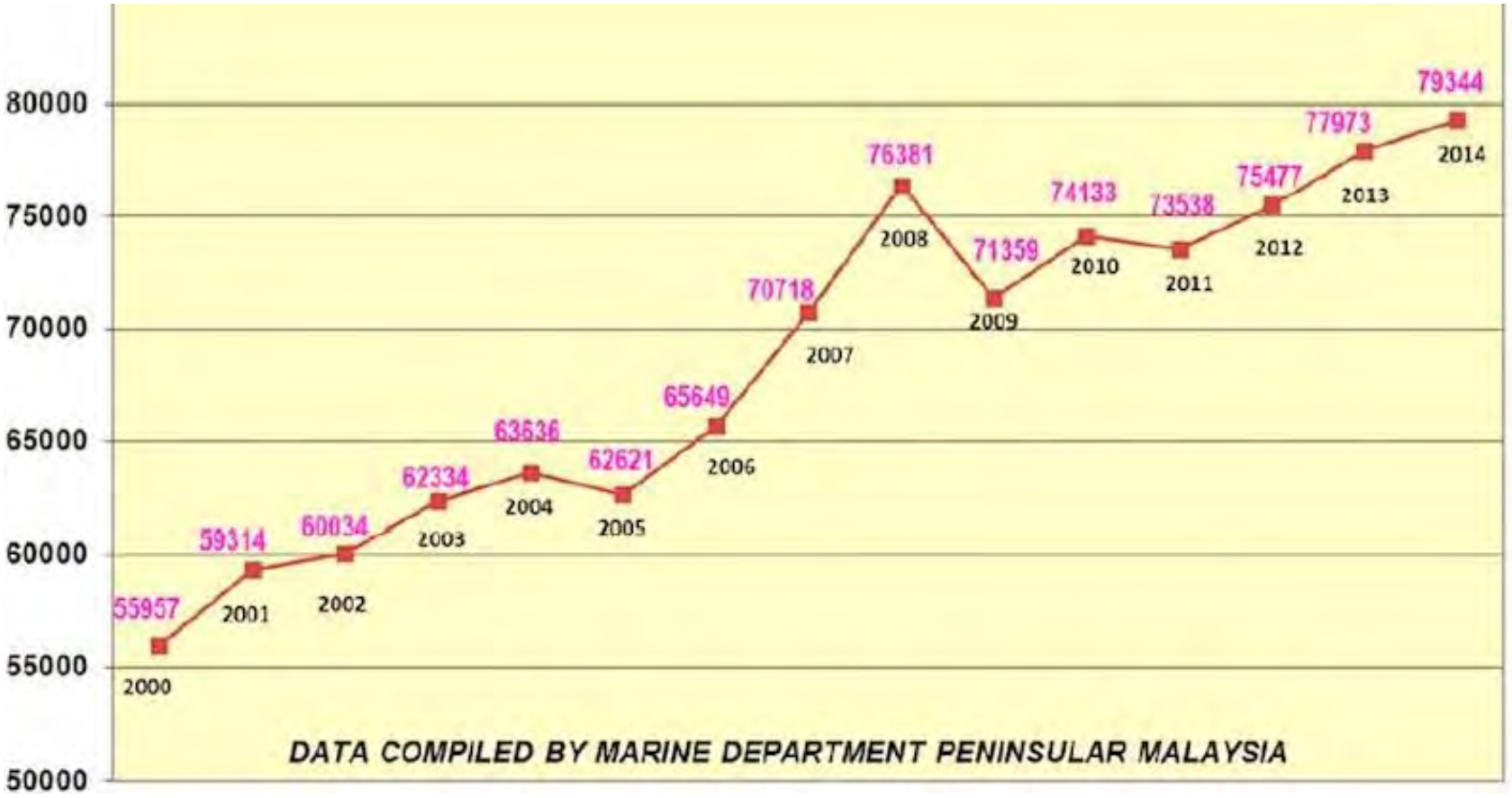
Sources: UNCTAD secretariat, based on OECD Main Economic Indicators, June 2015; United Nations Department of Economic and Social Affairs, 2015; LINK Global Economic Outlook, June 2015; UNCTAD *Review of Maritime Transport*, various issues; WTO, appendix table A1a, World merchandise exports, production and gross domestic product, 1950–2012; WTO press release 739, 14 April 2015.

Marine Vessel Traffic



Huntington et al., Vessels, risks, and rules: Planning for safe shipping in Bering Strait. Marine Policy, 2015.

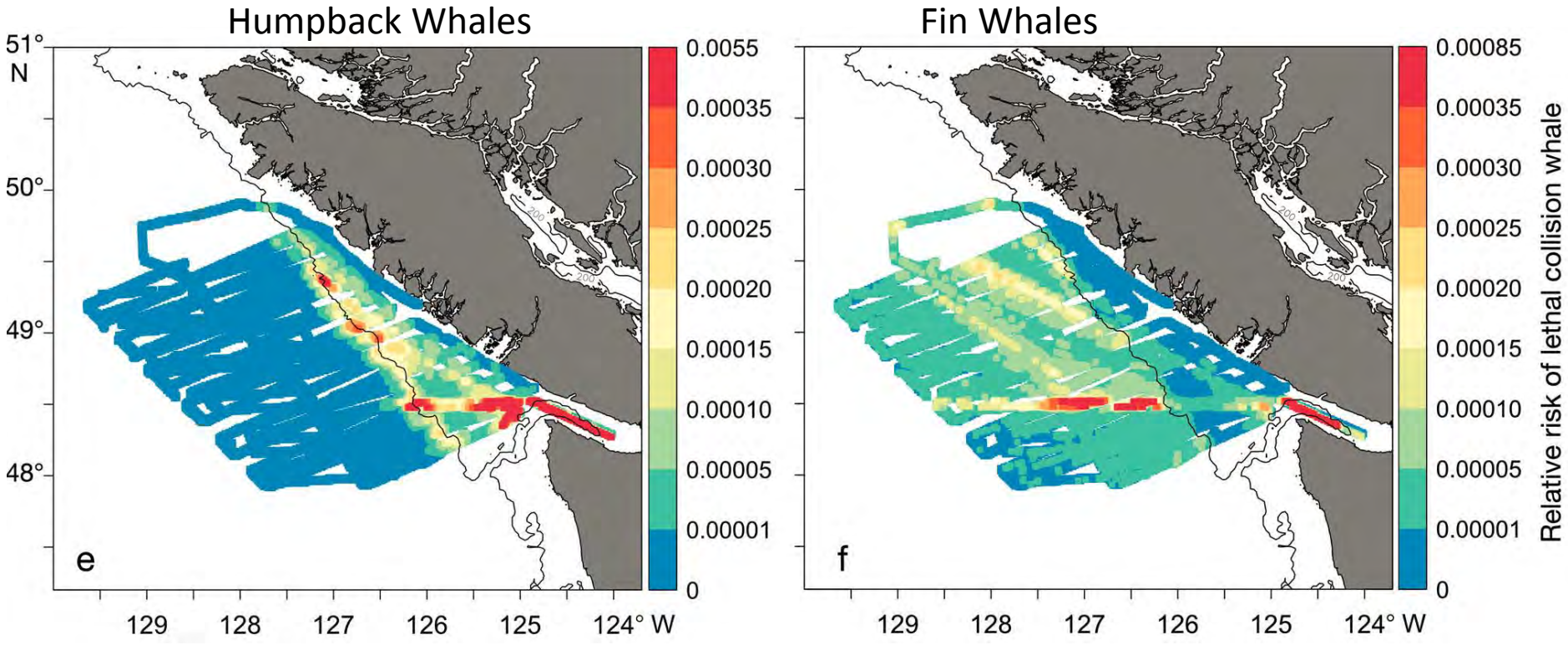
Marine Vessel Traffic



From: Seatrade Maritime News

Marine Vessel Traffic = Risk

1. Ship-strike



Nichol, L., Wright, B., O'Hara, P.D., and Ford, J.. **Risk of lethal vessel strikes to humpback and fin whales off the west coast of Vancouver Island, Canada. ESR , 2017**

Marine Vessel Traffic = Risk

1. Ship-strike
2. Introduced species

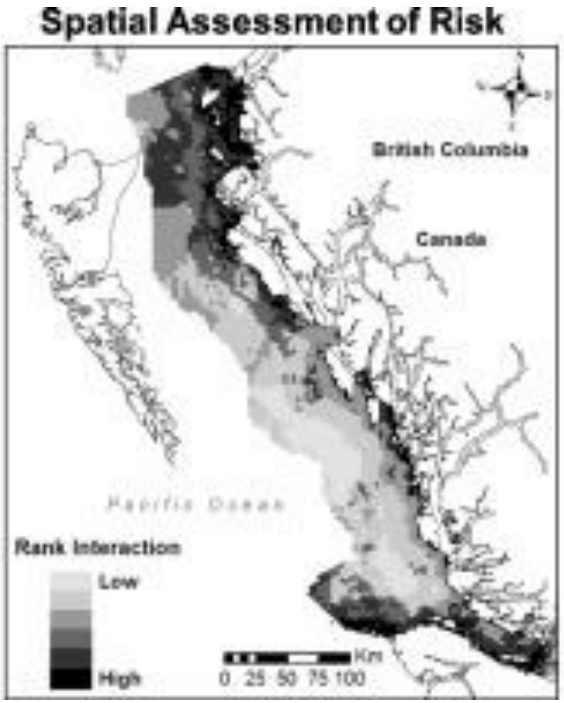
Marine Vessel Traffic = Risk

1. Ship-strike
2. Introduced species
3. Air Pollution

Marine Vessel Traffic = Risk

1. Ship-strike
2. Introduced species
3. Air Pollution
4. Oil pollution

Chronic Oil Pollution

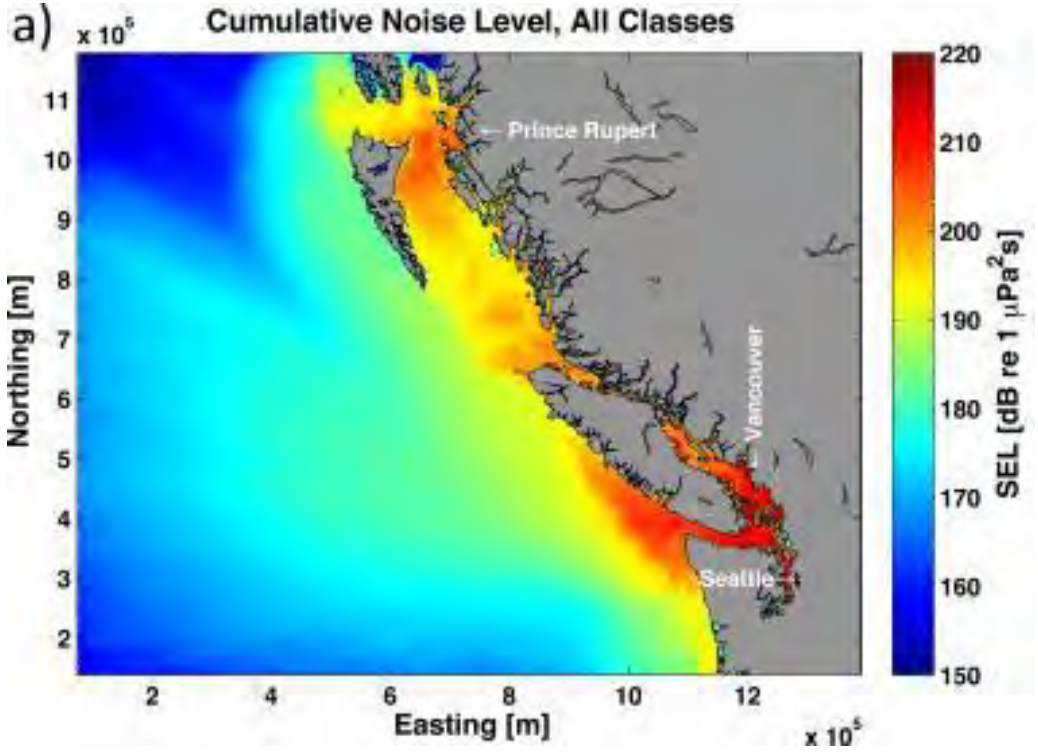


Marine Birds At Sea

Fox, FH, O'Hara, PD, Bertazzon, S, Morgan, KH, Underwood, FE, and, Paquet, PC. A preliminary spatial assessment of risk: Marine birds and chronic oil pollution on Canada's Pacific coast. **STOTEN**, 2016.

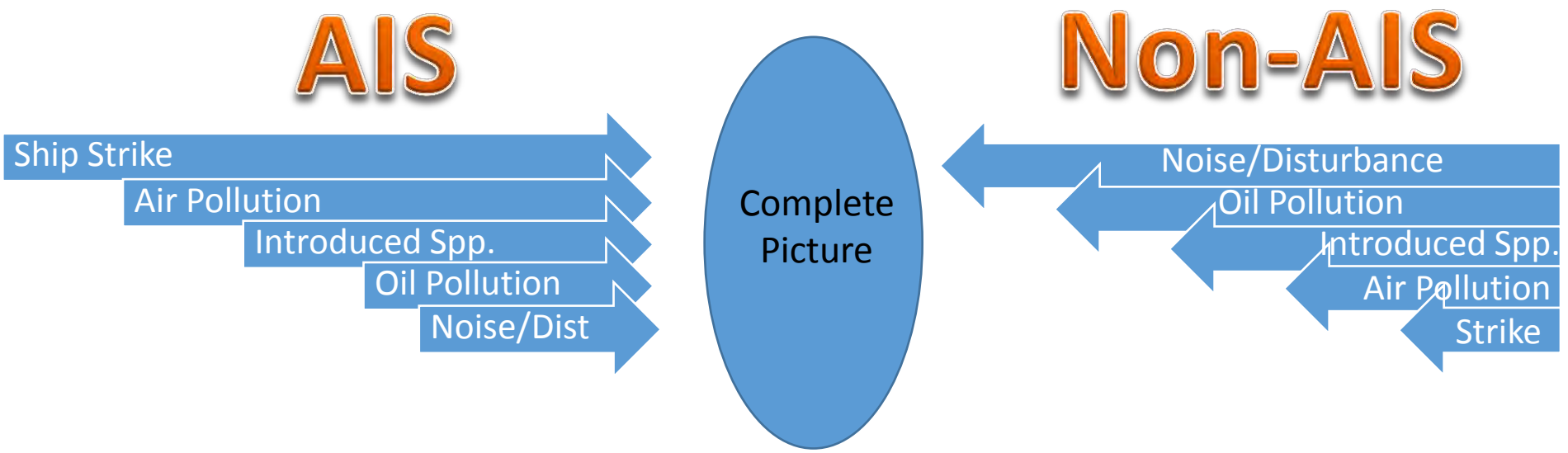
Marine Vessel Traffic = Risk

1. Ship-strike
2. Introduced species
3. Air Pollution
4. Oil pollution
5. Noise Pollution



Erbe, C. et al., **Mapping cumulative noise from shipping to inform marine spatial planning. JASA, 2012**

AIS = Marine Vessel Traffic = Risk ?



NEMES (Noise Exposure to Marine Ecosystems from Ships)

- 3 Main Study Areas:
  1. **Sachs Harbor** (Canadian Arctic)
  2. **Sgaan Kinghlas Bowie Seamount** (West of Haida Gwaii)
  3. **Salish Sea** (Southern BC)
- Project Objectives
  - Build reliable, comprehensive spatio-temporal **models of vessel movement**
  - Model **cumulative noise exposure** from marine vessels
  - Integrate vessel traffic models and noise exposure models to assist **decision making and outreach programs**

Focal questions for NEMES

- How can we better account for non-AIS) (smaller) boats?
- How can we better understand the acoustic interaction of marine vessels and marine mammals?
- What responsive and strategic measures can minimize impacts?

NEMES
Noise Exposure to the Marine Environment from Ships

NEMES – nonAIS and whales

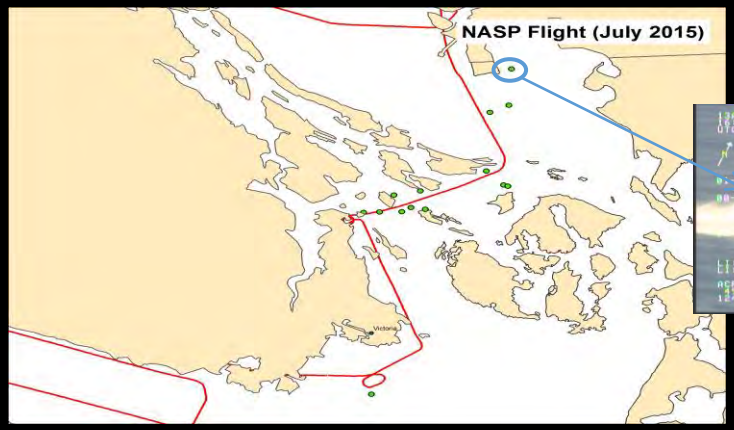
- Transport Canada's National Aerial Surveillance Program (NASP)
- Photographic Observation Study (POS)

NEMES
Noise Exposure to the Marine Environment from Ships

Small Vessels

Aerial surveys by the National Aerial Surveillance Program

- Collection of both AIS and non-AIS vessel data



Non-AIS vessel

University of Victoria

Environment Canada / Environnement Canada
Canadian Wildlife Service / Service canadien de la faune

NEMES

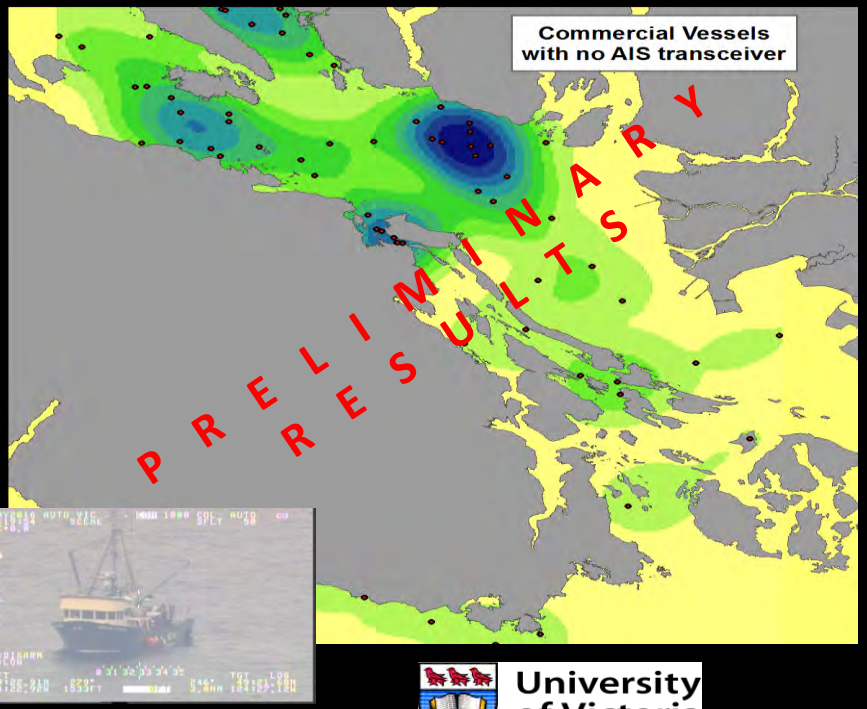
Noise Exposure to the Marine Environment from Ships

Small Vessels

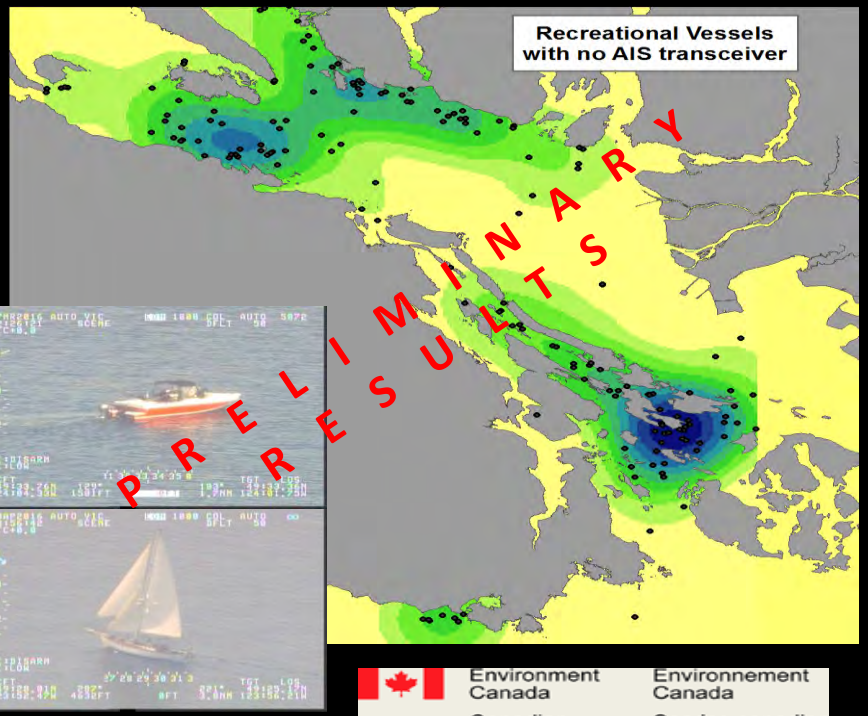
Small Vessels Distribution

NEMES
Noise Exposure to the Marine Environment from Ships

Commercial vessels with no AIS transceiver



Recreational vessels with no AIS transceiver



University of Victoria

Environment Canada | Environnement Canada
Canadian Wildlife Service | Service canadien de la faune

The ‘POS’ Unit

➢Photographic Observation Study Unit

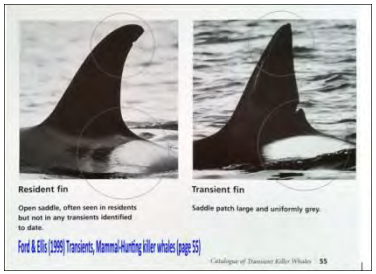
- Single board Raspberry Pi 3 Linux CPU.
- Canon DSLR controlled by a Python script.
- AIS receiver and antenna.
- Writing data to external HDD.
- Automatic restart to combat power outages.
- Enclosed in a weather proof box.
- Burst of three photos (5secs) every minute during daylight hours.
- Internet connection allows camera to be checked and modified remotely.

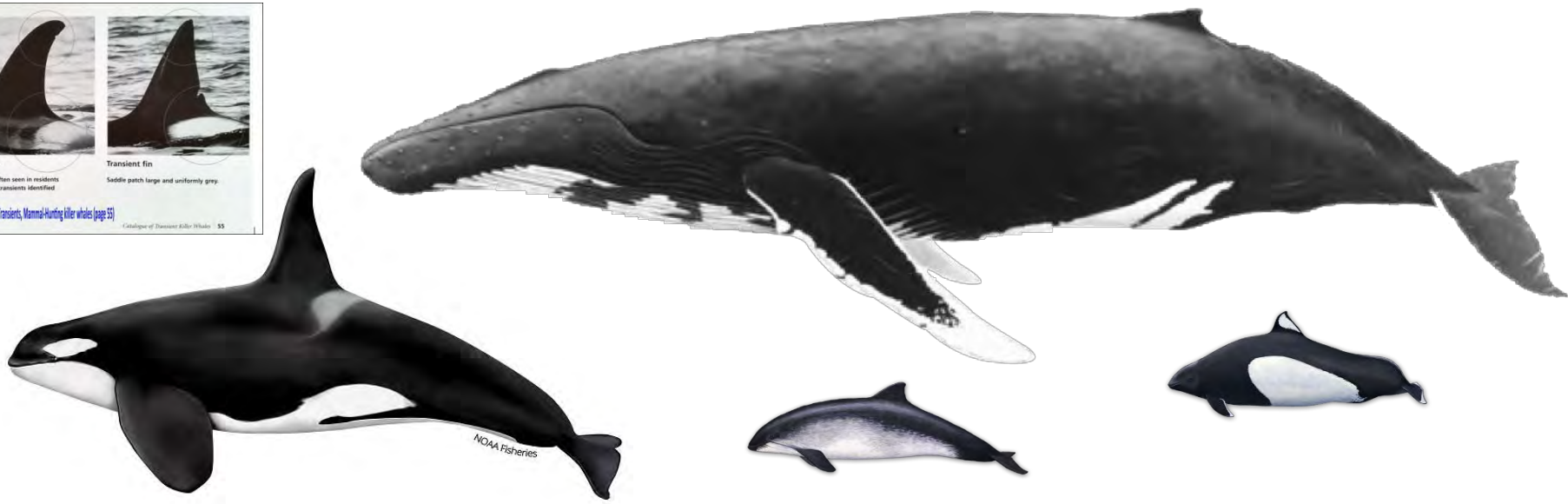

NYK LINE

Vessel moving right to left across the field of vision over 7 minutes.

Marine Mammal Data…

- Target Species: SRKW, Biggs KW, Humpback, Harbor and Dall's Porpoise
  - Identification if possible - many clues!
- Time stamp for cross reference with hydrophone data.
  - Are we seeing them and not seeing them?
  - With or without vessels present?
  - How many and what type of vessels are present?





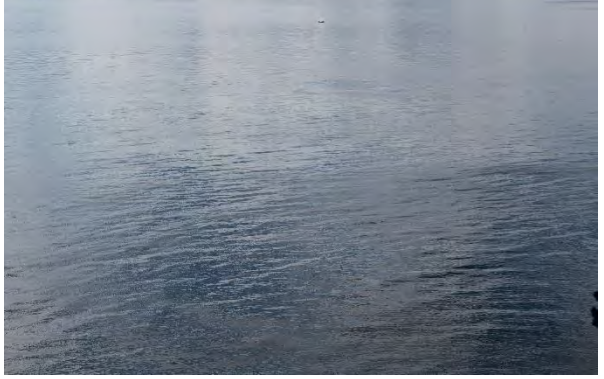

L-Pod

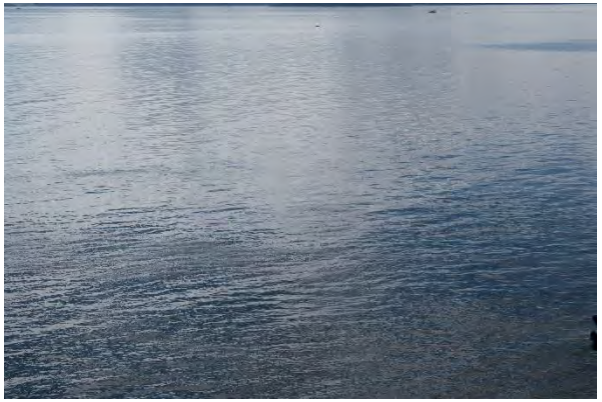
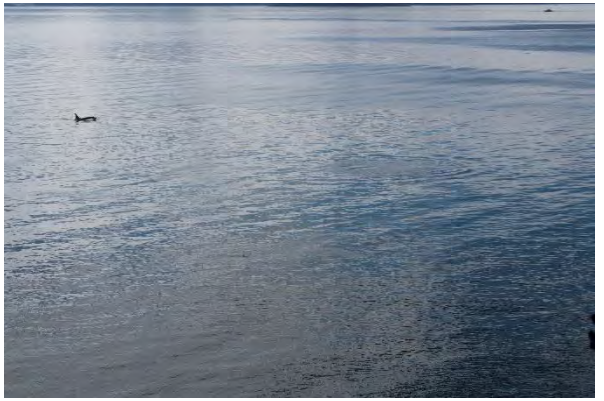
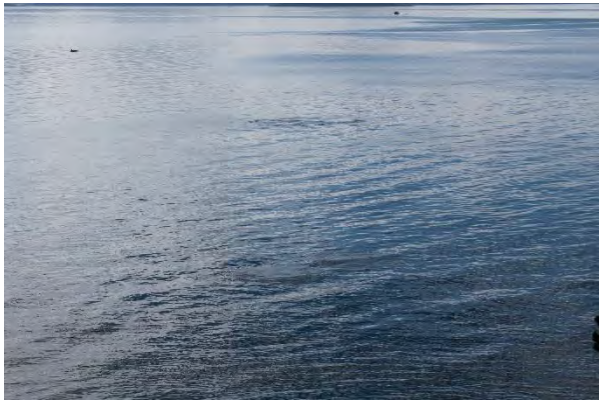
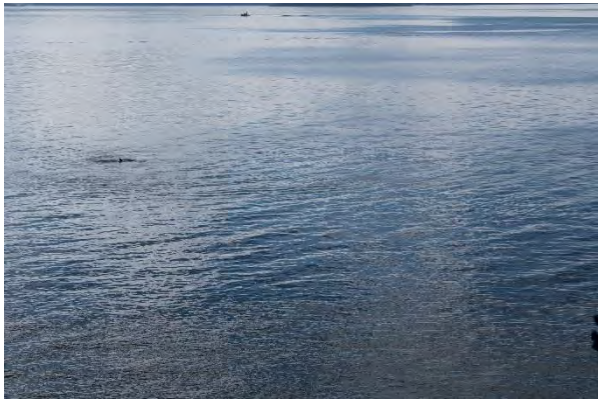
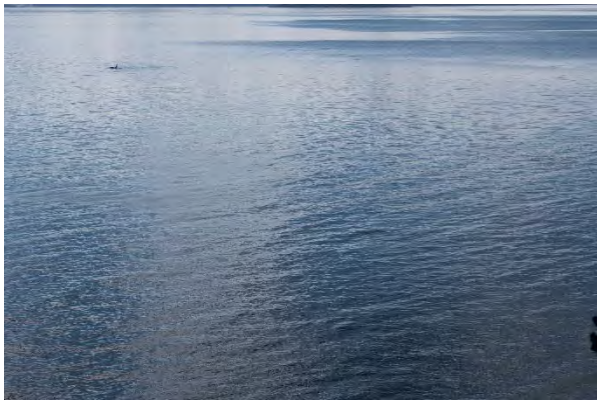
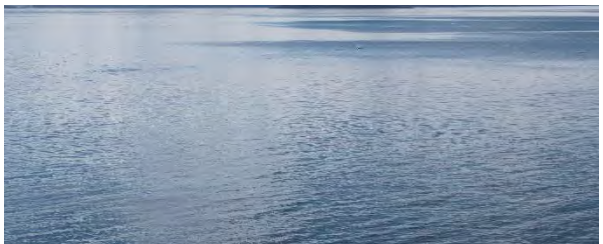
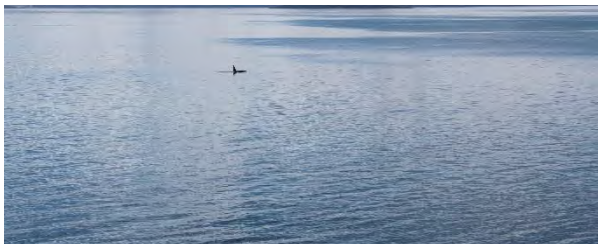

L-41


Transients


J-Pod

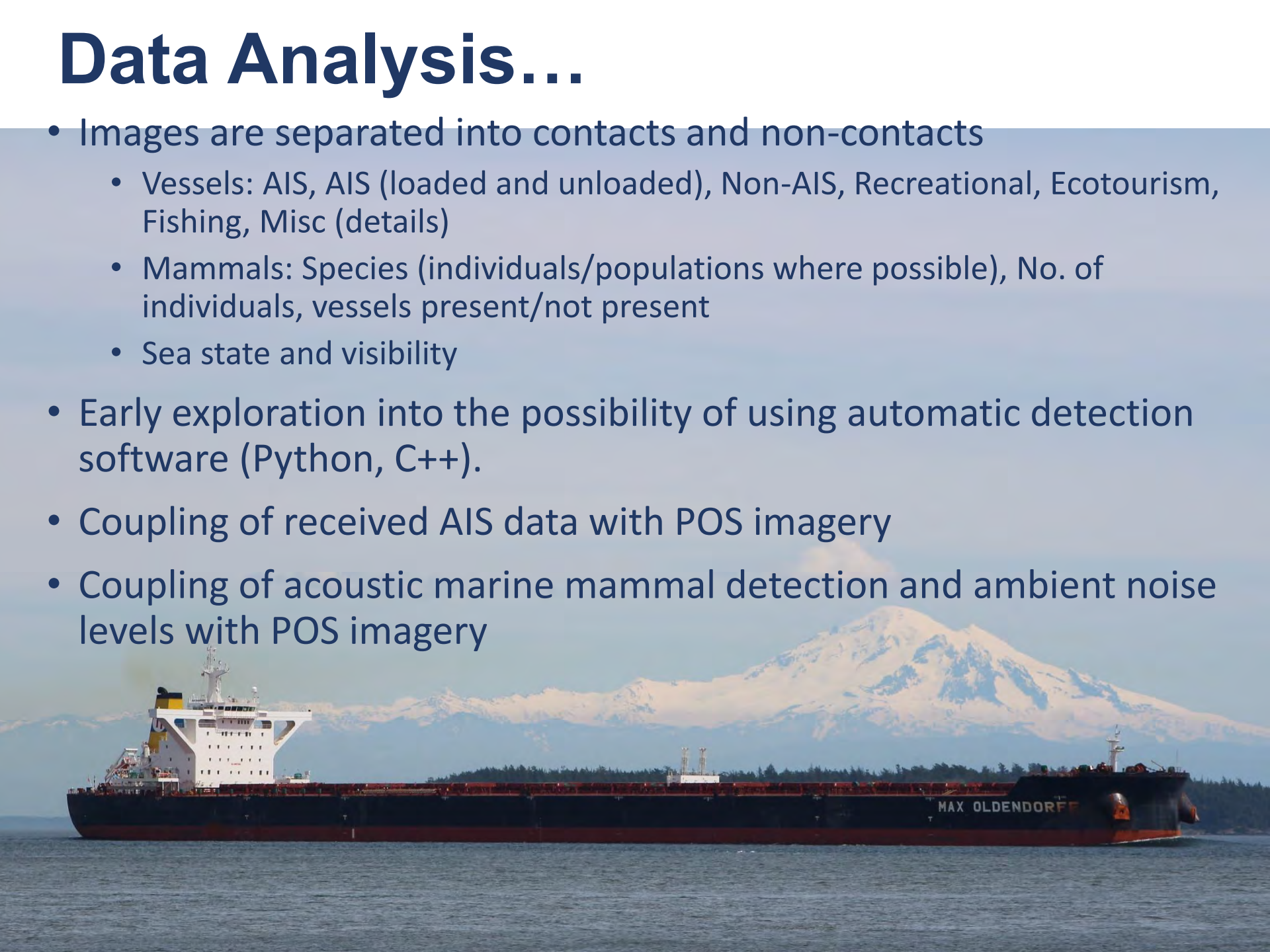





Data Analysis…

- Images are separated into contacts and non-contacts
  - Vessels: AIS, AIS (loaded and unloaded), Non-AIS, Recreational, Ecotourism, Fishing, Misc (details)
  - Mammals: Species (individuals/populations where possible), No. of individuals, vessels present/not present
  - Sea state and visibility
- Early exploration into the possibility of using automatic detection software (Python, C++).
- Coupling of received AIS data with POS imagery
- Coupling of acoustic marine mammal detection and ambient noise levels with POS imagery



спасибо!

Any Questions?