Beluga use of estuary habitats in the Western Hudson Bay

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Why do beluga use estuaries?

The Western Hudson Bay (WHB) beluga population occupies estuaries every summer. Investigating estuary habitat suitability can give insights on beluga biology.

Estuary habitat features that could explain beluga use[1]:

- Shallow waters protect from predators
- Warm water is beneficial for growth of young beluga and molting
- Estuary habitat is rich in prey

Study site

The summer habitat for WHB belugas, with high abundance areas in the Nelson, Churchill, and Seal estuaries. Tracklogs (blue) of the aerial photographic survey from the summer 2018 BaySys cruise.

Spatial analysis of beluga locations and habitat features can explain why beluga occupy estuaries and the patterns in habitat use.

Methods

- Beluga locations marked in ArcMap from georeferenced aerial photos
- Age class determined
- Overlap eliminated
- Distance from coast, age class, and estuary (Nelson, Churchill or Seal) used for habitat comparisons
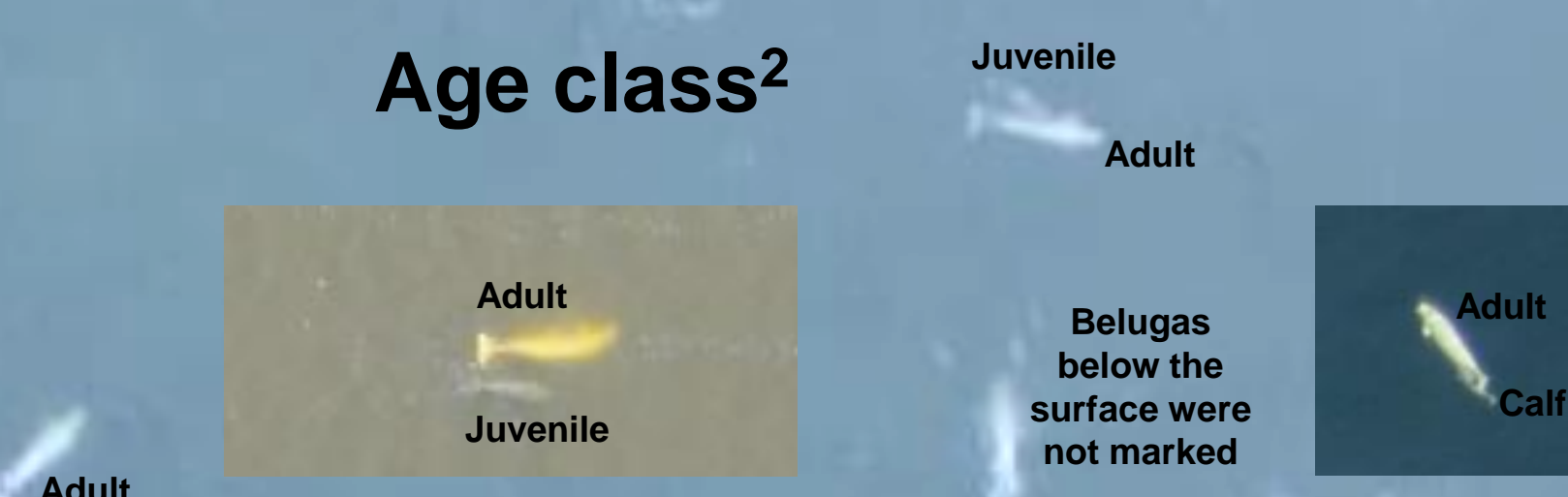

Age Class
- ○ Adult
- ● Juvenile
- ● Calf
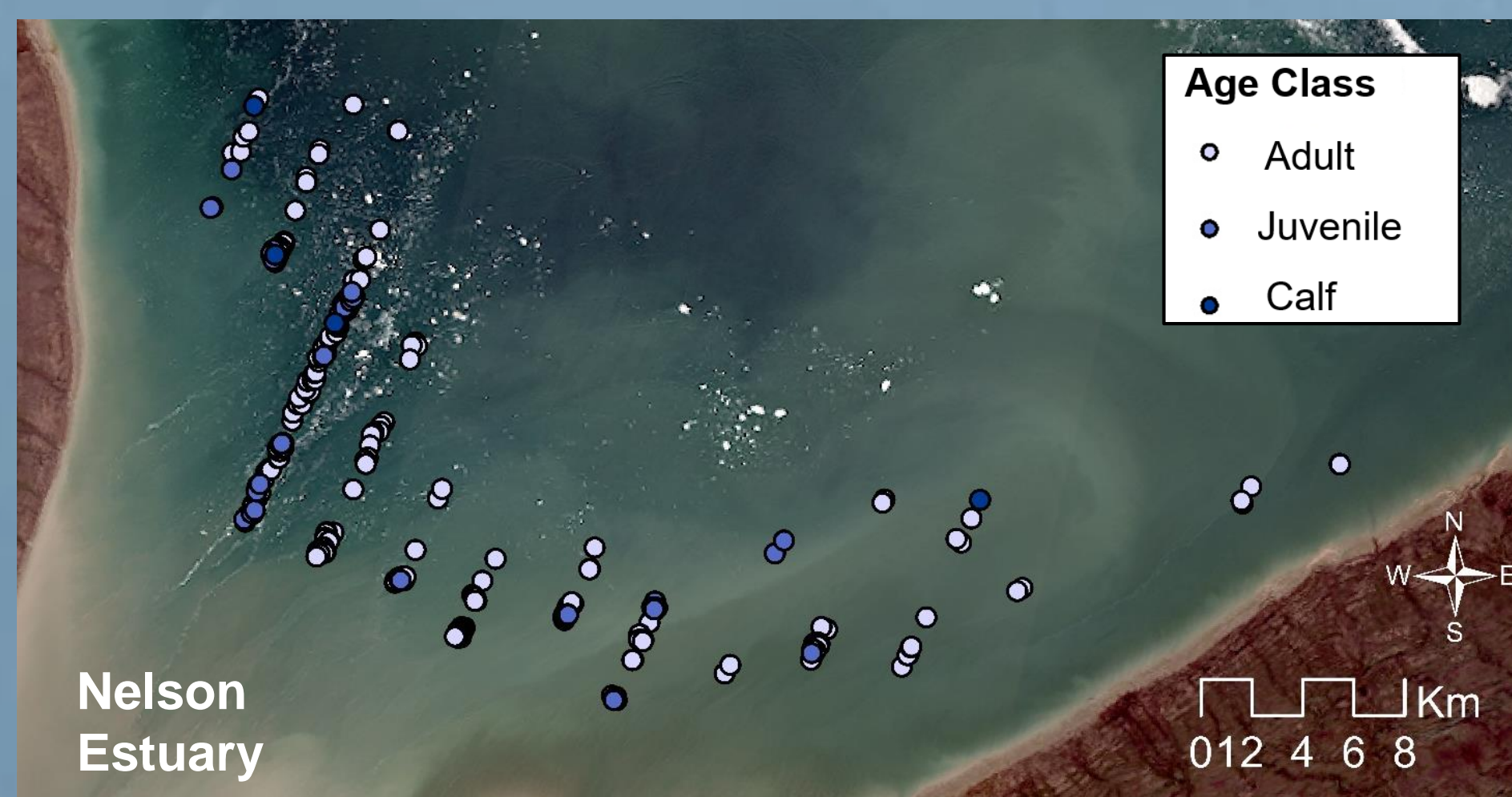
Locations of beluga adults, juveniles and calves in the Seal, Churchill, and Nelson estuaries, marked from aerial photos
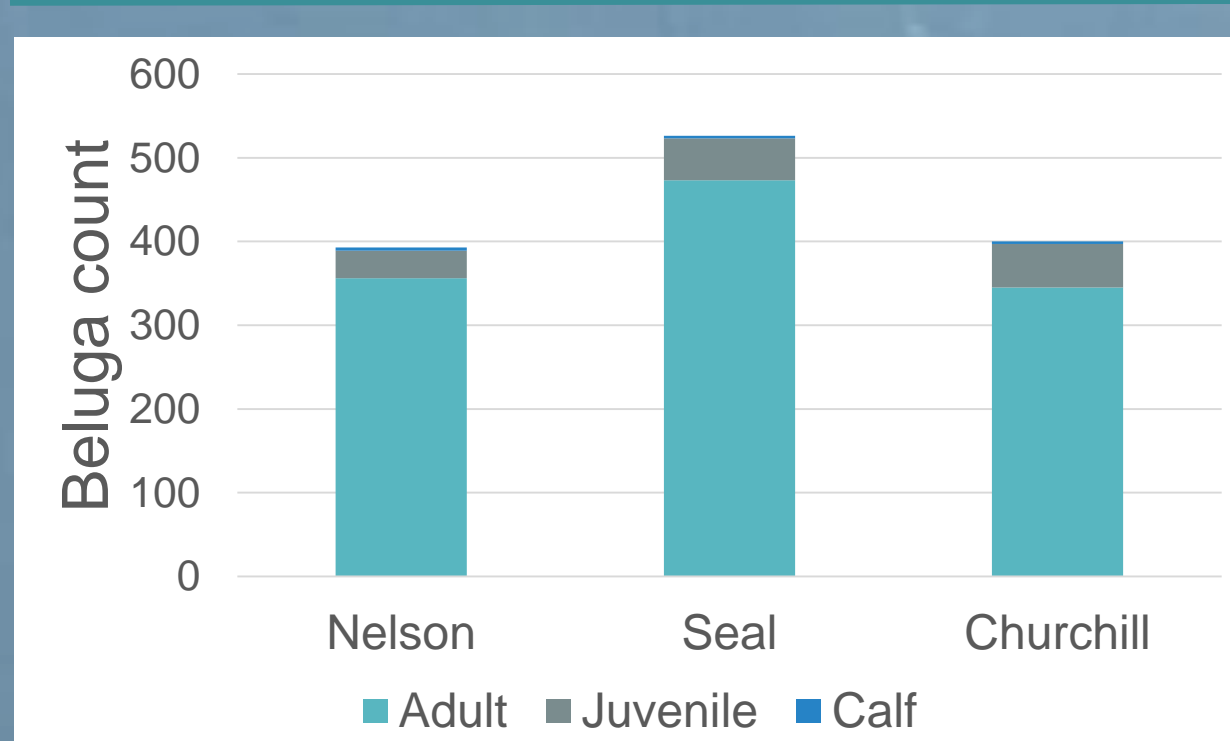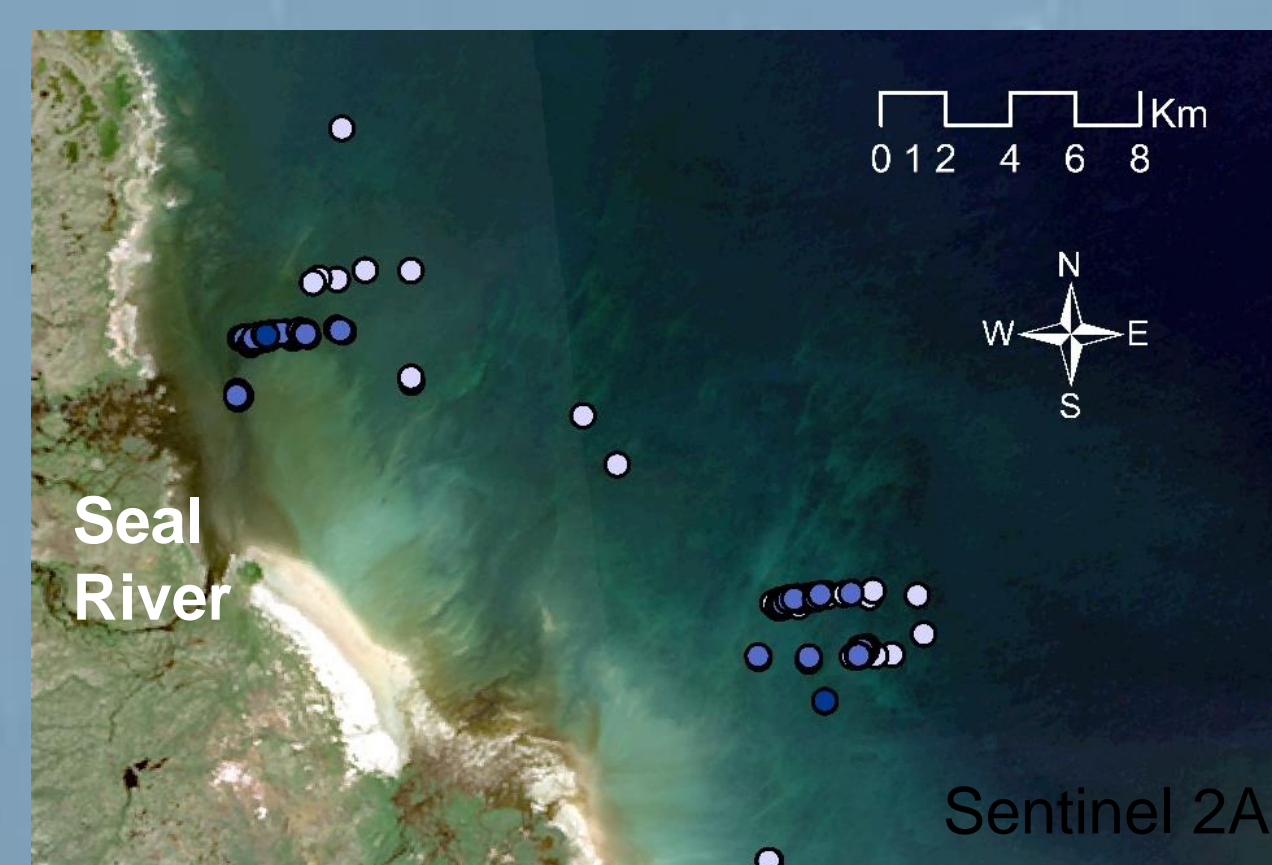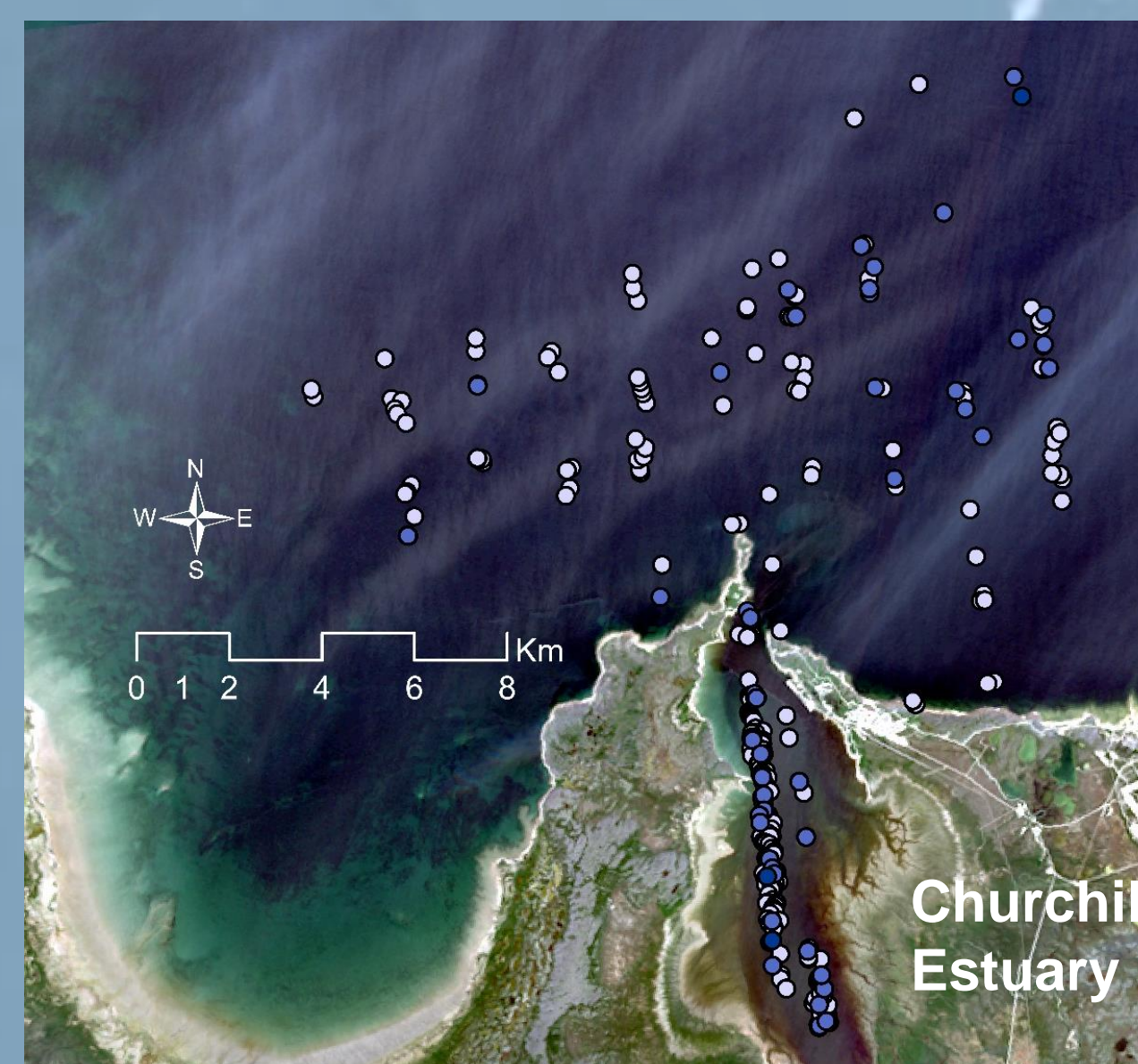
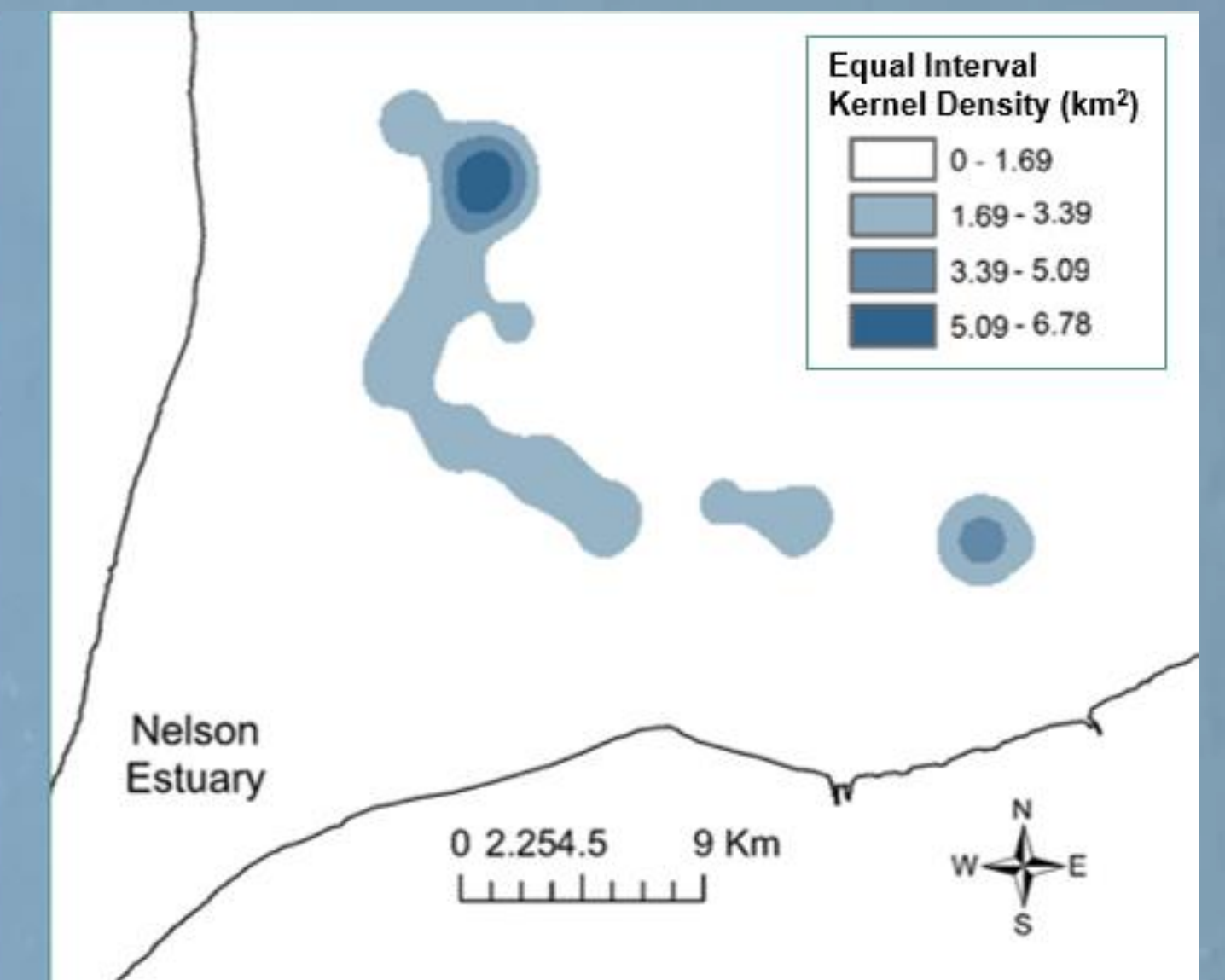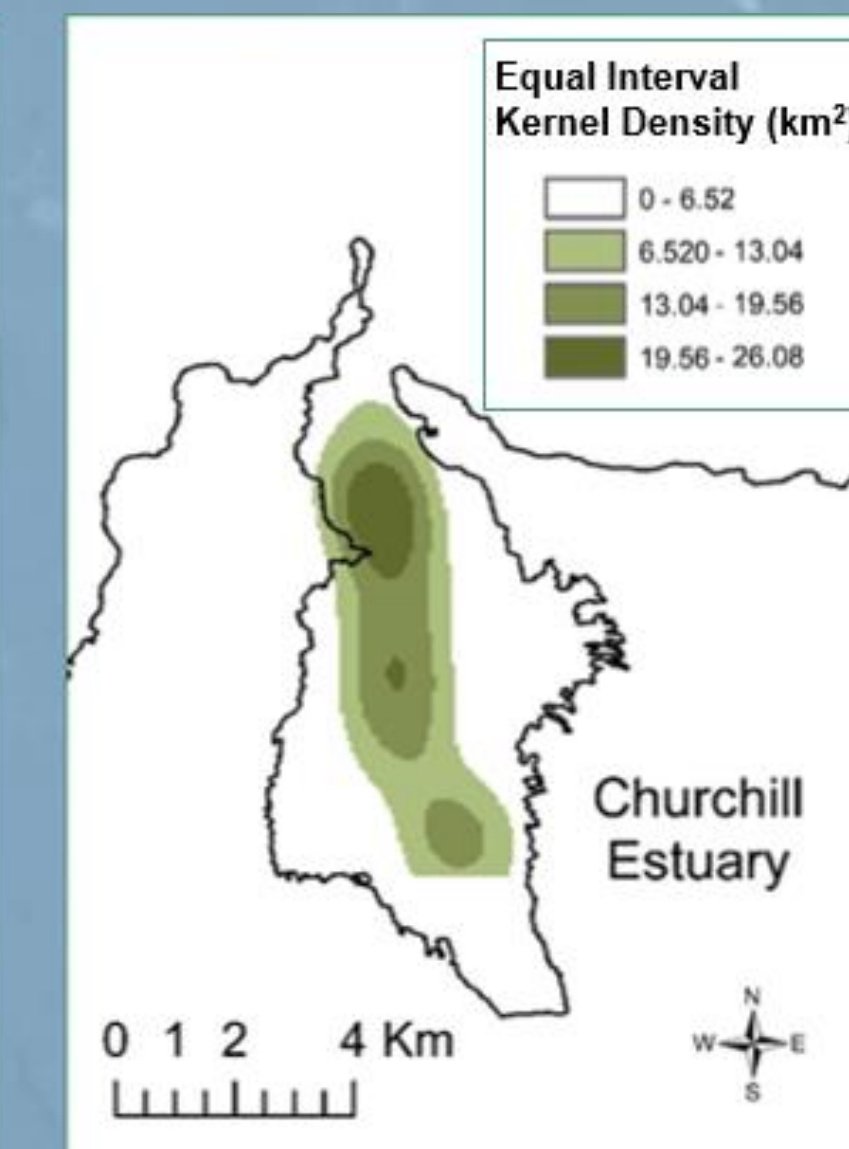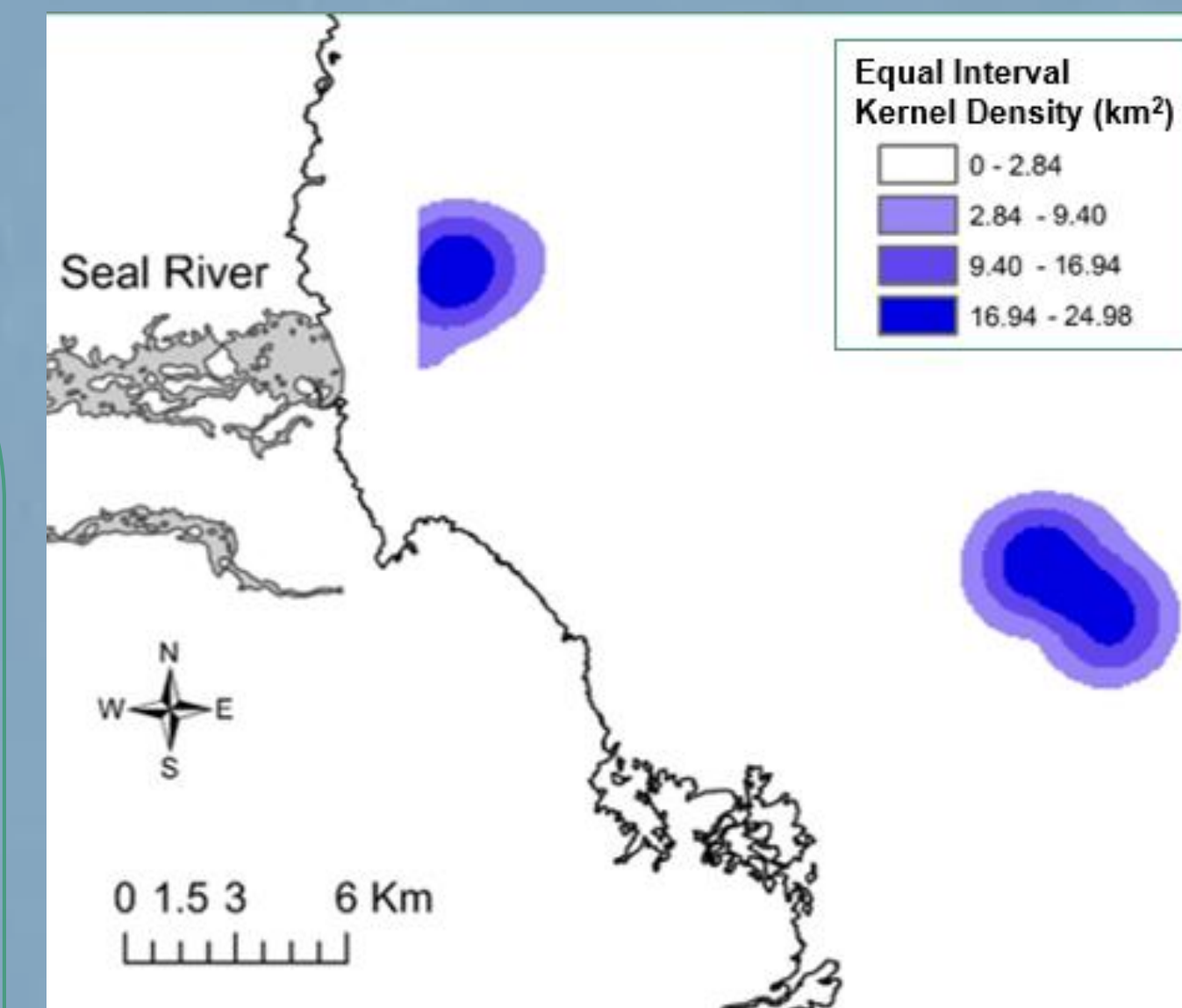Total count of belugas from each estuary

Age class[2]

Belugas below the surface were not marked

Adult: white, full size
Juvenile: between 1/2 - 2/3 adult length, grey
Calf: <1/2 of adult body length, dark, located near adult

Results

Results for Kernel Density analysis for beluga in the Seal, Churchill, and Nelson estuaries

Beluga in the Churchill estuary have the highest 4th quartile density (19.5 - 26 belugas/km^2)

Distance from shore ranged between 23m and 13,228m

WHB beluga distribution is not random

Kolmogorov-Smirnoff (KS) test showed beluga distances from shore by estuary were significantly different from randomly selected location distances ($p < 2.2e-16$)
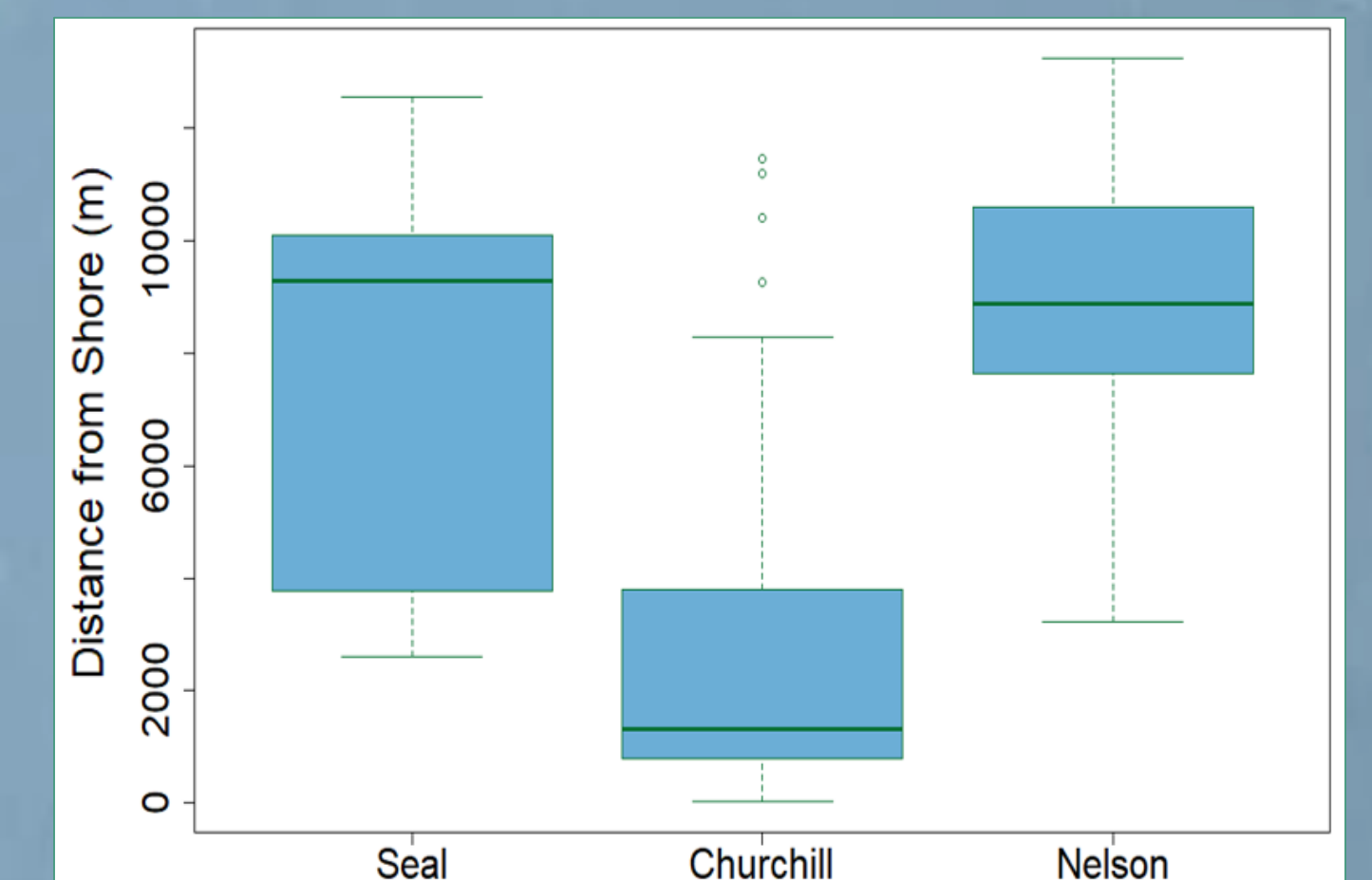
Age class, location, and distance to shore
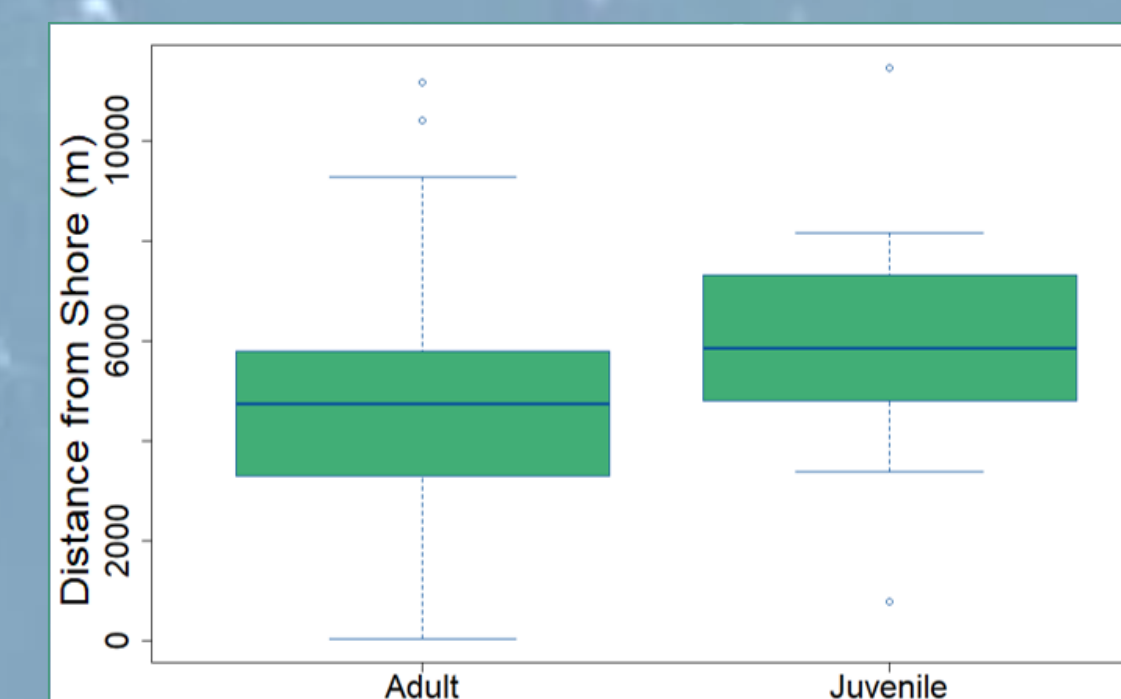
Distances of Churchill beluga from shore by age class. KS test rejected null hypothesis (p-value = 0.0074)

Beluga distances from shore differed based on location

Distance from shore differed based on age class in the Churchill Estuary

Distances of beluga from shore in each estuary. Kruskal-Wallis rank sum test rejects null hypothesis (p-value < 2.2e-16)

Significance: critical habitat

- Increased shipping traffic to the Port of Churchill could negatively impact belugas

- Habitat associations from spatial analysis can be used to map critical WHB beluga habitat

- This work will improve beluga management decisions and can contribute to the creation of a National Marine Conservation Area that would insure success of WHB beluga in a changing habitat
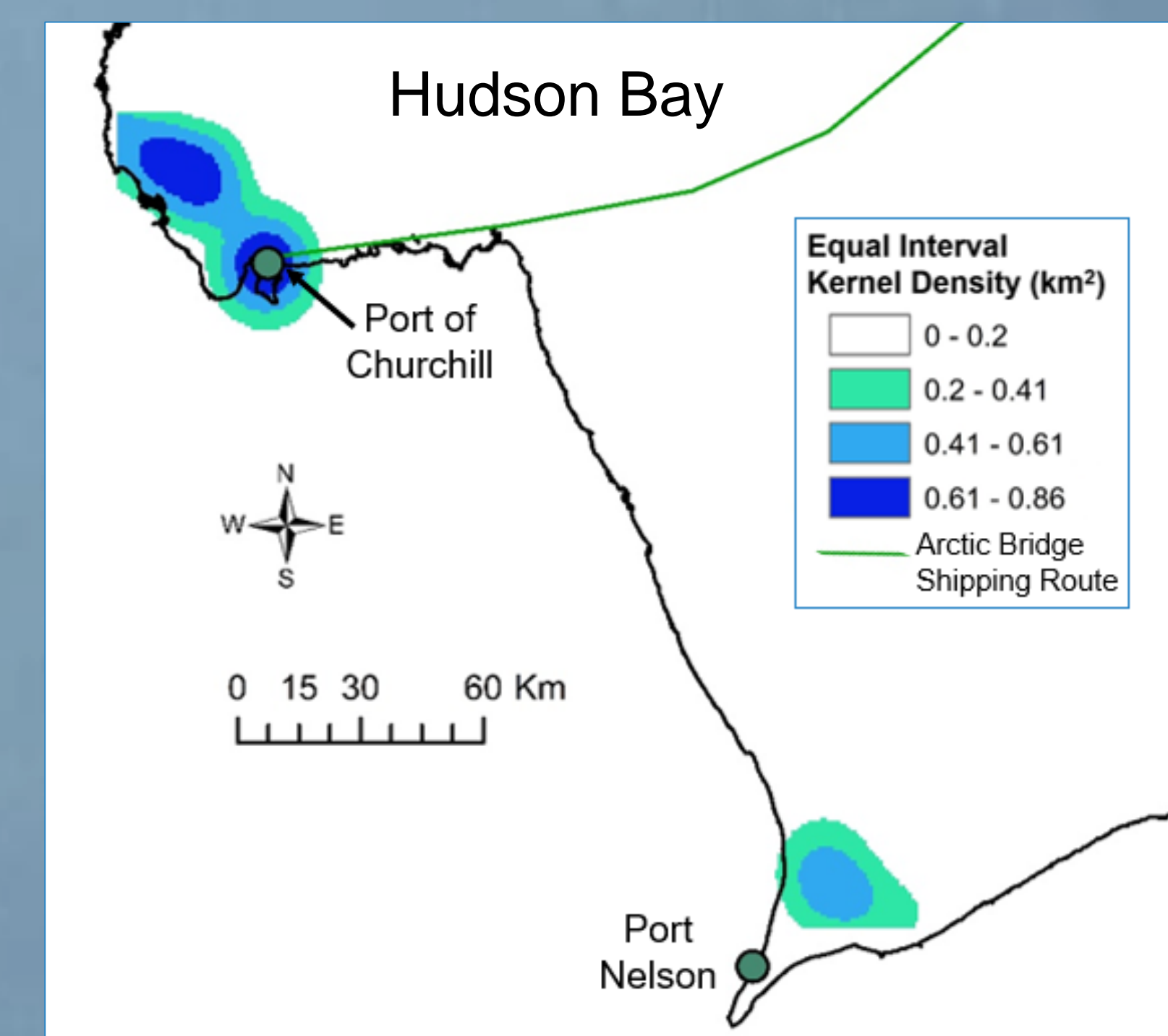
Results from Kernel Density analysis for all estuaries, showing potential critical habitat boundaries, with the Arctic Bridge shipping lane[3]

References:
1. Smith, A. J. Beluga whale (Delphinapterus leucas) use of the Nelson River Estuary, Hudson Bay. 187 (2007).
2. Krasnova, V. V., Bel'kovich, V. M. & Chernetskii, A. D. Formation of behavior in the White Sea beluga calf, Delphinapterus leucas, during early postnatal ontogenesis. *Russ. J. Mar. Biol.* **35**, 53–59 (2009).
3. Dawson, J., Pizzolato, L., Howell, S. E. L., Copland, L. & Johnston, M. E. Temporal and spatial patterns of ship traffic 1990 to 2015. *Arctic* **71**, 15–26 (2018).