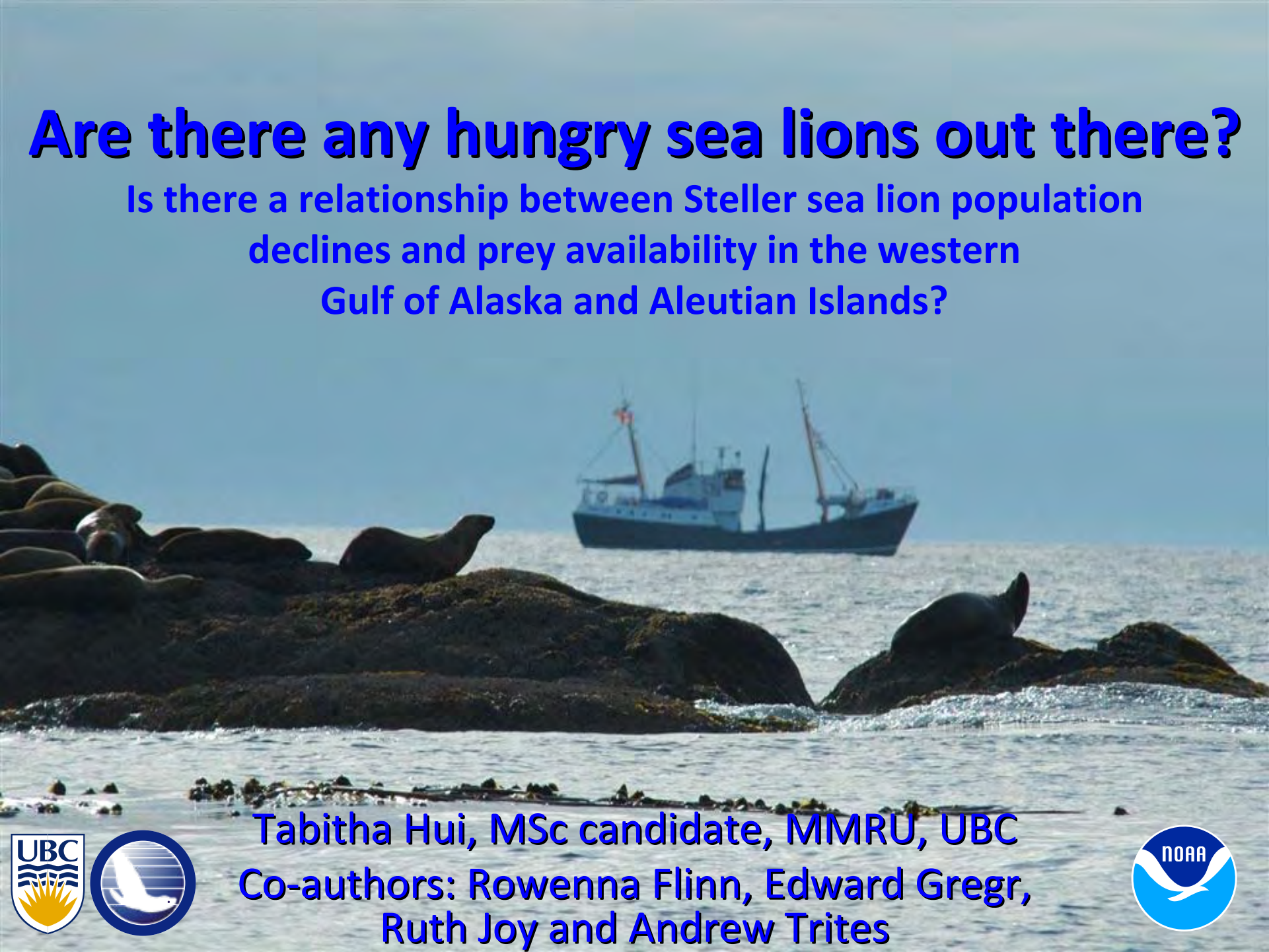
Are there any hungry sea lions out there?

Is there a relationship between Steller sea lion population declines and prey availability in the western Gulf of Alaska and Aleutian Islands?



Tabitha Hui, MSc candidate, MMRU, UBC

Co-authors: Rowenna Flinn, Edward Gregr, Ruth Joy and Andrew Trites

Why are Steller sea lions not recovering?

competition with fisheries

predation

Prey limitation

climate change

pollution

competition with other species

human disturbance

parasites & disease

by catch

hunting

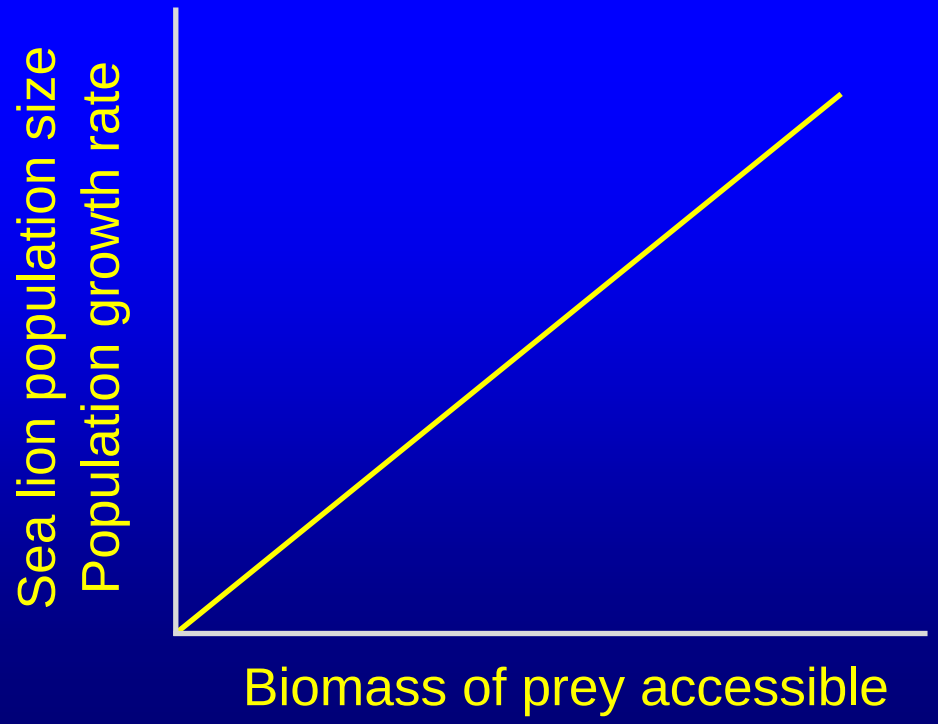
Competition with fisheries

Interspecific competition is an interaction between individuals of different species, brought about by a shared requirement for a ***resource in limited supply***

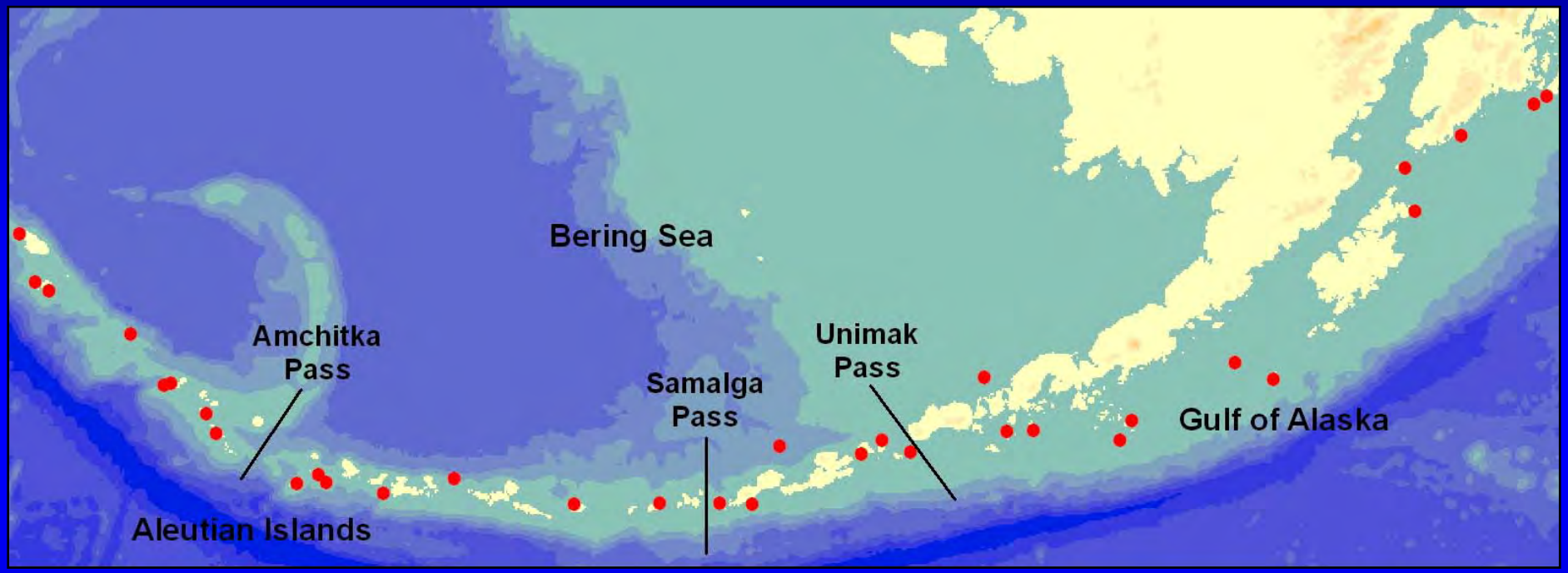
Research objectives

To determine whether there is a relationship between sea lion population trends and:

1. biomass of prey accessible in absence of fishing
2. biomass accessible after accounting for fishery removals



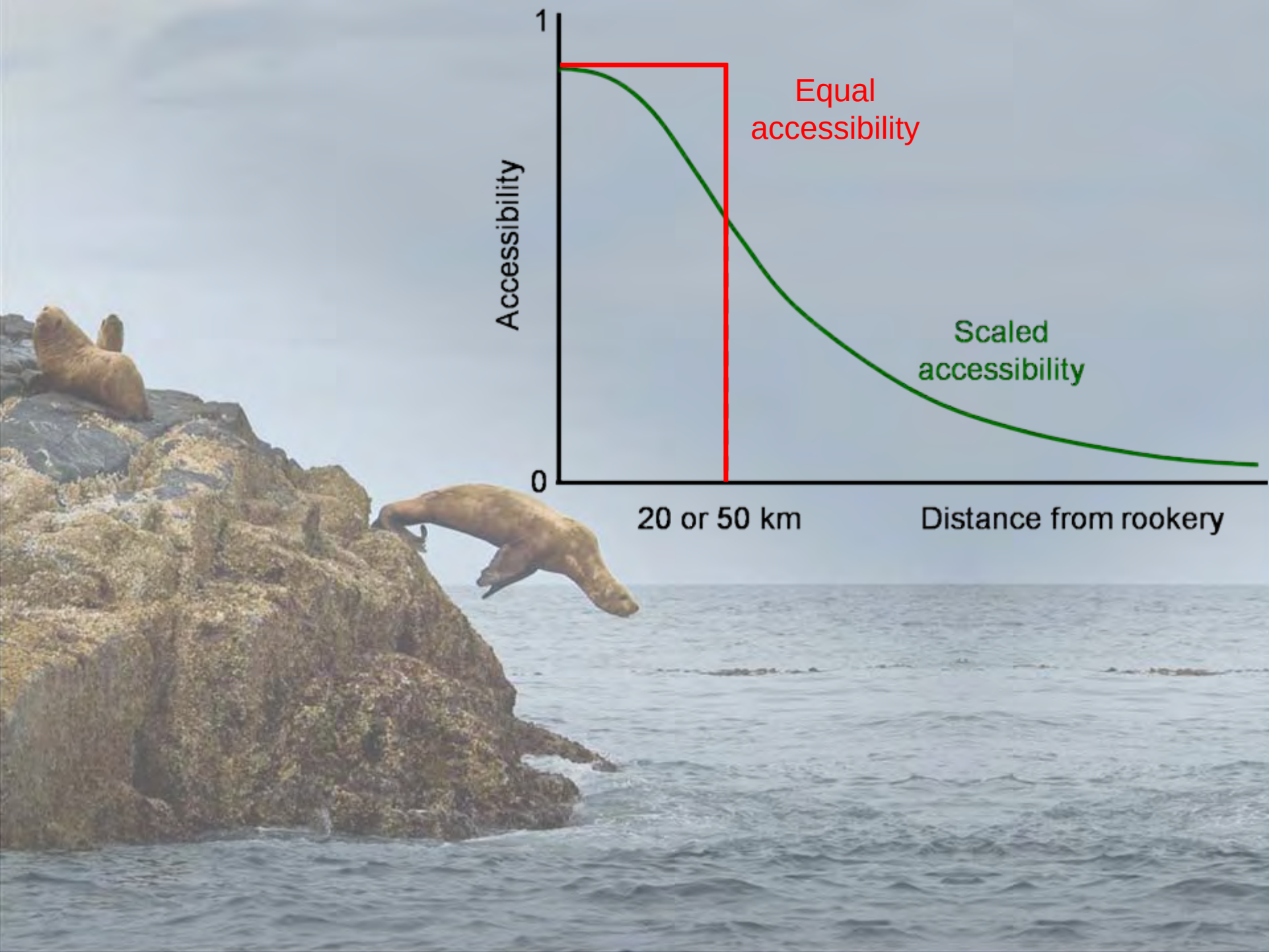
Study area



33 rookeries in four oceanographically distinct regions across the Aleutian Islands, Bering Sea and Gulf of Alaska

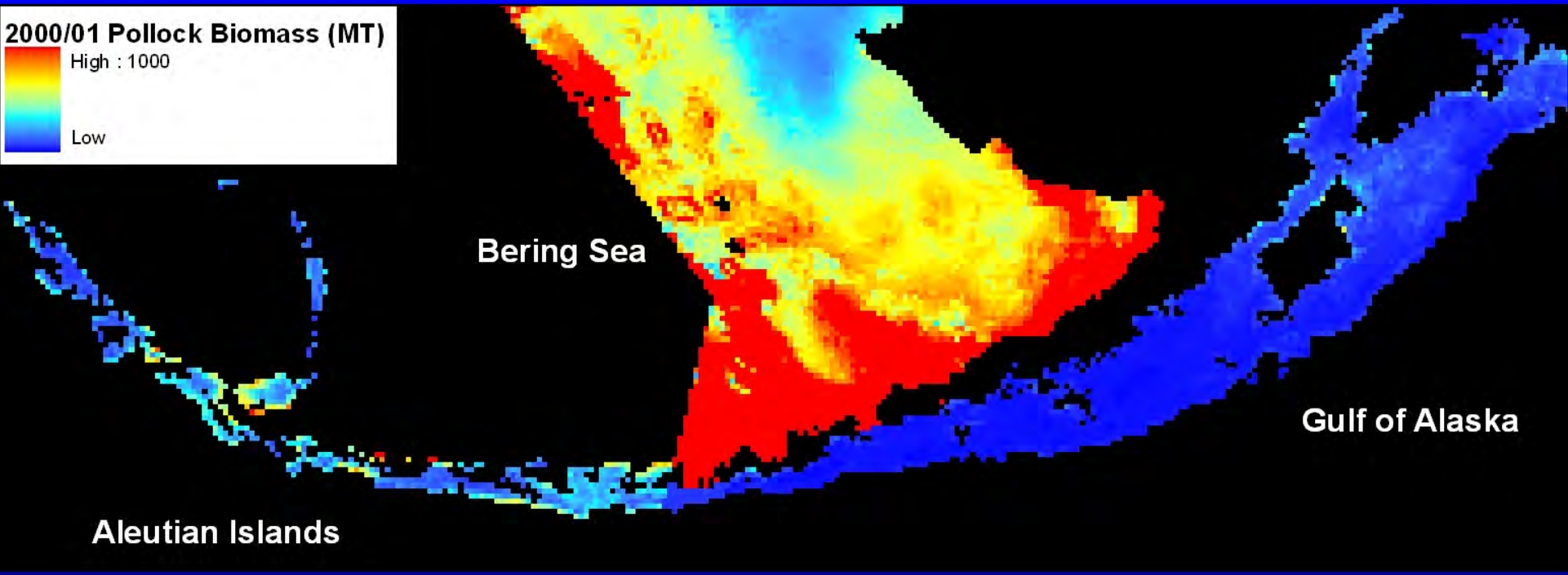
Prey accessibility?

- Accessibility is the likelihood of a sea lion encountering prey
- Sea lions rest on land and spend the majority of their time foraging close to these sites
- So prey accessibility should be highest closest to the rookeries
- How to model?


1
Accessibility
0
Equal
accessibility
Scaled
accessibility
20 or 50 km
Distance from rookery

How are prey distributed?

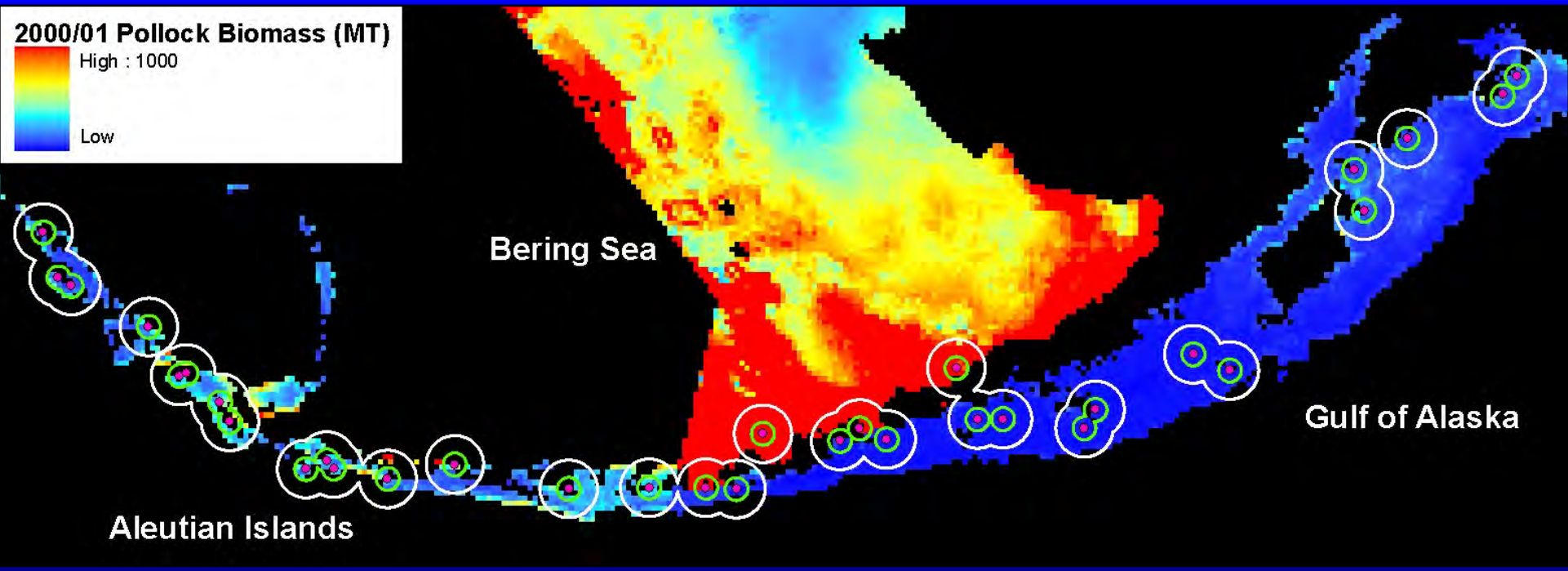
- Prey biomass distribution maps – walleye pollock, Pacific cod, Atka mackerel (R. Flinn, unpublished data)
- Derived from NMFS trawl survey data using Generalized Least Square models
- Aleutian Islands: 2000/02/04, Bering Sea: 2000-2004, Gulf of Alaska 2001/03



Predicted biomass of walleye pollock available in the Aleutian Islands (2000), Bering Sea (2001) and Gulf of Alaska (2001)

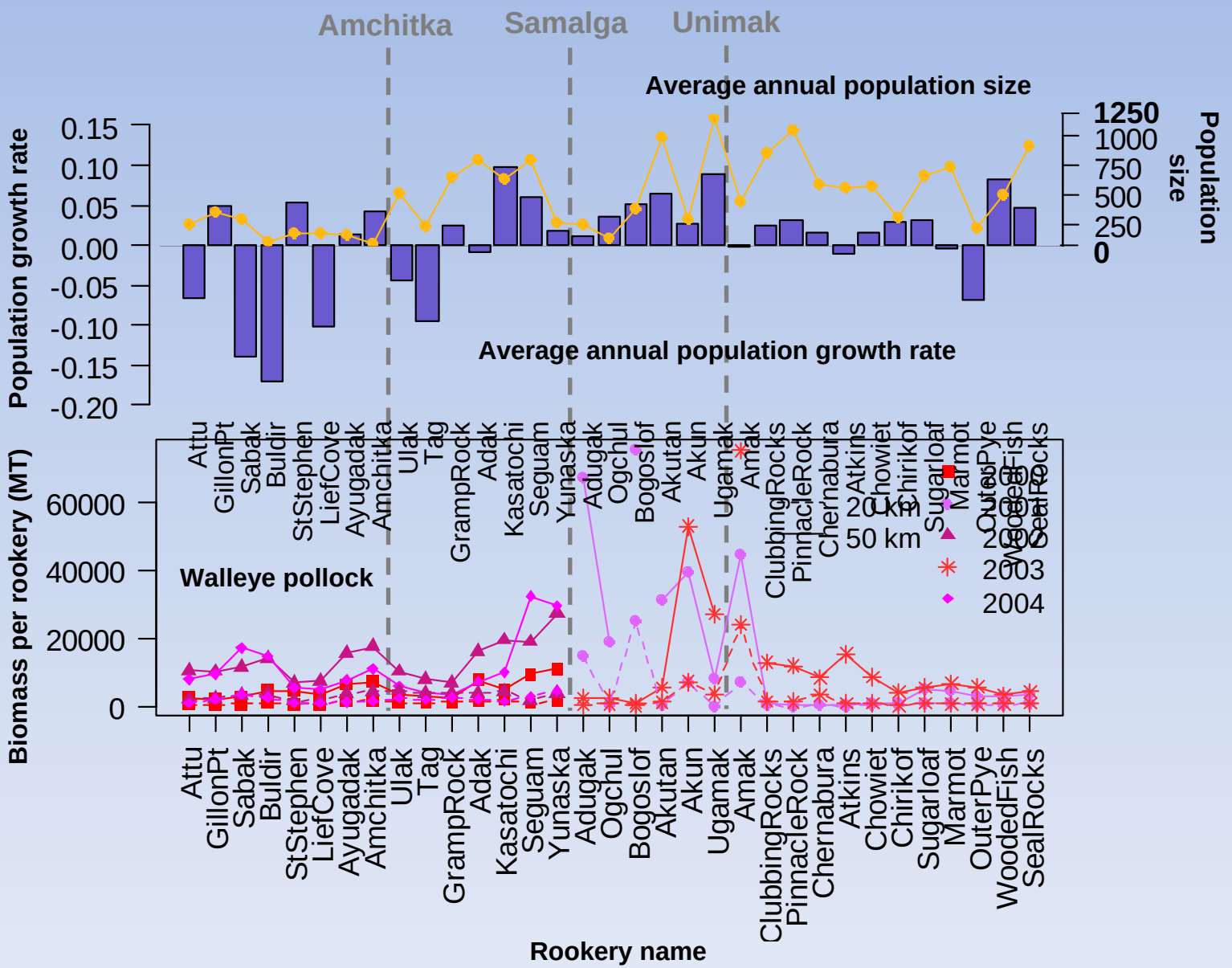
Prey biomass accessible to sea lions

- Prey accessibility model values at each distance were multiplied by the prey biomasses available at those locations
- Accessible prey biomass was summed for each rookery

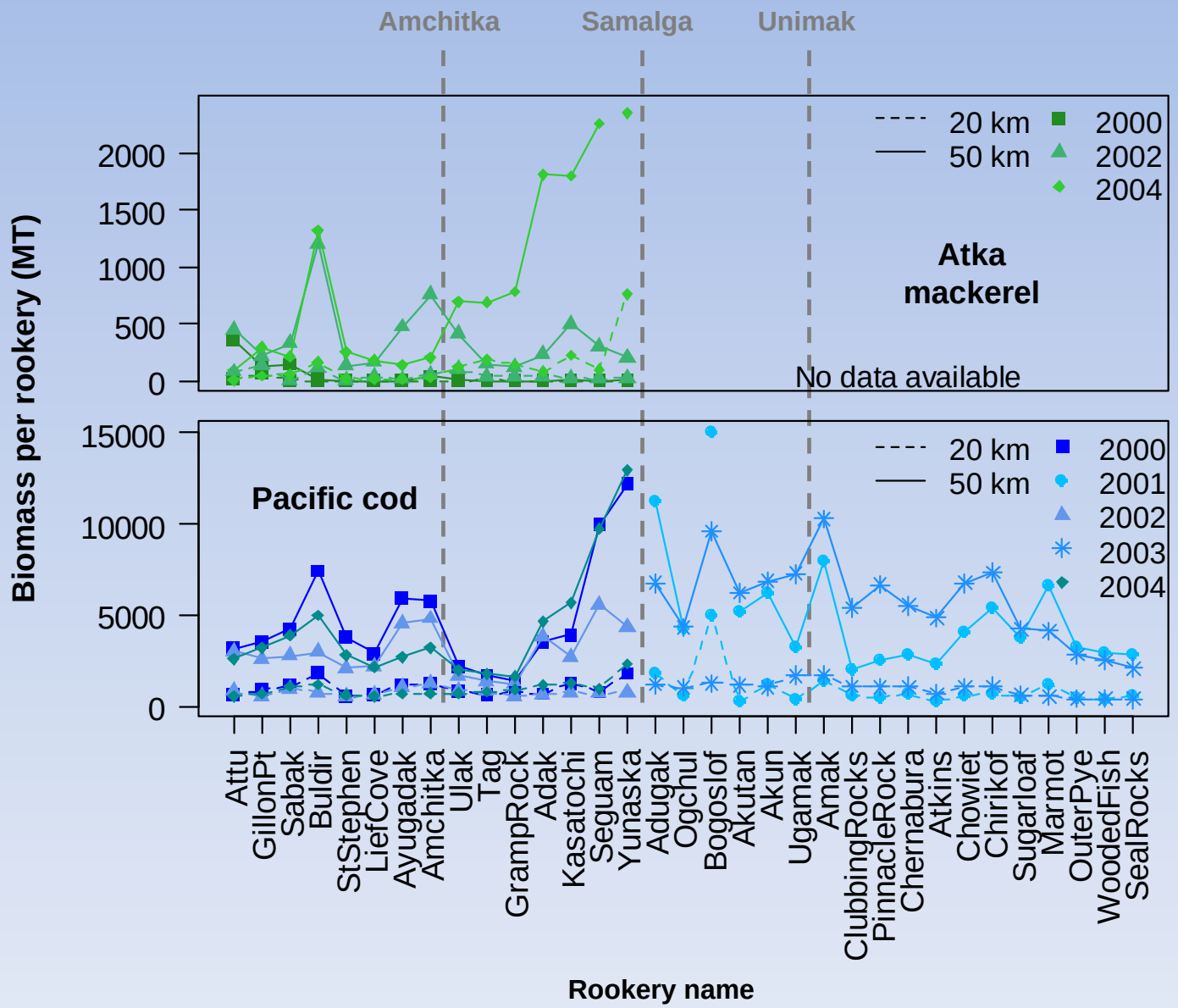


Prey accessibility model extents: 20 km (light green), 50 km (white)

Dependent and independent variables



Scaled accessibility model (no fishing)

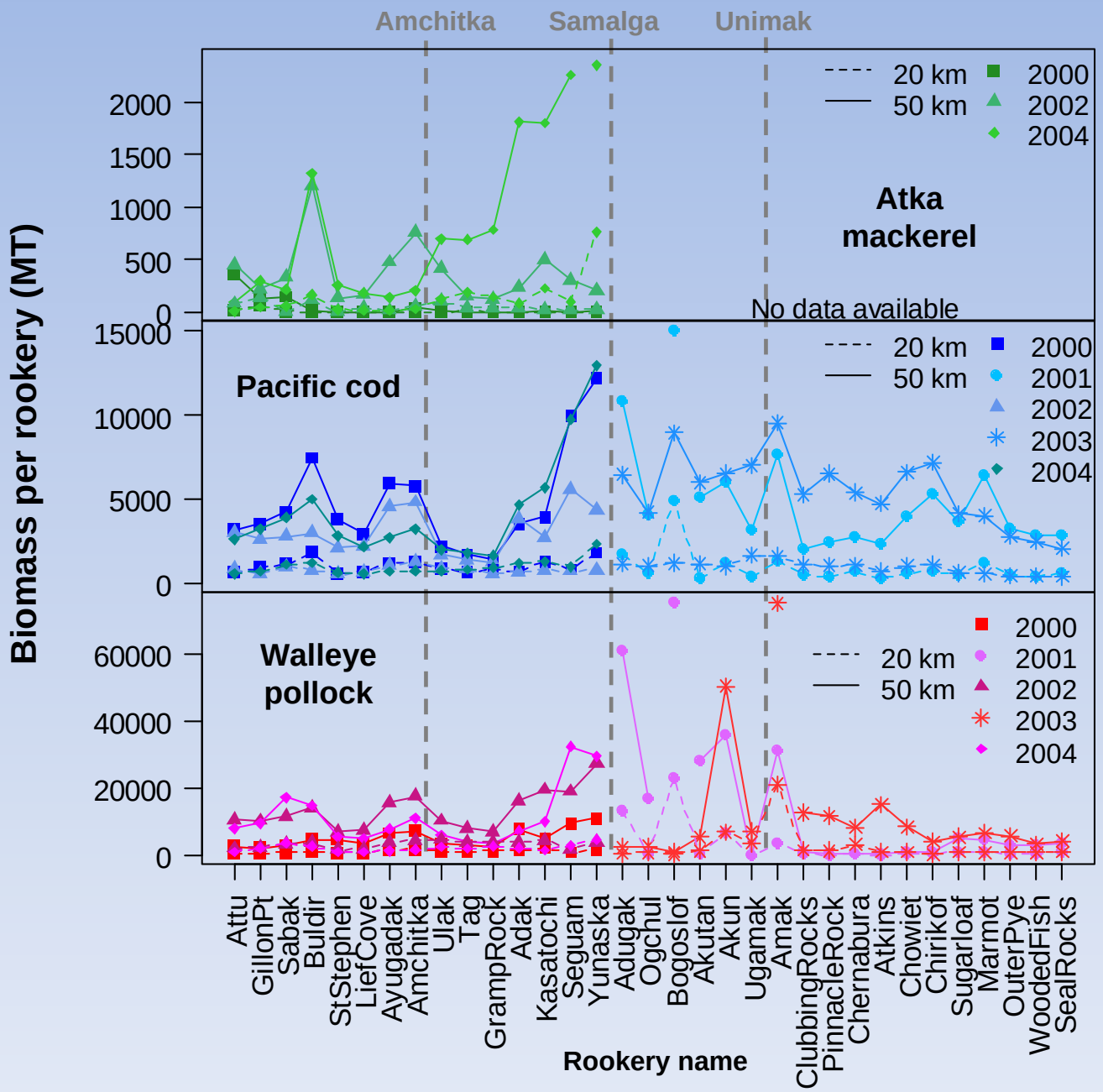


Prey biomass after fishing

Accounting for fishery removals…

1. Deducted Jan-May catch from survey biomass estimates
2. Distributed this fished biomass in proportion to the predicted Jun/Jul CPUE values at each location
3. Mapped the catch from Jun-Jul and deducted this from the fished biomass

Scaled accessibility model (with fishing)

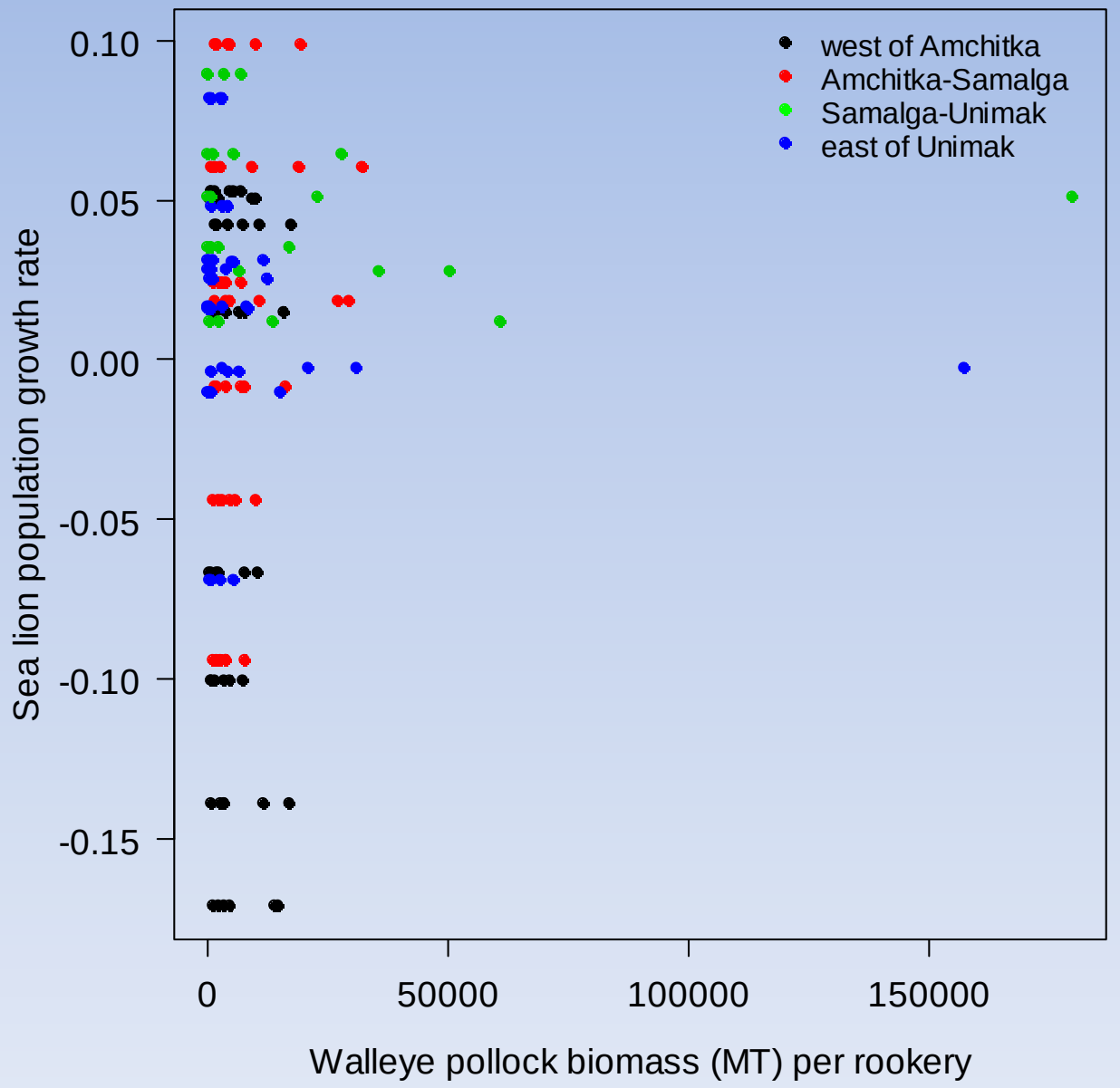


Statistical analyses

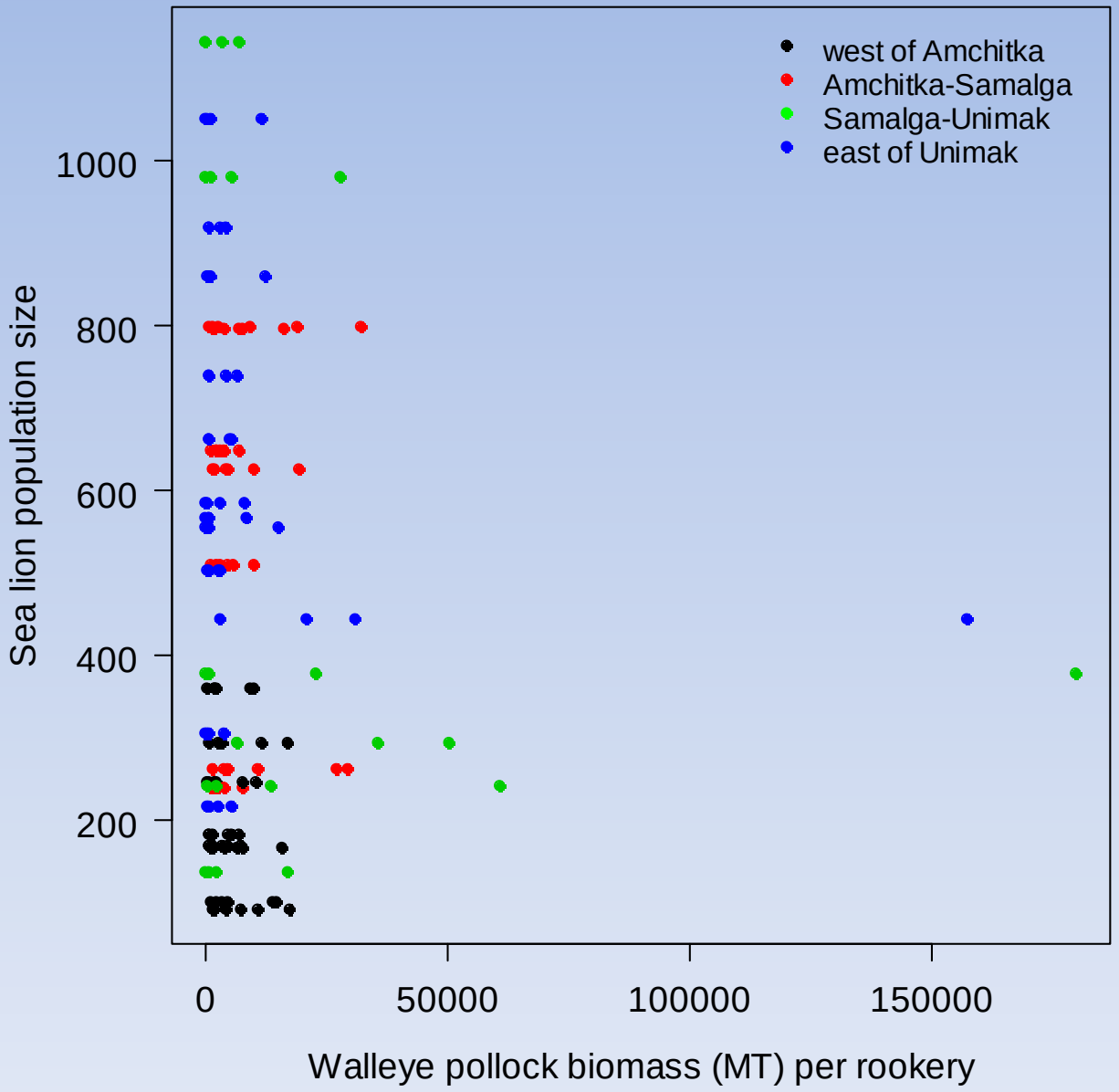
Sea lion population growth rate or size = *f*(prey biomass + region + year + max foraging distance)

- Used separate General Linear Models (GLMs) for each accessibility model and prey species (cod, pollock, mackerel)

Results (sea lion population growth rate)



Results (sea lion population size)



Results summary

Any significant relationship?	Scaled accessibility	Equal accessibility
Non-depleted prey biomass	No	No
Depleted prey biomass	No	No

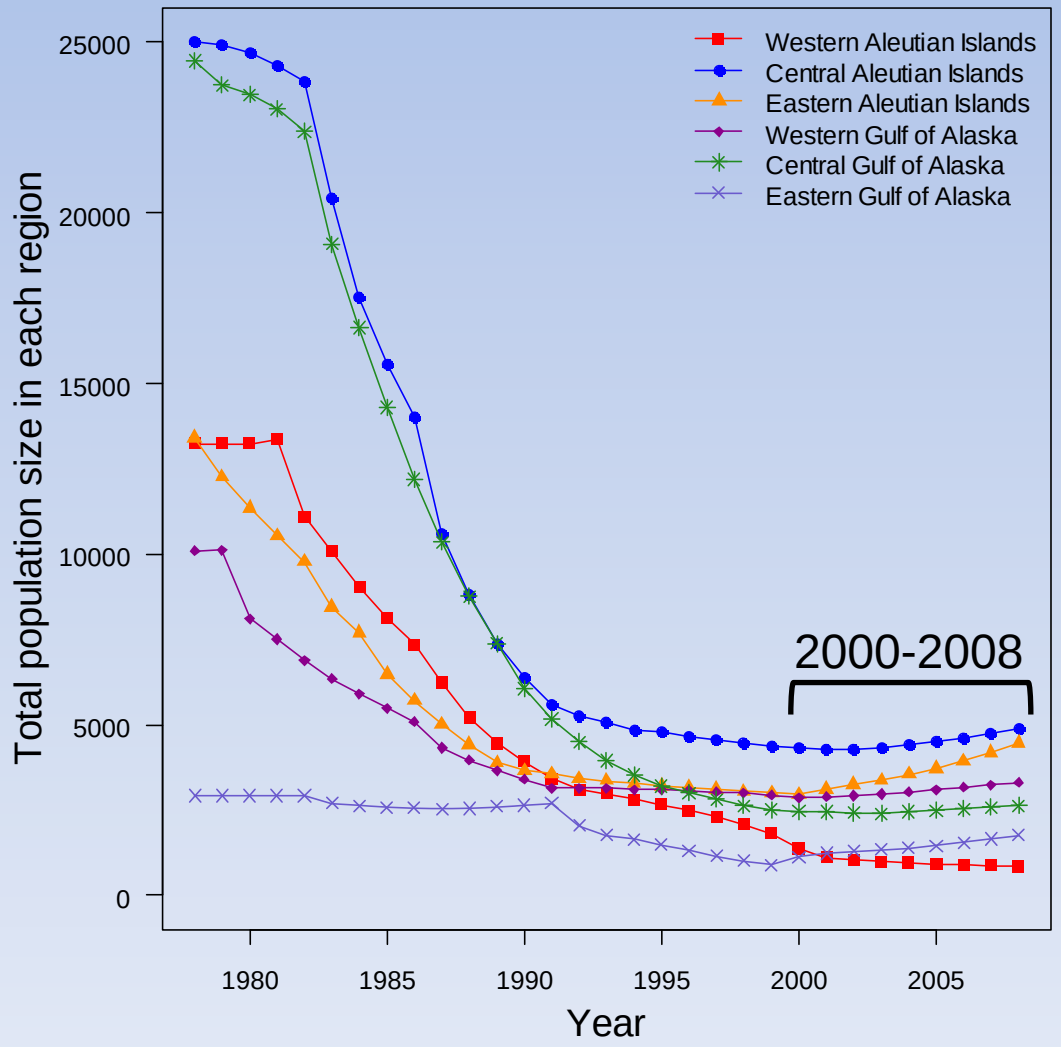
No significant relationships were found between the prey biomass accessible to sea lions and their population trends, whether or not fishery removals were accounted for

Location, location, location!

- Region was the only significant factor affecting sea lion population trends
- Sea lion population growth rate and size tend to increase from west to east
- This may be due to differences in oceanographic properties between regions (Ladd et al. 2005, Trites et al. 2007)

A time to reflect…

Time period analysed is after the sharpest declines in sea lion populations have occurred



Are there any hungry sea lions out there?

- Steller sea lions do not appear to have been prey limited in the Aleutian Islands, Bering Sea or Gulf of Alaska from 2000-2008
- Sea lion population trends appear to be unrelated to the prey biomass accessible near rookeries, suggesting that sea lion populations were unaffected by fishery removals during this period

References

Ladd, C., Hunt, G.L., Jr, Mordy, C.W., Salo, S.A. and Stabeno, P.J. (2005) Marine environments of the eastern and central Aleutian Islands. *Fisheries Oceanography* 14: 22-38.

Trites, A.W., Miller, A.J., Maschner, H.D.G., Alexander, M.A., Bograd, S.J., Calder, J.A., Capotondi, A., Coyle, K.O., Lorenzo, E.D., Finney, B.P., Gregr, E.J., Grosch, C.E., Hare, S.R., Hunt, J.L., Jr, Jahncke, J., Kachel, N.B., Kim, H.J., Ladd, C., Mantua, N.J., Marzban, C., Maslowski, W., Mendelssohn, R., Neilson, D.J., Okkonen, S.R., Overland, J.E., Reedy-Maschner, K.L., Royer, T.C., Schwing, F.B., Wang, J.X.L. and Winship, A.J. (2007) Bottom-up forcing and the decline of Steller sea lions (Eumetopias jubatus) in Alaska: assessing the ocean climate hypothesis. *Fisheries Oceanography* 16(1): 46-67.

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