



# Using Gray Whales to Track Climate Change in the Alaskan Arctic

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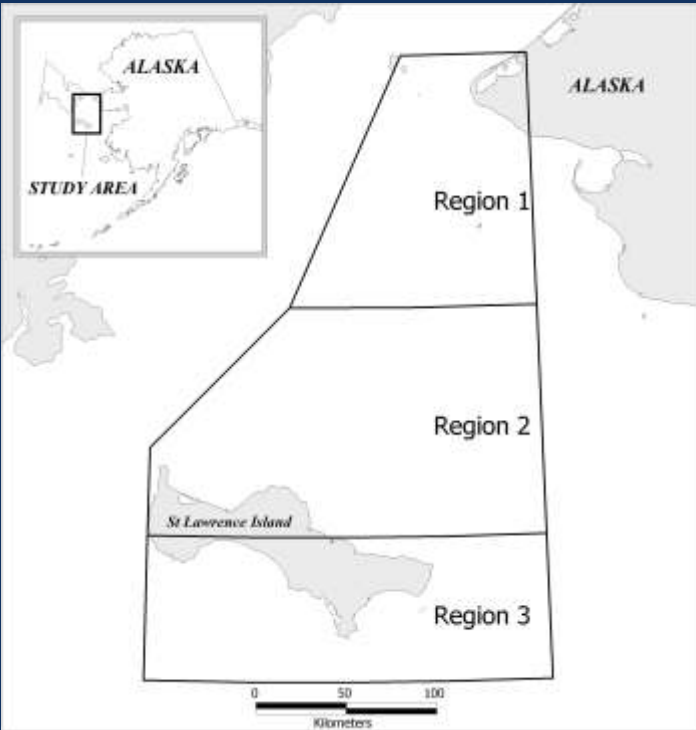
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## Abstract

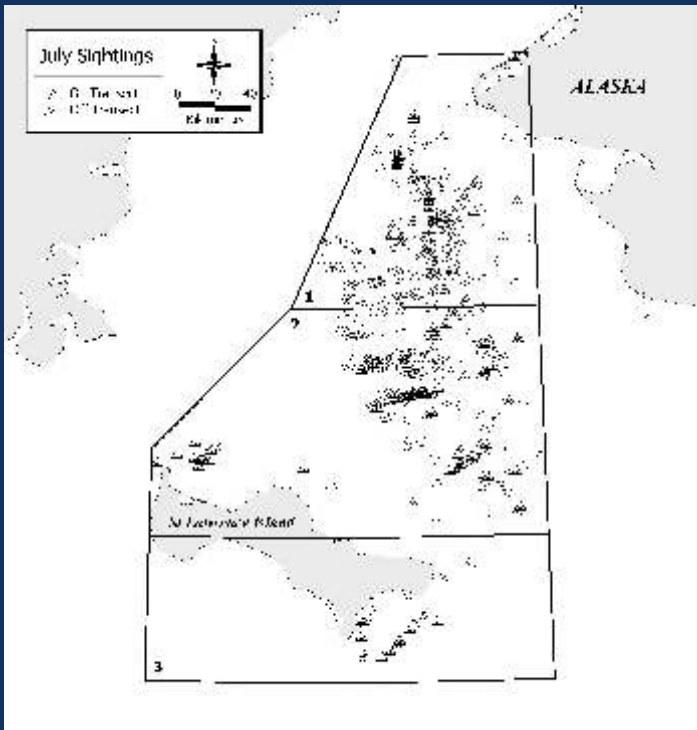
Climate warming has resulted in extreme seasonal retreats and thinning of sea ice in the western Arctic. However, other less obvious effects of warming on Arctic marine communities are difficult to discern. Because marine mammals are apex predators in the short food chains common to the Arctic, they can be good indicators of ecosystem response to climate change. Gray whales, due to their benthic foraging capability, may provide a clear link between atmospheric forcing and the pelagic-benthic coupling processes required to support a dense prey base. To explore this link, a 5-day aerial survey was conducted over the Chirikov Basin in the northern Bering Sea during summer 2002. In the 1980s, the Chirikov Basin was a prime gray whale feeding area, with an extremely productive benthic prey community. However, no comprehensive assessments of whale or prey distribution and abundance have occurred since then.

The 2002 survey for gray whales revealed restricted distribution in the basin and a 3 to 17-fold decline in sighting rates compared to the 1980s. Many more whales were seen north of Bering Strait, where the sighting rate was 0.49 whales/km compared to only 0.03 whales/km in the basin. Available measurements of biomass suggest a downturn in prey abundance that began as early as 1983, when estimates of gray whale population size were still increasing. These data, and reports of hundreds of gray whales feeding in the south-central and northwest Chukchi Sea and southeast of Kodiak Island in the Gulf of Alaska, suggest that benthic communities in the Chirikov Basin may no longer support large aggregations of whales and that gray whales are foraging elsewhere. Since multi-decade, time-series data are available for the Chirikov Basin, long-term studies of this area are encouraged to investigate predator-prey responses to changing ocean climate.

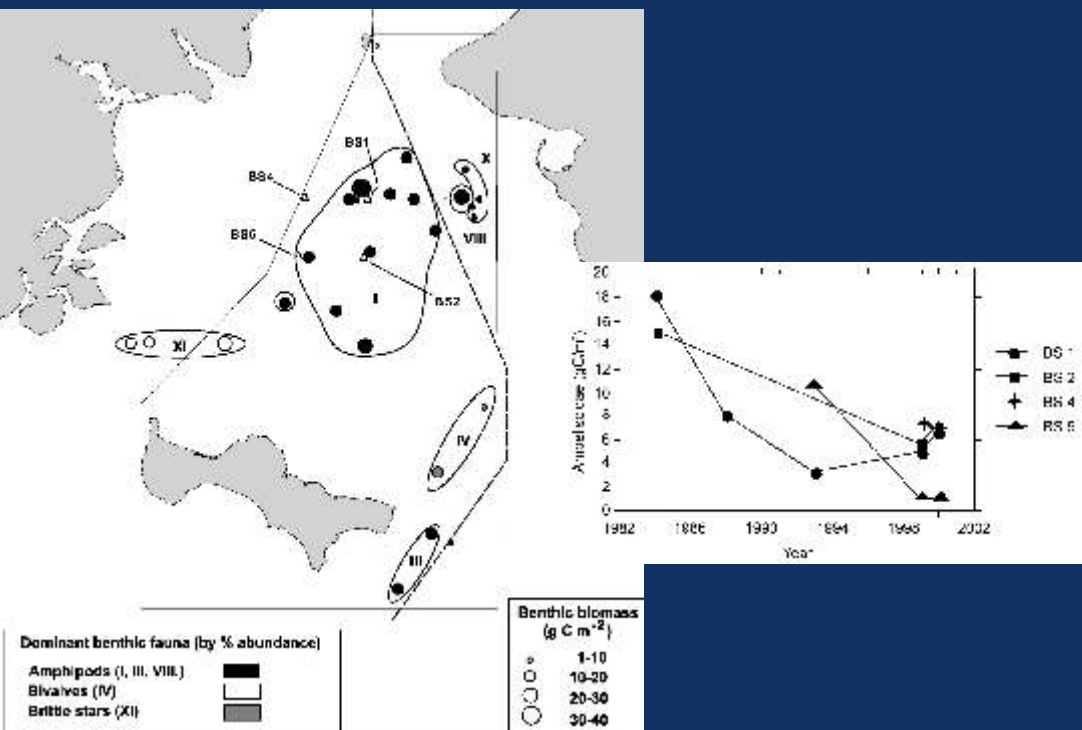
## 1980s Distribution of Gray Whales & Benthic Fauna in the Chirikov Basin, Northern Bering Sea



Study area in the northern Bering Sea post, stratified to three regions (from Moore et al. 2003, CJZ 81: 734-742).



Gray whale distribution in the study area in July 1981-1985.



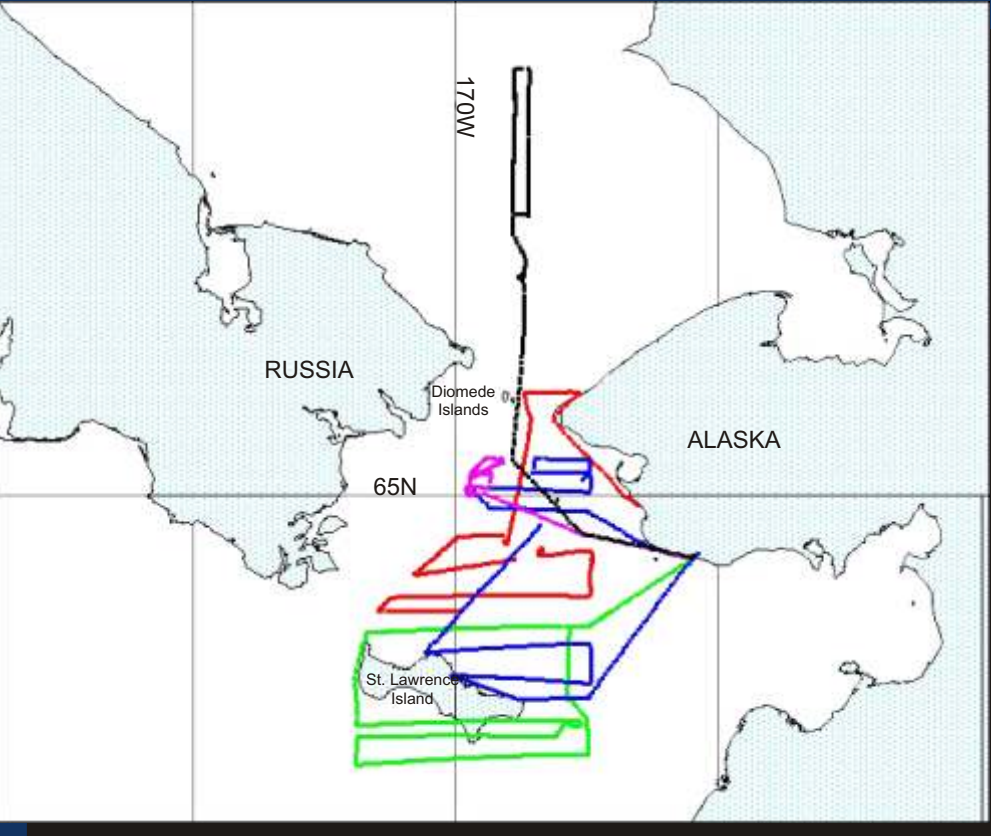
Distribution of benthic faunal communities in 1984-1986; note locations of benthic stations (BS1, BS2, BS4, BS5) for which declines of *Ampeliscidae* are shown.



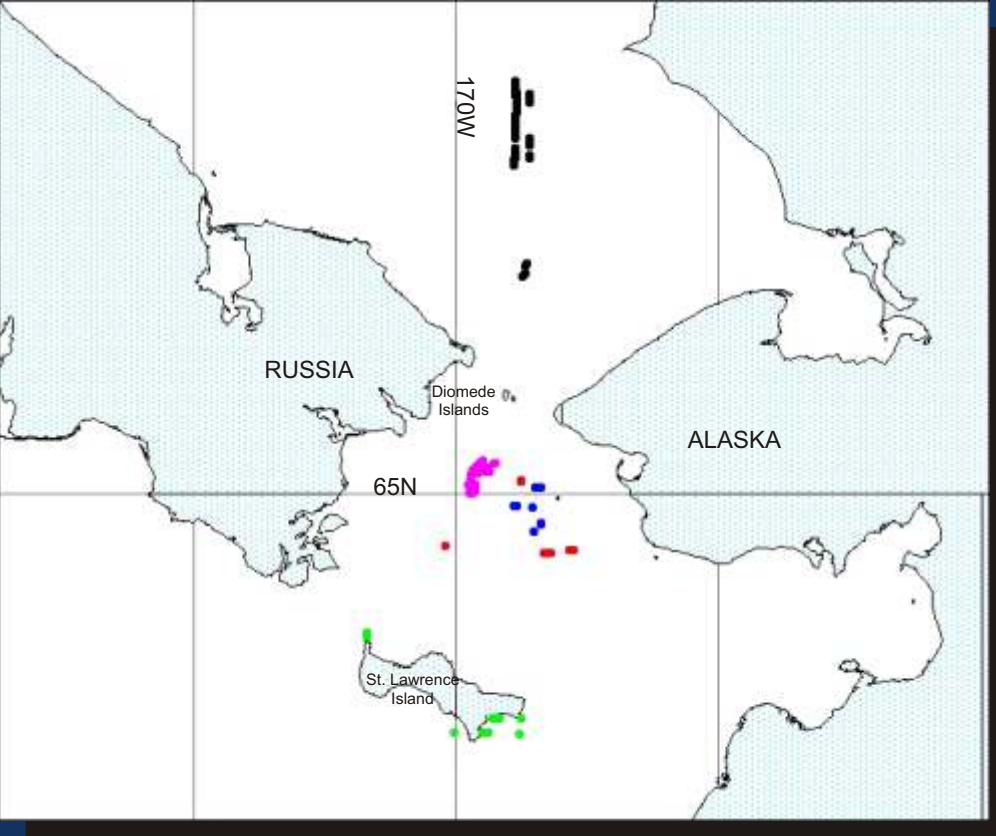
Summary comparison of gray whale sighting rates (no. whales/km) by region between late July 1981-85 and late July-early August 2002.			
Period	Region 1	Region 2	Region 3
1981 - 85	0.209	0.141	0.056
2002	0.070	0.008	0.014



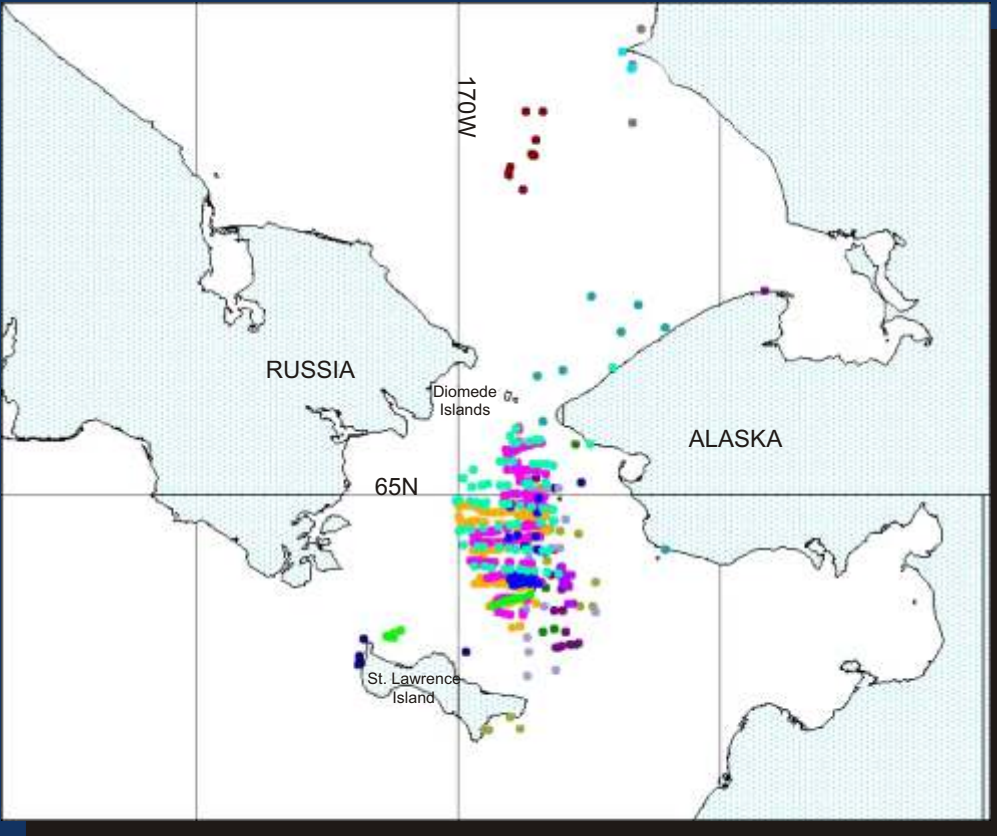
## 2002 Survey Effort and Gray Whale Distribution



Composite flight track for five surveys flown over the Chirikov Basin and southern Chukchi Sea from 29 July - 3 August 2002.



Distribution of gray whales in 2002; note restriction of whales to northern most waters of the Chirikov Basin and cluster of sightings in the southern Chukchi Sea.



Comparative plot of historical distribution, representing sightings during 16 surveys flown between 17-30 July, 1981-1985.

## Acknowledgements

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