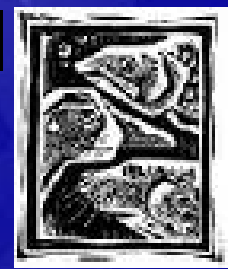
The CPR: Antique technology observing today's oceans

Sonia Batten

EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL



In 1927 Alister Hardy took part in the Discovery Expedition and deployed the MK 1 CPR. His intent was:

To carry out ‘meteorology’ of the seas, as a tool for fishermen

To map the ocean distributions of the plankton

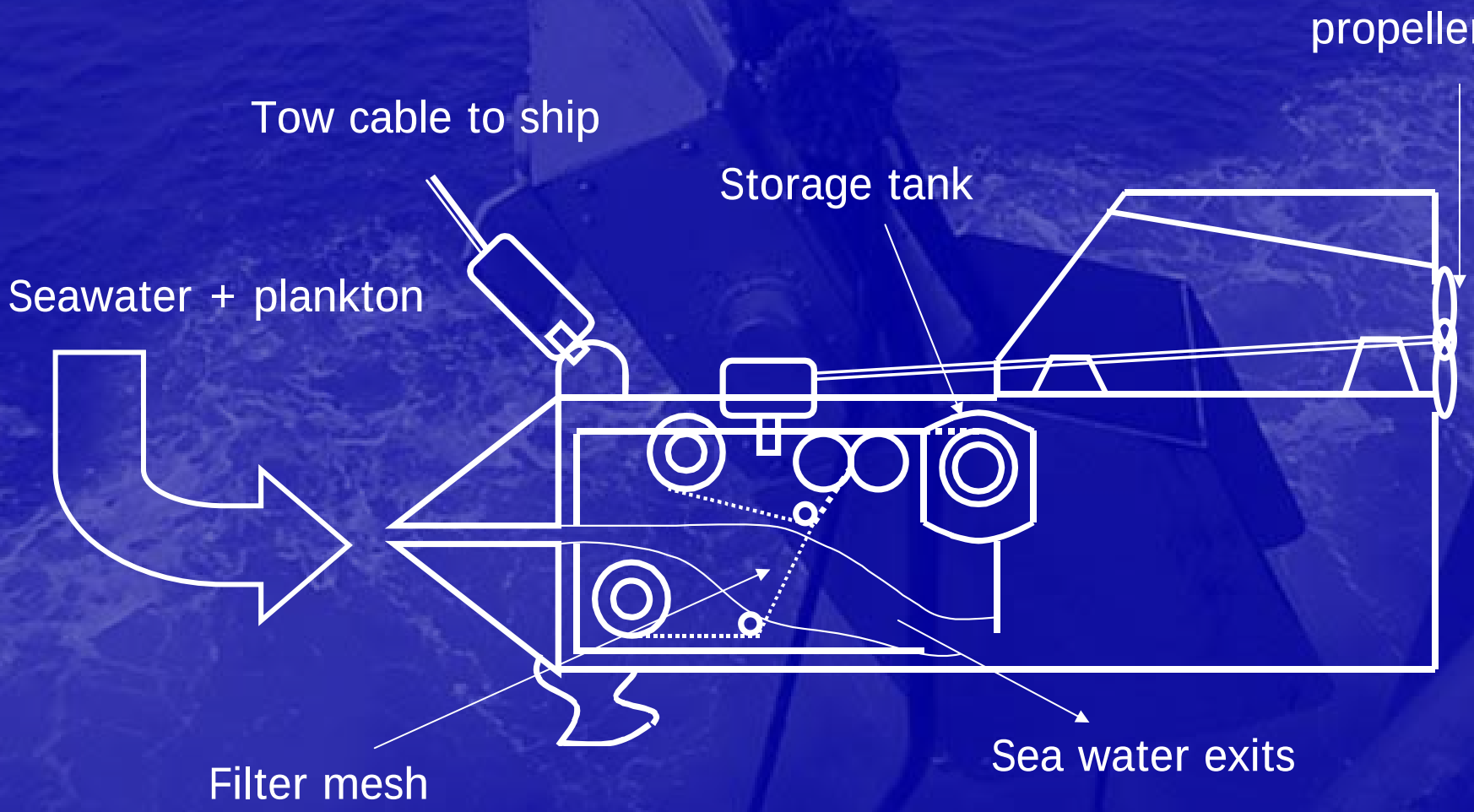
To record changes and to explain them

A CPR is a simple mechanical device that filters plankton from seawater

It is rugged, capable of being deployed at >20 knots

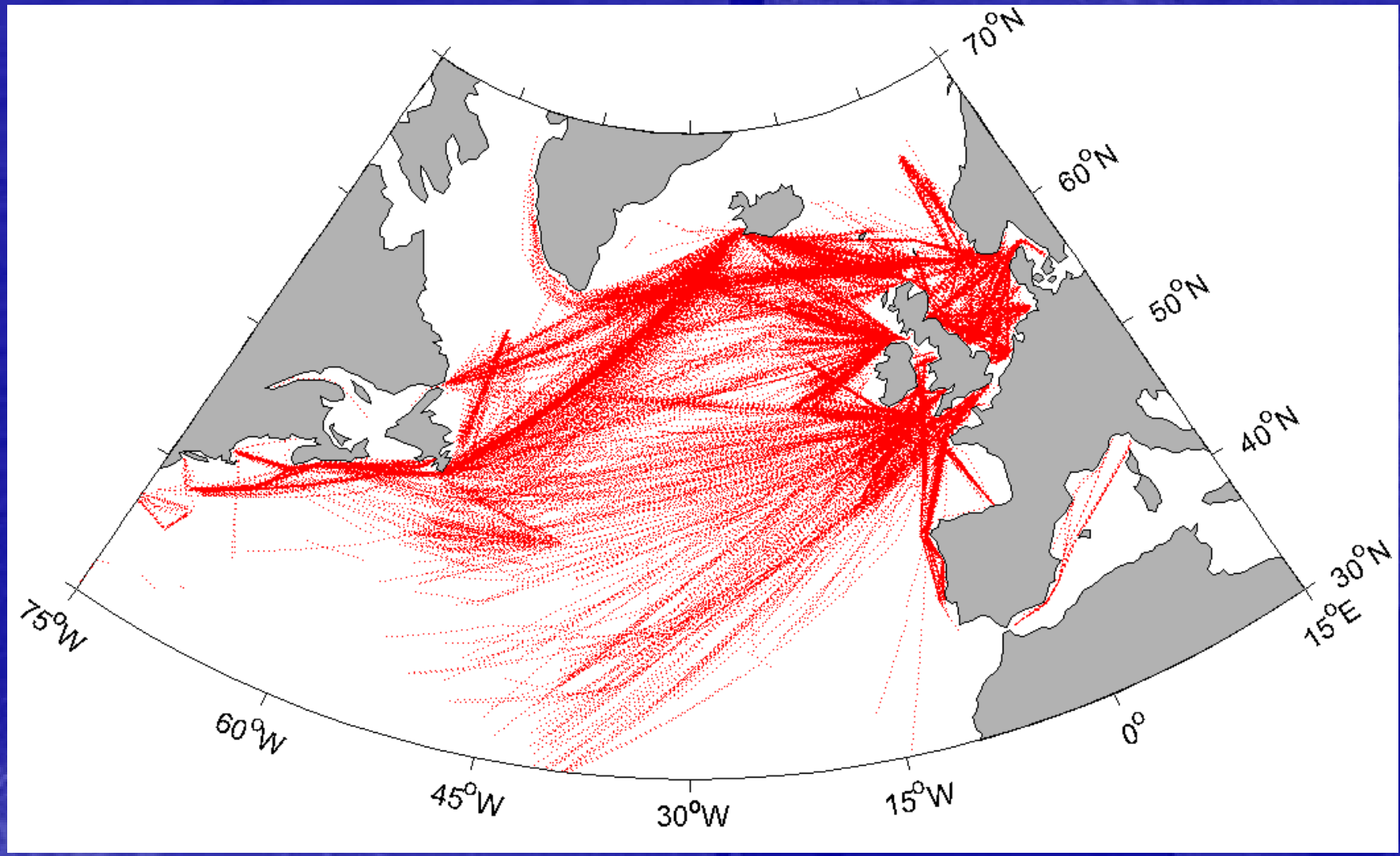
Commercial ships make an ideal deployment platform (cheap, have regular routes)

The outer body holds an internal changeable cassette that can be towed for 500 nm



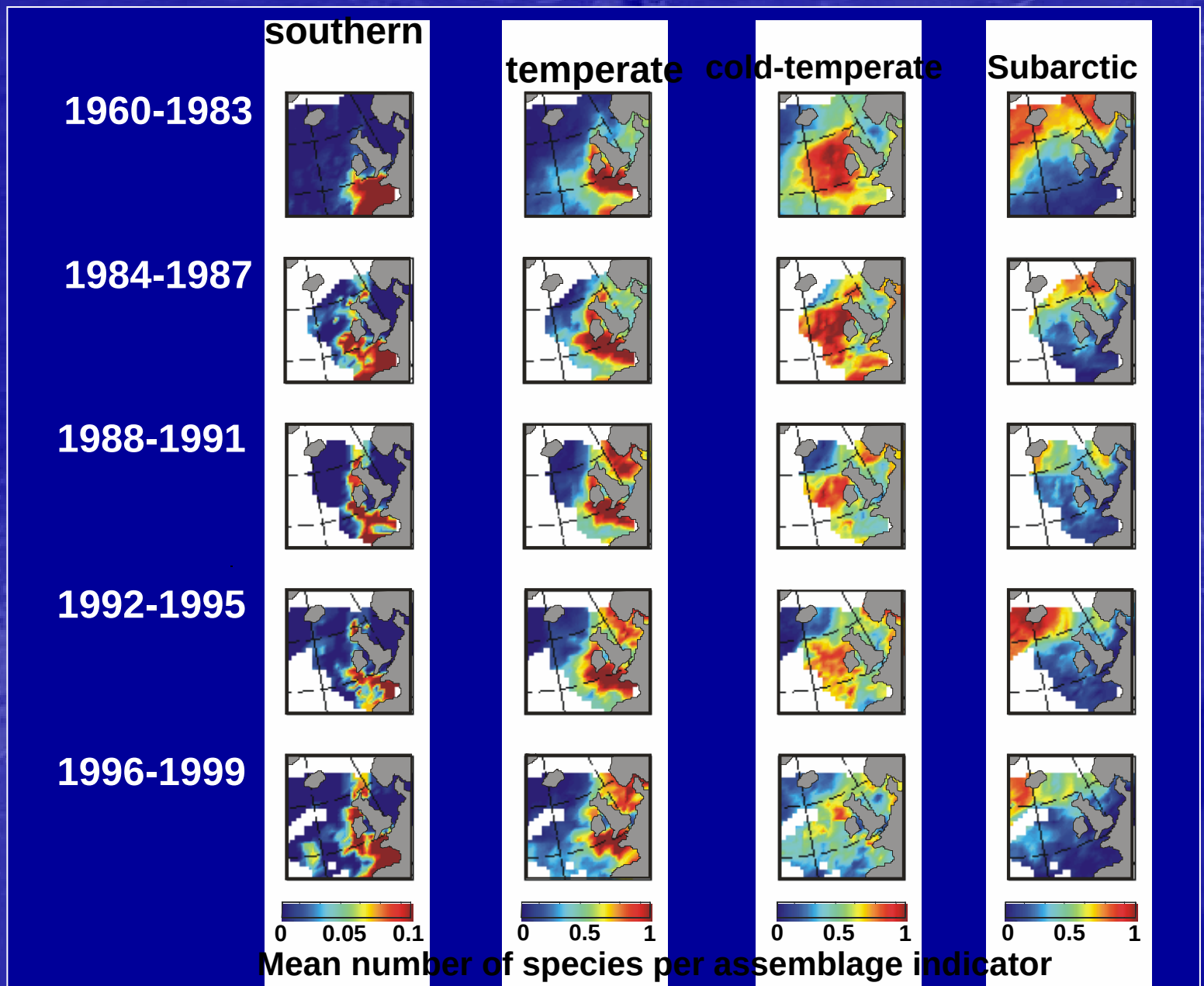
Back in the lab the length of mesh is cut into 10nm sections (a sample)

Plankton have to be examined and identified by eye. Each sample can take one to several hours to process



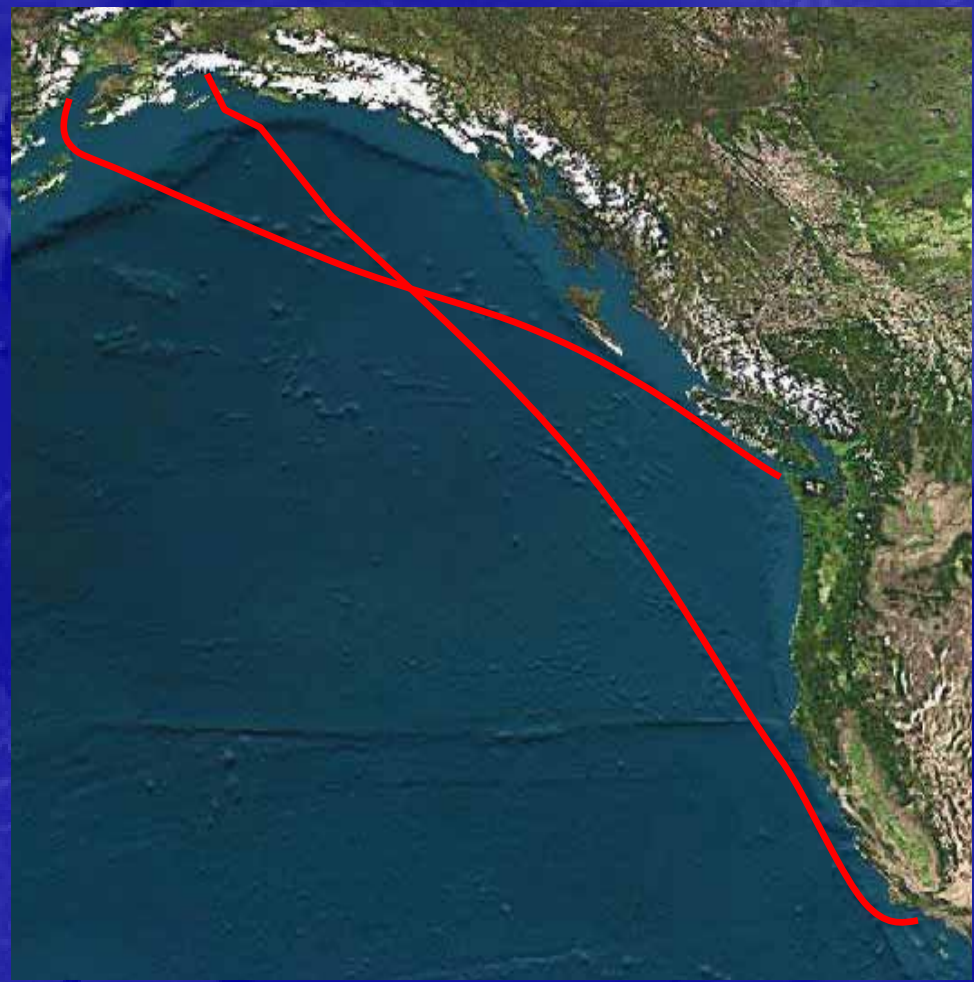
>50 years of sampling in the North Atlantic

Effects of climate change, *From Beaugrand et al. (2002). Science 296*

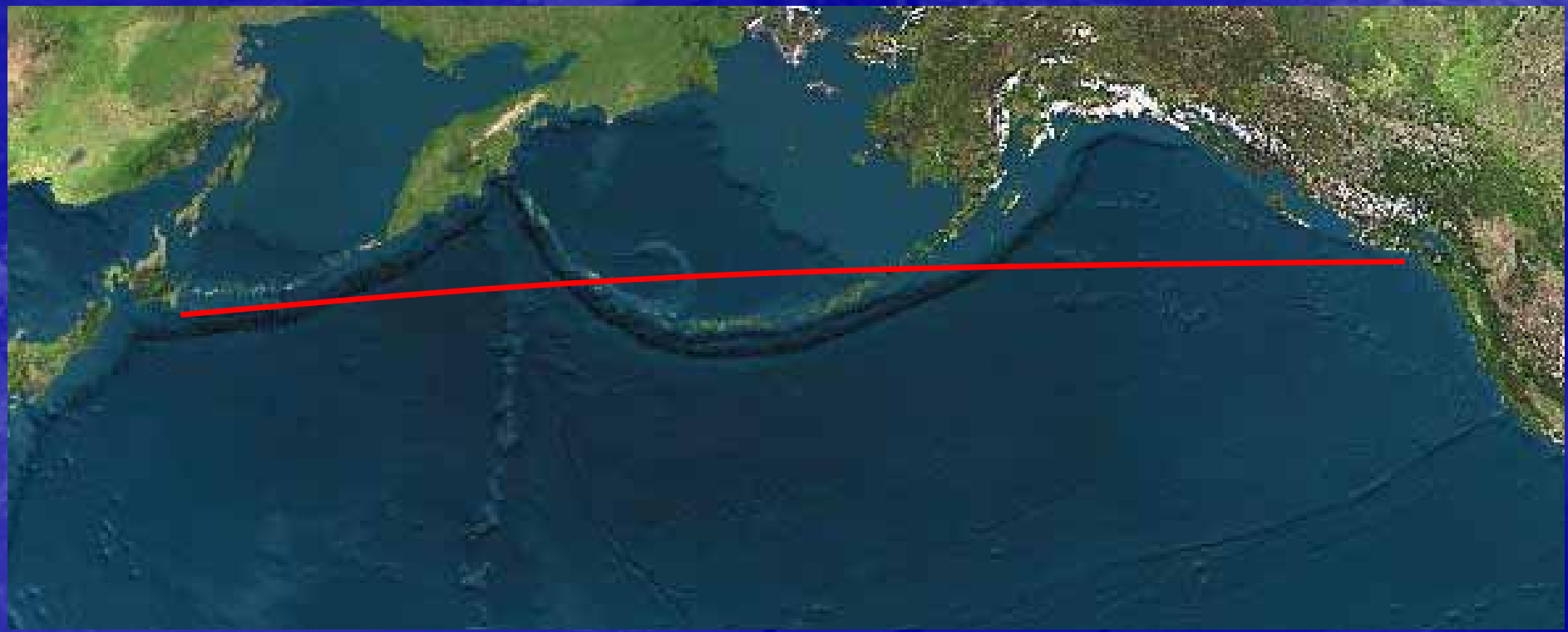



The North Pacific has not had the same level of historical plankton sampling

In 2000 a transect was started from Prince William Sound to California Since 2004 its from Anchorage (Cook Inlet) to Puget Sound

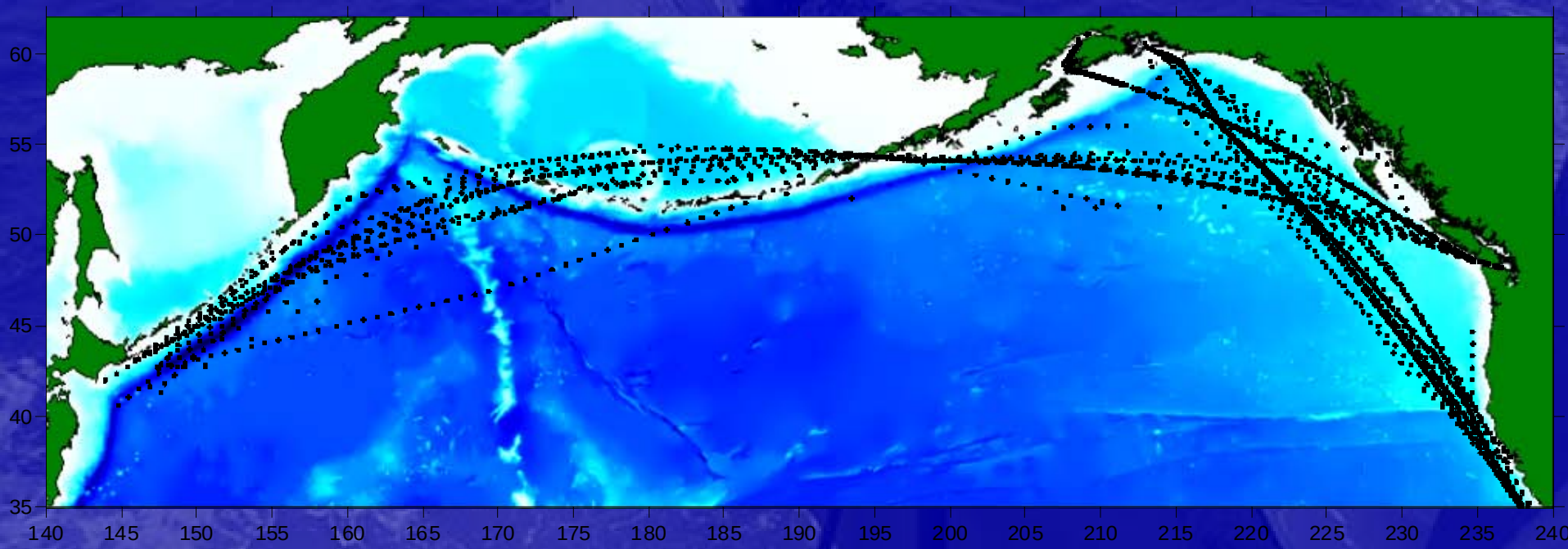


And a transect from Vancouver to Japan, supplemented by a seabird/mammal observer and CTD



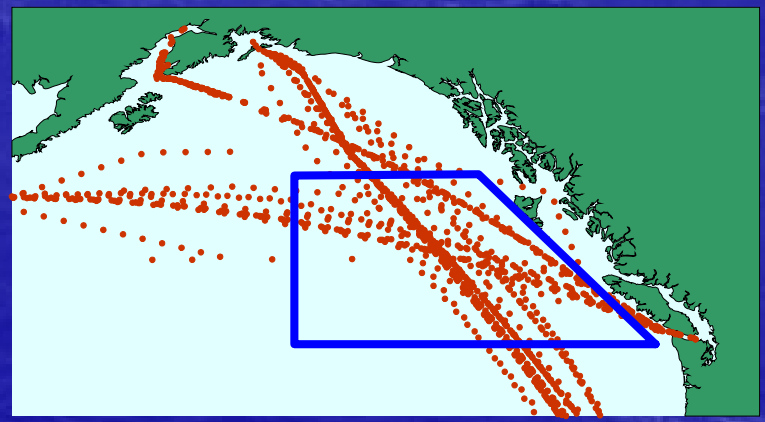
Ship routes are not exactly the same from month to month so coverage is quite widespread

All samples so far processed (2000 – 2006):

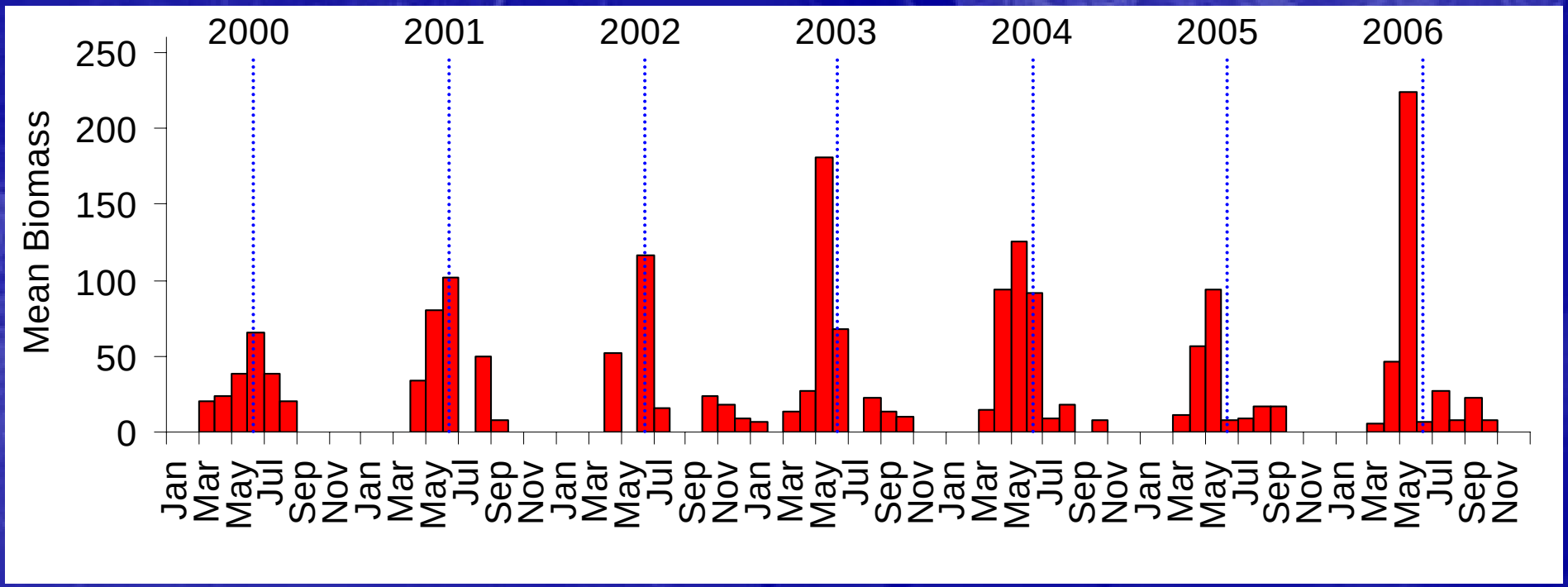


An additional ~8000 samples archived
>200,000 km of ocean sampled

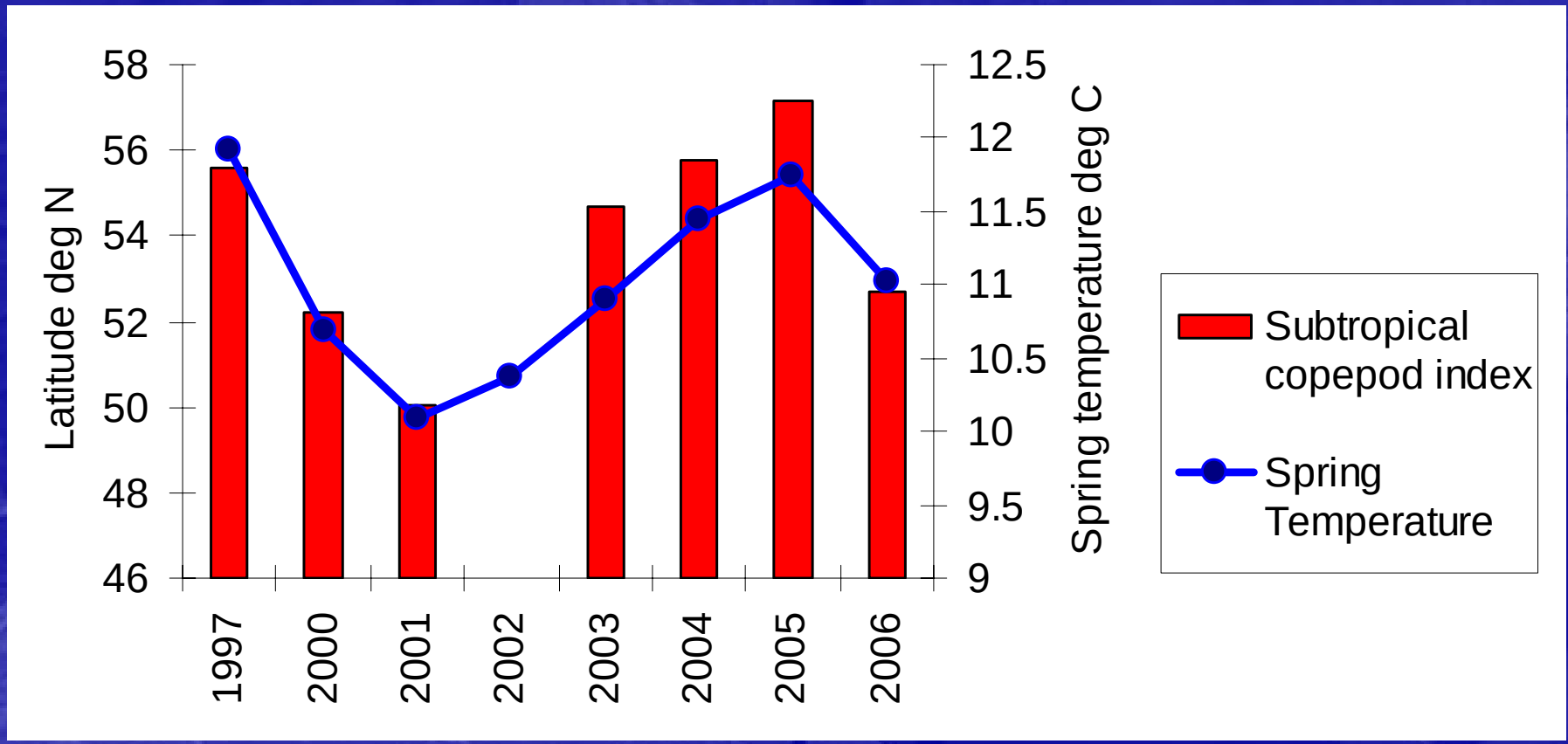
Time series of biomass in offshore box (sampled 9 times each year, March to October)



Peak biomass is advanced in warm years



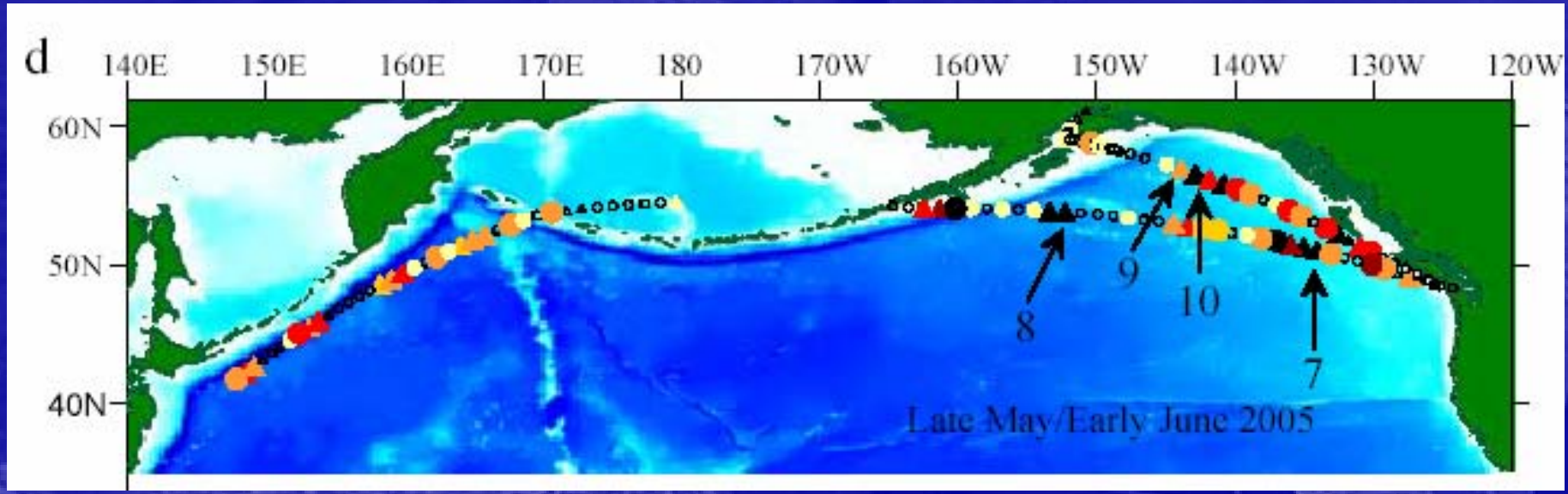
Calculated the latitude at which 75% of the subtropical copepod abundance had been reached v. SST at Amphitrite Point



Latitude significantly correlated with spring SST ($p < 0.01$)

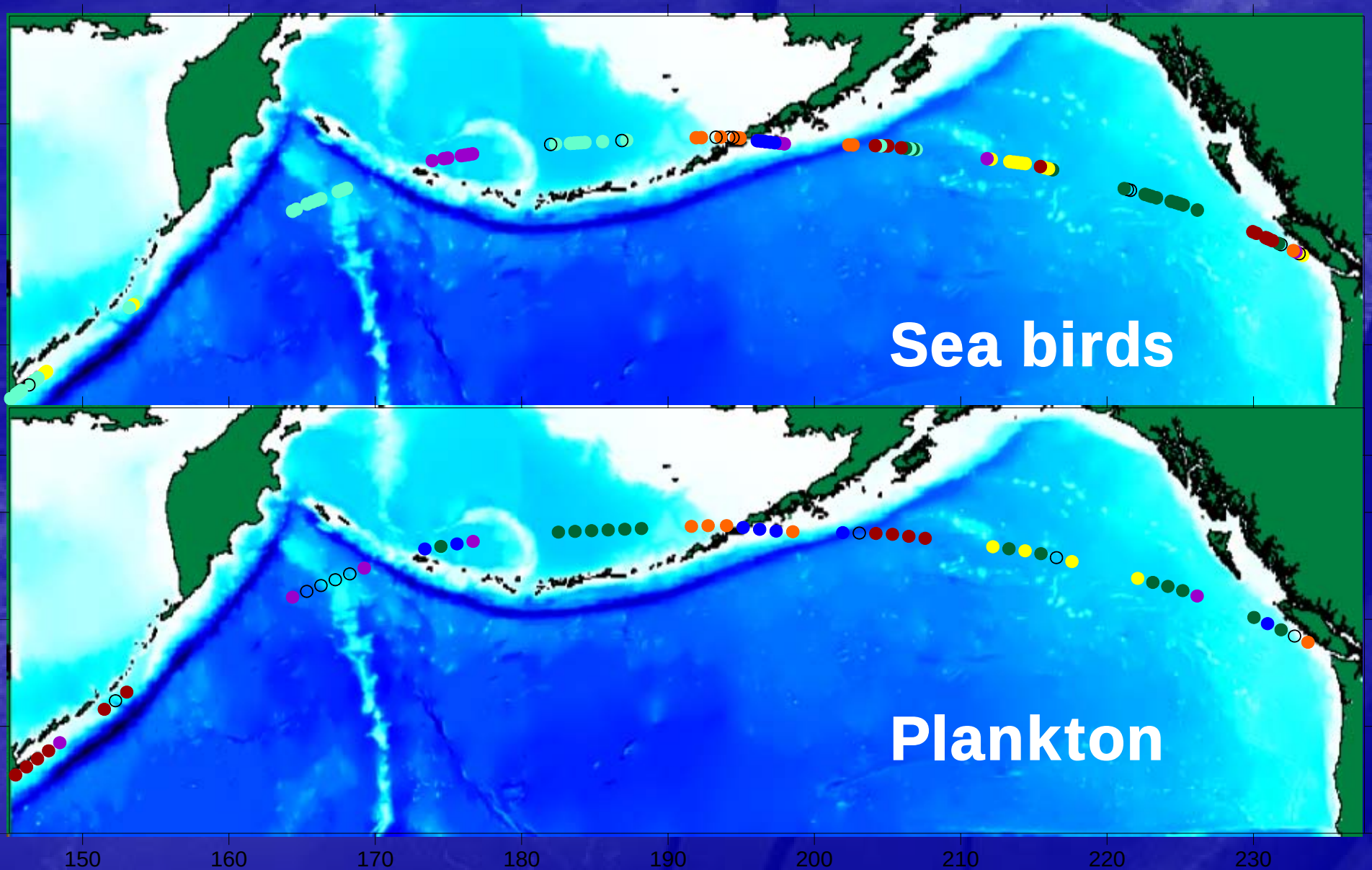
First population DNA study using CPR samples, Kirby et al., 2007

Neocalanus cristatus



Analysis of molecular variance (AMOVA) showed that a significant component of the total genetic variability was explained by differences among patches, e.g. patch 8 was genetically distinct ($p < 0.05$) to all other patches in May/June 2005.

Similarity in faunal boundaries between low and high trophic levels – June 2002

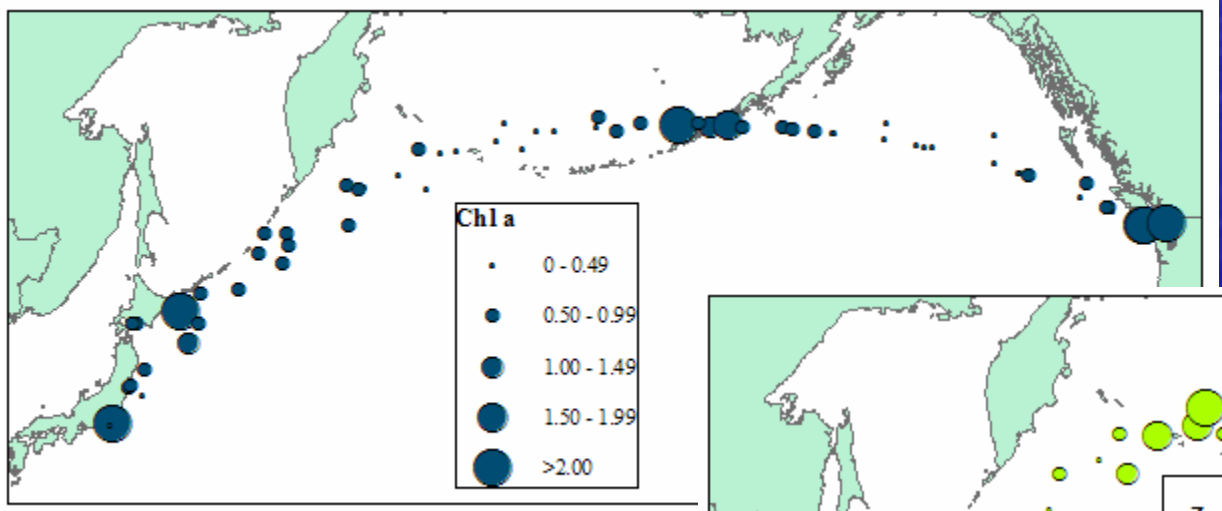


Now starting to model the pan-Pacific transect data examining trophic interactions :

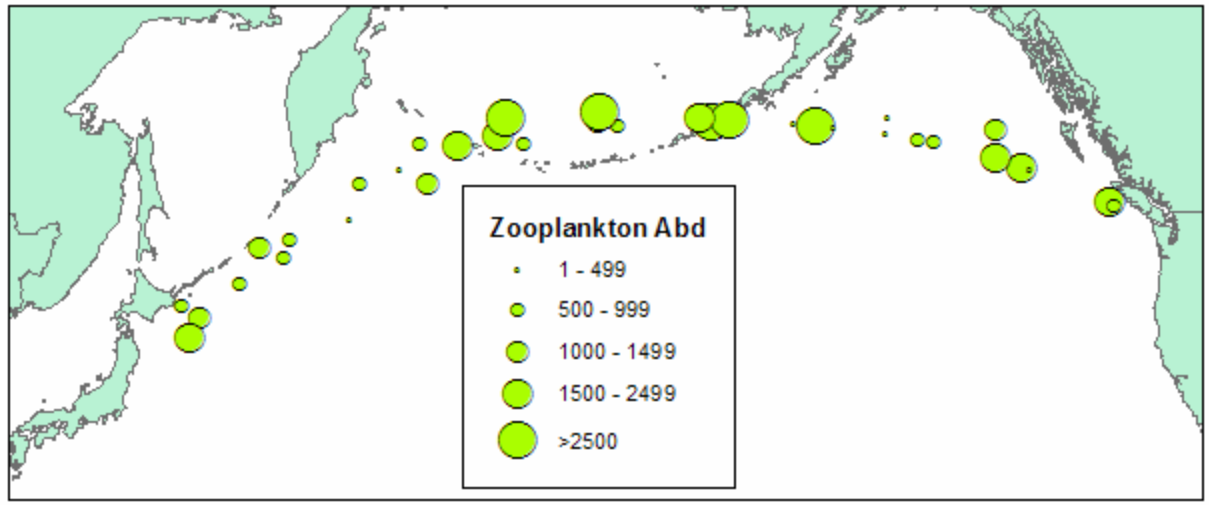
5 years of:
Net Primary Productivity and Chla (satellite data)
Zooplankton abundance, diversity (CPR data)
Bird abundance, diversity (on board observations)

e.g. in summer, Bird density is significantly correlated with zooplankton abundance

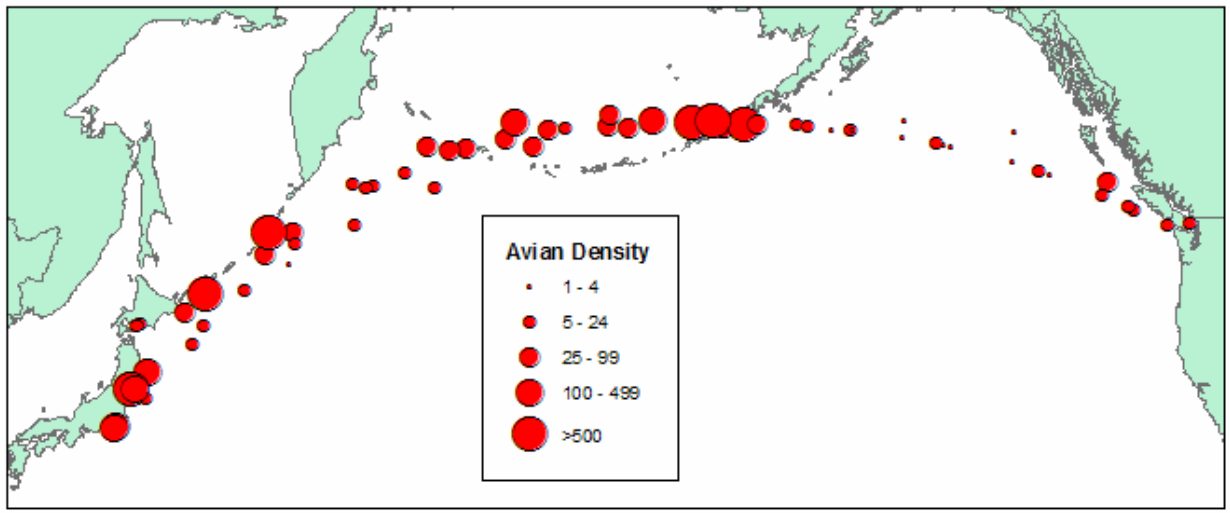
See Mike Henry's talk for more details and more results



Summer - Chlorophyll a (mg/m3)



Summer - Mesozooplankton Abundance

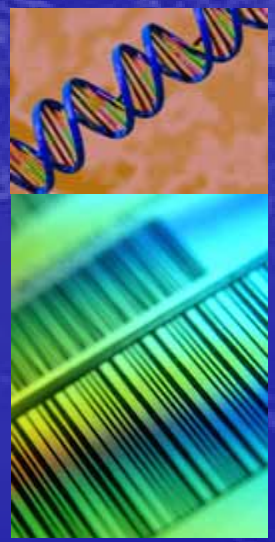


Summer - Avian Density (ind./km2)

At present, species level data is labour-intensive to produce (therefore expensive and time-consuming). In the future?

CPR sampling

DNA barcoding



+

Automated recognition and counting

Whatever the eventual analysis process one strength of the survey is in having a physical sample:

novel analyses
ability to re-analyse
historical record

Archiving is as important as collection!

Thank You!