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Development of seabird based sampling strategies for the determination of plankton communities with special focus on HAB species

Bernd Krock & Susan Waugh

1. Planktonic response to climate change in the Southern Ocean

Present plankton community

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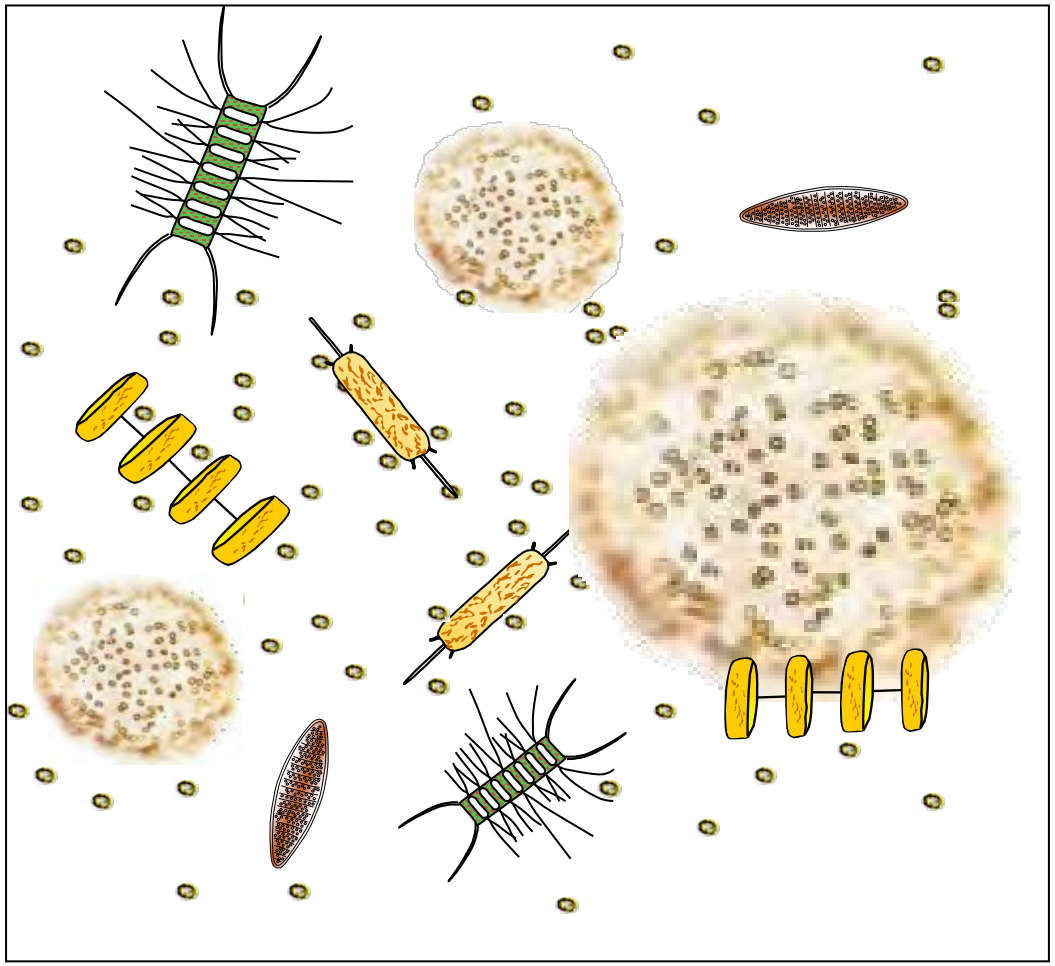
The Southern Ocean is dominated by a Diatom – Phaeocystis community



Ecosystem parameters:

Light
Temperature
Nutrient regime
Water column stability
Grazer control

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Southern Ocean diatoms

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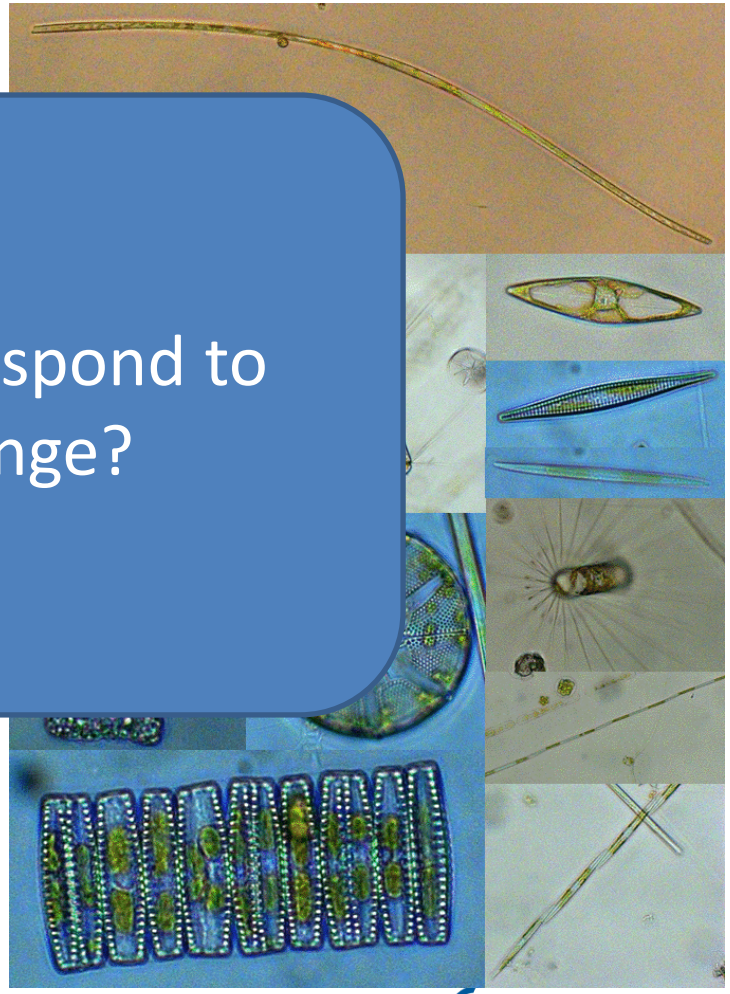
- Dominant primary producers of the SO
- Special ada
  extreme er
  - Strong s
    light lim
  - Deep m
  - Low mic
    (Fe)
  - High graz
- Substantial influence upon global elemental cycling of Si and C, climate regulation

How will they respond to climate change?



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Distribution models – *Fragilariopsis kerguelensis*

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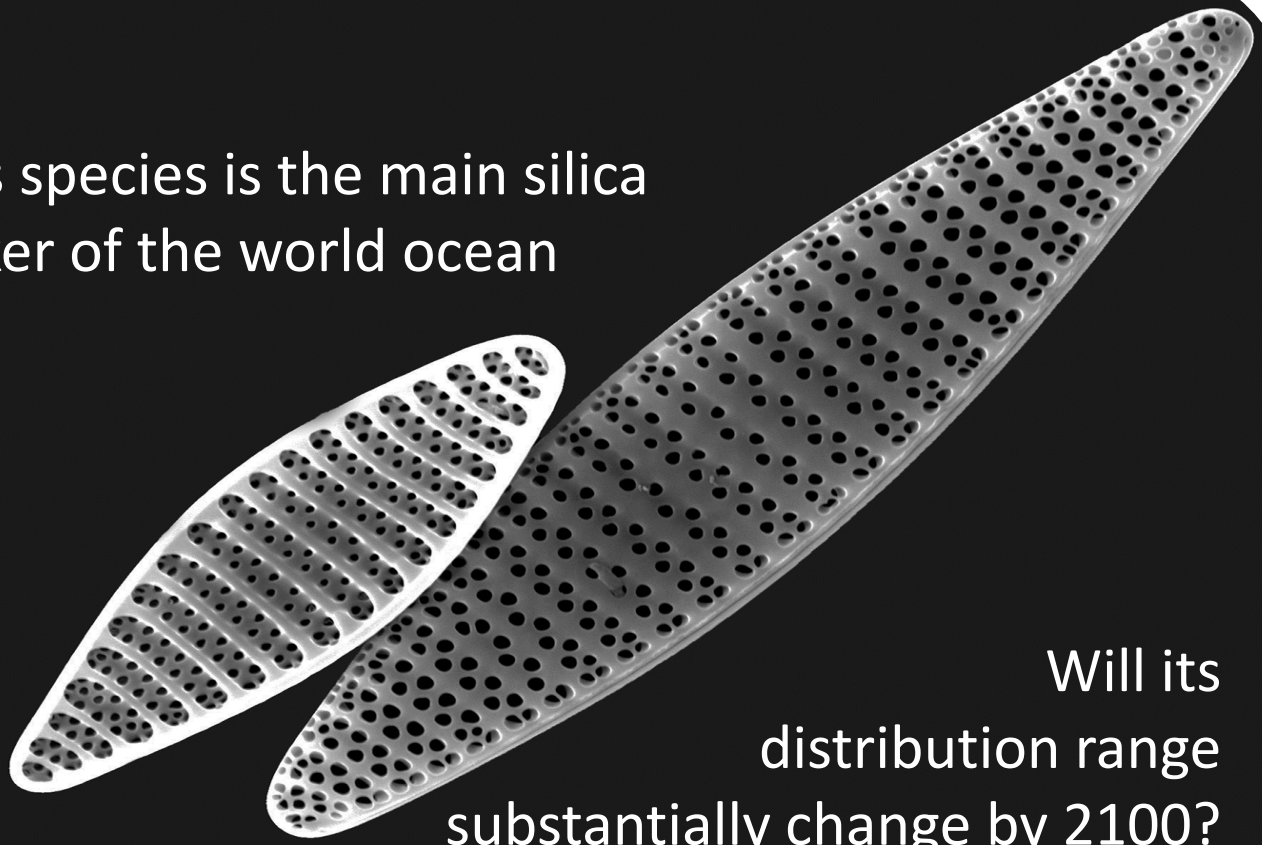
This species is the main silica sinker of the world ocean



Will its distribution range substantially change by 2100?

Biogeographic scenario projections

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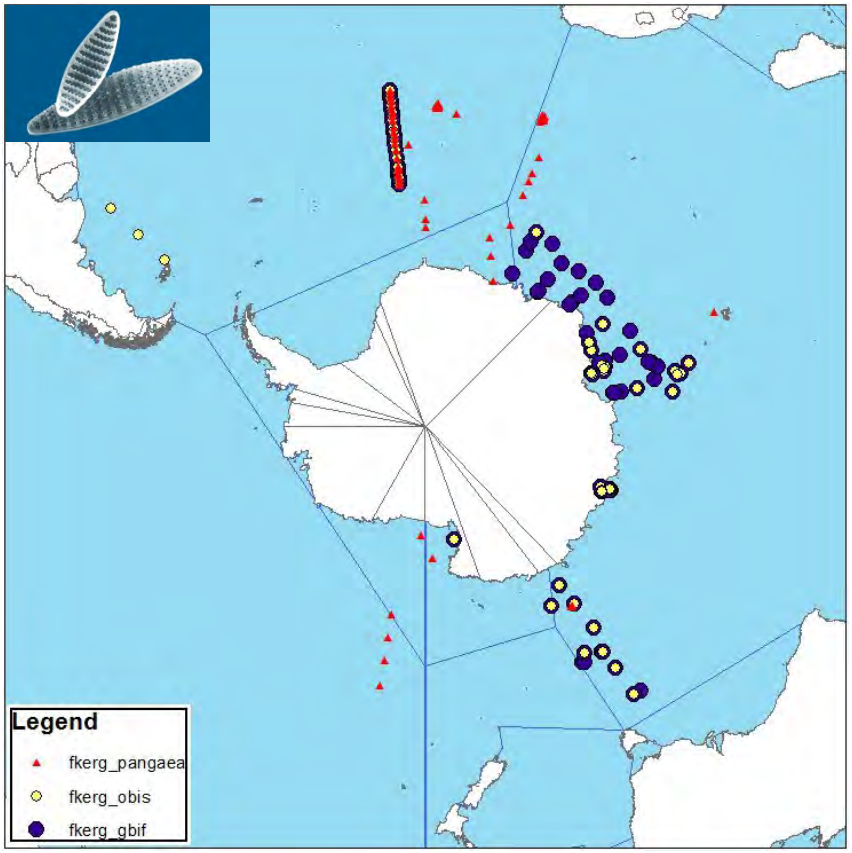
Occurrences
- Taxon observations
- Environmental data grids

Niche
- Niche model (hypervolume in env. variable space)

Distribution
- Project niche upon map layers of environmental variables



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Distribution models – *Fragilariopsis kerguelensis*

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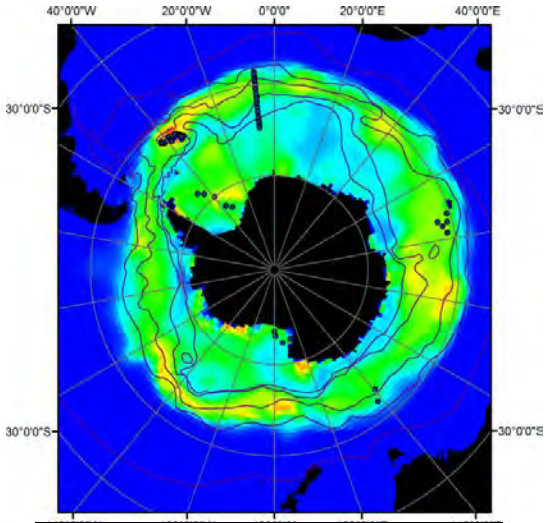
January

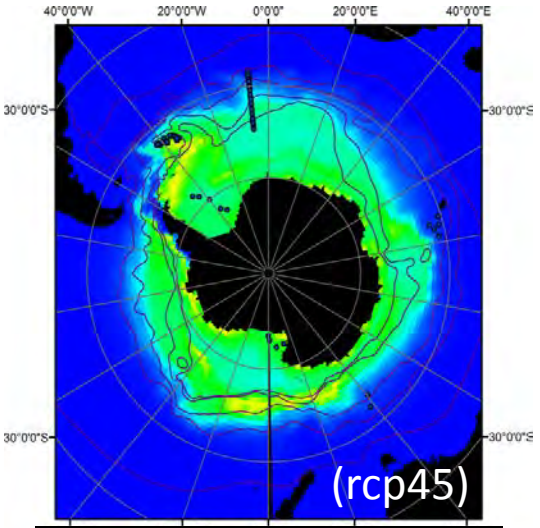
July

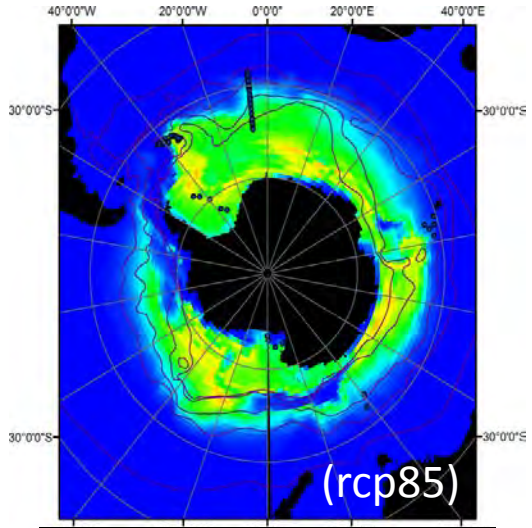
present

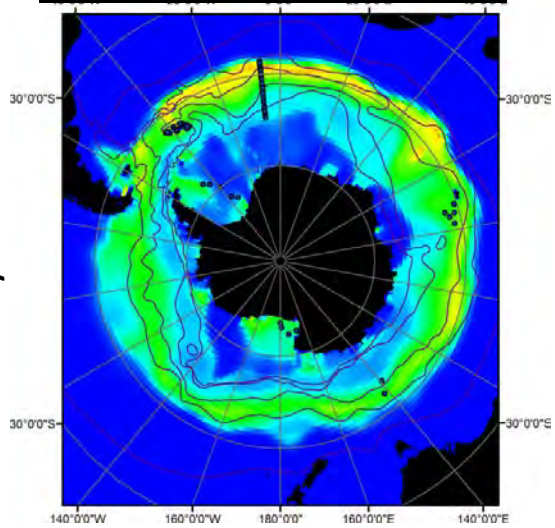
Projection for year 2100
less pessimistic scenario

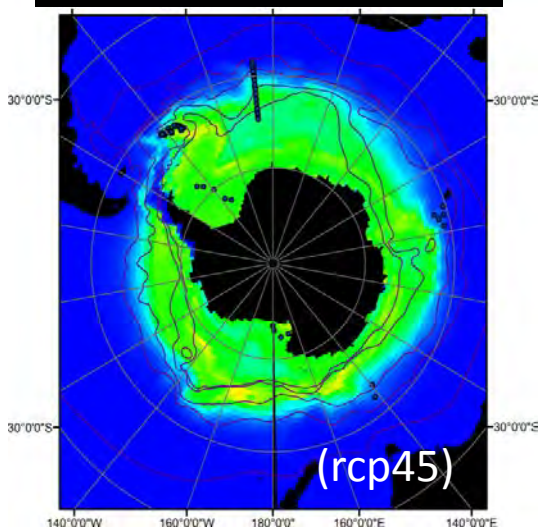
Projection for year 2100
more pessimistic scenario

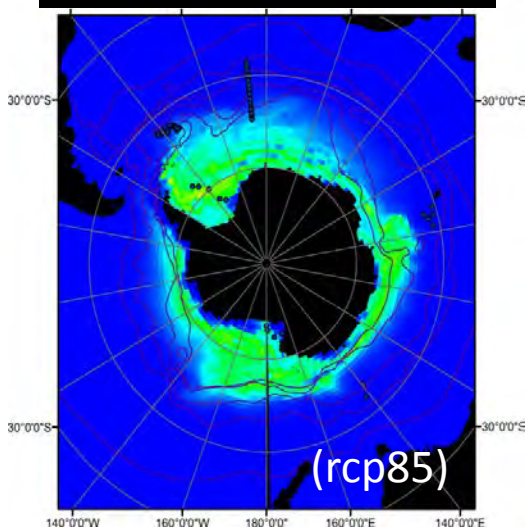






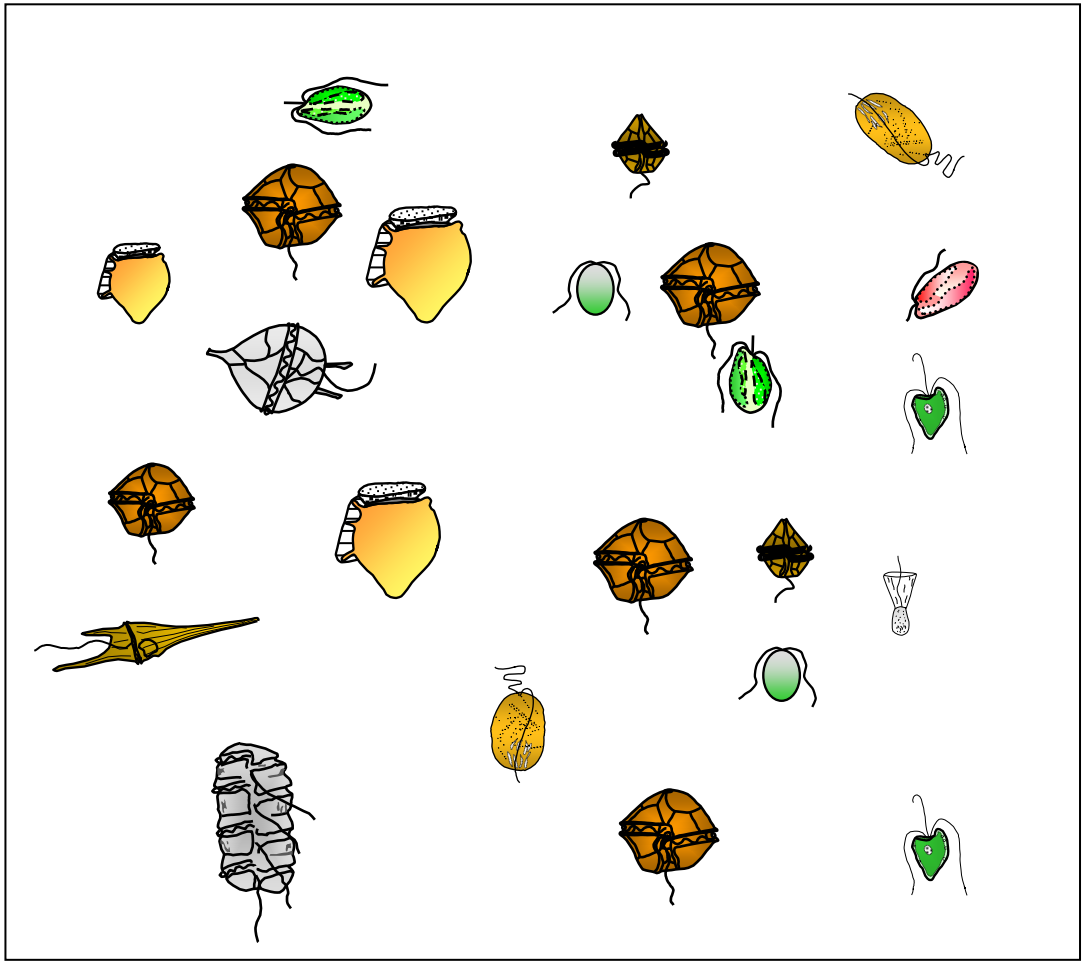






Future scenario

With decreasing diatom abundance there may be a shift to a Flagellate dominated community



including
Harmful Algal Bloom (HAB) species

Climate change indicator

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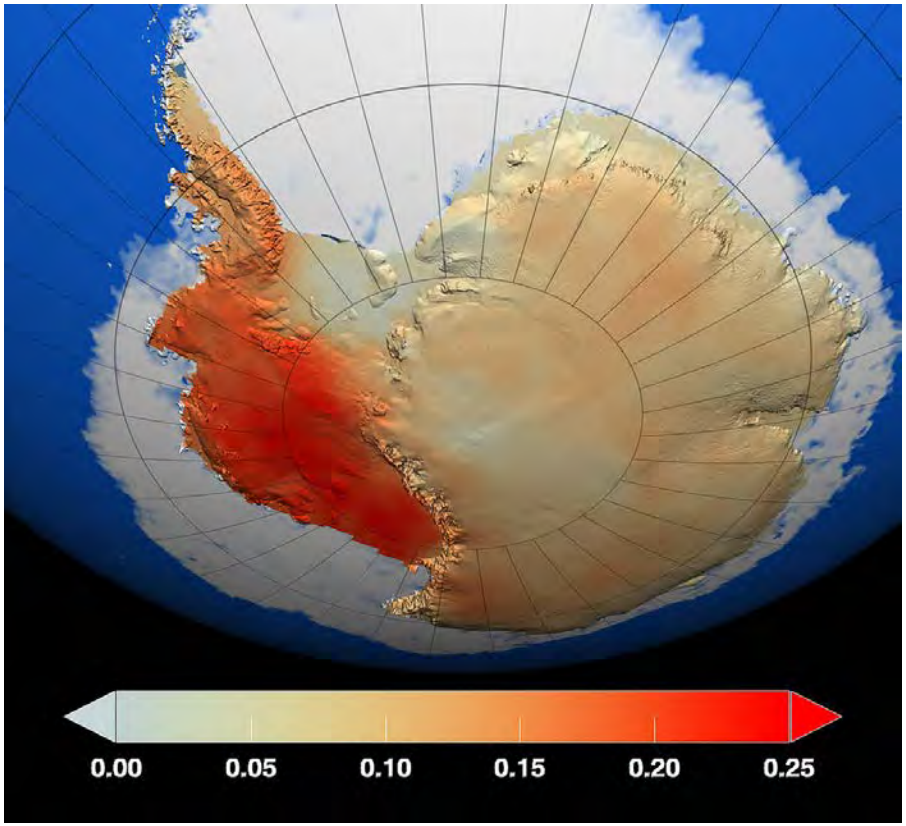
Antarctic Peninsula



Antarctic surface temperature trends for 1957-2006
Author: NASA Earth Observatory

The West Antarctic Peninsula is one of fastest warming areas on earth

Antarctic peninsula is a good model system to study changes in plankton community

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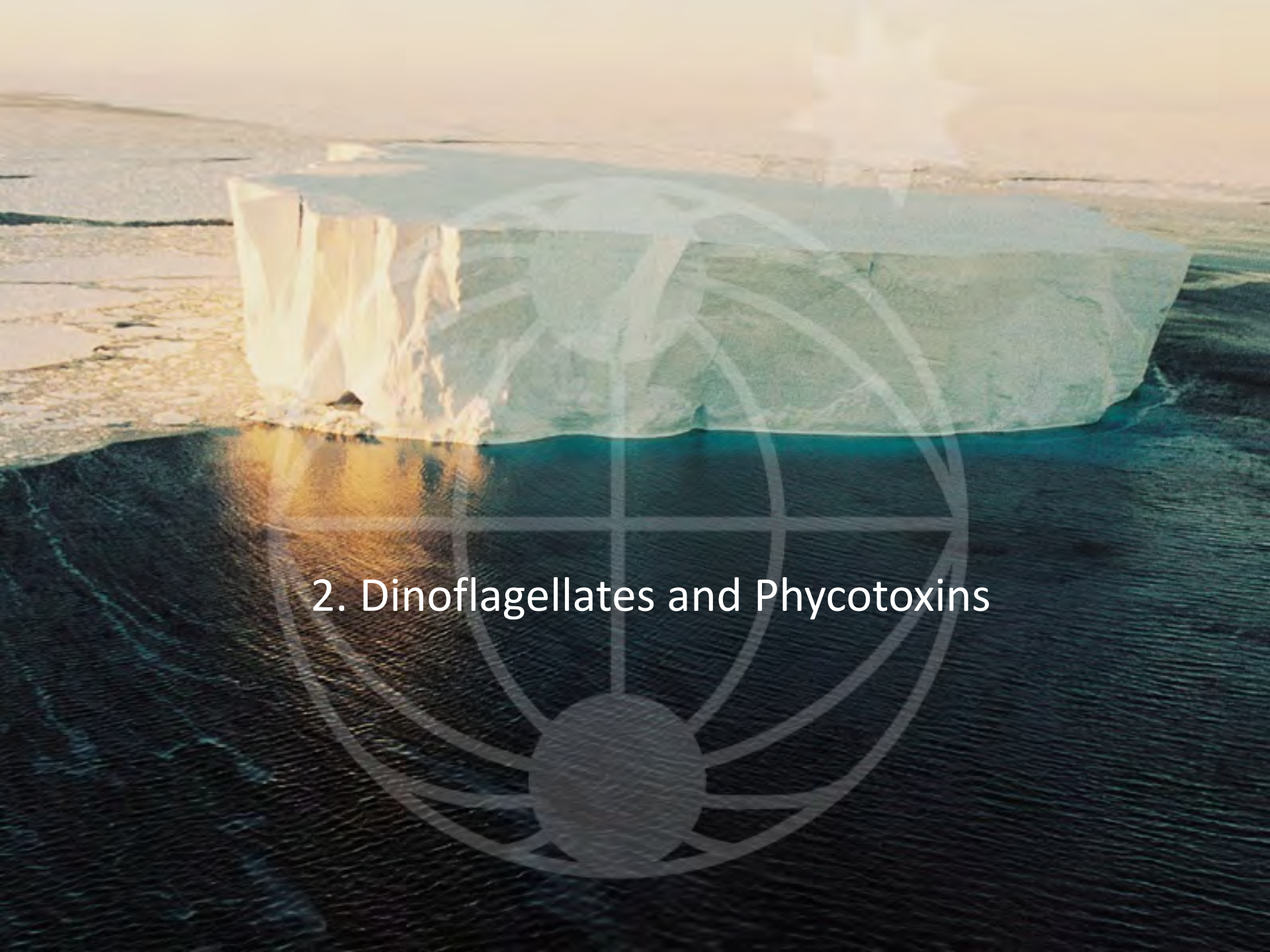
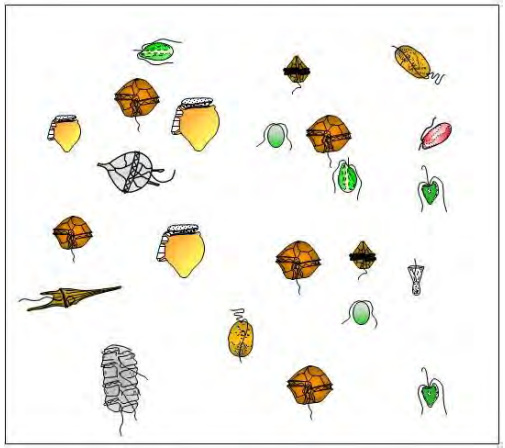


2. Dinoflagellates and Phycotoxins

Climate change indicator



Why are phycotoxins interesting apart from their toxic effects?

Phycotoxins can be used as

chemotaxonomic markers

which are (relatively) easy to sample/detect

HAB species in the Arctic

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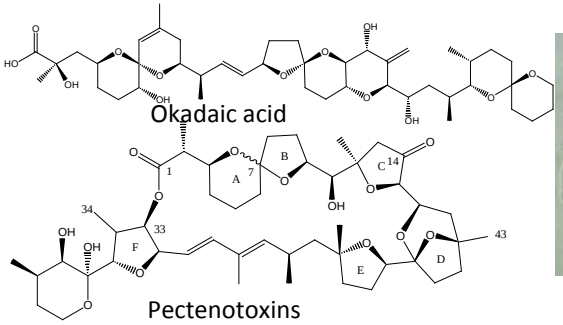
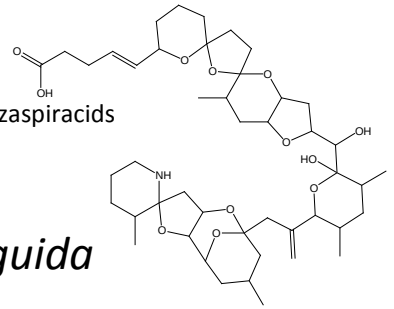
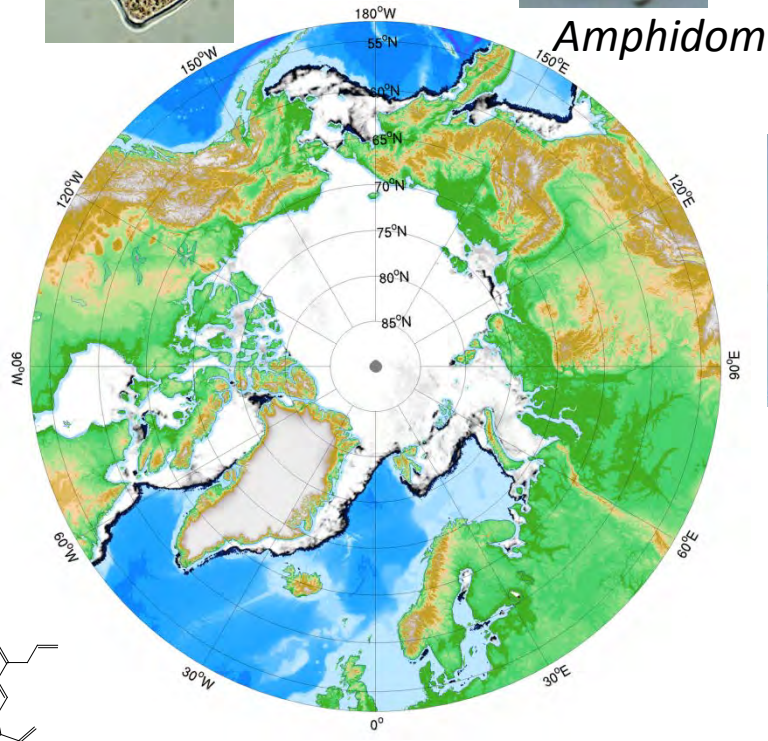
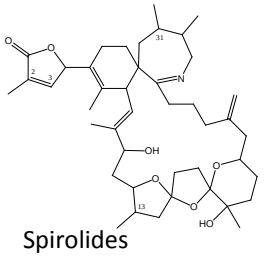


Dinophysis spp

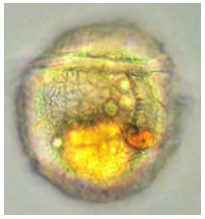
Amphidoma languida





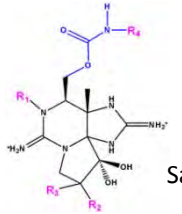


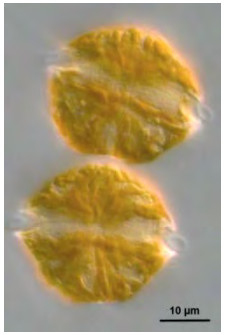
Alexandrium ostenfeldii



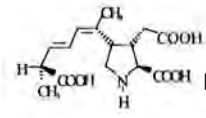
Protoceratium reticulatum

Pseudonitzschia spp





A. tamarense



Global distribution of PST

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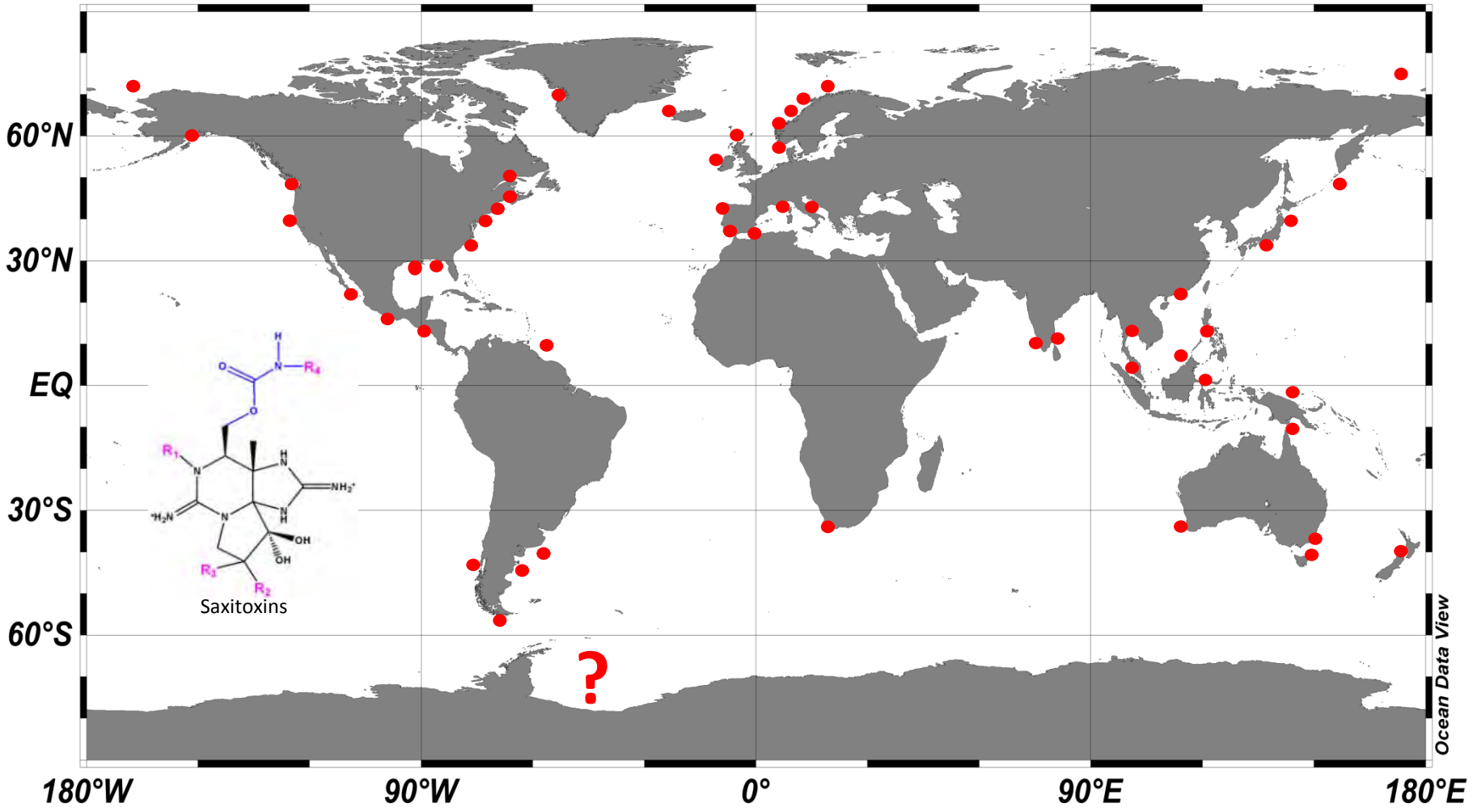

Global distribution of azaspiracids

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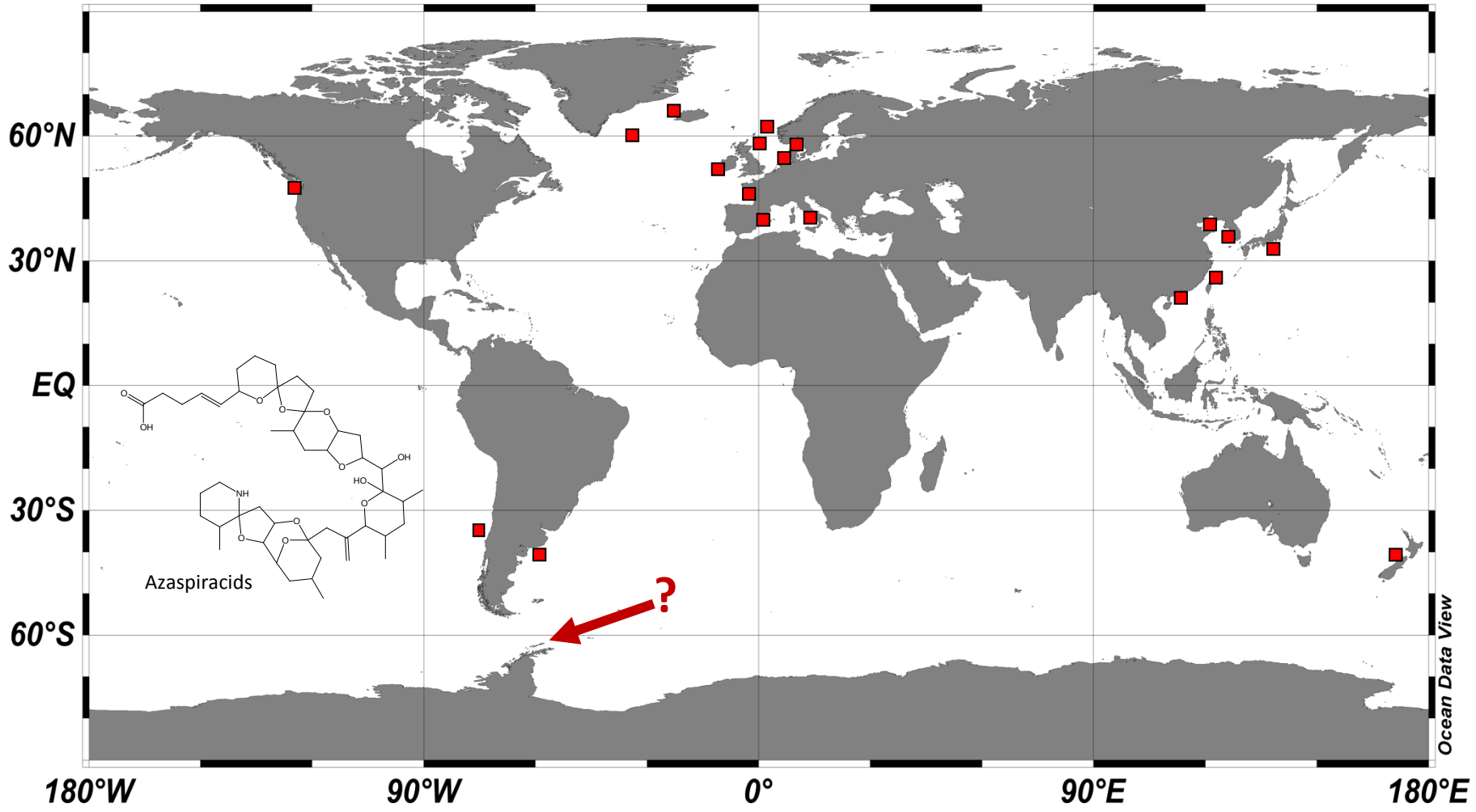
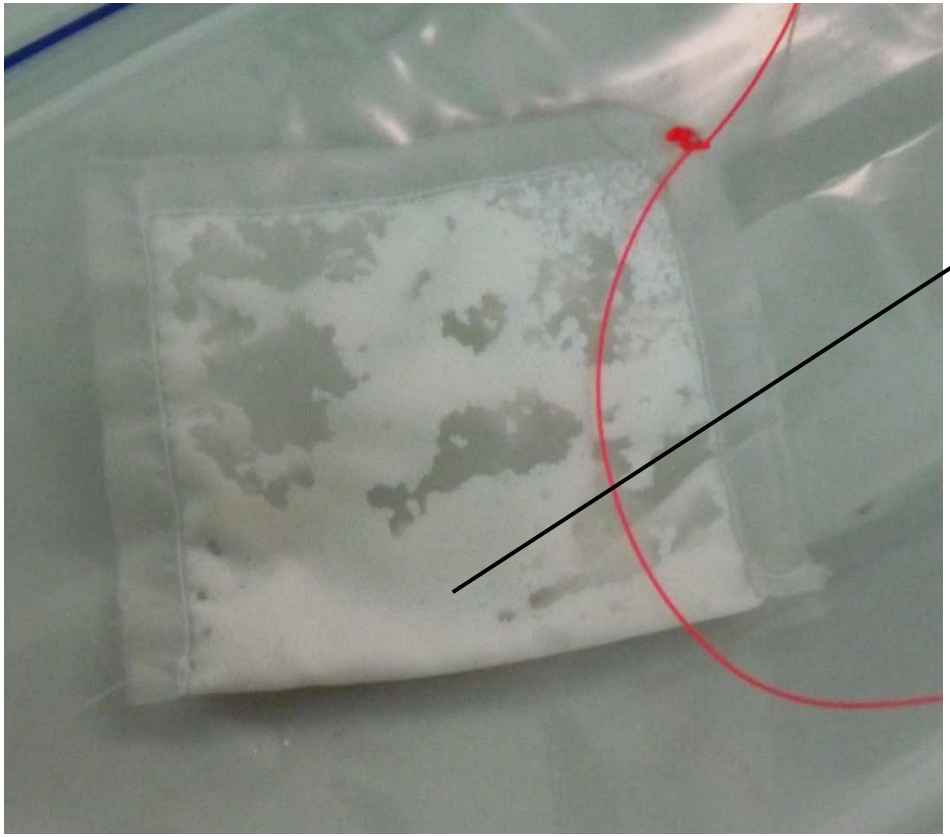


3. Passive sampling strategy for phycotoxins (and other chemotaxonomic markers)

Phyctotoxin sampling



Solid Phase Adsorption Toxin Tracking (SPATT)

MacKenzie et al. (2004), Toxicon 44 (8), 901-918.

Organic lipophilic (hydrophobic) polymer

Needs to be preconditioned (wetting with organic solvent e.g. methanol)

Rinsing with water

Must not become dry before application

Phytotoxin sampling

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Map: www.wikipedia.org

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Bundesministerium für Bildung und Forschung

First preliminary results

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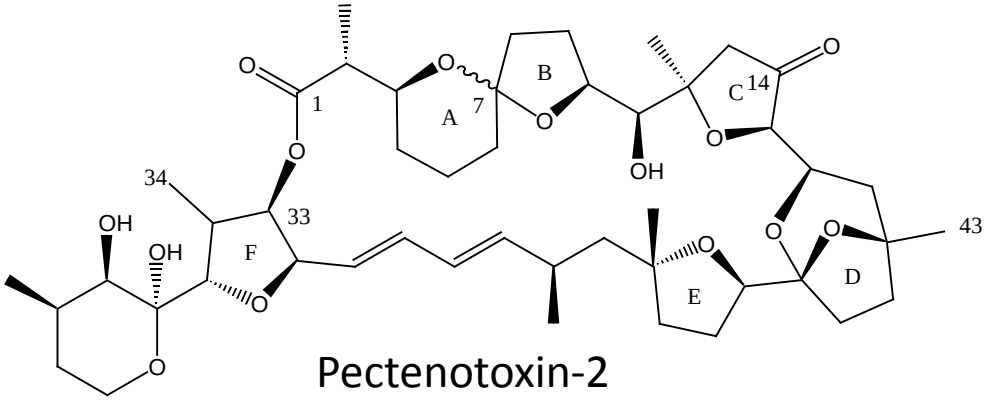
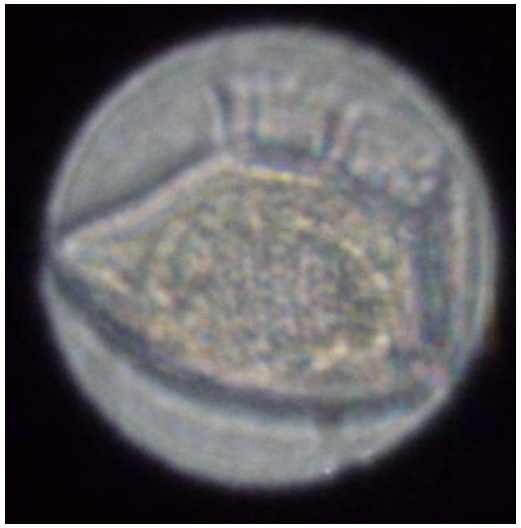


Pectenotoxin-2

Plankton Net Haul



Dinophysis (*norvegica* ?)

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4. Seabirds as sampling platforms?

Seabirds as sampling platforms

Why are seabirds interesting as sampling platforms?

1) Seabirds easily access otherwise difficult to reach areas

2) Seabirds actively search areas with high primary productivity

Seabirds as sampling platforms

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A first pilot study was performed in November 2014 in New Zealand in cooparation with the Te Papa (Natural history museum of New Zealand, Dr. Susan Waugh)

Why New Zealand?

1. There is already ongoing Penguin field work
2. NZ has set up a very dense phytoplankton monitoring which supplies reference data
3. Almost all known classes of phycotoxins occur in NZ waters

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Seabirds as sampling platforms

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Seabirds as sampling platforms

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Seabirds as sampling platforms

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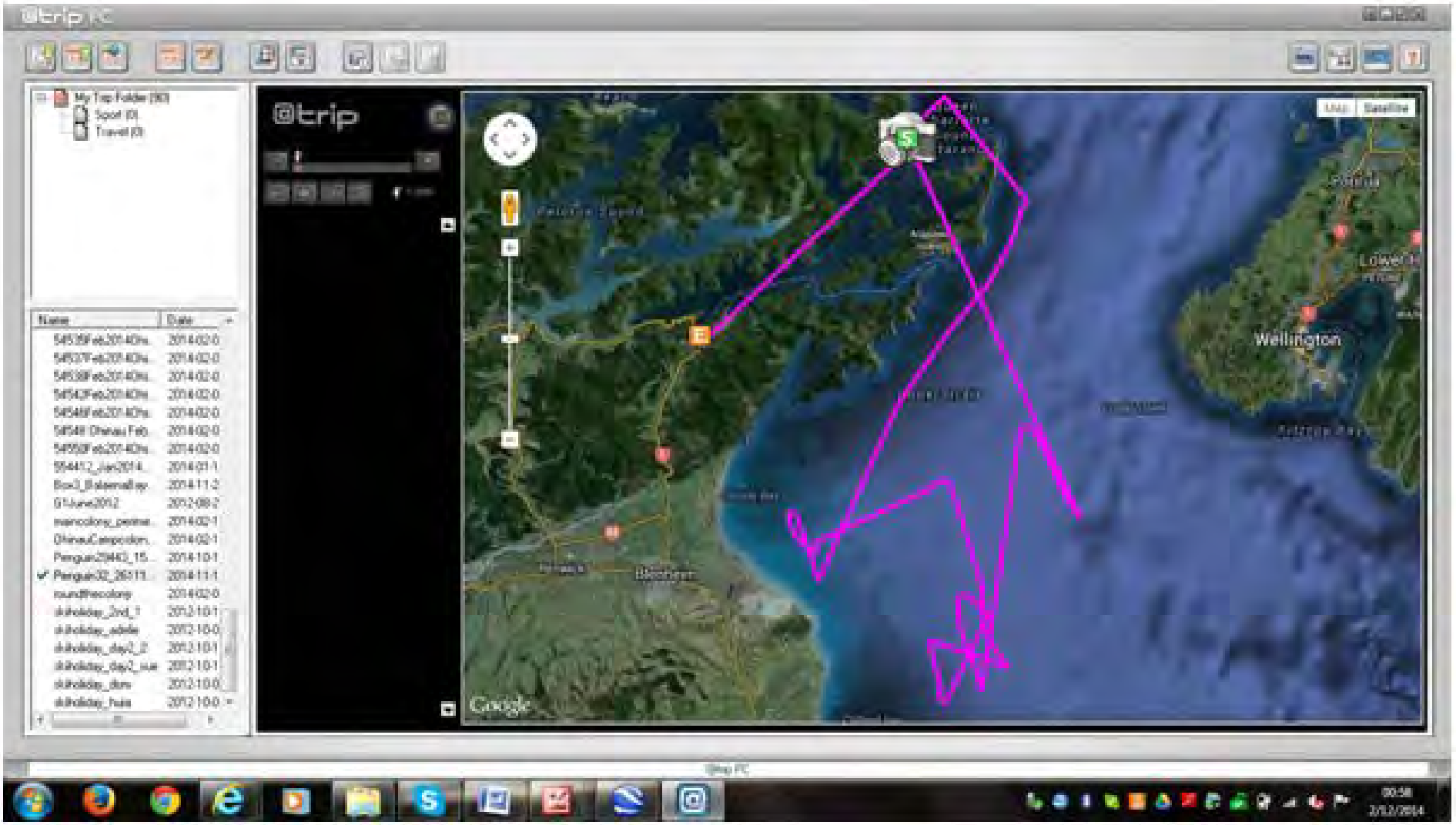

Seabirds as sampling platforms

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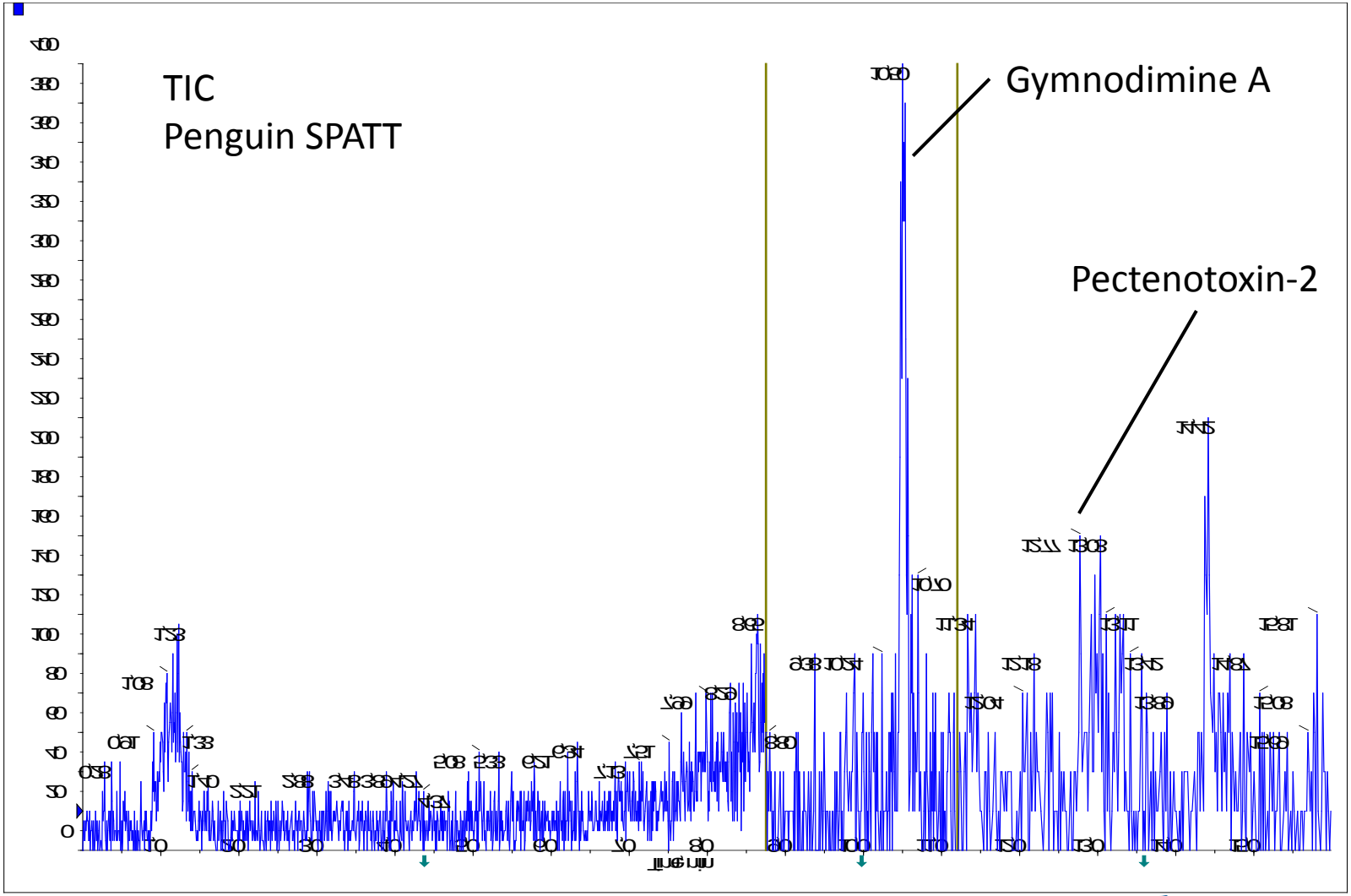

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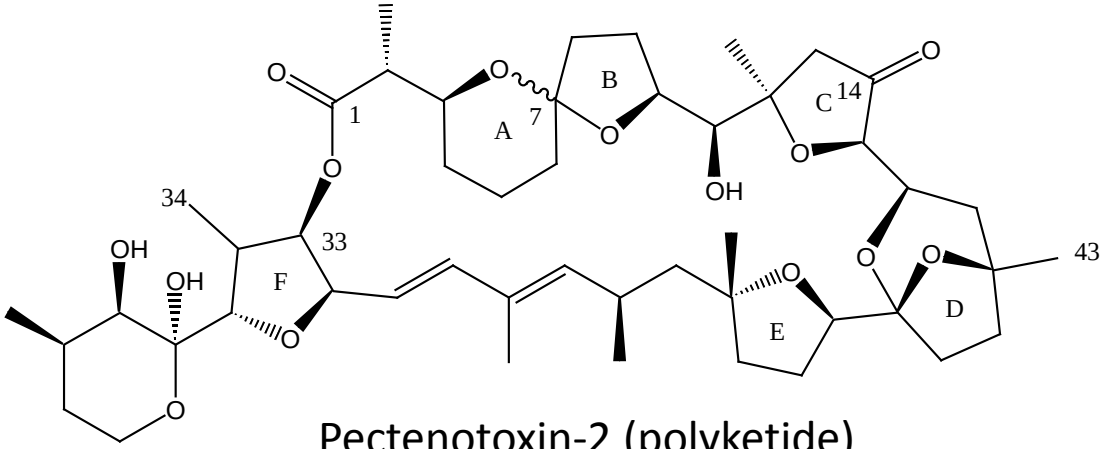
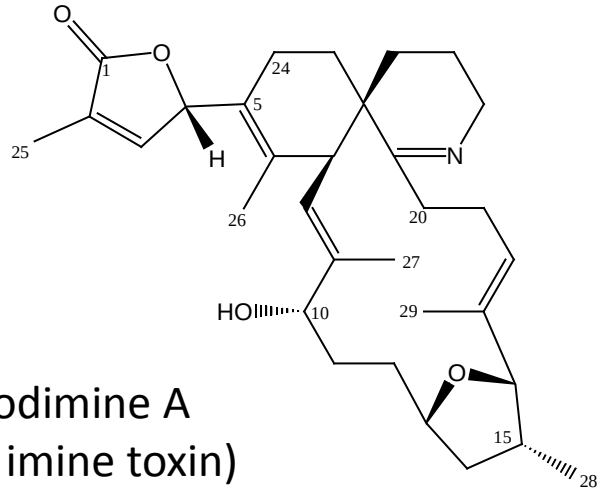
Seabirds as sampling platforms



Pectenotoxin-2 (polyketide)

Dinophysis spp.



Gymnodimine A
(cyclic imine toxin)

Karenia selliformis

Seabirds as sampling platforms

Implications:

1. Method works
2. Detection of low background level possible (no plankton bloom at this time/location)

Applications:

1. Assessment of phycotoxin distribution in remote areas
2. Plankton composition (by chemotaxonomic markers)

Summary

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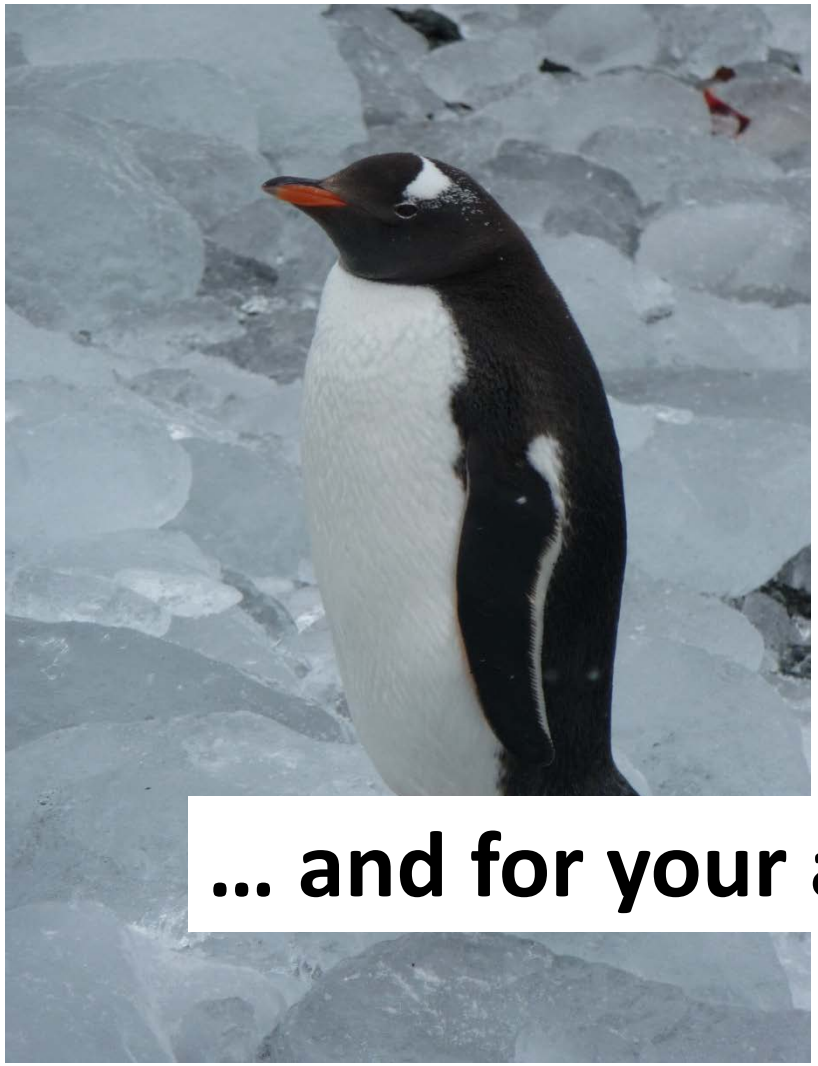
1. Ecological niche models predict that diatom abundance will be declining with increasing temperature in the Antarctic region

2. There may be a shift from a Diatom-Phaeocystis dominated plankton community to a Flagellate dominated community in the Southern Ocean including HAB species

3. Phycotoxins can be used as proxys for a changing plankton commmunity

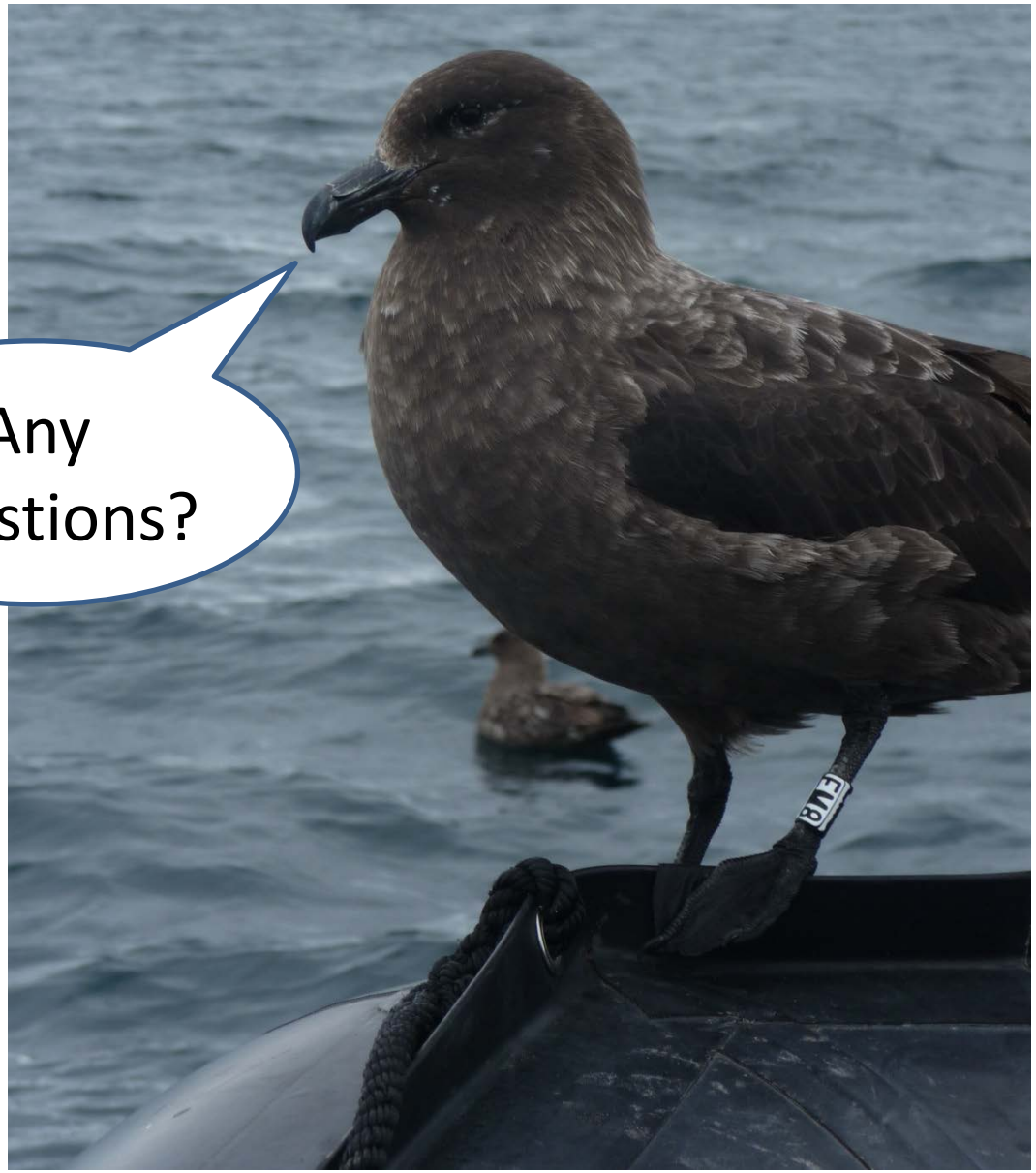
4. Seabirds may be intereting sampling platforms for phytoplanktonic chemotaxonomic markers in remote areas



Special thanks to…

Bánk Beszteri (AWI, DE)
Stefan Pinkernell (AWI, DE)
Nicole Trefault (U Mayor, CL)
Rodrigo de la Iglesia (PUC, CL)

… and for your attention!


Any
Questions?