Phytoplankton diversity and distribution in the Pacific sector of the Southern Ocean

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Objective

ultimate objective: detecting and assessing effects of global warming on the composition and distribution of phytoplankton assemblages in the Southern Ocean

comprehensive data needed

especially for the Amundsen Sea there is a lack of information

diversity of phytoplankton still largely unknown, especially for the smaller fractions

current study will provide:
→ comprehensive data set of the composition and distribution of phytoplankton assemblages in the Pacific Sector of the Southern Ocean
→ baseline for future investigations
→ promote next generation molecular tools
58 surface water samples were taken during the RV Polarstern cruise ANT XXVI/3

February 2010 → austral summer

- north-south transect through all water masses
- west-east transect along the coast of Antarctica
Methods

surface water sample

• 3-6 l of water sample were filtered
  • 5 ml were fixed

filter / fixed sample

molecular techniques

HPLC

flow cytometry

ARISA

454-pyrosequencing

comprehensive picture of the whole sample:
→ community structure
→ dominant groups/species
→ „rare biosphere“
Results

ARISA

2D stress = 0.2276

2D stress = 0.1594
Results
454-pyrosequencing

- Surface water temperature (°C)
  - 12°C
  - 5°C
  - 0°C

- Taxonomic distribution:
  - Haptophyta: 3303
  - Dinophyceae: 6039
  - Other Alveolata: 3154
  - Other Stramenopila: 5726
  - Bacillariophyceae: 1663
  - Rhodophyta: 0
  - Chlorophyta: 5
  - Other Eukarya: 3200
  - Pelagophyceae: 538

- Sample sizes:
  - N = 23126
  - N = 34497
  - N = 12604
  - N = 34497

- Spatial distribution:
  - Subantarctic Front
  - Antarctic Polar Front

- Color scale for surface water temperature (°C): 0, 2.5, 5, 7.5, 10, 12.5, 15
Results

454-pyrosequencing

- Haptophyta: 4681
  - Chlorophyta: 26
    - Cryptophyta: 21
  - Rhodophyta: 14
  - N = 2704

- Bacillariophyceae: 8156
  - Chlorophyta: 779
    - Cryptophyta: 15
  - Rhodophyta: 11
  - N = 3047

- Dinophyceae: 9716
  - Chlorophyta: 6
    - Cryptophyta: 6
  - Rhodophyta: 30
  - N = 23635

- other Eukarya: 2704

Other Alveolata:
- 775
- 1107

Other Stramenopila:
- 3047
- 1630

Pelagophyceae:
- 2575
- 56

Nitratophyceae:
- 9313

>33 PSU
- 41

<33 PSU
- 51

N = 29419

N = 19391

Surface water salinity [PSU]
Results

HPLC and 454 trends mostly consistent

Chlorophyta

Dinophyceae

Bacillariophyceae

Haptophyta
Summary

- Molecular tools seem to be appropriate for describing the community structure.

- Investigated water regions show clear differences in their community structure, according to the different environmental conditions.

- Data set can be used for future investigations to determine changes due to global warming.

- The “rare biosphere” represents a big part of the diversity (data not shown).
Thank you for your attention!

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Appendix

Pelagophyceae

Correlation: 0.27

Cryptophyta

Correlation: 0.99

Relative abundance [%]

Sample: 8 16 25 41 47 51
Appendix

![Graph of total Chla concentrations across samples](image-url)