**Introduction**

Arctic sea ice is a very dynamic environment which is currently suffering a rapid decline in extent and thickness. Besides the phytoplankton in the surface waters, sea ice algae can contribute up to 57% to primary production (Gosselin et al. 1997), but our knowledge about their activity, especially in the central basins, is still limited.

During the Polarstern summer expedition TransArc 2011 to the Central Arctic, potential Net Primary Productivity rates (NPP) and Chlorophyll a were measured in different habitats: surface waters, sea ice and melt ponds; to assess the importance of sea ice alga carbon fixation and biomass compared to phytoplankton and melt pond autotrophs.

**Methods**

- **Radioactive isotope ¹⁴C-METHOD**
  1. 24 h incubation (10 µE/m² s; Light, -2°C)
  2. Filtration 0.2 µm pore size
  3. Acidification 6M HCl
  4. Liquid scintillation counting

**Results**

**Sea Ice**

- Net primary productivity rates and chlorophyll a concentrations in sea ice samples collected in the Arctic during the summer season. The data show a clear decrease in productivity from the surface to the bottom of the sea ice.

**Melt Ponds**

- Net primary productivity rates and chlorophyll a concentrations in melt ponds sampled during the expedition. The data indicate higher productivity in the pond at station 212.

**Surface Water**

- Net primary productivity rates and chlorophyll a concentrations in surface water samples (2-5 m depth) from the Atlantic to Pacific influenced waters. The productivity rates are compared to the base and the top water layers.

**Conclusions**

- Sea ice hosts the most active autotrophs under low light conditions. Nevertheless, when compared to the integrated water column, its contribution to the arctic carbon cycle during summer is one order of magnitude lower compared to the water column.
- Melt Pond aggregates sustain the highest productivity rates of all before the re-freezing starts.
- Surface waters from the Atlantic influenced region show high phytoplankton biomass standing stocks but low productivity, while the other regions are characterized by generally low NPP rates compared to sea ice and melt ponds.

**Outlook**

- Unravel the limiting factors for primary productivity in sea ice and surface waters by nutrient bioassays and photosynthesis-irradiance curves.
- Upscale primary productivity to the entire Arctic Ocean.
- Reveal the key groups responsible for carbon fixation in each habitat.
- Determine the carbon transfer rates from melt pond algae to bacteria.

**Acknowledgements**

I would like to thank Kristin Hänselmann and Erika Alhusen for their help during the sampling; Ellen Damm, Elisabeth Helmke and Gerhard Deckmann for fruitful discussions; the AWI-Sea Ice Physics group for all their work and all the participants and crew members of the RV Polarstern ARK XXVI/3 Expedition 2011.