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zosiasmola@gmail.com

ABSTRACT

Phytoplankton wintering strategy in polar regions

Zofia Smoła[1] dr Calra Hoppe[2] dr Eva Leu[3] Ida Bernhardsson[4] dr Józef Wiktor[1] [1]*Polish Academy of Science, Institute of Oceanology - Centre for Polar Studies KNOW (Leading National Research Centre), Poland,* [2]*Alfred-Wegener-Institute for Polar and Marine Research, Am Handelshafen 12, 27570 Bremerhaven, Germany,* [3]*Akvaplan-niva AS, Science Park, Gaustadalleen 21, 0349 Oslo, Norway,* [4]*4Department of Ecology and Genetics / Limnology, Uppsala University, Norbyvägen 18 D, 75236 Uppsala, Sweden,*

One of the most important limiting factor for primary producers growth in polar regions
is specific light regime with absence of Sun light during polar night (116 days of dark in Kongsfjorden, Svalbard). Dark period contain about 19 - 58 protists life cycles. Hence during winter in water column we can find few specimens of autotrophic protists. However in the every spring year, those organisms forms blooms – main source of new organic carbon for polar ecosystems. For many years there was no clear answer to the question, from where autotrophic protists come from in pelagic ecosystem when the Sun returns above horizon. Weather they are transported northward with marine currents? Spent winter in pelagic environment harvesting on moonlight? Or are those organisms able to starve three month per year or longer? Little is known how microalgae survive unfavorable conditions, cells physiology and mechanisms indicating germination.

Some groups of protists can survive as a resting stages (cysts or spores). Some of them wintering in viable form can survive more than two years buried in sediments. Dormant photoautotrophs can wait for suitable conditions in three habitats: surface layer of sediments, under sea ice and in water column.

To answer for above questions, we conducted preliminary experiment in Ny-Ålesund, (Spitsbergen) during winter 2014/2015. Main scientific question was - does buried in sediment autotrophic protists are able to germinate after light return and if yes – what environmental condition initiate Spring bloom.

In course of experiment, surface layer of bottom (below 200m) sediment of Arctic fjord was incubated in different photoperiods and light intensities. During more than three weeks incubation, development of protists assemblages was measured. The biomass (chlorophyll *a* concentration), photosynthetic yield development, primary production and species composition evaluated.

Results indicated that light intensities about 50 µmol photons m^{-2} s^{-1} triggered

development – all evaluated parameters showed increase. However algae collected from Kongsfjorden surface water demonstrated that cells have active photosynthetic pigments. The measurements of primary production (C^{14} method) in situ during polar night do not allow to conclude about active production processes. This allow us to reject opinions that Moon light is able to trigger primary production. Presence of cells and cysts in sediment in turn, confirms the hypothesis about this type of microalgae survival strategy. Whereas growth of photosynthetic activity and yield in the relatively short and limited (presence of mineral particles in cultures) light exposition, suggest that phytoplankton is able to take active growth shortly after improving light conditions.