Geophysical Research Abstracts,
Vol. 11, EGU2009-12388, 2009
EGU General Assembly 2009

Effect of nitrogen fertilization on the activity and diversity of methane oxidising bacteria in the littoral zone of a boreal lake

A. Saari (1), H.M.P. Siljanen (1,2), S. Hämäläinen (1), L. Bodrossy (3), and P.J. Martikainen (1)

(1) University of Kuopio, Department of Environmental Science, Kuopio, Finland (anne.saari@uku.fi), (2) Finnish Environment Institute, Kuopio,Finland, (3) Austrian Research Centers GmbH - ARC, Department of Bioresources, Seibersdorf, Austria

Freshwater lakes are generally net sources of CH_4 and in boreal lakes a major part of the CH_4 emissions originates from the littoral zone during the ice-free season. Aerobic CH_4 oxidising bacteria, methanotrophs, significantly limit the flux of CH_4 to the atmosphere from sediments. Increased N load causes eutrophication and subsequent anoxia, which probably enhances CH_4 production. In addition, inorganic nitrogen (ammonium and nitrate) can inhibit CH_4 oxidation. Our study belongs to the research consortium METHECO (Eurodiversity programme of European Science Foundation), where the activity and diversity of methane oxidising bacteria are studied in various European ecosystems.

We studied with *in situ* manipulation the effects of eutrophication (added nitrogen) on the activity and diversity of methanotrophs in a littoral wetland of a small and shallow hyper-eutrophic lake in east-central Finland. We established in the area growing sedges (7-10 m from the shore line) three sampling plots (1.2 m x 1.2 m), which were irrigated four times (from 4th July to 9th August) with ammonium nitrate solution giving 10 g N $m^{-2}$for the total additional nitrogen load during the growing season. Three control plots were irrigated with equivalent amount of distilled water. The amount of added ammonium nitrate solution or water did not exceed 10% of the long-term (30 years) average rainfall in the area during the growing season. Sediment samples were taken from the depths of 0-2 cm, 2-10cm, 10-20 cm and 20-30 cm before, during and after the N treatment. Methane oxidation potential was studied in 550-ml flasks with sediment slurries and initial headspace CH_4 concentration of 0.1%. The diversity of methanotrophs was studied with *pmoA*-microarray.

Methane oxidation was most active in the organic surface sediment layer of 0-10 cm and the activity decreased with depth. Nitrogen addition *in situ* did not affect significantly the potential CH_4 oxidation rates, although nitrate inhibited CH_4 oxidation in a separate laboratory experiment. There were differences in the diversity of methanotrophs between various soil layers. Methanotroph community structure and especially the functional diversity of methanotrophs showed some changes as a result of the nitrogen fertilization.