OPEN ACCESS Freely available online

ISSN: 2473-3350
Journal of Coastal Zone Management

Opinion Article

Reduced Methane Oxidizing Activity of Sediment Methanotrophs in Shallow Coastal Zones

Carl J Reddin*

Department of Biology and Environmental Science, Stockholm University, Frescativägen, Stockholm, Sweden

ABOUT THE STUDY

Coastal zones are transitional zones between land and sea where microbes recycle large amounts of organic and inorganic carbon compounds. The main source of oceanic methane (CH_4) emissions has been identified as shallow zones near land. Water depth has been predicted as the best explanatory variable for CH_4 ebullition, but it is unclear how sediment methanotrophic bacteria mediate these emissions along water depth. The activity of methanotrophs in the sediment of shallow coastal zones with high CH_4 emissions was studied over a depth gradient of 10–45 m. Sediment slices were collected from eight stations along a coastal gradient (0–4 km from land) in the coastal Baltic Sea.

CH_4 is a potent greenhouse gas that has increased 2.5 times in the atmosphere since the industrial revolution, and is today at 1.85 ppm, and contributes to approximately 20% of tropospheric radiative forcing. Furthermore, the annual atmospheric CH_4 concentration measured during 2014–2017 was record high since 1980. The majority of CH_4 emissions are derived from human activities such as livestock, rice paddies, hydropower dams management. However, natural aquatic systems such as inland waters are reported to contribute a significant portion to CH_4 emissions (30% or more).

In marine ecosystems, coastal zones have the highest contribution to global CH_4 emissions, with shallow inshore waters closer to land being estimated to have an annual CH_4 emission 370 times higher compared to that in the open ocean. Globally, shallow water depths in coastal zones are linked to higher CH_4 emissions, but environmental predictors have been unable to explain this relationship. It is therefore possible that biological mechanisms are partly able to explain the discrepancy between coastal shallow and deeper areas. However, this has not been fully investigated and would help to increase the understanding of the controls of CH_4 cycling in coastal areas.

Shallow coastal zones are known to have high CH_4 concentrations in the water column compared to deeper waters. This was also indicated by our acoustic data of CH_4 seeps and the real-time measurements of CH_4 in the surface water. Here we build on these results and hypothesized that:

- Methanotrophic activity (i.e. CH_4 cycling) is higher in the shallow inshore stations.
- The relative proportion of methanotrophs are positively related to the CH_4 concentrations and number of CH_4 seabed.

On a global scale CH_4 emissions from coastal zones are higher at shallower water depths, and we also detected this relationship between water depth and CH_4 seeps and CH_4 concentrations in the studied costal ecosystem. Moreover, limited methanotrophic activity could also explain why shallow coastal waters in rapidly changing ecosystems like the East Siberian artic shelf have higher CH_4 emissions compared to the deeper offshore water.

Significant CH_4 emissions from the artic subsea might therefore only occur in the shallowest parts due to a limited activity of methanotrophs. Our results imply that methanotrophs, rather than solely methanogens, play a key role in shallow coastal zones regulating CH_4 emissions. Globally, low methanotrophic activity in the sediment could partly explain the substantial amount of CH_4 emissions from shallow inland water bodies and reservoirs. Methanotrophs' low CH_4 oxidising activity may explain why shallow parts of the costal rim have higher CH_4 emissions. This is an underappreciated mechanism that may help to explain the dynamics of greenhouse gas emissions from marine ecosystems.

Correspondence to: Carl J Reddin, Department of Biology and Environmental Science, Stockholm University, Frescativägen, Stockholm, Sweden, E-mail: redcarlj@su.edu.sw

Received: 01-Apr-2022, Manuscript No. JCZM-22-16634; **Editor assigned:** 04-Apr-2022, PreQC No. JCZM-22-16634 (PQ); **Reviewed:** 18-Apr-2022, QC No JCZM-22-16634; **Revised:** 25-Apr-2022, Manuscript No. JCZM-22-16634 (R); **Published:** 02-May-2022. DOI: 10.35248/2473-3350.22.25.496

Citation: Reddin CJ (2022) Reduced Methane Oxidizing Activity of Sediment Methanotrophs in Shallow Coastal Zones. J Coast Zone Manag. 25:496.