Proposed dissertation theme for the Doctoral degree Studies (2018-2022) in Ecology and Environmental Science at Klaipėda University

Title	**Pathways of anaerobic respiration in estuarine sediments: role of metal (Fe, Mn) reduction and methanogenesis**
Brief description of the topic	Estuarine sediments display horizontal and vertical zonation of microbial respiration, including aerobic and anaerobic pathways. Anaerobic respiration usually takes place in deeper, anoxic sediment layer. Main pathways of anaerobic respiration are nitrate (NO_3^-), metal (Fe and Mn) and sulfate (SO_4^{2-}) reduction and methanogenesis. In the Curonian (Baltic Sea) and in the Sacca di Goro Lagoons (Adriatic Sea), nitrate-based respiration (denitrification) is quite well studied while manganese (Mn(III/IV)) and iron (Fe(III)) reduction and methanogenesis (CH_4) are comparatively understudied. The research of metal reduction and methanogenesis would allow to better understand the cycle of key nutrients (nitrogen and phosphorus), that may be released in large amounts from sediments and affect algal blooms, later resulting in dystrophic events. Thus, redox processes determining the cycling of Fe, Mn and CH_4 is the topic of current PhD project. Both metals have soluble reduced forms and insoluble oxyhydroxides which are readily interconverted in the vicinity of a redox boundary. Domination of each forms are largely attributed to affinity to oxidation or reduction. It is known that Fe(II) can be readily oxidized than Mn(II) while Mn(IV) reduction is faster than Fe(III). Methane is mostly released by ebullition from deep sediments, where methanogenesis is more intensive. It is likely that in the less saline Curonian Lagoon methanogenesis is quantitatively relevant in comparison to the Sacca di Goro lagoon. In these shallow lagoons, mechanisms of reduction and oxidation process can be affected by bioturbation of invertebrates and macrophytobenthos (their roots), which extends redox boundary. This will be considered in various estuarine sedimentary environments, at the sediment-water interface and in anoxic and oxygenated waters in order to unify context of the processes occurring at a redox boundary. Results from these diverse sites along longitudinal gradient will be brought together to provide an overall understanding of the redox cycling of these two important processes in estuaries.
Requirements for a candidate	We are looking motivated student who holds master's degree in a relevant field (ecology and environmental research, biogeochemistry, geochemistry or chemistry). Applicant should have the interest and ability to learn new research methods as needed for attaining the tasks, should be able to work independently as well as in an interdisciplinary team; hence good communication skills are important. Good English language skills are necessary.
Research experience in the institution	PhD student will join to the young, leading "Aquatic Biogeochemistry and Ecosystems Functioning" research group, which conducted number of studies targeting nutrient and gas cycling, mediated by macrofauna, micro- and macroalgae. Therefore, the excellence of group relies on a combination of technical and scientific *know-how*. The scientists from the group are continuously involved in development and application of novel tools for biogeochemical processes analysis. The group is building an international research network that consolidates interactions among scientists from different countries (Italy, Sweden, Germany, France Denmark, USA and etc.). The thesis will be carried through the collaboration with GGF project (INBALANCE, 2017–2021) and national (NixFix, Patchy, 2017–2020) and EPA projects.
Existing research infrastructure and support	Marine Research Institute operates cutting of edge of analytical and experimental facilities that serves for observational and experimental research from the gene to the ecosystem level in both aquatic and terrestrial environments. The existing collaboration among Center for Physical Sciences and Technology, Parma and Stockholm Universities will provide access to unique infrastructure needed for achieving specific tasks. PhD scholarship includes: • Annual stipend: €7,140–7,800 (duration 4 years); • Support for travel and consumables: €6,400 for 4 years • Health insurance subsidy; • Access to new infrastructure at Institute of Marine Research including a climate

	rooms, sample preparation and analytical facilities. Additional: • Reduced fee accommodation (€1,360 / year) in the University campus; • Student rates for public transport; • Additional travel funding and extra stipend possibilities from National Research Council (subject to individual applications).
Potential supervisor [contact person for the topic]	Prof. Marco Bartoli (marco.bartoli@unipr.it)
Potential scientific advisor	Dr. Mindaugas Zilius