Shallow hard-bottom areas are complex habitats which support rich biodiversity. They constitute one of the most productive regions, nursery grounds and shelter for fish and variety of invertebrates. However, these ecosystems are poorly known in the Arctic, mostly due to difficulties in collecting biological material. Standard tools do not work effectively on hard bottom: grabs - gear which is descended from the ship vertically cannot collect the biota from rocks, dredges towed behind the ship on the bottom are a highly selective and destructive method leading to damaging delicate organisms and precluding further identification. The best method seems to be the use of SCUBA diving technique. Due to harsh conditions (low temperature, polar night lasting few months, sea ice cover), diving in polar waters is still a challenge and scientific diving is rarely undertaken. Proposed project aims at studying all components of hard-bottom using diving technique.

Spitsbergen (the largest island of Svalbard Archipelago) is a perfect study area. It is located on the border of two water masses: warming Atlantic waters and colder Arctic waters. Despite its high latitude, the process of atlantification, meaning gradual increase of water temperature, is observed in the last decades. It has a strong influence on the whole ecosystem (from changes in primary production, through food web modification and species distribution shifts). The process if succession, meaning directional alterations in species structure, can run differently under warming conditions due to the inflow of new organisms and new interspecific interactions.

The aim of the project is to study the influence of different water masses (warmer Atlantic and colder modified fiordic waters) on particular components of hard-bottom (macroalgae and macrofauna, discrete epifauna hidden in rocky crevices and zooplankton from the near-bottom layer) and succession rate on artificial experimental panels. Innovative methods of samples collection will be used and environmental experiment will be carried out.

The study will be conducted simultaneously at two stations in Isfjorden (largest fjord of west Spitsbergen): station S located on the southern coast influenced by warming Atlantic waters and station N situated on the northern coast under the influence of colder fjordic waters modified by glacial and river run-off. Experiment will consist in a photographic monitoring of artificial panels which were deployed in four seasons (summer, autumn, winter, spring) and will be photographed once a year during 5-years period in order to examine the influence of environmental conditions on the rate and direction of succession, and also to check whether season of initial deployment has any impact on succession process.

Use of novel tools will allow to collect a unique material of zooplankton from the near-bottom water layer and discrete fauna hidden in rocky crevices, which are unknown components of hard-bottom ecosystem. Zooplankton (tiny animals drifting in the water) will be collected for the first time in the near-bottom water layer. The commonly used plankton nets enable to collect samples only from 2 m above the bottom. Specially adapted net will be towed horizontally by divers as close to the bottom as possible. Underwater suction pump operated by divers will enable to obtain discrete, mobile fauna.

To better understand the ecosystem functioning, more comprehensive approach in necessary. Only when all particular components of the complex shallow hard-bottom ecosystem are analyzed altogether, the holistic picture emerges improving our knowledge about current state of this system and making it possible to detect and predict possible future changes driven by global warming.