SUMMARY FOR THE GENERAL PUBLIC

The proposed scientific project concerns the study of optical properties of marine waters in Arctic regions. Seawater is generally a complex medium which, in addition to chemically pure water, usually includes additional dissolved and suspended substances. In general, these substances can have a different nature (organic and inorganic) as well as different origins (autogenic or allogenic). The ability of seawater to absorb and scatter visible light is precisely described by the quantities called *inherent optical properties*. Unlike dissolved substances that contribute mainly to the light absorption, suspended substances (*suspended particulate matter*) can also effectively scatter light. The composition of suspended particulate matter in coastal regions is usually much more complicated than in open oceanic regions. In such reservoirs, seawater optical properties cannot be effectively described/parameterized using only one quantity - the concentration of chlorophyll *a*, which is often used as an approximate measure (proxy) of the abundance of autogenic photosynthesizing plankton. The proposed empirical research will be carried out in the western Spitsbergen fjords, which can be an example of particularly *optically-complex waters*. In these waters there may be variable concentrations, composition and properties of suspended matter, both of autogenic and allogenic origin, with significant changes in the proportion between organic and inorganic fractions.

A review of the literature on the subject indicates that the research on the optical properties of suspended particulate matter occurring in coastal Arctic regions was conducted only to a limited extent. It also seems that under the new project it will be possible and advisable to apply concepts and methodologies that have previously been used in research conducted in other marine areas.

The main goal of the project is to precisely characterize the variability of the inherent optical properties of seawater in selected fjords of western Spitsbergen, in relation to the concentration, composition and size distribution of the suspended particulate matter populations found in these waters. The proposed studies are activities in the field of basic sciences. In addition, however, the new results achieved will allow us in the future to increase the accuracy of practical optical methods for studying the marine environment (both *in situ* methods and remote sensing).

As part of the project, field measurements and sampling will be carried out in selected fjords of western Spitsbergen (Hornsund, Isfjorden and Kongsfjorden), during three expeditions of the r/v Oceania to the Arctic in years 2021-2023. As part of the research, selected inherent optical properties of seawater as well as biogeochemical and physical properties of suspended matter will be determined. The following quantities will be analysed: spectral values of light absorption, scattering and backscattering coefficients, concentrations of suspended particulate matter and its organic and inorganic fractions, concentrations of chlorophyll *a* and other phytoplankton pigments, as well as size distributions of suspended particulate matter populations. These analyses will be conducted on both original and size-fractionated water samples.

The collected new empirical material will allow to implement the following specific objectives:

- determining the absorption budget and the variability of absorption coefficient by particles in relation to the biogeochemical and physical properties of suspended matter;
- determining the variability of scattering, and backscattering coefficients by particles, and also the variability of backscattering ratio;
- checking whether in the studied environment it is possible to use ratios of relatively easily measurable optical coefficients to estimate the composition of suspended matter;
- checking the effectiveness of existing so-called *optical pre-classifications* and, if possible, proposing new ones to improve the accuracy of practical interpretation of data from direct and remote optical measurements.

The project will be implemented by a future PhD student and his supervisor (author of this project), in cooperation with other employees of the Institute of Oceanology of the Polish Academy of Sciences. Project results will be presented, among others, in a series of publications in international peer-reviewed journals that will form the basis for preparing a PhD student's dissertation.