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Research on oxygen minimum zones: International team of experts develops white paper

From August 30 to September 1, 2015, the Leibniz Institute for Baltic Sea Research Warnemünde (IOW) hosts a workshop of high-ranking international experts from the Scientific Committee on Oceanic Research (SCOR) working group "Microbial Community Reponses to Ocean Deoxygenation". The 16 scientists from seven different countries are discussing methodological standards and best practice examples for analysing marine microbial communities and biogeochemical processes of oxygen minimum zones (OMZ). The workshop aims at developing guide lines, which provide an orientation for researchers worldwide to standardize and optimize their work on OMZ.

"We count on an intensive, exciting exchange of ideas," says Klaus Jürgens, head of the IOW working group Microbial Ecology and coordinator of the Warnemünde SCOR meeting. "Exploring OMZ in detail is a significant research field at our institute. Our investigations at the interface of oxygen-rich and oxygen-poor zones in the Baltic Sea and in the Black Sea have resulted in important insights about matter cycles in those areas and the participating organisms, which have generated quite a bit of interest among ocean researchers worldwide. Furthermore, we are looking forward to present and get feedback for our sampling technology, which was developed at the IOW and is pending patent," says Jürgens.

With about 250 active members from almost 40 different countries, SCOR is one of the most important international science organisations in the field of marine research. Specialized SCOR working groups focus on topics of particular scientific or societal importance to develop strategies within a set time-frame to overcome deficiencies in methodology, cooperation and financing. The investigation of microbial communities and biogeochemical matter cycles in OMZ presents a special challenge in so far as the original *in-situ* status of these areas can be significantly altered merely by sampling them. To resolve this problem, many technical approaches have been developed without ever defining a methodological standard. This also applies to the analysis of the samples and the interpretation of the results. The SCOR working group, which is currently holding its meeting in Warnemünde, has recognized the method diversity as a serious handicap that impedes the worldwide scientific synthesis in this field of research. The workshop therefore aims at pooling the current knowledge as a basis for establishing standards in technology, techniques and analyses that are applicable worldwide.

Background Information on oxygen minimum zones (OMZ):
OMZ or so-called "dead zones" in marine environments – deep water layers with so little dissolved oxygen that many marine organisms cannot survive in these areas – have been the focus of research and public interest for quite some time. They develop in stratified water bodies, where well-aerated, warm surface water overlays a cold and therefore heavier deep water layer, which is not affected by surface mixing processes. By degrading organic material sinking down from the surface, bacteria and other microorganisms use up

the available oxygen in those deep water layers. The OMZ phenomenon is typical for nutrient-rich, tropical oceans with very warm surface waters. But also in marginal seas, where the stability of the water stratification is rather caused by gradients in salinity than temperature gradients, deeper zones regularly become oxygen-depleted. The OMZ's hostile living conditions become even more pronounced by toxic substances such as hydrogen sulphide, which develop through microbial degradation processes. Therefore only highly specialized microorganisms can survive in the dead zones.

The essentially natural phenomenon of the OMZ increasingly becomes problematic as these zones are spreading worldwide. Presumably, climate change is a major contributing factor. Since the 1970s, the seas' surface temperature has been increasing on average by 0,1 °C per decade. Warmer water can absorb less oxygen than cold water. The temperature rise in surface waters also enhances the stratification effect that impedes mixing and the ventilation of deeper layers. Another contributing factor – especially in coastal areas – is anthropogenic eutrophication. Currently, 8 % of the world's marine areas are OMZ. The progressing expansion of these zones will have far-reaching consequences for marine ecosystems as the areas, which are habitable for oxygen-depending sea-life, decrease.

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