



**GAPS IN OCEANOGRAPHIC RESEARCH AND
ENVIRONMENTAL MONITORING OF
THE BLACK SEA:
*WHAT SHOULD THE SCIENCE DO TO SUSTAIN
BLUE GROWTH
IN THE BLACK SEA?***

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- The Black Sea shores are inhabited from the early Stone Age.
- Several modern cities on the coast have 2-3 thousand years of continuous history.
- The first descriptions of the sea were made by the ancient Greeks and the Romans, modern oceanographic studies had started in the 19th century.
- It seems that there couldn't be any riddles...
- Despite these facts, the Black Sea is still the least explored sea in Europe!
- What haven't we known yet? What do we need to know for the sustainable use of the Black Sea?

- The main mystery and the problem: the hydrogen sulfide layer origin and dynamic.
- 90% of water mass – anoxic zone that is saturated with hydrogen sulfide.
- The established fact: the thickness of the oxygen zone decreases.
- The expeditions 2016-2017 have found the hydrogen sulfide at a depth of 50-70 m in some areas, instead of 100-120 m as previous investigations had shown. It is danger.
- The question is: what determines the hydrogen sulfide layer dynamic? Is it climate? Could streams cause it? Maybe it's all about anthropogenic impact or eutrophication? Or it's just biological processes?

- Hypoxia in coastal waters: unpredictable, often recurring disaster.
- It is a matter of common knowledge, that there is often a temporary hypoxia on the Black Sea shelf that destroys a huge number of fish and shellfish.
- However, we cannot predict this phenomenon. That is why we don't have ability to prevent it.

- Who contaminates the Black Sea?
- Only 6 countries are located on the Black Sea shores.
- But 22 countries in Europe and Asia are located in the Black Sea catchment area. The pollutants of all these countries come to the Black Sea with river runoff.
- The ratio of the sea area to the drainage basin land area is 1:5. It means that every square kilometer of sea surface gets pollution and garbage from 5 square kilometers of land area.
- The research of 2016-2017 had shown a significant number of pollutants, which were not taken into account previously: pharmacological industry products (antibiotics, antidepressants, hormones ...), derivatives of household chemicals, mercury.
- We do not know where each pollutant comes from, which country makes the largest contribution. And until we do not know it, it's impossible to regulate it. That is why we need a "large investigation" of the Black Sea pollution, based on the basin approach.

- The least-studied and the most dangerous pollutant is plastic marine litter.
- Million tons of empty plastic containers and bottles are delivered to the Black Sea, and are gradually converted into microplastics, toxic to marine animals.
- The research of marine litter in the Black Sea has started only a year ago like pilot project. The microplastics was not investigated at all.

Fish Resources: the independent estimate is absent.

- Almost all estimates of fish stocks are based on non-independent fishing data, that are biased.
- EU regulations require a fishery-independent studies of fish resources as the basis for determining catch quotas. However, this approach has not been implemented in the Black Sea yet.

- Operative oceanography: the pulse of the Black Sea
- The Black Sea is only one sea in whole Europe, that does not have any operational oceanography system – for the online measurement of environmental parameters, for quick management decisions.
- There are less than 20 ARGO-buoys in whole the sea, less than 10 “smart buoys”, no ferry-boxes.
- The bases of oceanographic data are quite completed, although they are not updated online, but with months’ delay.

What shall we do? The next years' challenges:

- The implementation of operative oceanography system based on the latest technologies: online databases, "smart buoys", ARGO buoys and ferry-boxes
- Deep investigation of the hydrogen sulfide layer dynamics: special surveys and a especial system of deep-water ARGO buoys
- The stock assessment of the commercial fish and shellfish that has to be independent on the fishery, preferably international
- Modeling and forecasting of coastal hypoxia
- "Large Basin Investigation" of the organic pollutants and toxic metals origin, identification of their sources and regulatory proposals
- Monitoring of the plastic litter and sea pollution with microplastics

The role of the International Center for Black Sea Studies:

- The Center is independent on all Black Sea coastal countries. The Center could play a leading role in the above-mentioned research and be a coordinator of these studies. The Center could develop international projects with the participation of Black Sea countries' research institutes
- The Center could be a mediator for the involvement Greek oceanographic institutions in the Black Sea investigation, and for the implementation of the Aegean Sea research and monitoring experience for the Black Sea ("Poseidon" system and others)
- The Center could play role of a "bridge" between the Black Sea and the European Union programs