Joint Cruise Methodology

Istanbul, 1 October
The main goal of the Joint Cruises

To provide ecosystem monitoring of the open waters of the Black Sea on inter-annual and decadal scales

Reason: the open basin with its key processes in the ecosystem, which are crucial for understanding the long-term climate and anthropogenic impacts, is not included in the national monitoring programs. The Joint Cruises seems to be the best way for resolving this problem.
Objectives of Joint Cruise Methodology

- To develop a long-term monitoring strategy based on the identified scientific needs as well as existing capacities.
- To evaluate areas of joint research, time and frequency of observations and measured parameters.
- To estimate and provide recommendations for cost-efficiency of the Cruise.
- To suggest a scheme of data exchange between the partners based on uniform methodology for processing and data storage in joint data bases.
- A parallel objective is also to provide a platform for training, education, inter-calibration and testing of new methods of monitoring observations.
Main scientific priorities for the Joint Cruises monitoring program

- Intensity of the winter convection and formation of the Cold Intermediate Layer in context of Climate changes:
- Eutrophication of the deep basin (main nutrients) in connection with anthropogenic and climate impact
- Processes in hydrogen sulfide zone
- Changes in biodiversity
- Natural phenomena like blooms or mass developments of organisms
- Indigenous and harmful species
- Fish populations (ichthyoplankton)
Scheme of series of offshore transects.
The map and bathymetry of the Black Sea (after Oguz et al., 2001). The light blue zone around the periphery signifies the continental shelf region with depths less than 200 m.


**Time period**

- **February** – winter convection, CIL formation
- **March** – phytoplankton bloom
- **May-June** – remnants of winter convection, zooplankton reproduction, coccolithophores, Mnemiopsis, Noctiluca
- **August** – the most stable period, balanced algae growth and grazing, microbial loop, Beroe
- **November** – erosion of seasonal pycnocline, autumn phytoplankton bloom
Fig. 2. Multi-annual monthly average wind speed
Monthly means for the eastern central open waters (data from 2001 to 2012; reanalysis)
The **first** priority parameters for ecological monitoring to be measured are:

- **Abiotic** - temperature (T), salinity (S), beam attenuation (BA), fluorescence (F), dissolved oxygen (DO), nutrients (nitrates NO$_3$, nitrates NO$_2$, ammonium NH$_4$, phosphate PO$_4$, silicates SiO$_4$), H$_2$S.

- **Biotic** – bacterioplankton total numbers and biomass (BACT); phytoplankton species composition, numbers and biomass (PHYTO); mesosooplankton species composition, abundance and biomass (ZOO); jelly-fish species composition, abundance and biomass (JELLY) ichthyoplankton species composition, total numbers (ICHT);

**Second** priority parameters include:

- **Abiotic** – PAR irradiance; Disk Sechii transparency; currents; particulate organic carbon (POC), nitrogen (PON) and phosphorus (POP), dissolved organic carbon (DOC), nitrogen (DON) and phosphorus (DOP), pCO2, pH, total alkalinity (TA), dissolved inorganic carbon (DIG), marine floating litter (LIT)

- **Biotic** – chlorophyll-a (Chl-a), heterotrophic zooflagellates and ciliates total numbers and biomass (HETER); ichthyoplankton species composition, total numbers (ICHT); cetacean count (CET)

**Third** priority parameters are:

- **Abiotic** – heavy metals; oil products, pollutants, aerosols

- **Biotic** – HPLC pigment analysis; bacterial, primary and zooplankton production, and vital rates measurements.
Cruise management

• The total length of the Cruise route, including 4 transects and the distance between them and the return of the vessel to the port of origin, is more than 2,000 miles. Assuming 5 working days per transect, 7 days for the vessel movements, 3 days for stormy weather, the total duration of the Cruise will make 30 days. Taking into account the ship time cost, which depends on ship scale and capacities (~$ 12000 per day for large vessel) the total freight will be close to $ 360000.

• Another case is a multi-ship survey. 4 transects can be fulfilled by 4 different vessels for a total of 20 days (5 days per each transect, smaller vessels, less freight – $ 8000 per day), which would cost $ 160,000, i.e. significantly cheaper.
Thank you!