UNDP GEF Black Sea Ecosystem Recovery Project

MORPHO-FUNCTIONAL INDICIES OF SEAWEED COMMUNITIES IN ZERNOV'S *PHYLLOPHORA* FIELD

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The north-western shelf is a unique part of the Black Sea ecosystem and includes an area covering 20 000 km2 with small 30-60 m depths. In central part of north-western shelf there are large aggregations of red seaweed from the genus – *Phyllophora* Grev. The first aggregations were recorded in April 1909 by Academician S.A. Zernov which were named in his honor as the Zernov's Phyllophora Field (ZPF). The ZPF approximately up to the mid 1950s estimated an area of 10 000 km2. At that time the average values of the macrophyte biomass made up 1.5-2.0 kg.m-2 while maximum exceeded 10 kg.m-2. The total phyllophora stock for this period was 10 mln. tons. Intense eutrophication from man-made sources which from the early 1970s spread over the northwestern shelf for decades, changed the rate of production processes, and drastically the structural-functional organization of the communities in the ZPF. In the late 1980s the average phyllophora biomass was only a few hundred grams per square meter of sea bottom and the total stock fell to 0.3 mln tons.

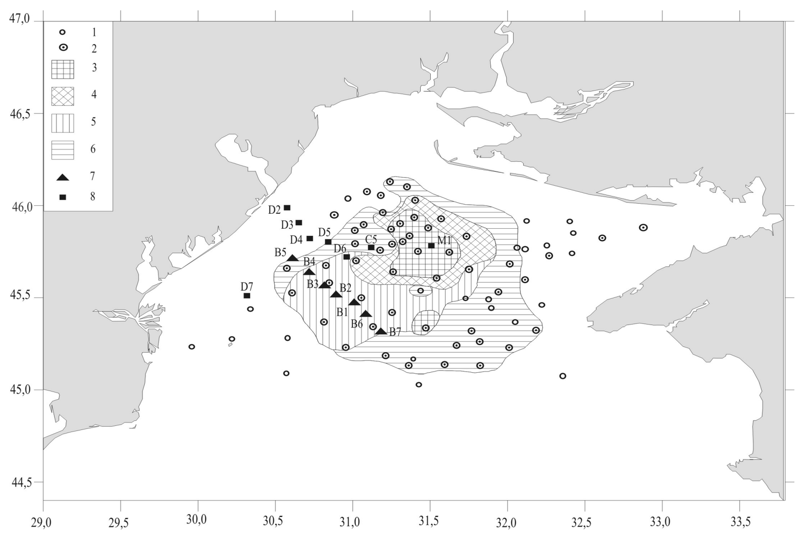

Fig.1. Quantitative distribution of *Phyllophora* in the ZPF: 1 – stations (S.A. Zernov`s expedition 1908-1911); 2 – stations, Institute of Oceanology expedition 1951–1954; 3 – areas with biomass (kg. m²) from 1 to 2; 4 – from 0.5 to 1; 5 – from 0.1 to 0.5; 6 – from 0.001 to 0.5 (Schapova, 1954). 7 – 8 – stations of two transects of the Akademik cruise, 2006.

Information about the modern state of the seaweed community of ZPF was obtained in an international cruise of the Bulgarian RV Akademik in the Black Sea Ecosystem Recovery project during 25.07-04.08.2006 **(Fig.1.)** In the 2006 cruise, macrophytes were encountered at 15 stations located in the ZPF area. Visual studies of macrophyte distribution were made with an underwater video camera by Dr. Tim Stevens (Plymouth University, UK) **(Fig.2.)**. The longevity of the path of study of bottom vegetation was 4.5 km which is equal to 100 h of seabed surface. For a quantitative description of the structural-functional organization of the phytocoenoses of the ZPF, a number of morpho-functional indices was given.

Fig.2. The video camera display and *Phyllophora* on the deck of RV Akademik

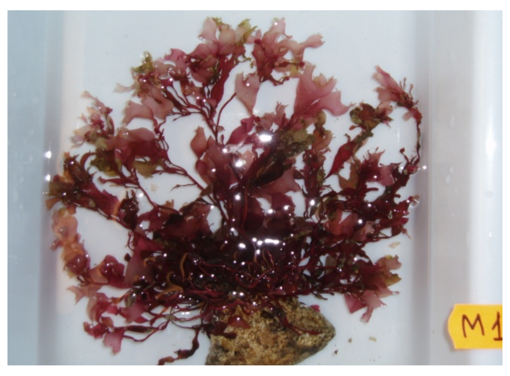

Fig. 3. *Phyllophora truncata*

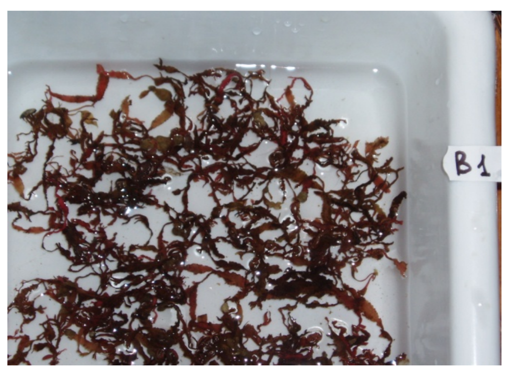

Fig.4. *Phyllophora crispa*

At present the greatest diversity is characteristic for red alga. The *Phyllophora* genus is represented by two species *Ph. truncata (synonym: Ph. brodiaei)* and *Ph. crispa (synonym: Ph. nervosa),* the genus *Polysiphonia* – by species of *P. sanguinea* and *P. elongata*. **(Fig.3-4.)**

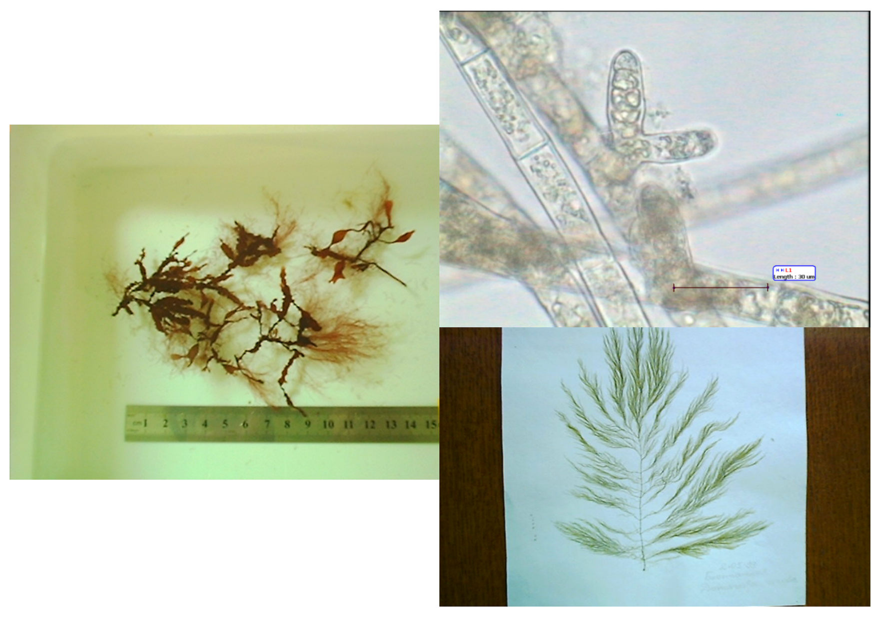

Fig.5. Fine filamentous species (*Polysiphonia sanguinea, Feldmannia irregularis, Desmarestia viridis)* which have replaced *Phyllophora*

The specific surface of mass species of filamentous algae developing on *Phyllophora* thalloma and on the freed substrate with from 10 to 40 fold higher ecological activity than the *Phyllophora* itself. The specific surface of *Ph. crispa* and *Ph. truncata* is 7.34 ± 0.31 and 10.16 ± 0.33 (m2.kg-1), correspondingly.
The specific surface of aggressive species:
Polysiphonia sanguinea – 80,0 ± 1,4;
Desmarestia viridis – 78,3 ± 2,3;
Feldmannia irregularis – 303,2 ± 16,2 (м2.kg-1). **(Fig.5.)**

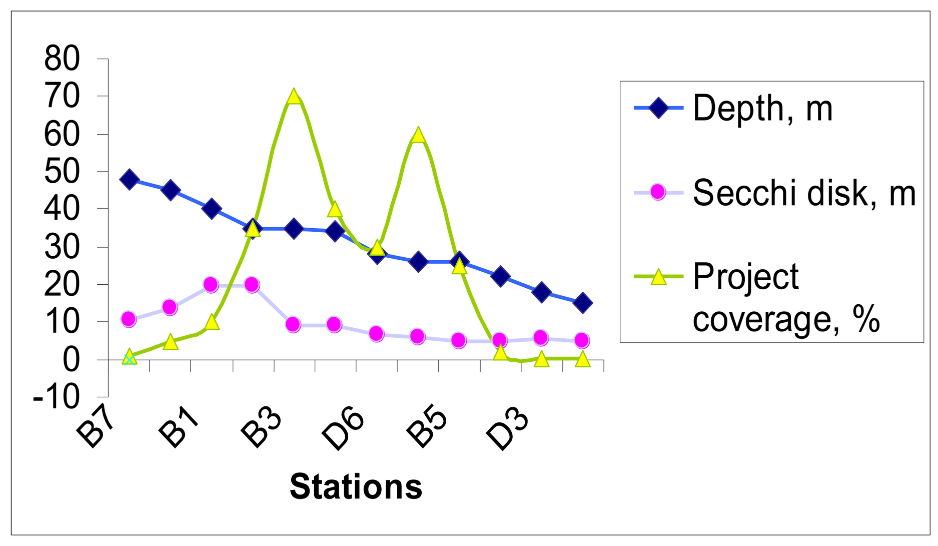

Fig.6. Changes in the project coverage of seaweed community on the ZPF sea bed in relation to depth and transparency.

The relation to the total coverage of sea bottom with macrophytes has shown that maximum coverage of the sea bottom with vegetation is between 25-35 m **(Fig.6).** Consequently, today the most intense development with maximum project coverage with macrophytes is characteristic for communities where small filamentous algae replace the *Phyllophora*.

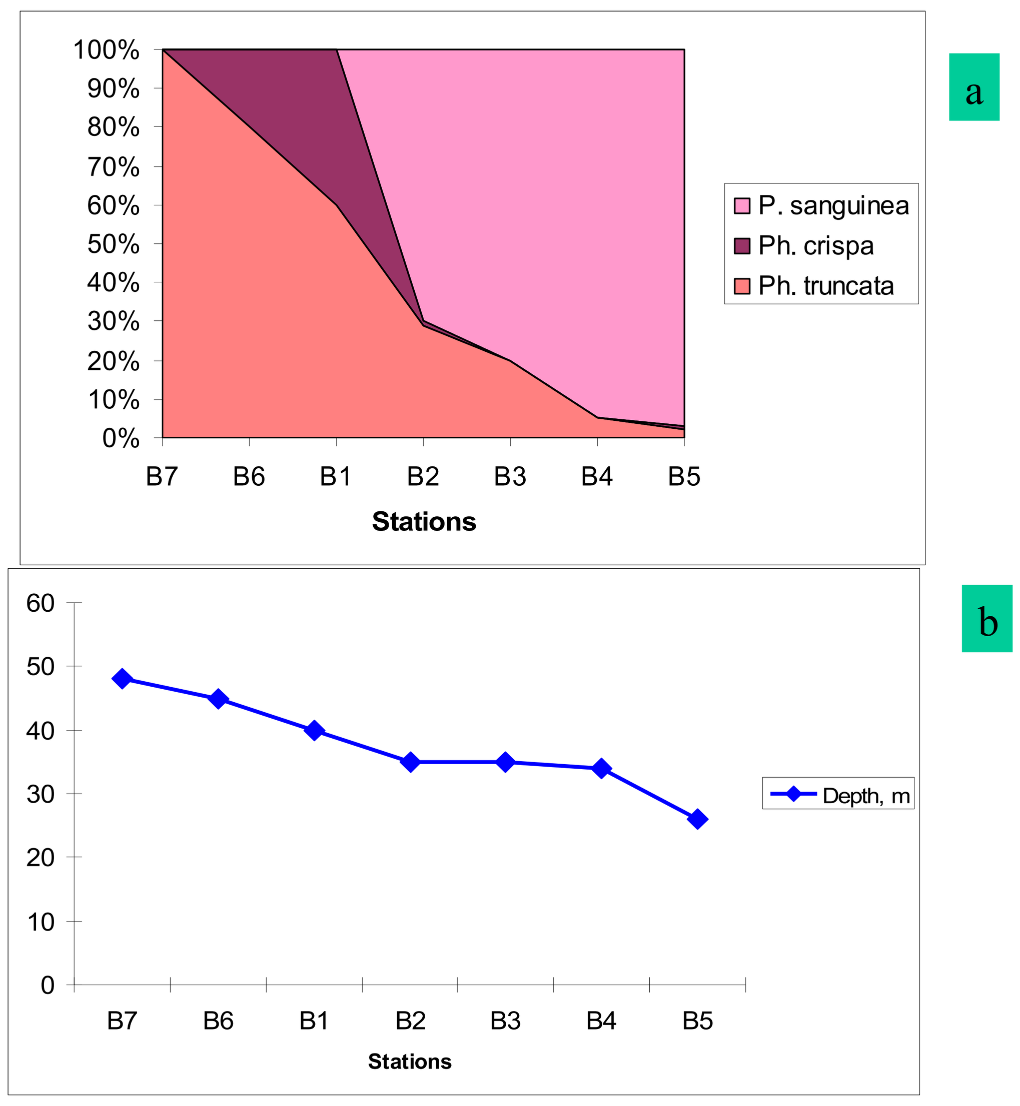

Fig.7. Changes in the role of dominating species at stations of the B transect (a) in relation to depth of growth (b)

With decreasing depths and advancing towards the coast, the community of two species of *Phyllophora* has been replaced by ***P. sanguinea***. From the 35m depth Polysiphonia is dominating, and towards a 25m depth has practically completely squeezed out Phyllophora **(Fig.7.).**

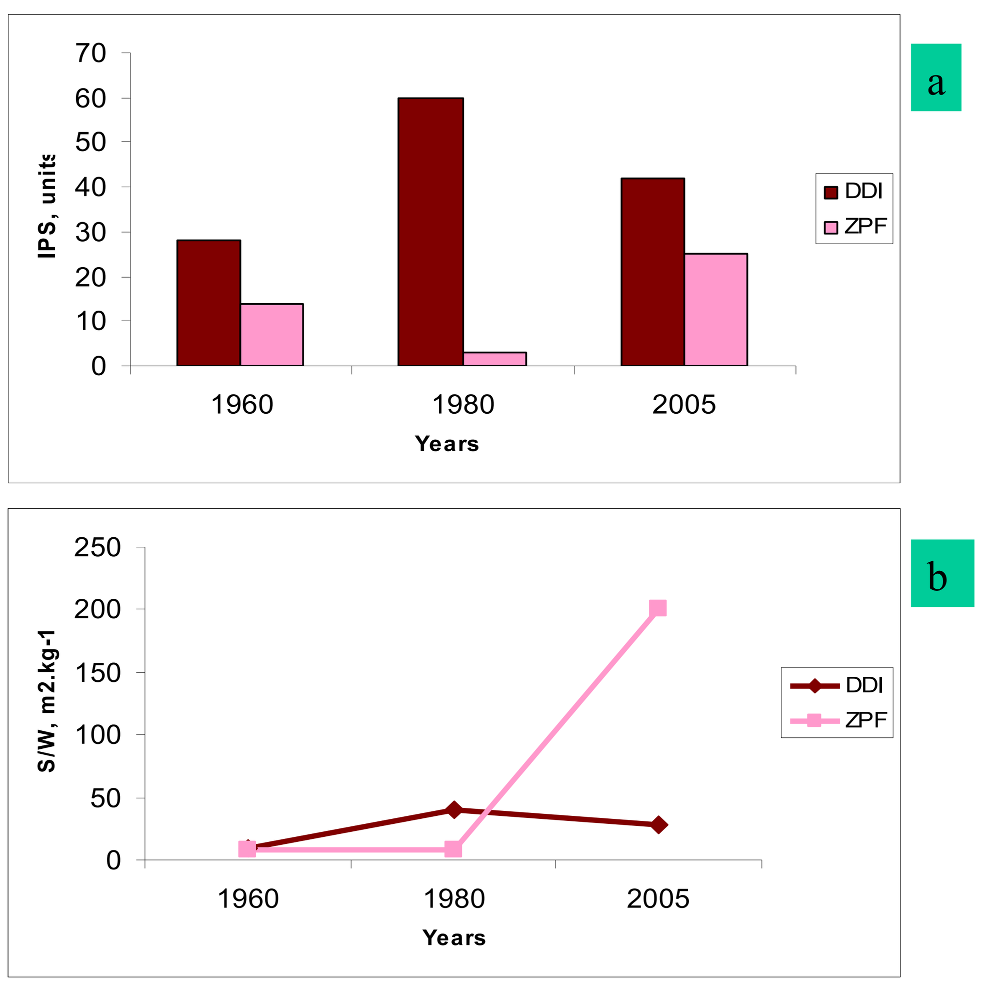

Fig.8. Changes in the morpho-functional parameters of macrophyte communities in the coastal zone of the Danube-Dnieper interfluve (DDI) and in the Zernov's Phyllophora Field (ZPF): a – index of the phytocoenose surface (IPS); b – specific surface (S/W).

The morpho-functional transformation of *Phyllophora* communities has a more marked, outbursting nature in contrast to the more smooth pattern of reorganization of coastal phytobenthos. It can be assumed that due to a high wave burst, a return to the original state of *Phyllophora* communities will be much more rapid than for Cystoseira and will take 10 – 15 years. **(Fig.8).**

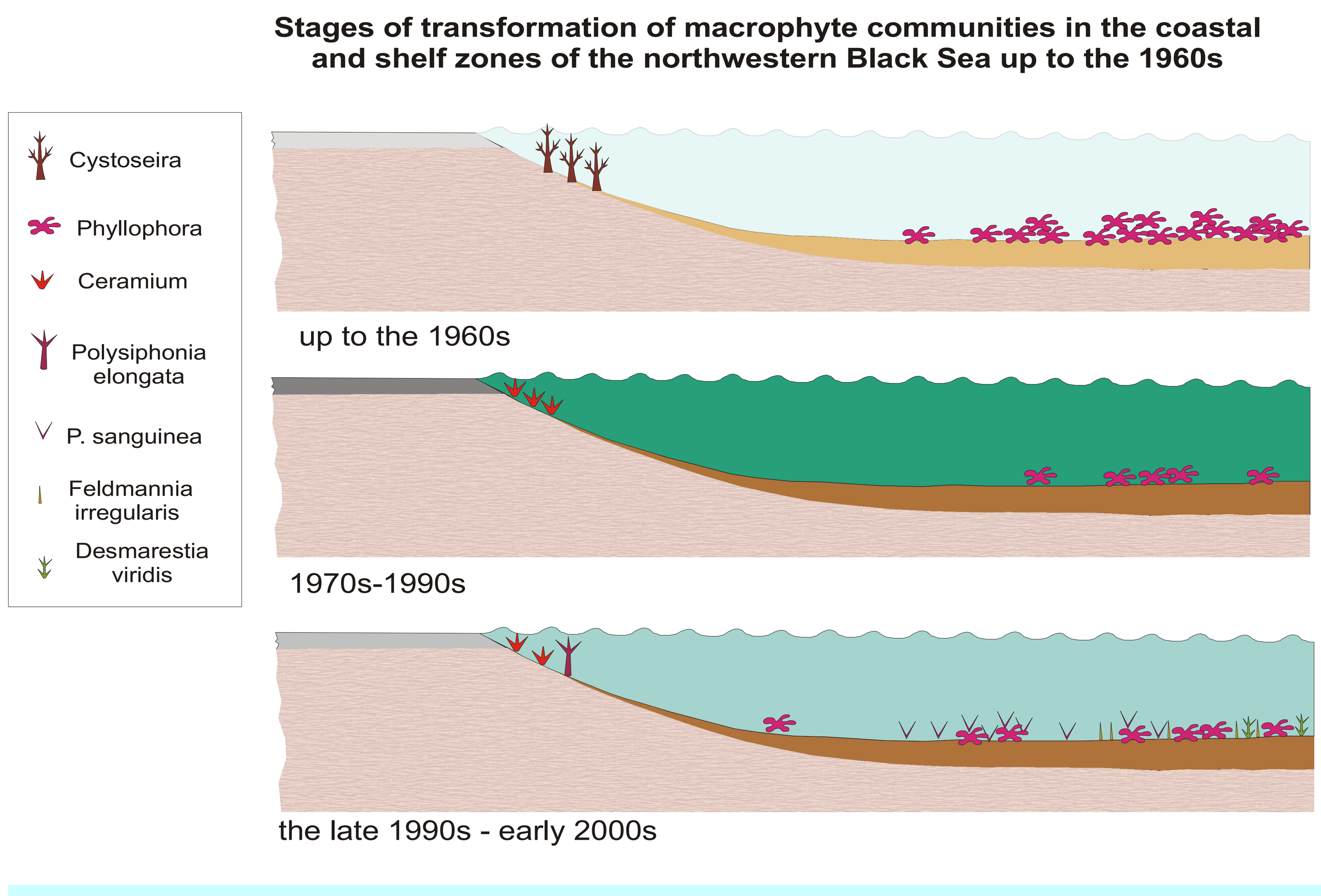

Fig.9. A scheme of changes in seaweed ecological activity in relation to level of eutrophication

The period **up to the 1960s** may be considered as the **natural state** in the coastal area and on the shelf where large perennial species of vegetation with low ecological activity dominate. The coastal area in this period flourished with *Cystoseira*, the deep water shelf – with *Phyllophora*. At **the stage of intensive eutrophication (1970s-1990s)** the increase in nutrients in the river runoff led to a replacement of *Cystoseira* in the coastal area with fine filamentous algae. Because of phytoplankton blooms and lowering of transparency, a significant degradation and decrease in *Phyllophora* overgrowth occurred in the shelf zone. **The stage of stabilization and deeutrophication tendency (the late 1990s-early 2000s).** For coastal macrophytes, a restoration succession process which in 5 – 8 years may cause a return of *Cystoseira*. The drop in phytoplankton biomass and accumulation of nutrients in bottom sediments stimulate the reorganizing processes of plant communities which occurred 25 years ago. Fine filamentous algae at present have replaced *Phyllophora*. **(Fig.9).**

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