THE LONG TERM EFFECT OF CONSTRUCTION OF OFFSHORE WINDPARK ON BENTHIC BIOTA IN THE NE BALTIC SEA

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1. INTRODUCTION

In Estonia, wind energy is one of the most credible alternatives to solve the problems which have associated with the depletion of fossil fuels and their negative impact on the environment and thus pressure on the suitable marine habitats is likely to increase in nearest future. Effects of construction and exploitation of offshore wind parks on benthic communities are difficult to predict. Our study was designed to evaluate possible effect of construction of offshore wind farms on benthic communities and included set of experiments on colonisation experiments of artificial substrate and recolonisation experiments of natural hard substrate after mechanical destruction of sessile communities.

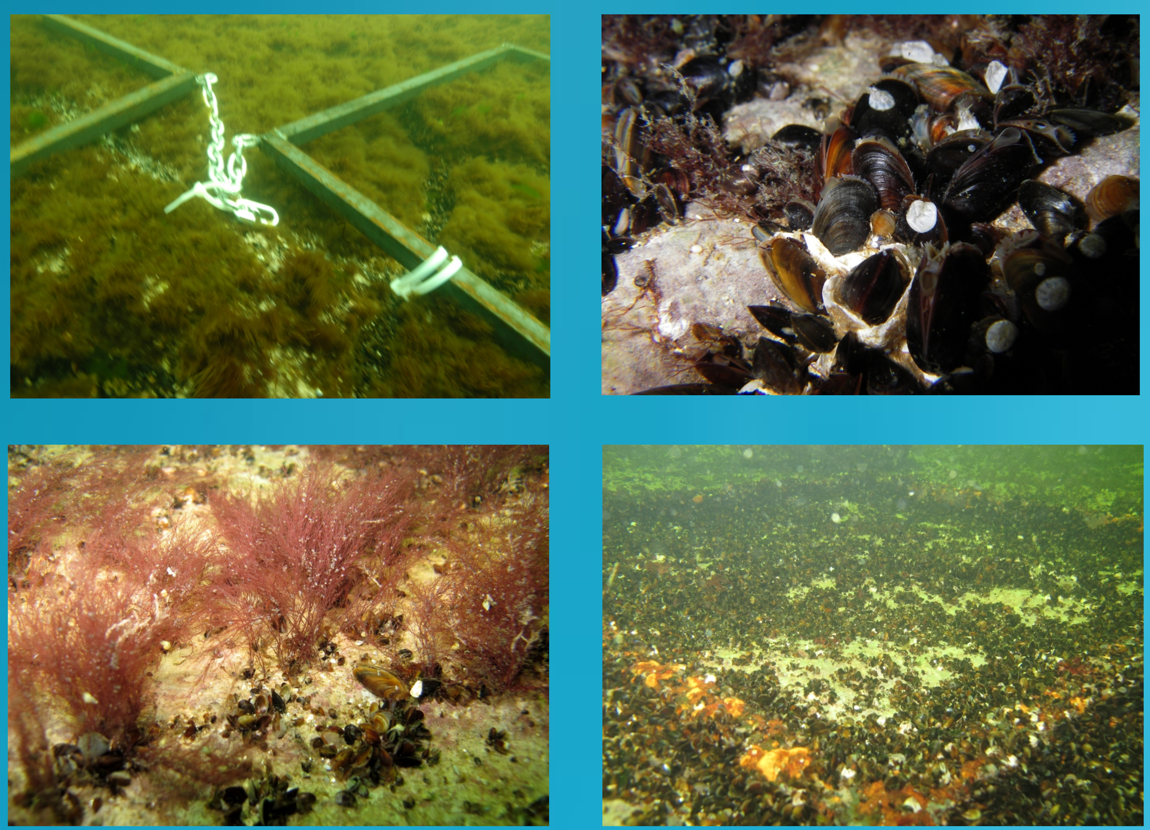

Fig.1. Hard bottom benthos at Neugrund reef.

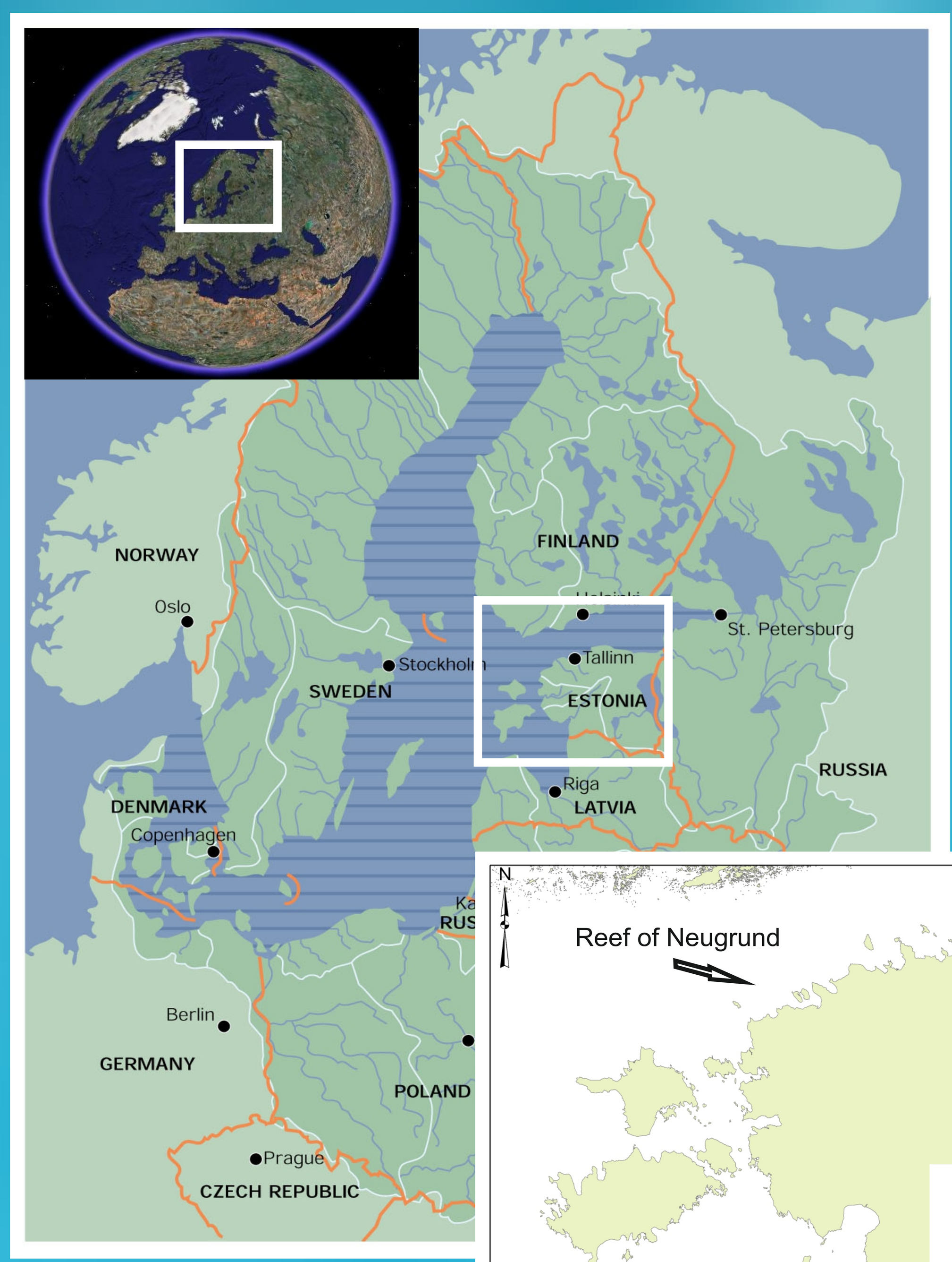

Fig.2. NE Baltic Sea.

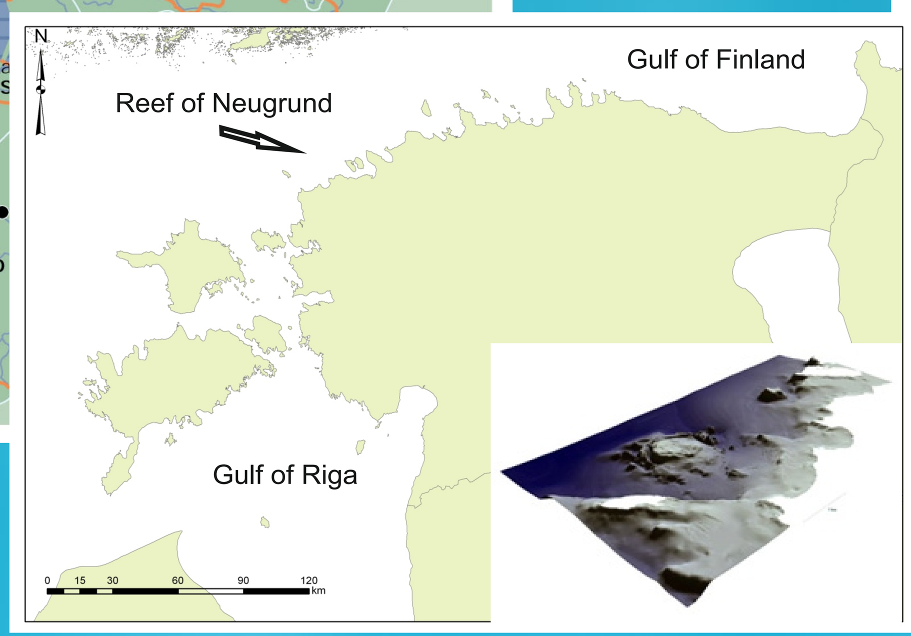

Fig.3. Location and 3D model of Neugrund reef.

2. STUDY AREA AND METHOD

Material for current study was collected during the investigations carried out in the process of EIA of Neugrund offshore windpark project in Gulf of Finland, NE Baltic Sea (Fig. 2 and 3). The Neugrund shallow is composed of hard limestone located in the area of a prehistoric meteorite crater (Fig.1).

Experiments included mechanical damage of limestone seafloor communities and then following the recolonisation of treated plots. Tratments were replicated in 4, 6 and 8 m in 2008 and 2012.

Three metal frames, in each depth (Fig 4.), were placed on the bottom of the sea. Hard bottom communities were disturbed in 2008 April, May and June (substrate was mechanically cleaned of all vegetation and attaced benthic fauna). Recovery of disturbed substrate was observed May until October 2008 and then four years later August 2012.

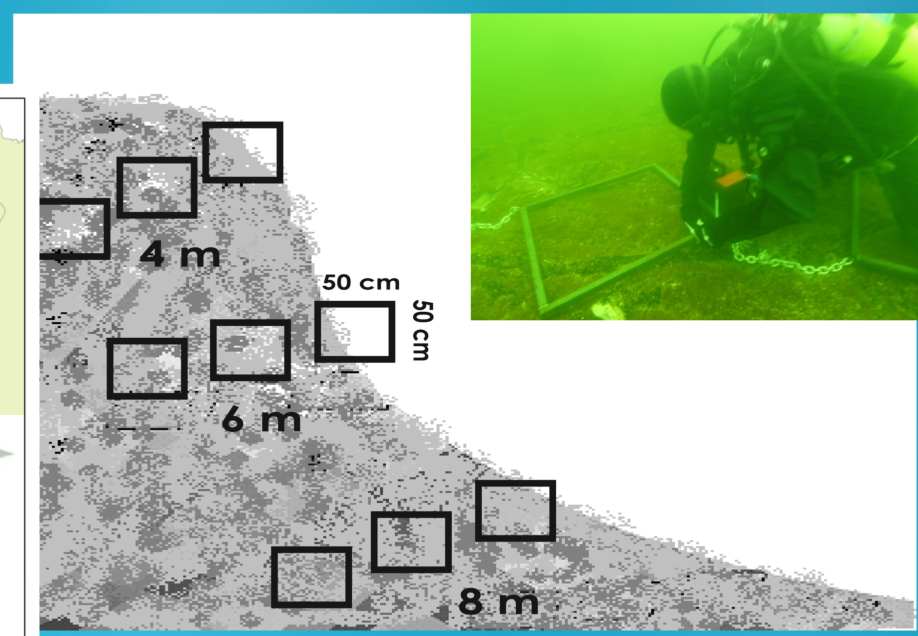

Fig.4. Scheme of *in situ* experiment.

- Total coverage of benthos
- *Ceramium tenuicorne*
- *Pilayella littoralis*
- *Amphibalanus improvisus*
- *Mytilus trossulus*

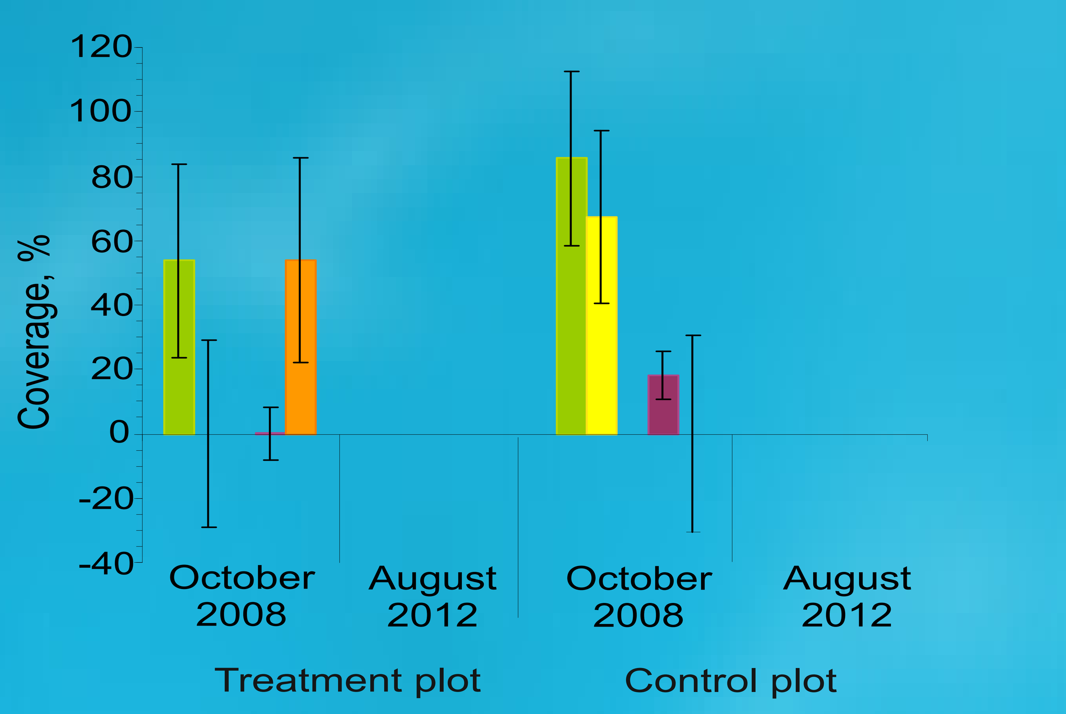

Fig.6. Total coverage of benthic species at 4 m depth.

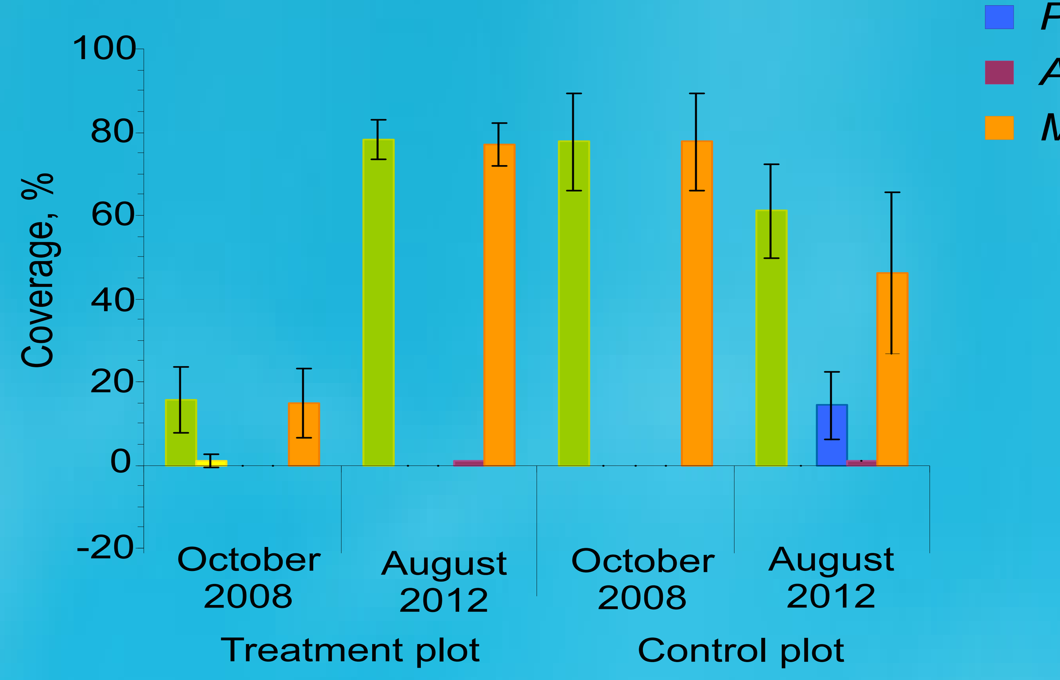

Fig.7. Total coverage of benthic species at 6 m depth.

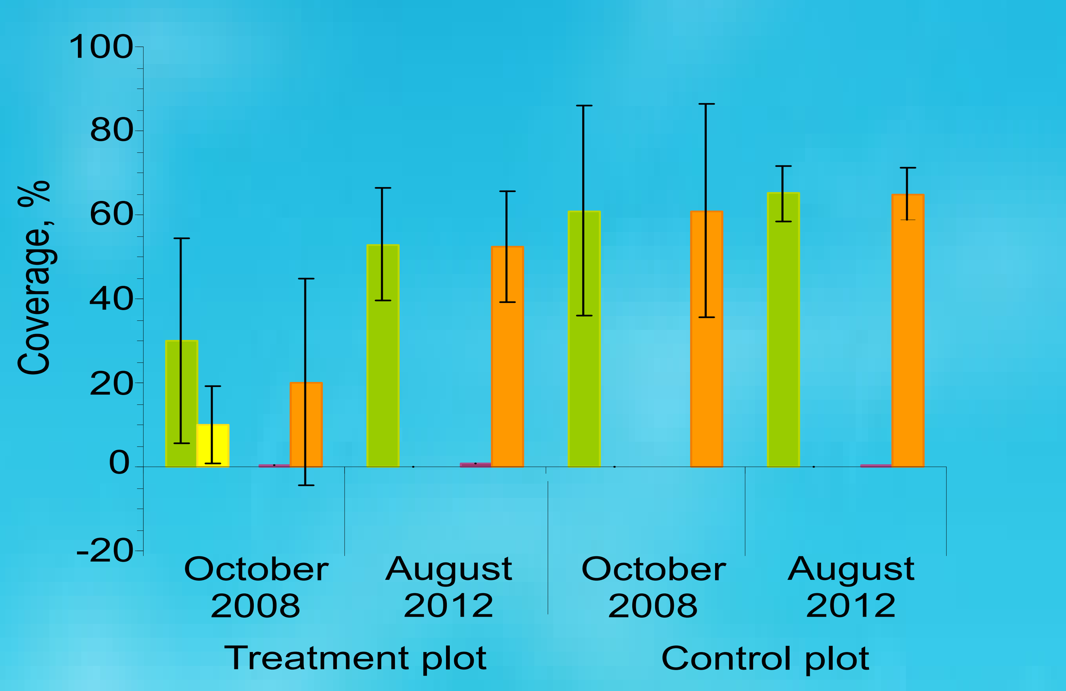

Fig.8. Total coverage of benthic species at 8 m depth.

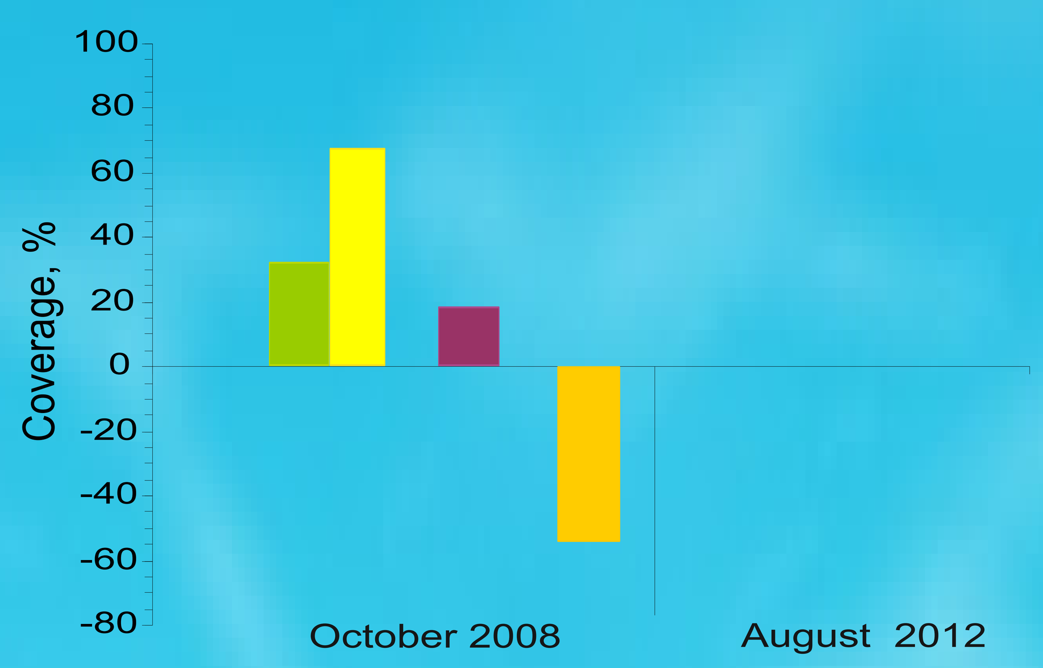

Fig.9. Deviation from control. Disturbance in April 2008 at 4 m depth.

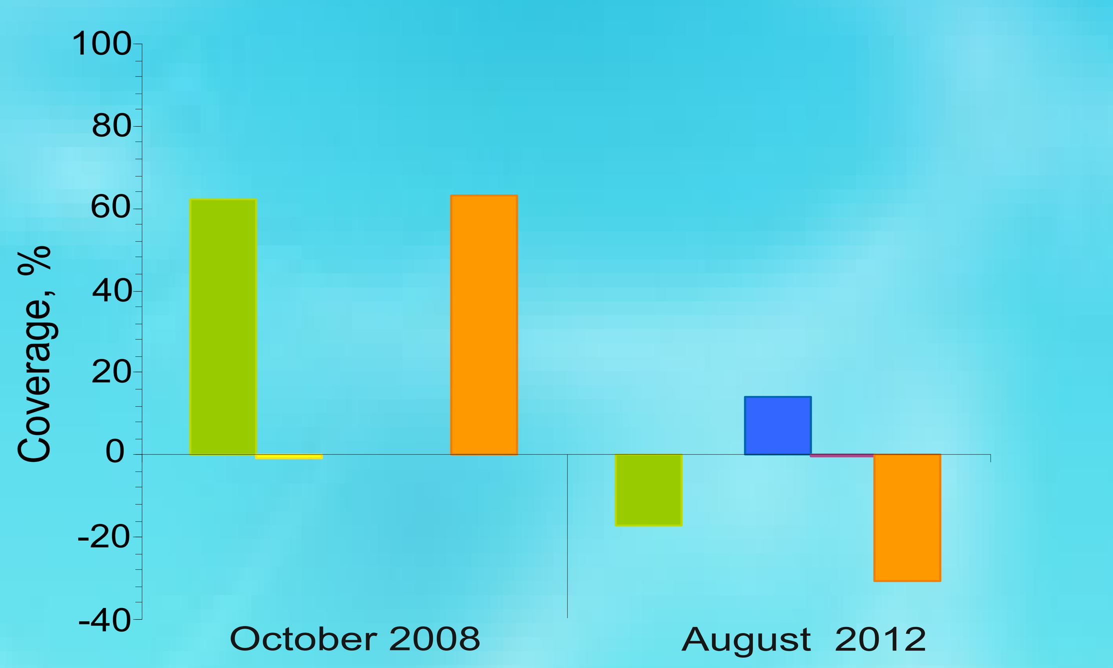

Fig.10. Deviation from control. Disturbance in April 2008 at 6 m depth.

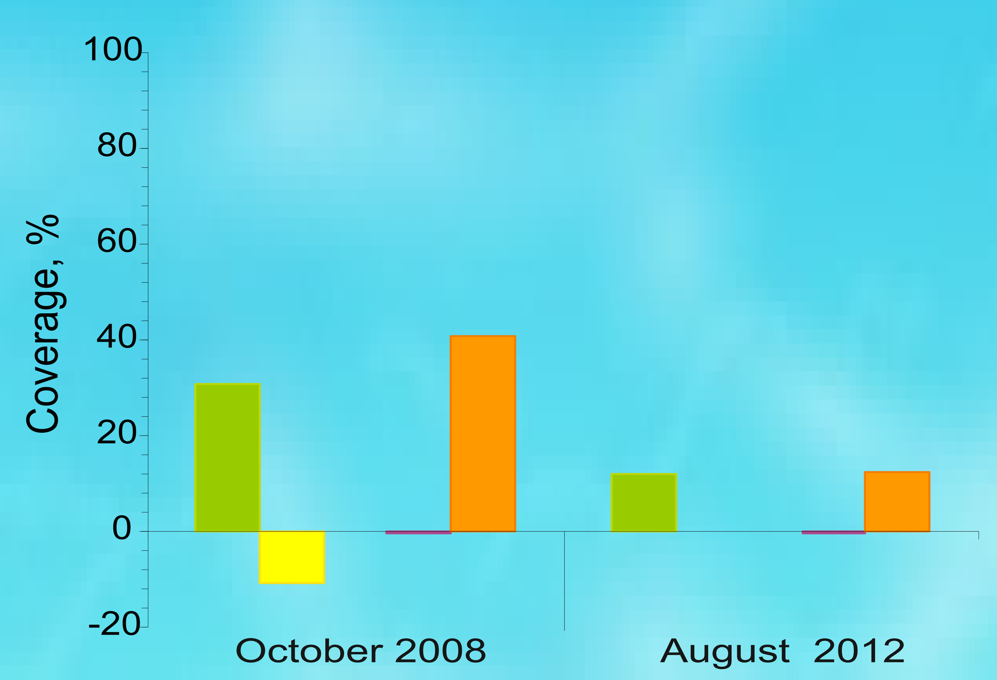

Fig.11. Deviation from control. Disturbance in April 2008 at 8 m depth.

3. RESULTS OF *IN SITU* EXPERIMENT

Species diversity of hard bottom community was poor on reef of Neugrund. It is typical for the extremely exposed sea areas of northen Baltic Proper – most of the growth is taking place in spring and beginning of summer. During this period filamentous algae (*Ceramium tenuicorne* and *Pialyella littoralis*) dominate the benthic communities while in the second half of the summer and autumn benthic animals *Amphibalanus improvisus* and *Mytilus trossulus* are dominating benthic communities.

Recolonisation of new substrate took place suprisingly fast after April 2008 when substrate was mechanically cleaned. The negative effect was stronger in greater depth (on the limit of photic zone), while communities in shallowest parts restored during vegetation period.

On figures 6, 7 and 8, the coverage of treated plots was compared to control according to observations of October 2008 and August 2012 (exept for figure 6, because metal frames were gone). Results showed that recolonisation patterns depended on depths, season of the year and climate conditions. The timing of the disturbance had no major effect on the recovery pattern. No new species were observed in recovering communities.

Observation data from the shallowest treatment in 2012 is missing because of the loss of metal frames. Considerable deviation in coverage of benthic species was observed both in October 2008 and four years later. Magnitude of deviation was different at two observed depths. In the deeper treatment the recolonisation of originally disturbed substrate appeared to be considerable slower.

4. CONCLUSION

During first vegetation season the difference between treated plots and control communities remained very high at larger depth (close to the limit of photic zone) while in shallowest treatments community qualitative and quantitative structure almost restored.

Longterm observations reveiled the longlasting effects even after four years period.

Results of this investigations will help to assess better the possible environmental impacts of large scale construction projects and also will help to predict possible changes in benthic hardbottom communities connected to climate change.