Ecological investigations at North East Sakhalin Island shelf, including monitoring around Molikpaq platform

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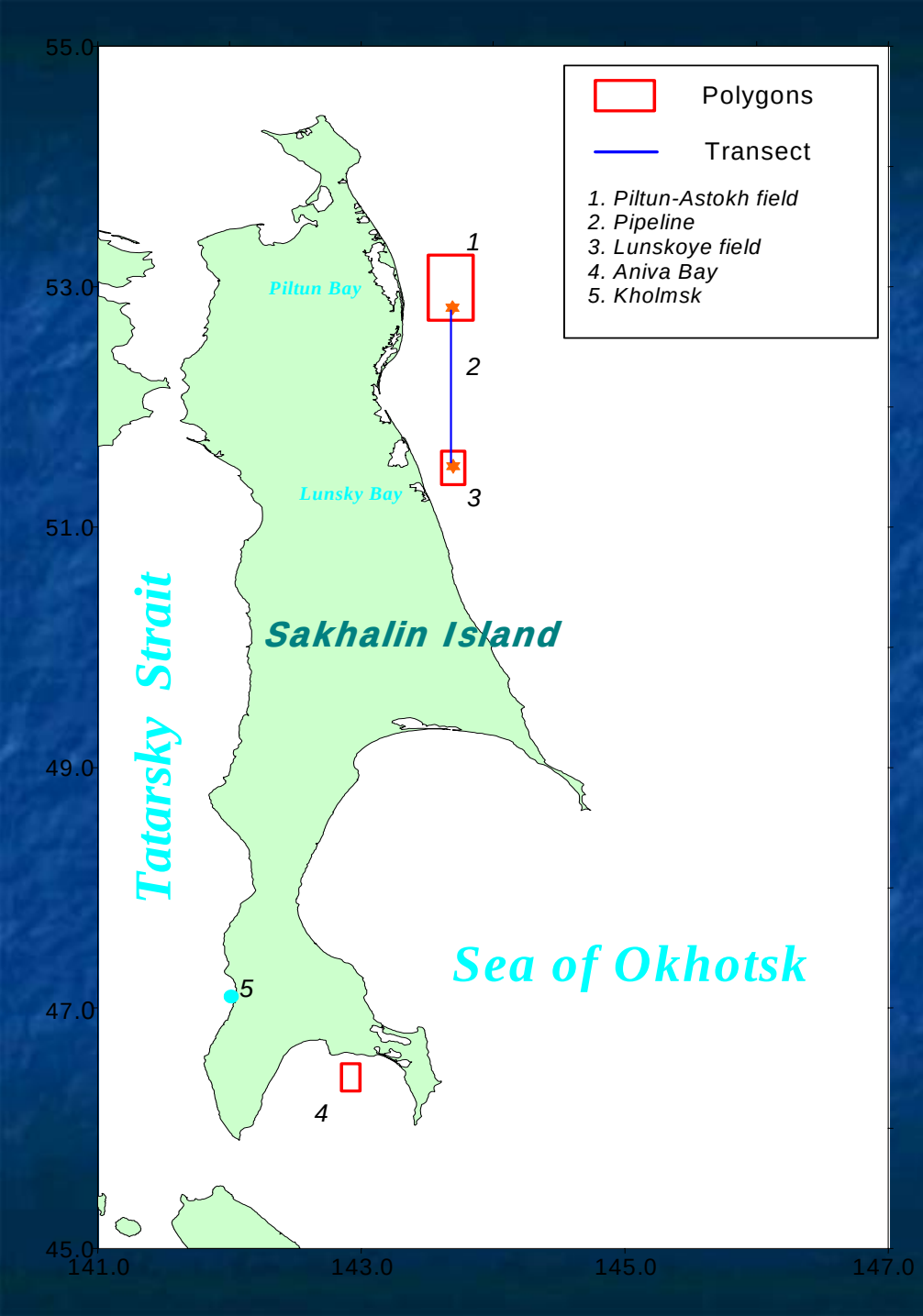
Introduction

- Since 90s, FERHRI scientists began ecological investigations along the NE Sakhalin Island shelf in relation to possible oil and gas development in the region.
- In 1998-2003, observations were carried out at Lunskoe and Piltun-Asokhskoye oil fields, along future pipeline routes and in some bays (Chayvo, Nabil, Aniva, etc.). The main goal of these observations was to get background characteristics of the marine environment in the study areas.
- Observations around Molikpaq platform were implemented in 1998-2001 in order to estimate the changes in the marine environment quality around the platform.
- Studies included measurements of numerous parameters of seawater, bottom sediments, pelagic and bottom communities.



Location of the study areas in 1998-2001

In this presentation, results of monitoring around the Molikpaq platform are presented

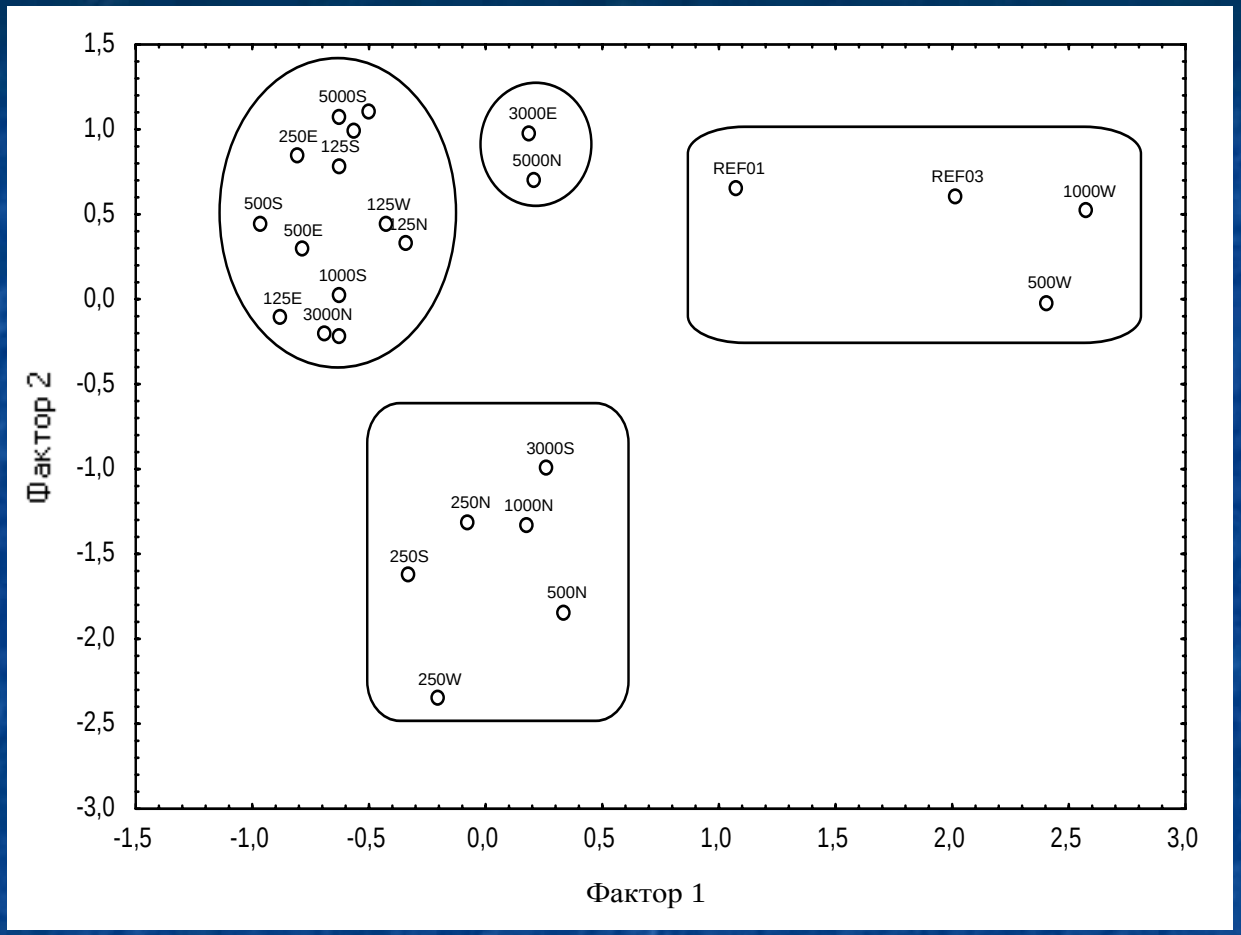
Methods

- Most informative monitoring parameters are characteristics of bottom sediments and benthic fauna. Therefore, sediment grain size, concentrations of trace metals and petroleum hydrocarbons in bottom sediments and characteristics of benthos were used as monitoring parameters.
- In this study, mainly methods of multivariate statistics (cluster analysis and factor analysis) were used as these techniques allow to distinguish natural variability from anthropogenic changes.

Sediment grain size

- Using area-averaged grain size distribution data, increase of fine sand fraction was observed in 1998, probably due to sediment relocation during the platform installation. Further investigations in 1999-2001 have shown that sediment grain size characteristics became similar to background values.

Grain size: sediment types

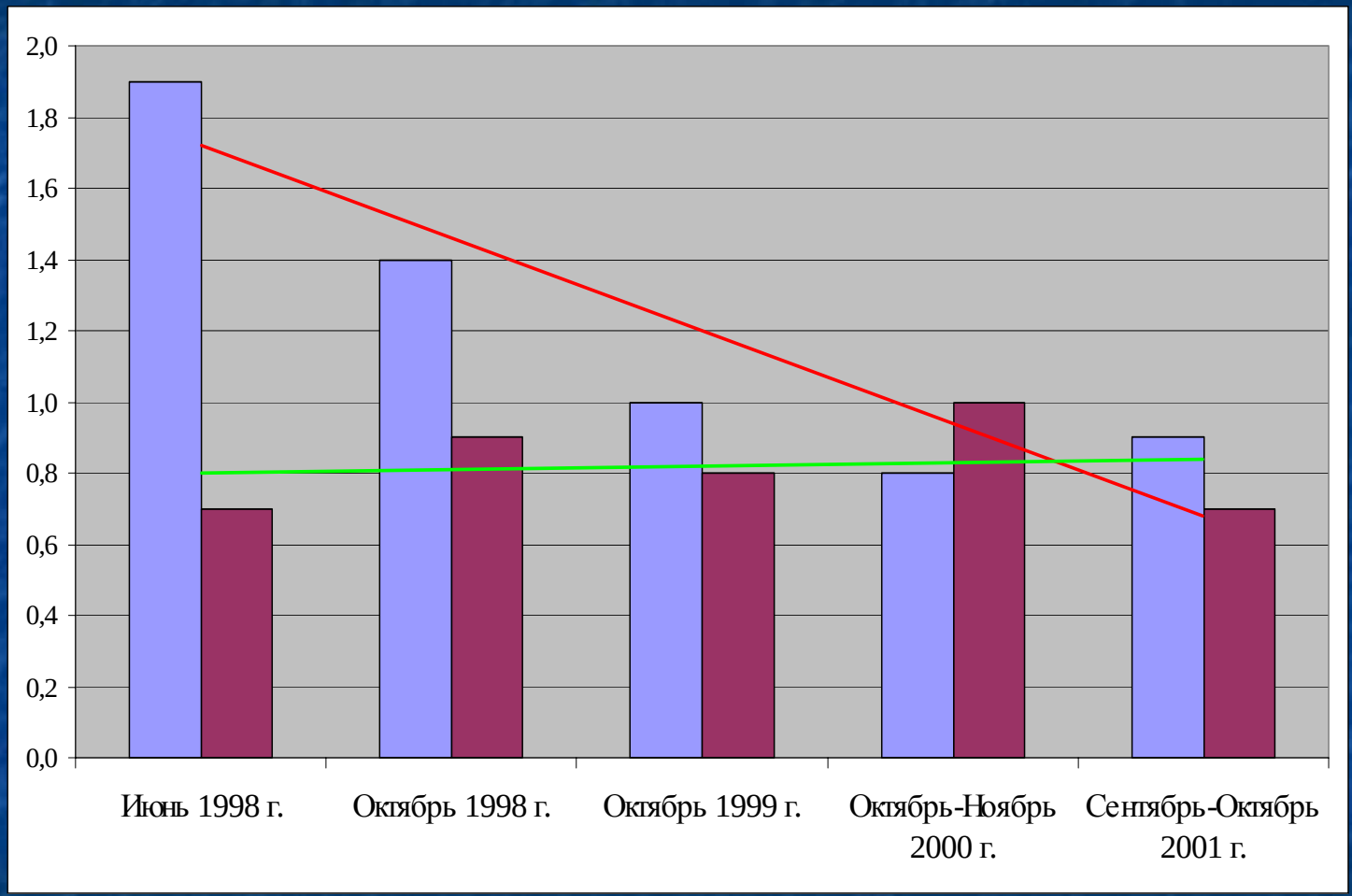


Factor analysis allowed to distinguish four main types of sediment: fine, medium and coarse sands, and gravel.

Content of PHCs

- Maximum petroleum hydrocarbon (PHC) content in bottom sediments (22.7 ppm) was observed in June 1998 before platform installation. From October 1998 to October 2001, maximum PHC concentrations decreased from 11.1 to 6.0 ppm (average concentrations decreased from 1.4 to 0.9 ppm).
- Total concentrations of polyaromatic hydrocarbons (PAH) were two orders of magnitude below values which could cause negative biological effects (Long et al., 1995).
- Therefore, the concentrations of PHC and PAH observed did not reveal any negative anthropogenic effects around the platform.

Content of PHCs

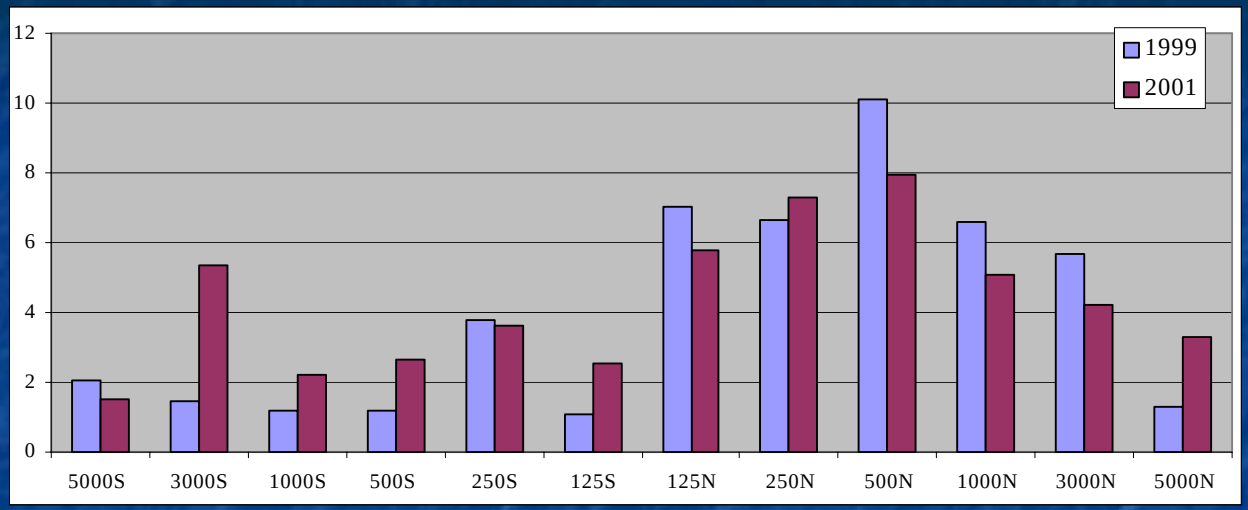


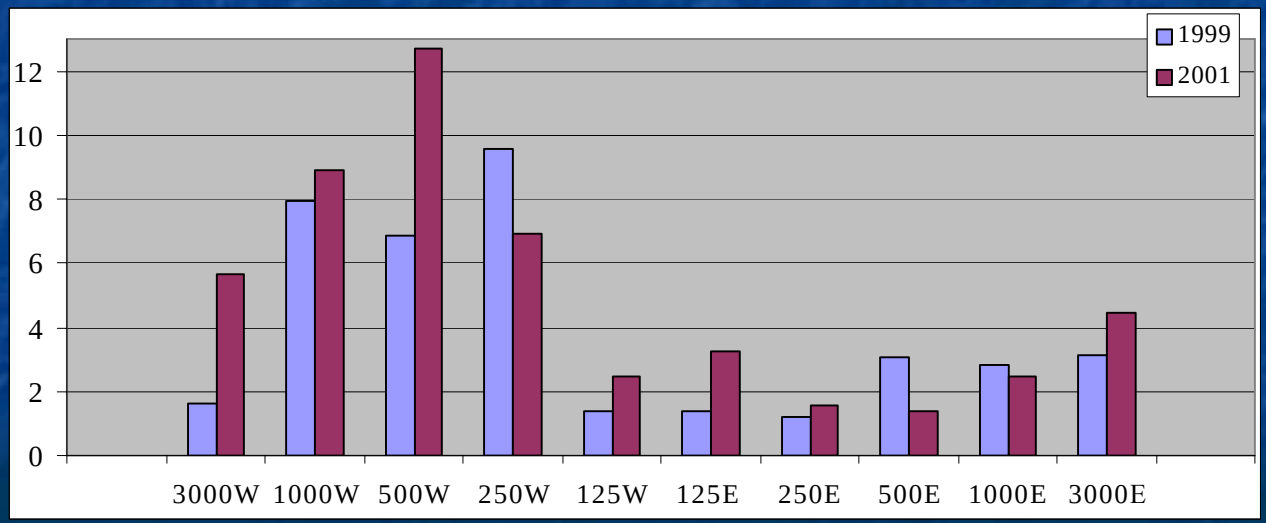
Trace metals in bottom sediments

- Concentrations of most trace metals (except barium) in 1998-2001 were 1-2 orders of magnitude below the values which might cause negative biological effects (Long et al., 1995)

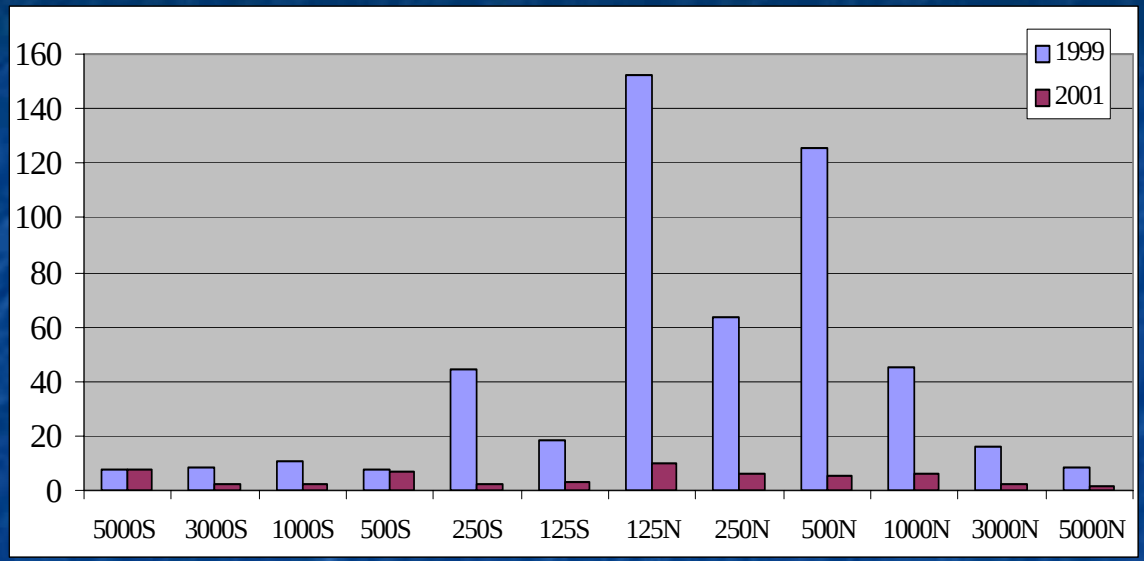
- Contents of Ba in 1999 were several times higher that background values, most probably due to drilling discharges from the platform.

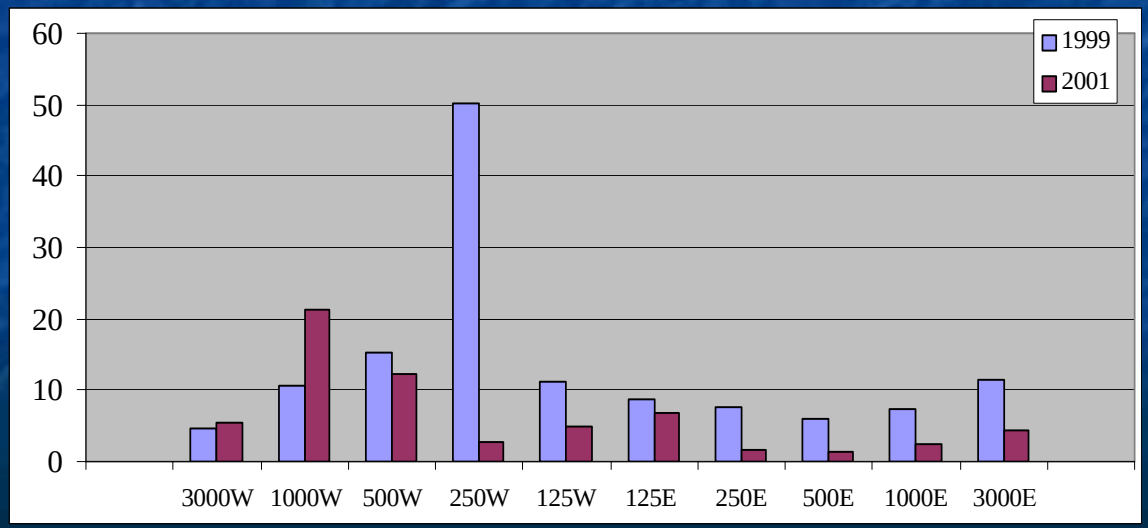
Distribution of Zn in bottom sediments in 1999 and 2001





Distribution of Ba in bottom sediments in 1999 and 2001

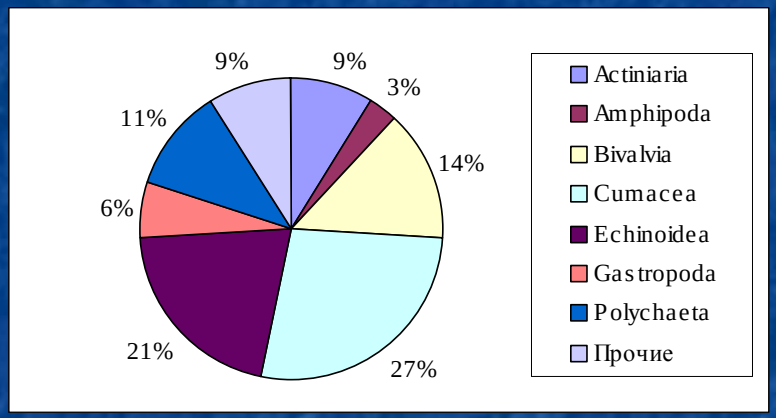


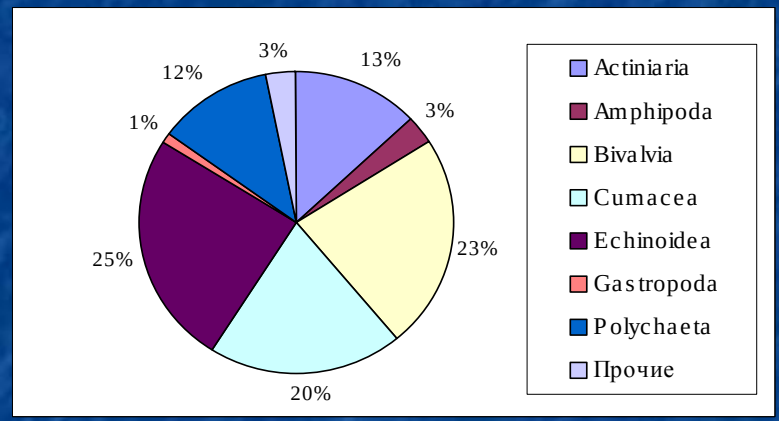


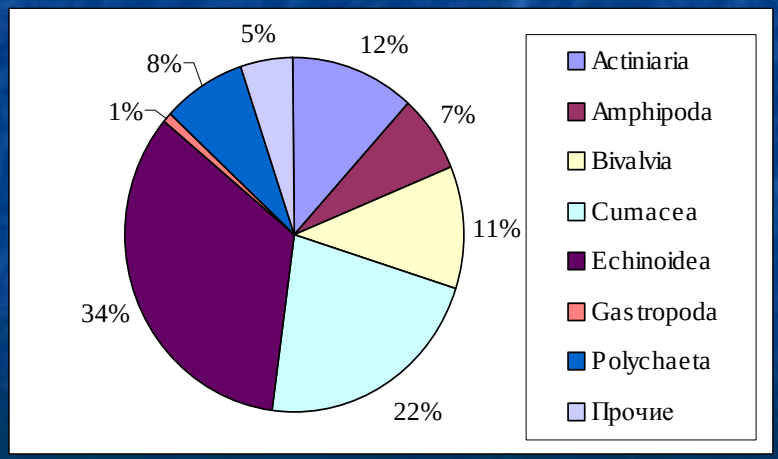
Benthos (1)

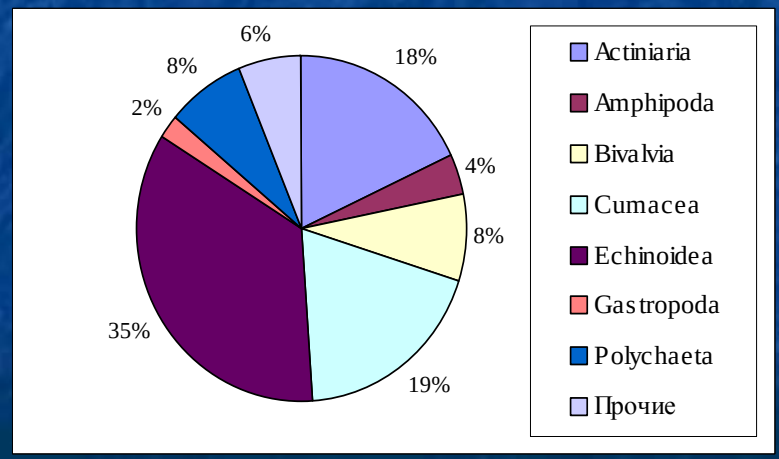
- Benthos analysis have shown that faunistic groups are quite stable. This fact confirms the absence of negative anthropogenic influence associated with the Molikpaq platform operations.

Benthos: the dynamics of biomass of the basic faunistic groups (the data from 4 surveys, October 1998 – October 2001)





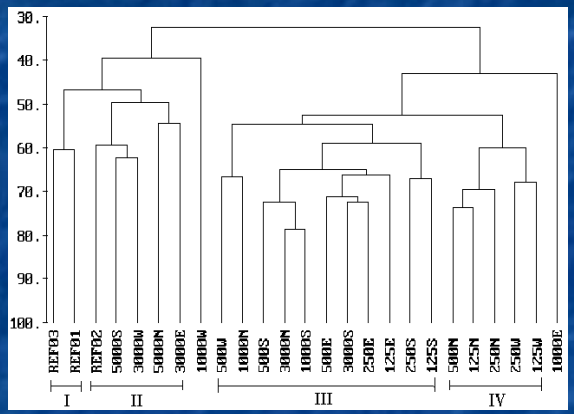


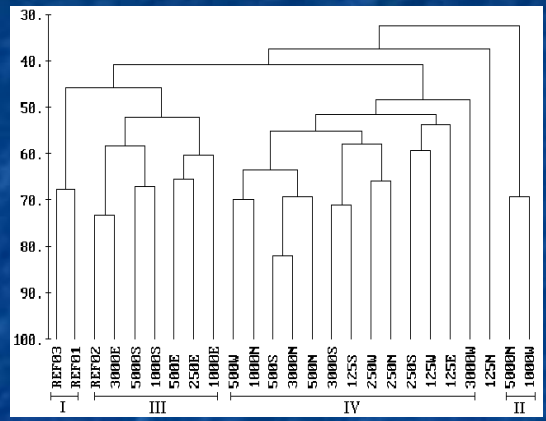


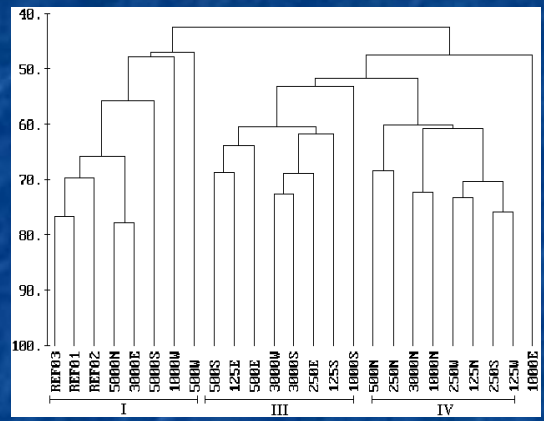
Benthos (2)

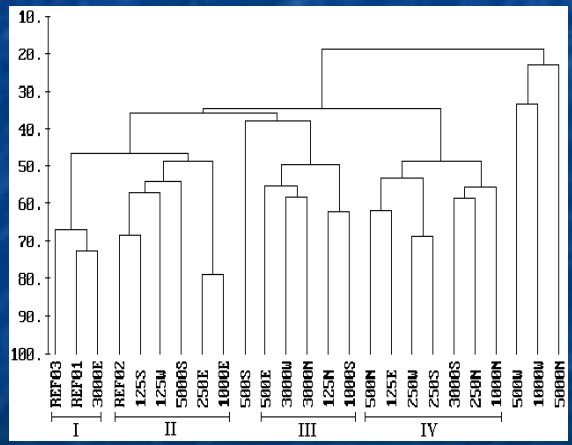
- Cluster analysis of benthic samples for 1998-2001 have revealed four stable bottom communities. These clusters are associated with specific types of bottom sediments:
- 1. Monodominant community of fine sands, where sea urchin *Echinarschnius parma* dominated.
- 2. Monodominant community of fine and medium sands, where cumacean *Diastylis bidentata* prevailed.
- These communities were characterized by low species diversity and the highest biomass and\or abundance.
- 3. Polydominant community of the coarse sands, where a few species were prevailed (sea anemone *Halcampoides purpurea*, sea urchin *E. parma*, polychaete *Nephtys caeca*, bivalve *Mysella kurillensis*) .
- 4. Polydominant community of gravel sediments . Dominate species were presented by sessile animals (sea anemone *Epiactis arctica*, polychaetes *N. caeca* and *Ampharete lindstromi* , hydroides, tunicates, sponges). Polydominant agglomerations characterized by the highest species diversity and low biomass (abundance).

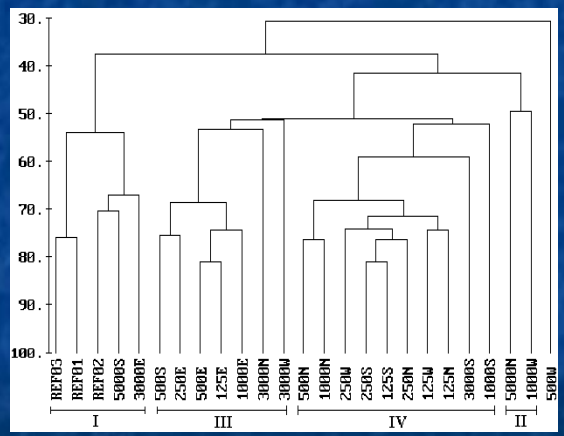
Benthos: cluster analysis (1998-2001, 5 surveys)











Conclusions

1. Pollutant contents around the Molikpaq platform are typical for the NW Pacific marginal seas, any negative changes in the marine environment were not detected so far.
2. The relocation of bottom sediments and drilling from the platform were not associated with the elevated contents of petroleum hydrocarbons and trace metals (except Ba) in bottom sediments. The pollutant contents in 1998-2001 were 1-2 orders below of threshold concentrations (Long et al., 1995).
3. Benthos species composition and faunistic groups around the platform have not changed, the only variations observed were associated with the grain size changes. Changes in grain size (and associated changes in benthic communities) are caused mostly by strong near-bottom currents in the study area.