



**Gulf of Finland  
Co-operation**

# **Gulf of Finland Trilateral Scientific Forum**

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**Finnish Environment Institute SYKE**



# Contents

## ORAL PRESENTATIONS

Y. Polyak\*, L. Bakina, T. Shigaeva, V. Kudryavtseva, Y. Gubelit

**Factors and mechanisms controlling microbial distribution, activity and dynamics in the eastern Gulf of Finland coastal sediments**

A. Ivanchenko, D. Burkov

**Estimation of pollution of air pool in port from vessels**

V. Ryabchenko, A. Isaev, T. Eremina, O. Savchuck, R. Vankevich

**Model estimates of the eutrophication of the Baltic Sea and Gulf of Finland in modern and future climate**

N. Aladin, T. Asanova, M. Dianov, L. Zhakova, T. Nikitina, A. Egorov, N. Zueva, I. Plotnikov, A. Smurov

**Main results of the two-year studies made by Aqua biological research unit under umbrella of ENPI Project SE717**

E. Daev\*, L. Barabanova

**Cytogenetic estimation of water state in Dubki recreation area of the Gulf of Finland near Saint-Petersburg**

S. Kondratyev, E. Ivanova

**Assessment of the possibility of carrying out of BSAP recommendations to reduce nutrient load into the Gulf of Finland from the Russian part of the catchment area**

T. Eremina\*, E. Voloshchuk, O. Khaimina, O. Vladimirova, E. Kochetkova

**Assessment of biogeochemical changes in the sediments of the Eastern Gulf of Finland**

S. Golubkov\*, M. Golubkov, A. Tiunov, V. Nikulina

**The role of allochthonous and autochthonous organic matter in benthic food webs in the upper and in the middle part of the Neva Estuary**

M. Golubkov\*, S. Golubkov

**Primary production and chlorophyll a concentration in mixing zone of the Neva Estuary**

N. Berezina\*, Y. Gubelit, Y. Polyak, A. Sharov

**An integrated approach to the assessment of the eastern Gulf of Finland health**

H. Kuosa

**The eastern Gulf of Finland eutrophication status according to GoF data set**

T. Kuznetsova, S. Kholodkevich, A. Sharov, A. Kurakin, U. Lips, N. Kolesova

**Testing applicability of a bioelectronic cardiac monitoring system for the determination of biological effects of pollution on bioindicator species in the Gulf of Finland**

D. Lajus

**Fisheries and fish populations in the Eastern Gulf of Finland during the 15-20th centuries**

A. Maximov\*, N. Berezina, O. Vladimirova, T. Eremina, A. Isaev

**The recent measurement of benthic phosphate fluxes in the eastern Gulf of Finland**

V. Goncharov, E. Zueva, E. Pavlova

**Simulation of Crude Oil Spreading within Ice Channel after Emergency Ship**

A. Pedchenko, T. Pakarinen, T. Raid

**Some aspects on further joint fisheries research in the Trilateral Estonian-Finnish-Russian cooperation in the Gulf of Finland**

V. Tarbaeva

**Enhancement of data provision system of the state monitoring of the Russian part of a catchment basin of the Baltic Sea on a condition of superficial water currents and the marine environment in HELCOM**

H. Vallius\*

**Sediment quality in the Gulf of Finland**

P. Ekholm\*, M. Ollikainen, E. Punttila, S. Puroila

**Reducing agricultural phosphorus losses in a large-scale gypsum pilot**

---

A. Rybalko A., O. Korneev

**Problems of the organization of joint control over the state and health of the ecosystem of the Gulf of Finland**

---

R. Aps\*, M. Fetissova, J. Kottaa, V. Karvinen, K. Kostamo, R. Varjopuro

**Towards environmental safety of Maritime Spatial Planning for Sustainable Blue Economies**

---

R. Aps\*, M. Fetissova, M. Heinvee, F. Goerlandt, P. Kujala, K. Tabri

**Systems-Theoretic approach based environmental safety management of maritime navigation in the Gulf of Finland (Baltic Sea)**

---

N. Lemesko1\*, V. Evstigneev

**Current climate change over the territory of the Leningrad region and their consequences**

---

A. Lappo, L. Danilova

**Национальная программа по изменению климата в Ленинградской области**

---

J. Lehtoranta

**Atmospheric forcing controlling inter-annual nutrient dynamics in the open Gulf of Finland**

---

A. Antsulevich

**Environmental researches and surveys in frames of the Nordstream-2 project**

---

H. Pitkänen\*, U. Lips, T. Zagrebina, T. Eremin, A. Jaanus, P. Kauppila, S. Lainela, Inga Lips, M. Raateoja

**Monitoring of eutrophication: consequences and recommendations emerging from the GOF assessment work and the most recent data**

---

L. Bugrov\*, T. Eremina, E. Kohanyuk, V. Ryabchenko

**Aquaculture development concerns and prospects in relation with climate change: Eastern part of the Gulf of Finland**

---

N. Kolesova\*, K-L. Siimon

**The effect of contaminants on Monoporeia affinis embryos in the Gulf of Finland**

---

N. Kudryavtseva\*, T. Soomere

**Changes in the Baltic Sea wave climate and estimation of extreme events from multi-mission satellite altimetry.**

---

T. Liblik\*, S-T. Stoicescu, U. Lips

**Variations of the halocline and oxygen distribution in the Gulf of Finland**

---

I. Andreeva, E. Voyakina

**Seasonal and interannual dynamics of phytoplankton and chlorophyll a in eastern part of Gulf of Finland**

---

M. Leppäranta

**Role of sea ice in the state of the Gulf of Finland**

---

A. Tuvikene\*, R. Kreitsberg, J. Baršienė

**Biomarkers of environmental contaminants in the coastal waters of Estonia: effects on perch, flounder and Baltic herring**

---

N. Kovalchuk

**Pilot estimation of species biodiversity of macroalgae on some water areas of the creating strict nature reserve "Ingermanlandsky"**

---

M. Kämäri, S. Tattari, J. Koskiahho, E. Lotsari

**How accurate are estimates of external riverine loads entering into Gulf of Finland?**

---

J. Rytönen, T. Kõuts, S. Aysinov

**Some of the latest actions to improve maritime safety in the Gulf of Finland waters**

---

J. Kaitaranta, L. Laamanen

**Developing a holistic assessment of ecosystem health in the Baltic Sea**

## POSTERS

L.Barabanova \*,S. Galkina ,E. Mikhailova

### **Karyotype analysis of amphipod *Gmelinoides fasciatus* in the population from the Gulf of Finland**

A. Brodsky,E. Pankova,D. Safronova\*,V. Samuta

### **Influence of heavy metals on littoral communities due to the dredging work in Saint-Petersburg water zone**

J. Bublichenko

### **The Great Cormorant (*Phalacrocorax carbo sinensis*) in the Eastern part of the Gulf of Finland, Russia**

G. Frumin

### **Input of nutrients to the Gulf of Finland from Russian and transboundary rivers**

E. Glazkova

### **Invasive vascular plant species in the flora of the Russian islands in the Gulf of Finland**

Yu.Gubeliit\*, N. Berezina, Yu. Polyak , G. Dembska, G. Pazikowska-Sapota

### **“Green tides”: regulating factors and main consequences for the coastal zone in the eastern Gulf of Finland, Baltic sea.**

N.N.Kamardin

### **The bioindication of chronic pollution of littoral vegetation and soil using terrestrial molluscs *Bradybaena fruticum* Mull.**

S.V. Kholodkevich, A.N. Sharov

### **Bivalve mollusks of eastern part of the Gulf of Finland as a tool for ecosystem health bio-indication**

V. Malyshev, T. Zmeeva

### **Evaluation of the monitoring results of microbial and viral contamination of waters of the Neva Bay and the Gulf of Finland**

A. Jaanus, S. Lehtinen, M. Nurmi, A. Sharov\*, E. Lange

### **Phytoplankton long-term monitoring in the Gulf of Finland**

V. Sukhachev,E. Zakharchuk, U. Lips, N. Tikhonova, I. Suhhova

### **Water dynamics and variability of thermohaline structure during the dangerous sea level rises in the Gulf of Finland.**

A. Demchuk\*, S. Golubkov

### **Feeding of three-spined stickleback (*Gasterosteus aculeatus* L.) in Eastern Gulf of Finland**

E. Chernova\*, I. Russkikh, E. Voyakina, Z. Zhakovskaya, M. Orlova

### **Cyanotoxins Occurrence in Gulf of Finland, 2012-2015**

I. Russkikh \*, E.Chernova, Z. Zhakovskaya, V. Nikiforov, N. Vieno

### **Hormones as an indicator of anthropogenic pollution of the Baltic Sea (2011-2013)**

B. Babikov

### **Monitoring of the water feeding of the rivers in Leningrad region**

A. Lappo, L. Danilova

### **Proposals on structure of INPUT and OUTPUT Data for holistic GoF MSP**

M. Polyak\*

### **A modern approach to visualisation of long-term biological monitoring data of the Neva Bay**

O. Liashenko ,E. Svetashova ,S. Ekimova

### **Heavy metal content in fish and their habitat in the Neva Bay of the Gulf of Finland**

E. Litina\*, E. Zakharchuk, N. Tikhonova.

### **Assessment of nonstationarity in seasonal variability of thermohaline structure in the Gulf of Finland**

O.Susloparova, Y. Zuyev, V. Ogorodnikova

### **Present state food supply for fish in the eastern Gulf of Finland**

O. Valdez Banda, F. Goerlandt, P. Kujala

### **Strategic and Operational Risk Management for Wintertime Maritime Transportation System (STORMWINDS)**

R. Vankevich, E. Sofina, O. Vladimirova, T. Eremina

### **Modelling of the submesoscale flows in the Gulf of Finland (GOF)**

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E. Kochetkova, A. Isaev, T. Eremina

**Application of the Remote Sensing and In-Situ Data for Chlorophyll a Variability simulation in The Eastern part of the Gulf of Finland**

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K-L. Siimon, N. Kolesova, U. Raudsepp

**Fucus vesiculosus morphology and its associated fauna along southern coast of the Gulf of Finland**

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**Gulf of Finland  
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## Oral presentations

# Factors and mechanisms controlling microbial distribution, activity and dynamics in the eastern Gulf of Finland coastal sediments

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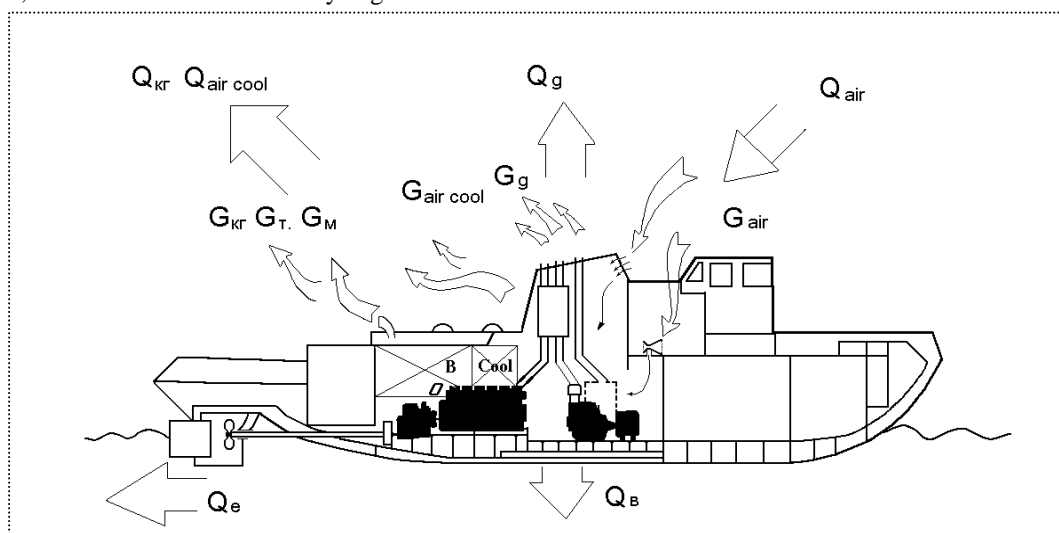
The 5-year study was aimed to understand the factors and mechanisms that cause spatial and temporal changes in the abundance and activity of sediment microorganisms in the eastern Gulf of Finland coastline. Factor analysis determined that 77% of the total variance was explained by four factors, which are, pollution, sediment particle size, redox conditions, and salinity. The observed differences in sediment microbial activity could be explained in two ways. Firstly, spatial variations of microbial activity may naturally occur. Secondly, the variability reflected a response due to heavy metal and oil pollution. Temporal patterns were evident, showing the predominance of either anthropogenic or natural factors, depending on the considered year. Long-term exposure and selection pressure of pollutants on sediments of the eastern Gulf of Finland induced the formation of the specific adapted autochthonous microorganisms. In polluted sediments, the number of hydrocarbon-oxidizing bacteria and metal-tolerant bacteria was as high as more than 10% of the total number of heterotrophic bacteria, while in non-polluted sediments the percentage of specific bacterial groups was less than 2%. These data demonstrate that the indigenous sediment microbiota contributed an important ecosystem service for remediation of the eastern Gulf of Finland coastline. Taking into account the role of sediments in self-purification of contaminated water, determination of sediment microbial activity gives the opportunity to assess the ecological status and forecast possible changes in the aquatic ecosystem.

## Estimation of pollution of air pool in port from vessels

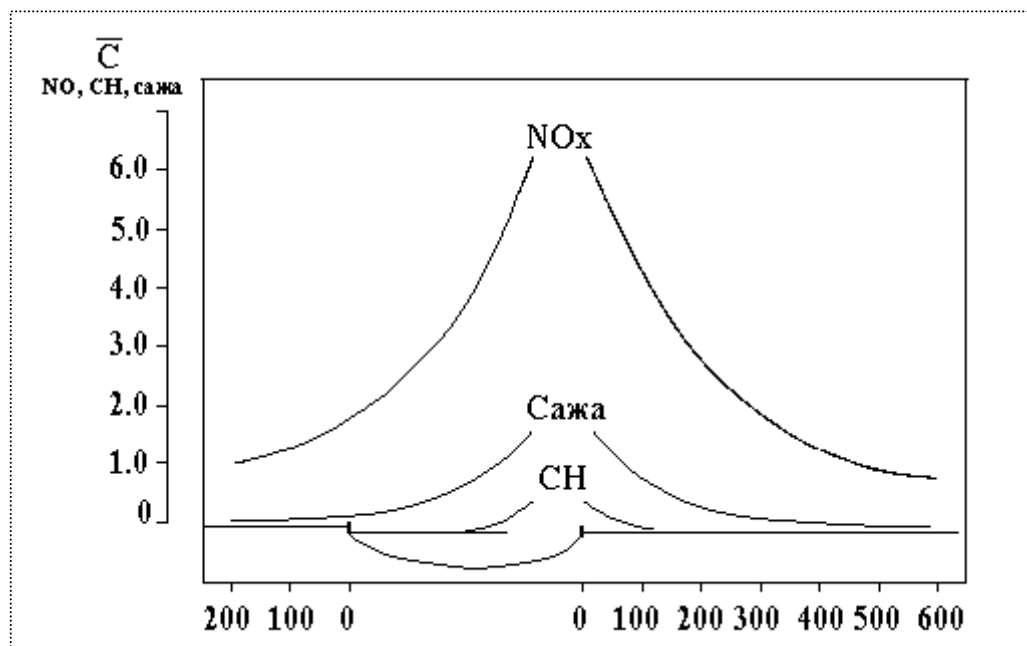
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In article considered the question of an estimation pollution of air pool in transport process by harmful emissions from vessels in port. As research the area of a mouth of the Neva estuary to the Blagoveshchensk bridge is chosen. Рассмотрены два случая. Two cases are considered. In the first case, on all vessels work auxiliary engines and steam boilers, in the second - on three vessels from a waterway are started and the main engines get warm, on all vessels work auxiliary engine and boilers.



Also, take into consideration of the vessels going under the Blagoveshchensk bridge and on the approach to it. Contributions of all sources of pollution of atmospheric air are considered in two any points taken in the middle of quay. Results of calculations of dispersion  $SO_x$ , CO, CH, NO, NO, NO<sub>x</sub> (in reduction to NO<sub>2</sub>) and soot in spot-check water areas on the right coast of Neva in 300 m below the Blagoveshchensk bridge designed for anchorage awaiting pass under bridges or preparing to sail are shown in picture.



Consideration of settlement materials shows, that by regulating the water area filling vessels can provide the desired air quality in the port area.



# Model estimates of the eutrophication of the Baltic Sea and Gulf of Finland in modern and future climate

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Oral

The St. Petersburg Baltic eutrophication model (SPBEM) is used to assess the ecological condition of the sea under possible changes in climate and nutrient loads in the 21st century. According to model estimates, in the future climate water quality will worsen, compared to modern conditions. This deterioration is stronger in the climate warming scenario with a stronger change in future near-surface air temperature. In the considered scenarios of climate change, climate warming will lead to an increase in the area of anoxic and hypoxic zones. Reduction of nutrient loading, estimated in accordance with the Baltic Sea Action Plan (BSAP), will only be able to partially compensate for the negative effects of global warming.

According to model estimates, the future changes in the eastern Gulf of Finland (GOF) area due to climate change will be partly different. Climate warming here will lead to increased surface water temperature and increased riverine inflow. Increased riverine inflow will reduce the salinity throughout the water column due to the almost complete vertical mixing during the autumn-winter period. Changes in the deep layer salinity will be greater than that in the surface layer, causing weakened salinity stratification. The weakened stratification would result in a rise of the bottom water oxygen concentration, which hinders the release of P and N from the sediments, and nutrient stocks in the water will decrease.

Future changes in nutrient loads into the GOF were considered according to two scenarios:

- 1) the reference (REF), using modern atmospheric deposition and concentrations in rivers. Here, N deposition and concentrations of nutrients and organic matter in rivers were assumed to be constant as of 2007, equaling their average values in 1995 – 2002;
- 2) the BSAP, using reduced concentrations of nutrients in the rivers recalculated using target HELCOM loads for the GOF and a 50 % reduction in the atmospheric deposition. Here, concentrations of nutrients in the rivers and the atmospheric deposition decrease linearly between 2007 and 2020 from modern to future values. As of 2020, these characteristics were assumed to be constant.

The BSAP scenario, if realized, will lead to a pronounced decrease in the dissolved inorganic nitrogen and dissolved inorganic phosphorus concentrations in all the sub-areas of the eastern GOF by the end of the 21<sup>st</sup> century, in comparison to what the REF scenario suggests. Compared with present (the early 2000's) eutrophication state of the GOF, the BSAP scenario would lead to lower eutrophication state in the Neva estuary and to a lesser extent also in the offshore eastern GOF, whereas the REF scenario would not.

## Main results of the two-year studies made by Aqua biological research unit under umbrella of ENPI Project SE717

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### Oral

The objects of the two-year study of ENPI Project SE-717 Aqua biological research unit were fish fauna, zooplankton, zoobenthos and macrophytes of Luga River and its tributaries Saba and Yaschera and current state of their ecosystems. Ichthyofauna consists of 30 species and is formed mainly by biofund of Gulf of Finland and also includes non-migratory species. The highest biological diversity is in Luga River. In zooplankton 10 species of invertebrates were found. In zoobenthos 15 species were found. Their species composition showed that water of these three rivers is clean. Only in some places water can be described as moderately polluted. In the communities of macrophytes 65 species were found. The highest biological diversity is noted in Luga River. Degree of overgrowth varies and depends on the hydrological and geomorphological features of biotopes as well as saprobity determined by degree of human impact. The most frequent species were  $\beta$ -mesosaprobies indicating satisfactorily clean waters. Indicating clean water oligosaprobies and indicators of polluted waters  $\beta$ - $\alpha$ -mesosaprobies were met sporadically, in river Yaschera they were not met at all. In Luga River a lot of species indicating human impact, organic pollution, eutrophication, heavy metal pollution and acidification was met. Determining water saprobity allows quickly assess degree of small water bodies and streams contamination. Even with these simple techniques we can catch the changes in the state of the water body. Aquatic biotops located near major roads, fields, settlements and popular beaches are subject to increasingly strong anthropogenic load and therefore need regular monitoring of macrophytes flora. Sufficiently high diversity of macrophytes indicates their relative prosperity. An increase in biodiversity, as well as its decrease, says about the change of trophic status. It is necessary to carry out activities to raise environmental awareness and responsibility of the population, especially schoolchildren, in relation to nature and, in particular, to the purity of both the water bodies and the surrounding areas.

# **Cytogenetic estimation of water state in Dubki recreation area of the Gulf of Finland near Saint-Petersburg**

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Cytogenetic monitoring was conducted in Dubki recreational area near Saint-Petersburg (18 km from the city border). Amphipod *Gmelinoides fasciatus* (Crustacea) was used as bioindicator. Analysis of mitotically dividing embryo cells shows that total frequency of chromosomal aberrations in 2016 is around 2,4%. There is no significant difference with corresponding level that was measured in Dubki in 2015 (2,2%).

Comparison was made with the frequencies of chromosomal aberrations in Baikal Lake which is original area for *G. fasciatus* (Bolshie Koty sampling site). The level of mitotic disturbances was 2,2% in 2015 and 1,7% in 2016. The last value is lower ( $P=0,012$ ) than in Dubki (2016). There were found no any other differences.

Similar data were obtained for some other species in the Baltic Sea basin. For example, the frequency of chromosomal aberrations for *Gammarus zadachi* species in reference site of Baltic Sea was around 2,5% (Daev et al., 2014).

Usage of *G. fasciatus* as a new bioindicator demands checking of its sensitivity to genotoxic pollutants.

Earlier data obtained in *Asellus aquaticus* (fresh water species of Crustacean, Isopoda) suggest that the frequency fluctuation to 10% reflects safe level of genotoxic pollution of water (Daev et al., 2009). But to be sure, it is necessary to conduct further special experiments determining cytogenetic sensitivity of embryonic cells of the *G. fasciatus* at least for typical environmental pollutants of anthropogenic origin.

# **Assessment of the possibility of carrying out of BSAP recommendations to reduce nutrient load into the Gulf of Finland from the Russian part of the catchment area**

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The purpose of this work was distribution of the recommended reduction of the nutrient load between different parts of the Russian catchment area of the Gulf of Finland, to allow carrying out of BSAP recommendations. As a spatial basis for source data capture and assessment a nutrient load into the Gulf of Finland, it was taken the water management scheme of dividing Russian part of the catchment area on the water management districts – WMD. Nutrient load analysis was done for 7 WMD, which carry load directly into the Gulf of Finland and into the Neva River.

For calculation a necessary nutrient load reduction from the various parts of the catchment area, it was used an approach based on distribution of the load reduction responsibility with taking into account a potential of possible load reduction.

The work was carried out by following stages:

- assessment of the attained level of the load reduction in comparison with the level of 1997-2003 years and calculation of the necessary level of load reduction for carrying out of BSAP recommendations for the present-day conditions;
- assessment of the load reduction potential from the point sources and diffuse sources for each WMD;
- distribution of the recommended BSAP reduction for WMD proportionally to the nutrient load reduction potential.

For assessment of the present-day level of the water nutrient load into the Gulf of Finland from the territory of Russia, were used the researches results 2012-2013 years made by Institute of Limnology. Load reduction potential, formed in WMD was defined as difference between actual load level from the various sources and predicted load values, defined by implementation of the most effective technological solutions for sewage water treatment and optimization of agricultural production. Analysis of the obtain results shows that estimate values of the recommended standards for the load reduction don't exceed the potential of the load reduction for all WMD. That argues for capability of carrying out of BSAP recommendations for the Russian part of Gulf of Finland catchment area.

# Assessment of biogeochemical changes in the sediments of the Eastern Gulf of Finland

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Oral

Analysis of nitrogen, phosphorus and some other chemical compounds as well as invasive species *Marenzelleria* spp. population were held in the sediments at the stations in the Eastern part of the Gulf of Finland in 2013, 2015 and 2016 years. Vertical profiles of compounds in the pore water (phosphates, nitrates, ammonia, sulphate and total manganese and iron) and solid phase of the sediments (organic carbon, total iron and total manganese) were considered.

Since polychaete *Marenzelleria* spp. are known to be active turbators, they are capable to influence on physico-chemical characteristics of the sediments. Cluster analysis allowed to identify regularities of chemical compounds distribution of solid phase of sediments in connection to *Marenzelleria* spp. population. On the data 2013 and 2015 years concluded that intensive bioturbation activity of *Marenzelleria* spp. in terms of their high abundance leads to decreased organic carbon burial in the upper layer of sediments. Significant impact of polychaetes bioturbation activity on total iron and manganese content was not identified.

The main results will be discussed.

# The role of allochthonous and autochthonous organic matter in benthic food webs in the upper and in the middle part of the Neva Esruary

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Oral

Modern definition considers an eutrophication as an increase in the rate of supply of organic matter (OM) to an ecosystem (Omstedt et al., 2014). Therefore, detail investigations of different forms of OM coming from the watershed and creating in the system are required to realize the ecosystem function and to develop effective remedial measures. This study shows the importance of allochthonous organic matter in carbon cycling in the Neva Estuary. The negative balance of its ecosystem, the prevalence of mineralization over production of organic matter in the upper and the middle parts of the estuary confirms considerable role of allochthonous carbon in the ecosystem. The carbon isotope signature of seston and of the most zoobenthic species in the upper part of the estuary (Neva Bay) was close to the signature of allochthonous carbon leaking from watershed ( $-27\%$ ). Higher values of  $\delta^{13}\text{C}$  indicate to an intensive creation of primary production in the epilimnion of the Middle estuary in mid-summer. The carbon isotopic signature of zoobenthos in this part of the estuary was also in general lower than in Neva Bay reflected higher importance of autochthonous organic matter in food webs of the Middle estuary. Considerable increase of production and biomass of mid-summer phytoplankton was observed in this part of the estuary during the last decades as compared to 1980s mainly due to considerable increase in biomass of cyanobacteria. However, they are mostly concentrated in the upper water layers and probably only a small part of them reached the near bottom waters and may be used as a food by zoobenthos. We did not found definite sings of nitrogen fixation in the system. The values of  $\delta^{15}\text{N}$  was rather uniform in both part of the estuary and water layers.  $\delta^{15}\text{N}$  signal of predatory *Saduria entomon* was considerably higher as compared with non-predatory benthic species (except alien polychaete *Marenzelleria arctica*) that indicate the higher trophic position of this species.  $\delta^{15}\text{N}$  signal of non-predatory *M. arctica* was practically similar to the signal of *S. entomon*. It was attributed to a higher isotopic fractionation by the polychaete and its probable consumption of older microbial processed organic matter as compared with indigenous crustacean species. Similar nitrogen isotopic signature of *S. entomon* and *M. arctica* points out that *Marenzelleria* is not a food item for *Saduria* probably because this polyhaete is able to escape the predator in the deep borrows constructed this worm in bottom sediments.

# **PRIMARY PRODUCTION AND CHLOROPHYLL A CONCENTRATION IN MIXING ZONE OF THE NEVA ESTUARY**

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Oral

There are several publications that describe the effect of river and marine water mixing in estuaries on the algae communities, but this effect is poorly understood until now. Geomorphologic structure of the Neva Estuary (eastern Gulf of Finland) provides smooth mixing of river and marine waters. Owing to this feature the Neva Estuary is a convenient object to investigate this effect. Integrated water samples were taken from the epilimnion (above thermocline) and from the hypolimnion (below thermocline) at 27 sampling stations in the Neva Estuary at the end of July and very beginning of August of 2003 – 2016. Physicochemical parameters of the water were measured using CTD 90M Probe (Sea&Sun Tech.). Optical characteristics of the waters were investigated by means of C-6 multisensor platform (TurnerDesigns). Primary production, decomposition of organic matter, concentration of total phosphorus in unfiltered water (TP), concentration of suspended organic and mineral matters were also measured. According to our data maximum primary production of plankton and concentration of chlorophyll *a* in the Neva Estuary were observed in the zone where salinity increased from 0.06 up to 2 ‰ and depth increased up to twenty meters. Calculations showed that 95% of particulate matter deposits in this zone of the estuary due to decrease of water flow and changing of electro-chemical potential. Highest concentrations of TP and frequent algae bloom were also observed in this part of the estuary.

# An integrated approach to the assessment of the eastern Gulf of Finland health

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Oral

Eutrophication and chemical pollution are typical threats to the ecosystem of the Gulf of Finland. This paper aims to make a comprehensive assessment of the environmental status of coastal habitats in the easternmost Gulf of Finland (Neva River estuary) by using different physical, chemical and biotic variables to find cost-effective indicators for further monitoring. During summers of 2014 and 2015 we measured water salinity, phosphorus (eutrophication marker), biomass of harmful filamentous macroalgae (coastline hypoxia inductor), sediment hazardous substances (trace metals, polycyclic aromatic hydrocarbons) and other concomitant characters at 12 sites in the gulf. Also, we analyzed responses of the phytoplankton and benthic organisms, including metal-tolerant and hydrocarbon-oxidizing bacteria, meio- and macrofauna, to these factors. We compared the indicative sensitivity and efficiency of several well-known biotic indices and methods, including a Saprobity system (basing on phytoplankton), Raffaelli and Mason index (meiobenthos), and two macrobenthic derived indices (Goodnight-Whitley Index and Benthic Quality Index). Also, we applied a new index – the embryo malformation frequency in benthic amphipods. To estimate the level of bottom hypoxia induced by the macroalgae blooms, we measured the algal cover and thickness of the algal mats. To verify our assessment, we tested correlations between all used variables. Biotic communities of these areas are subjected to high phosphorus and macroalgae blooms, toxic pollution, water salinity and other factors. We concluded that environmental state of coastal habitats at several southern sites (in Koporskaya Bay and near port Bronka) and near port Primorsk in the north was bad, while the state of the rest of sites was moderate or good. The integrated approach for the assessment may be recommended for monitoring programs as an important tool for studying human-mediated and other effects on brackishwater coastal environments..



# The eastern Gulf of Finland eutrophication status according to GoF data set

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Oral presentation

The Gulf of Finland (GoF) data set includes data from the Eastern GoF from 1996 onwards. The Russian national data creates a distinct unit as its sampling programme is tailored to suit local conditions, but its geographic coverage, continuous sampling and stable methods makes it a potentially valuable contribution. I will show the results of preliminary analysis of the Russian GoF data on the eutrophication status of the Eastern GoF. My aim is to open discussion with Gulf of Finland experts on the scientific value of the analysis and how the next steps would optimally be done (or not done).

The Russian data set was divided into two periods, the first being years 1996 to 2004 and the second (representing declined nutrient input from St Petersburg) 2005 to 2013. Additionally, the data set was divided into two geographic regimes according to their distance from St Petersburg. These regimes were the inner and shallower part and the mostly deeper outer part covered by the Russian monitoring programme.

Sampling mainly during the growth season prevents the utilization of inorganic nutrients on the assessment of nutrient status as does the high dissolved organic background concentration on total nitrogen. However, total phosphorus level was about 25% lower at the latter period. Hydrography, mainly the intrusion of Baltic Sea water did not explain the difference. Chlorophyll-*a* concentration has also decreased, but near-bottom oxygen conditions remained similar. The GoF data shows better eutrophication status in the Eastern GoF after the effective removal of nutrients in St Petersburg, but the additional evidence would confirm the finding.

# Testing applicability of a bioelectronic cardiac monitoring system for the determination of biological effects of pollution on bioindicator species in the Gulf of Finland

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An analysis of the potential development of innovative technologies based on bioelectronic cardiac monitoring systems is carried out. Application of the original bioelectronic system and methods on its basis are useful tools in the complex biomonitoring of freshwater and brackish water areas of the Gulf of Finland. The approach of measuring biological effects in mussels and clams deployed in cages in specific target areas has been successfully used to evaluate decline in adaptive potential of exposed mollusks. Our study of 2014-2016 years have showed that the selected mollusks (*Mytilus trossulus*, *Macoma balthica* and *Anodonta anatina*) are suitable for using them in such systems. Mollusks taken from reference sites demonstrated a heart rate recovery time of < 60 mins under testing with salinity load, while those collected from the sites with anthropogenic pressure demonstrated a prolonged recovery time of up to 110-360 mins. These results give a possibility to clear discrimination of the study sites based on the assessment of adaptive capacities of species living there. The study also identifies gaps in our knowledge of the cardiac system functioning in different species usually used as bioindicators of the environmental state (e.g., *M. balthica*). More information is needed on the peculiarities of their vital systems functioning in normal conditions to make conclusions on the adverse exposure effects on cardiac activity. Development of methodological basis for testing adaptive capacities (health) of key aquatic organisms will provide a new understanding of biological effects of anthropogenic chemical stress on aquatic organisms.

# **Fisheries and fish populations in the Eastern Gulf of Finland during the 15-20<sup>th</sup> centuries**

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Oral

The paper analyses data on historical fish catches of the eastern part of the Gulf of Finland (Baltic Sea) for a period from the 15th to late 20th centuries. Atlantic salmon and whitefish were very important commercial species since the 15-16th centuries till the 19th century, but were gradually losing their significance since about mid-19th century due to human-induced factors and overfishing in particular. Similar pattern were observed for other migrating species such as brown trout, vimba bream, eel. Sturgeon lost its commercial significance even earlier. Two other anadromous species, vendace and lamprey, show notable fluctuations, but without obvious association with any environmental or human-induced factors. Smelt for long period showed increase of catches mostly due to increase of fishing effort, and during a long period was the most commercially important anadromous species, but drastically declined recent decades. Herring catches quickly increased since mid-19th century and it soon became the most important commercial fish of the region. Catches of other marine species such as sprat, flounder, cod, eelpout, increased in periods of higher salinity. Therefore our study describes main patterns of long-term changes fisheries and fish populations of the eastern part of the Gulf of Finland, reveals drivers responsible for such changes.

# The recent measurement of benthic phosphate fluxes in the eastern Gulf of Finland

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Oral

In the semi-enclosed eutrophicated eastern Gulf of Finland sediment-related internal processes play the essential role in the phosphorus cycling. As consequences the nutrient regime of the eastern Gulf of Finland seems to be sensitive to changes in the benthic communities which recently were radically changed by large-scale biological invasions of deep-burrowing annelid worms especially polychaetes *Marenzelleria arctica*. Invasion-induced changes in nutrient cycling were confirmed by monitoring data and modelling studies. However the actual direct benthic flux measurements are not available. In late July – early August 2015 the sediment–water phosphate fluxes were measured at four sites using incubation of sediments in core tubes. Fluxes were oppositely directed at studied sites differing in structure of benthic communities. At the most of sites fluxes were negative, indicating uptake of phosphorus by the sediment. The comparison with results from earlier studies indicates the drastic changes in sediment-water nutrient fluxes in the study area. These changes may be attributed to shift in structure of benthic communities and bioturbation activity of invasive worms. Benthic fluxes measurement supports conclusions from field and modelling studies about increase of phosphorus retention in sediments of the Gulf of Finland after *Marenzelleria* invasion.

# **Simulation of Crude Oil Spreading within Ice Channel after Emergency Ship**

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Gulf of Finland is the water area with the most intensive winter (ice) navigation among all seas including polar seas. Therefore, the risk of the emergency oil spill in ice conditions is high enough one and preparedness for oil spill combating is important problem. Solution of this problem requires the adequate model of the oil spill spreading in ice conditions.

Navigation within the ice channel created by the icebreakers is the usual method of navigation in the Gulf of Finland. In case of the accident with tankers or cargo vessels, the spilled oil will spread within the ice channel among small ice floes. Therefore to develop the adequate model of the oil spill spreading, it is necessary to define the sizes and amount of ice floes within channel (the ice concentration) and develop the analytical description of the oil flow along sea surface among the ice floes.

Given problem was studied in framework of Neighborhood Programme “South-East Finland – Russia” (Projects RescOp and WINOIL) and proceeded during the Gulf of Finland Year 2014.

Presentation contents the analytical model of the oil flow among the ice floes, the statistical data about ice concentration and sizes of the ice floes in dependence upon the ice cover thickness and results of simulation of oil spill spreading within the navigable ice channel.

Outcomes of the investigation can be applied for improvement the simulators that are used for training personal for the emergency oil spill combating.

## **Some aspects on further joint fisheries research in the Trilateral Estonian-Finnish-Russian cooperation in the Gulf of Finland**

**Pakarinen Tapani** (*Luke*), **Raid Tiit** (*Estonian Marine Institute*) and **Pedchenko Andrey** (*GosNIORH*)

The implementation of the project "Gulf of Finland Year 2014" made it possible to compile and analyze data on fish stocks of the Gulf of Finland taking into account recent changes in the ecosystem.

One of the main goals of our project was to bring together scientific organizations of our countries to study fish stocks and their habitats in the Gulf of Finland. We have taken steps and actions to implement this goal for several decades and now succeeded to reach it. Our joint projects in the field of fisheries and research on fish stocks has become the basis for present and future work. It is important to set ambitious and challenging objectives in the sphere of fisheries research and maintenance of a strong knowledge base for fisheries management and other environmental decision making. These challenges can be solved only by joint efforts.

To date, we have been able to generalize the findings of the national research in previous decades, in order to assess the dynamics of abundance of the most valuable fish species of the Gulf of Finland, and also to assess the influence of climatic and anthropogenic factors on their behavior and state of the stocks.

In order to strengthen the cooperation on fisheries research further a working group of experts has been formed. Priority in the group's work will be to strive for the objectives set out in the Declaration on the cooperation for the protection of the marine environment of the Gulf of Finland:

- Gain a good ecological state of migratory fish stocks by ensuring the access to spawning habitats and successful reproduction in rivers by:
  - fisheries management and prevention of illegal fishing,
  - removal of unnecessary dams from rivers and building fish passes at the migration obstacles,
  - restoration of spawning and rearing habitats in rivers
  - working with taking steps in order to reduce the load of solid matter and nutrients from of catchment areas of human impacted river ,
- Implementation of measures to restore Atlantic salmon stocks in the four major rivers: the Neva, Narva, Luga and Kymi.
- Take actions to reach a good ecological state in the spawning and nursery areas for herring and other coastal fish species (e.g. by reducing eutrophication)
- Control and development of recommendations and implementation of measures for reducing the anthropogenic influence as a result of hydraulic engineering, pollutant emissions and other human activities in order to maintain the productivity of stocks of all fish species in the region and the health of the marine environment.

It is important to note that these very ambitious objectives in the sphere of fisheries research and management can be solved only by joint efforts.

## **Enhancement of data provision system of the state monitoring of the Russian part of a catchment basin of the Baltic Sea on a condition of superficial water currents and the marine environment in HELCOM**

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Since 1987, HELCOM carries out regular compilation of loading of the pollutants arriving from the territories of member countries of HELCOM within a catchment basin of the Baltic Sea.

Compilation of loading of pollution is intended for assessment of tendencies in intake of biogenous substances from member countries and the corresponding adjustment of the purposes and priorities of nature protection policy in the region, efficiency evaluations of the measures for decrease in negative impact taken by the countries, and also for determination of need of acceptance of additional measures. Compilation is based on data of national monitoring of member countries of HELCOM and creates necessary information base for distribution between member countries of liabilities on decrease in anthropogenous loading.

The system of collection and information transfer in HELCOM which developed in the Russian Federation doesn't provide fully accomplishment of liabilities on data presentation for the purposes of compilation of loading of pollution that for many years sparks criticism from other member countries of HELCOM as it is the reason interfering forming of objective assessment of general load of the Baltic Sea and tendencies in change of loading.

Within the scientific project "Scientifically based offers on establishment of biogenous load of the Gulf of Finland from Russia and determination of compliance of loading to requirements of the Copenhagen Ministerial Declaration HELKOM (2013)" according to the contract No. 58 -2015 of 16.10.2015 on implementation of the Federal target program "Development of a Water Management Complex of the Russian Federation in 2012-2020" the following tasks are solved:

1. The methodology of distribution of values of permissible biogenous load and quotas is developed for the Russian part of a reservoir of the Baltic Sea.
2. Calculation of permissible biogenous load for the rivers of the Russian part of a reservoir of the Gulf of Finland and water management sites is executed.
3. Calculation of admissible impact for gross (general) forms of nitrogen and phosphorus is executed (on the example of water management sections of the Luga River).
4. Scientifically based offers on establishment of biogenous load in gross (general) forms of nitrogen and phosphorus of the Russian reservoirs of the rivers of the basin of the Baltic Sea are prepared.

Also a number of suggestions for improvement of system of provision of data of the state monitoring of the Russian part of a catchment basin of the Baltic Sea on a condition of superficial water currents and the marine environment in HELCOM was formulated.

# Sediment quality in the Gulf of Finland

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Oral

Maritime spatial planning requires proper knowledge of the seafloor. When a sea area like the Gulf of Finland is loaded with harmful substances, sometimes with rather high contaminant levels, established sediment quality guidelines (SQGs) provide good frame for evaluation of sediment quality for the permitting authorities. In the Gulf of Finland this approach was used for heavy metals on two datasets of 84 sediment cores. The data consists of altogether 1811 subsamples which were classified using North American and Norwegian SQGs in lack of “own” Baltic Sea guidelines. The obtained results reveal that in the majority of the subsamples the heavy metals and arsenic exceed the threshold levels of the used SQGs, some exceed also the probable effect level and sometimes belong to the IV and V classes of the Norwegian guidelines. There are however some discrepancies between the American and the Norwegian guidelines, which complicates interpretation, especially regarding copper and lead. The best solution would be to have own guidelines for heavy metals in Baltic Sea sediments.

Heavy metal and arsenic deposition in surface sediment of the Gulf of Finland is declining, but cadmium, mercury, and especially zinc concentrations still occur at unacceptably high levels in the Gulf of Finland sediments. This is important to remember in environmental impact assessments and maritime spatial planning of the Gulf of Finland.

## References

Vallius, H. 2015. Applying Sediment Quality Guidelines on soft sediments of the Gulf of Finland, Baltic Sea. *Mar. Poll. Bull.* 98, 314-319.

Vallius, H. 2015. Quality of the surface sediments of the northern coast of the Gulf of Finland, Baltic Sea. *Mar. Poll. Bull.* 99, 250-255.



# Reducing agricultural phosphorus losses in a large-scale gypsum pilot

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Oral

Novel measures may aid in reducing agricultural phosphorus load into the Baltic Sea. The SAVE project examines the feasibility of a gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) amendment in cutting down the losses of particulate and dissolved phosphorus from clayey agricultural fields. In autumn 2016, gypsum was spread (4 t/ha) on 1550 hectares of fields in the middle reaches of the river Savijoki catchment, south-western Finland. The upper reaches of the river were left as a control area, where gypsum was not used.

Runoff quality was monitored before, during and after gypsum amendment at the control and the gypsum area by using on-line sensors and by manual water sampling and laboratory analysis. The effect on the quality of soil and crops were monitored by a systematic soil and vegetation sampling. The effect of sulphate on river biota was examined by using biotests and biological monitoring. Ground water was also monitored for possible gypsum leakage.

The presentation will reveal whether we can already see changes in runoff quality. In addition, the presentation will discuss farmer's willingness to take part in the gypsum experiment and how the large-scale gypsum pilot – recruiting farmers, transporting and spreading gypsum – was organised in practise.

# Problems of the organization of joint control over the state and health of the ecosystem of the Gulf of Finland

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Oral

Last Year the Gulf of Finland-2014 on the one hand revealed many weak points, but at the same time raised a number of problems of joint use of data on the geochemistry of bottom sediments. At the present time as a result of long-term monitoring of the bottom sediments in the Russian part of the Gulf of Finland marked areas of permanent contamination. The control of these stations annually produces stable trends, and evaluate changes of the environment of the Gulf of Finland.

The main anthropogenic pollution factor currently in the Russian part of the Gulf of Finland are various types of dredging, especially in the areas of primary contaminated sediments.

The real problem is the regulation of data exchange and different classifications used for assessment chemical contamination of bottom sediments, as well as for the ecological status of waters.

Specific questions to be discussed are:

- establishment of a joint regulation of sampling, including sampling with uniform intervals, preservation, and transport of samples to the laboratories;
- intercalibration used chemical methods of sample preparation to analysis;
- establishment of a single scale of critical levels of the chemical trace elements in bottom sediment. It is compare data from all of the Baltic countries in the future;
- Finally, the last objective is to create a single portal health of the Gulf of Finland (within HELCOM).

I ecological status of waters.

# Towards environmental safety of Maritime Spatial Planning for Sustainable Blue Economies

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The aim of the INTERREG Central Baltic project “Maritime Spatial Planning for Sustainable Blue Economies (Plan4Blue)” is to promote sustainable planning and management of marine and coastal areas of Gulf of Finland and Archipelago Sea. The WP “Environmental management” is focusing on advancing sustainable, resource efficient and environmentally safe blue growth based on increased capacity of public authorities and practitioners within the blue economy sectors. The Gulf of Finland environmental vulnerability profile as descriptions of environmental vulnerabilities in light of driver/pressure cause-and-effect pathways to environmental effects against the risk criteria and the environmental risk profile as spatial and temporal areas of highest risk, based on the likelihood and magnitude of environmental effects are considered to be valuable baseline information for the incipient actual MSP processes in Estonia and Finland. "Environmental management Strategy for MSP" is considered to be an important tool to integrate the ecosystem based approach into the maritime and coastal spatial planning processes. The "Guidelines on environmental management for sustainable planning" seek to enhance the institutional capacity of maritime and coastal zone spatial planning authorities and stakeholders in Estonia and Finland to develop maritime and coastal zone spatial plans that are environmentally safe, trans-boundary coherent and, thereby, create conditions for optimal Blue Growth gains.

# **Systems-Theoretic approach based environmental safety management of maritime navigation in the Gulf of Finland (Baltic Sea)**

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The primary aim of the BONUS project "Strategic and Operational Risk Management for Wintertime Maritime Transportation System (BONUS STORMWINDS)" is to develop various risk-informed services and decision support models for shipping accidents in the Northern Baltic Sea, which are essential tools for accident prevention and response. The STAMP-Mar research concept and application positions under development embrace a) the hierarchical regulatory levels of maritime navigation safety control, b) maritime navigation safety constraints, and c) maritime navigation safety control structure. The mandatory ship reporting system in the Gulf of Finland (GOFREP) is analysed and used as a testbed for STAMP-Mar based enhancement of maritime navigation safety control system in the Gulf of Finland. As a vital element of this system the basic configuration and essential functionalities of the Next Generation SmartResponse Web (NG-SRW) application are presented and discussed. Ecosystem context of the GOFREP maritime navigation eco-socio-technical system is characterized by Regional Environmental Sensitivity Index (RESI) that can be used for STAMP-Mar based maritime navigation operational safety management as well as for setting the MSP processes related environmental constraints.

# Current climate change over the territory of the Leningrad region and their consequences

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A feature of modern global warming is manifested in the uneven warming over area and characterized by significant differences for seasons of the year.

The growth of air temperature is evident throughout the Leningrad region, in all seasons and months. Linear trends are for average annual temperature  $+1.5^{\circ}\text{C}/30$  years.

According to the study of average monthly values, it follows that the main contribution to the positive trends of the winter season make two months - January and February and spring season – March and April. However, the most noticeable temperature increases at stations in the Northern part of the region in January and July (2, 5-2, 8  $^{\circ}\text{C}/30$  years). The change in mean values may have a significant impact on nature and economy, but even more important may have changes in the minimum and maximum values of air temperature and precipitation, duration of warm and vegetation periods, the frequency of occurrence of such unfavorable phenomena as drought, frost, hail, and floods.

The absolute minimum temperature in winter was reduced compared to the climatic norm at  $3-13^{\circ}\text{C}$ , and such low air temperature values in 1961-1990<sup>th</sup>, the last 30 years was observed. Also, for 2-3 days reduced the period of continuous severe frosts with temperatures below  $-25^{\circ}\text{C}$ . Warming has led to increase in 3-5 days number of days with thaw, and warm and growing periods increased by 7-9 days. Changes in precipitation in the region have a much more complex space-time structure than temperatures due to their greater variability. To provide clear, unidirectional trends failed, and the common tendency of decreasing annual precipitation equals by about 2 mm/10 years, seems to be uninformative, especially from a practical point of view for the economy.

## **To the question about holistic GoF**

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The presentation includes proposals for cross-border coordination of national maritime spatial plans and prospects for joint MSP in the Gulf of Finland. According to them, planning solutions include all the entire of GoF and, with regard to the Russian part of the GoF, coastal enterprises and nature protection zones, directly related to marine activities and affecting the ecological status of the marine waters.

Analysis of legal instruments that would be used by the Russian side in the implementation of joint maritime spatial plan of GoF would be made. It is noted the necessity of a thorough analysis of predictable changes in the climate conditions and their impact on the ecological state of the Gulf, and human activities in its waters and shores, including the impact on coastal towns and cities. The report emphasized a conflicts between the conventional periods of strategies for socio-economic development (3-10, maximum 15 years) and the impact period of climate changes, measured in tens of years.

As part of the work it is proposed to prepare a joint vision for the development of human activities in the waters of the GoF for all three countries – Russia, Finland and Estonia, taking into account different scenarios of climate changes and human activities. To assess the impact of expected changes in the ecosystem of the Gulf all three countries are invited to carry out joint strategic environmental assessment on the priority scenario of the situation.

The report identifies features of the Russian system of maritime activities in the current period and the changes in its management, the expected adoption of the Federal Law "On state control of maritime activity in the Russian Federation", and the differences in the approaches to the management of maritime activities and maritime spatial planning in the countries of the GoF.

Proposal for the GIS layers of the income and outcome data would be done. These proposals are prepared on the basis of the recommendations of UNESCO and the results of HELCOM/VASAB Working Group on MSP, taking into account the experience of the Russian pilot MSP projects. More detailed proposals on a set of income and outcome data for joint MSP of the Gulf of Finland are presented in a poster presentation.

# Atmospheric forcing controlling inter-annual nutrient dynamics in the open Gulf of Finland

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Oral

## Abstract

The eutrophic Gulf of Finland receives a large nutrient input from its catchment compared to the other sub-basins of the Baltic Sea. The load of P has reduced but no clear improvement in the P condition has been observed in the open Gulf where the concentrations of both inorganic N and P still vary greatly between the years. Our objective was to study can the internal processes driven by atmospheric forcing in the Gulf be responsible for the inter-annual changes in the nutrient conditions. We found that the long-term stratification in the Gulf follows that in the northern Baltic Proper. However, the winter winds were able to regulate the stratification and its' strength within short time-scales. The wintertime stratification conditions, in turn, correlated significantly with hypoxic area and the pools of DIN and TP in the Gulf. We conclude that the winter-wind conditions controlled the stratification and mixing causing a great inter-annual variation in the pools of N and P and bioavailability of nutrients. The changes in the pools of nutrients have potential to lead to greatly variable production regimes affecting the spring and blue-green algae blooms. Our study indicated that nutrients transported along the bottom of the Gulf from the main basin are likely to be lifted to the surface waters in the Gulf which points out that the reduction of nutrients is needed in the entire catchment of the Baltic Sea to improve the trophic status of the open Gulf.

## Environmental researches and surveys in frames of the Nord Stream 2 project

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Successful realisation of the first Nord Stream project and new economic challenges pushed forward ideas of Nord Stream **EXT**ention (NEXT feasibility studies). New international project Nord Stream 2 will provide an additional link between Russian gas suppliers and EU gas consumers via the shortest route through the Gulf of Finland and the Baltic Sea. Detailed environmental researches are the basement for EIA, for permitting procedures and for the project development. The Scope of work for EIA was elaborated in accordance to both Russian state environmental standards and requirements of Espoo protocol. Scope of environmental investigations in frames of the Nord Stream 2 project include onshore such topics as follows: landscape studies, survey of atmospheric air, quality of ground water, continental water bodies hydrobiology and ichthyology, flora of vascular and lower plants (lichens, mosses, fungi) and vegetation distribution studies, terrestrial invertebrates and vertebrates, avifauna, soil physical structure and contamination by many chemical parameters, radiology, invasion by bacteria and parasites, dangerous geological exogenous processes. Offshore surveys include large scale investigations of bottom grounds physical and chemical parameters, water quality, bacterio- and phytoplankton, photosynthetic pigments, macrophytes, zooplankton and zoobenthos, coastal and pelagic fish communities, waterfowl and marine mammals. Culture heritage objects will be investigated as well both onshore and underwater. The surveys were organised in consequent stages started from field observations, sampling and/or other way fixation of studied objects (like photo, video or audio registration) to laboratory processing, data analysing and final reporting. All surveys were done in a wide terrestrial and marine corridors of Koporskaya Bay and Narva Bay and adjacent important areas, where new gas pipeline route can be considered. Environmental researches and surveys in frames of the Nord Stream 2 project recently are on a stage of field works finishing and final reports collection from contractors. When completed, the EIA report together with all materials according to Russian law will be submitted to State environmental expertise for authorized inspection.



# Monitoring of eutrophication: observations and recommendations emerging from the GOF assessment work and the most recent data

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Oral presentation/ Abstract

Results and recommendations related to monitoring of eutrophication are presented and discussed based on the recently published Gulf of Finland assessment, the GOF2014 dataset and the latest monitoring data. The assessment revealed strong spatio-temporal variation of nutrients, oxygen and chl $a$  for different parts of the Gulf. This causes high requirements for the state monitoring of the GOF, and highlights the importance of the use of all available data, the integration between traditional ship-based monitoring, automated monitoring (ferry-box, buoys) and remote sensing methods, as well as the development of different monitoring methodologies. The GOF2014 data set with other available data enabled the assessment of eutrophication and its dependency on external and internal factors in the different parts of the Gulf. They also helped to identify inconsistencies in nutrients and chl $a$  results caused by differences in analytical methodology or due to varying sampling periods and depths. Some inconsistencies in country-wise results were also observed with no clear explanations due to different methodology, sampling time or geographical location. In the cases of lack of direct comparability, it is not possible to produce uniform basin-wide concentration fields or fully consistent trend analyses for different parts of the GOF. This greatly emphasizes the importance to further develop both traditional and automated monitoring between the three countries in accordance with Guidelines and frames set by HELCOM and EU, as well as the continuation of intercalibration work started during the 2014 GOF Year project.

# Aquaculture development concerns and prospects in relation with climate change: Eastern part of the Gulf of Finland

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Oral

Sustainable aquaculture development in the Gulf of Finland depends on the impact of potential climate change in the 21st century on the Baltic Sea ecosystem. According to the content of dissolved oxygen situation in the Gulf of Finland will be safe under the eco-hydrodynamic model SPBM (St. Petersburg Baltic Model) for REF scenario and BSAP. The estimated for summer season (average for the period June-August) benthic oxygen concentration in the subarea 32 has remained stable or even slightly increased with time (or REF and BSAP nutrient load scenarios). Paper describes the dynamics of the seasonal distribution (winter and summer) of water temperature at various depths horizons in the period from 1970 to 2098 years for the 6 potential sea sites for fish farming in the Russian part of the Gulf of Finland. Increasing the temperature of the water can be traced for all seasons, and considered the deep horizons, but is particularly noticeable trend of growth of winter temperatures in the surface layers, which is very important with all-year round cycle for fish farming in sea cages. Here, however, there may be critical situations with extreme heating of the upper layer of water in some areas during the summer period that requires the use of submersible cages for growing coldwater fish species.

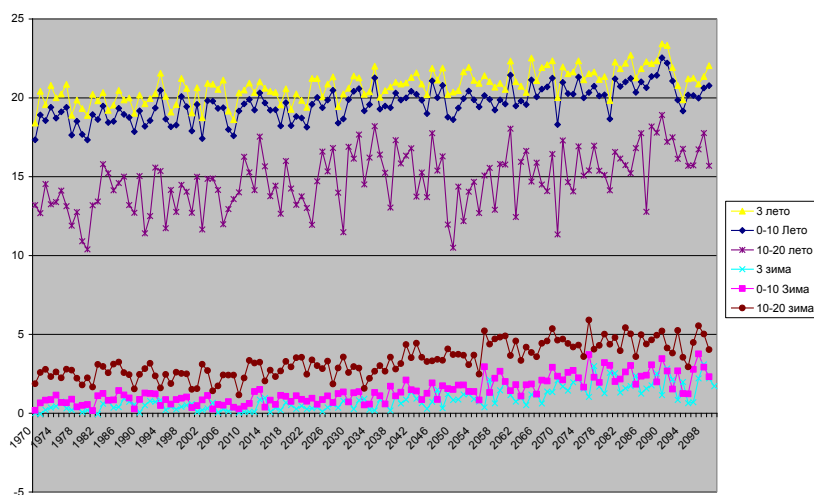


Fig. 1 – Example of seasonal distribution (winter and summer) of water temperature at various depths horizons at the one of 6 potential fish-farming sea sites in the Eastern part of the Gulf of Finland

# The effect of contaminants on *Monoporeia affinis* embryos in the Gulf of Finland

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Oral

The amphipod *Monoporeia affinis* plays an important role in the Baltic Sea as detritivore, food source for fish as well as a bioturbator. Malformations of *M. affinis* embryos were used as bioindicator for contaminant effect of sediment in Swedish coastal waters more than 20 years, but no studies are performed in Estonian waters. The aim of this study was to observe the impact of potentially contaminated sediments on embryos of *M. affinis* and estimate the applicability of the bioindicator for the Estonian coast.

During the study we analyzed more than 4200 embryos from five sampling sites along the Estonian coast in the Gulf of Finland. *M. affinis* individuals and samples of the marine sediment for chemical analysis were collected from each site in the mid of January 2016. More contaminated sites showed higher proportion of malformed embryos. Also the proportion of females with more than one malformed embryo was higher in areas with more polluted sediments. Good environmental status (GES) was not achieved on all investigated stations. We found that the bioindicator is applicable to assess the sum effect of contaminants in the sediment in the Gulf of Finland.

# Changes in the Baltic Sea wave climate and estimation of extreme events from multi-mission satellite altimetry.

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Oral

We present for the first time an analysis of the wave climate and estimation of extreme events in wave heights for the Baltic Sea over 25 years derived from a multi-mission satellite altimetry data. The data are from 1990 till 2015 and count about 700 000 individual measurements. The data were cross-validated with available buoy measurements and corrected (or doubtful observations removed) for (1) ice cover, (2) distance from the land and (3) biases between different missions. The analysis of the resulting dataset shows that annual mean SWH shows statistically significant increase 0.005 m yr<sup>-1</sup> in the basin-wide average wave heights. The Gulf of Finland also showed an increase in the wave heights over last 25 years. Different quantiles of the wave heights exhibit different kinds of temporal variations. The 99th and 90th quantiles (that correspond to strong storms) show no significant trend but are oscillating on a timescale of about three years. The 75th, 50th, and 25th percentiles (that characterize the most prevalent wave conditions) show very different behavior. Their most visible feature is a cyclic variation with a period of about 15 years. Extreme wave heights are estimated using Generalized Pareto distribution, with maxima selected with the block maxima and peak over threshold methods. Altimeter estimates are compared to extreme wave heights calculated using the in-situ buoy data. We will discuss the return periods and changes in the extreme events basin-wide and in the Gulf of Finland over the last 25 years.

# Variations of the halocline and oxygen distribution in the Gulf of Finland

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## Oral

Deep layer hypoxia in the Baltic Sea has been partially related to the anthropogenic eutrophication in the Baltic Sea. Besides the biogeochemical effects, physical processes play a role in oxygen dynamics of the deep layer in the gulf as well. Oxygen depletion after the eighties is associated to strengthened stratification since Major Baltic Inflows 1993 and afterwards.

In synoptic scale, the depth of the halocline and the hypoxic layer thickness are sensitive to wind forcing. Westerly winds cause weakening of the halocline and decrease of the hypoxic layer thickness while easterlies have opposite effect. In seasonal scale, deep layer conditions are impacted by oxygen consumption during detritus decomposition by bacteria. Besides the estuarine circulation reversals, only vertical mixing can import oxygen to the deep layers of the gulf.

On the basis of shipborne and autonomously collected data, we describe the halocline and oxygen dynamics in recent years. Deep layer of the gulf can be considered as very salty and often oxygen depleted in 2016. We aim to find the contribution of the pre-described processes (changes in stratification, wind-generated advection, seasonal oxygen consumption and vertical mixing) to oxygen dynamics in 2016.

# Seasonal and interannual dynamics of phytoplankton and chlorophyll *a* in eastern part of Gulf of Finland

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oral

Structural and functional characteristics of phytoplankton are widely used to determine the status of aquatic ecosystems in monitoring researches. Eutrophication of water bodies leads to active vegetation of cyanobacteria and water blooms. HAB have become common in North-West Russia water reservoirs.

For many years the eastern Gulf of Finland, Baltic Sea is exposed to anthropogenic pressure related to intensive human activities in the region. The Gulf of Finland is situated in the eastern part of the Baltic Sea. The eastern part of Gulf of Finland consists of three main areas: the Neva Bay (surface area 400 km<sup>2</sup>), the inner and the outer estuary (total surface area 3200 km<sup>2</sup>). Because of the large influx of fresh water from the Neva River, the gulf water has very low salinity – between 0 and 5 ‰ at the surface. The coastal zone of the eastern Gulf of Finland has been intensively used for recreation and different industries. Large oil and coal port terminals have been constructed in this part of the Gulf of Finland over last decades. The Neva River is the largest river and a source of pollution in the eastern Gulf of Finland.

The study area covered both inner and outer parts located in the eastern Gulf of Finland, between the latitudes 59°42' and 60°09' N and the longitudes 27°23' and 29°52' E. The sampling area included 15 standard monitoring stations from Bjorkezund Strait (Primorsk) on the north to Luga Bay on the south. Sampling was performed in period of 2010 - 2015.

Different areas of the Gulf of Finland varied considerably in the structure of phytoplankton and concentration of chlorophyll *a*. The great number of species of green algae, diatoms and cyanobacteria were noted in species composition of phytoplankton. It's typical for the most water reservoirs of North-West Russia. The number of species varied greatly in different parts of the Gulf of Finland: the least of all species of algae have been found in Koporskaya Bay (37 - 57) and Luga Bay (39 - 57), the largest number of species - in Inner estuary (107 - 117) and Vyborg Bay (115). Usually freshwater species dominated in plankton in the inner estuary of the Gulf of Finland. Brackish-water species such as *Nodularia spumigena* and *Dinophysis sp.* were common in outer estuary of the Gulf of Finland. Cyanobacteria were dominated in phytoplankton in all part of eastern Gulf of Finland. Biomass of phytoplankton in studied samples varied in the range of 0.35 (outer estuary) - 25.25 g m<sup>-3</sup> (inner estuary). The lowest average biomass of phytoplankton was recorded in outer estuary Gulf of Finland (1.79 g m<sup>-3</sup>), the largest average biomass was noted in inner part (5.93 g m<sup>-3</sup>). Also, the average biomass of phytoplankton varied significantly from year to year, the maximum average biomass was in 2014 (3.91 g m<sup>-3</sup>), minimal – in 2013 (1.60 g m<sup>-3</sup>). *Aphanizomenon flos-aquae*, *Snowella lacustris*, *Skeletonema subsalsum*, *Cryptomonas spp.* dominated during the summer. The share of *Planktothrix agardhii* in plankton decreased significantly in recent years.

The interannual dynamics of chlorophyll *a* due to the instability of hydrodynamic regime. Under conditions of high salinity, concentration of chlorophyll *a* was low throughout the eastern Gulf of Finland. The maximum concentration of chlorophyll *a* was in 2010 (11.2 mkg dm<sup>-3</sup>), minimum – in 2015 (3.9 mkg dm<sup>-3</sup>). In general, on concentrations of chlorophyll *a* and phytoplankton biomass eastern Gulf of Finland can be classified as mesotrophic waters.

# Role of sea ice in the state of the Gulf of Finland

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Oral

Ice forms in the eastern part of the Gulf of Finland annually, while the whole basin freezes over in normal and severe winters. The length of ice season is five months, and the thickness of undeformed ice reaches 30–60 cm. The ice cover appears as landfast ice zone in the coastal regions from the shoreline to sea depths of 5–10 m, and further out drift ice fields are found. The ice has major influence on the oceanography of the basin, since atmospheric forcing is modified for its magnitude and length scale. Atmospheric deposition is stored on the ice to be released on the short melting period that causes a peak in the geochemical loading of the surface waters. Marine biology is influenced by the particular stratification caused by the ice: beneath landfast ice there is a thin low-salinity layer due to weakness of turbulence and freshwater inflow, and beneath drift ice there is a low-salinity layer in spring due to presence of melt water. Ice is also an important geological factor. It scours the bottom to the depths of the scale of ridge keels, and it deforms the shore areas by onshore ridging and riding. This presentation gives a review of sea ice and its environmental impacts in the Gulf of Finland.

# **Biomarkers of environmental contaminants in the coastal waters of Estonia: effects on perch, flounder and Baltic herring**

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Oral presentation preferably

Baltic Sea near the Estonian coast is heavily navigated by numerous ships and oil tankers. There are relatively few data on the distribution and effect of environmental contaminants, especially polycyclic aromatic hydrocarbons (PAHs) there. The aim of present research was to study the responses of selected biomarkers of contaminants in different areas of Gulf of Finland close to Estonian coast as well as in Estonian big lakes (perch from the lakes Peipsi and Võrtsjärv). During 2014-2016, we measured PAH metabolites, geno- and cytotoxic abnormalities in blood erythrocytes, and parasites from the perch, flounder, and Baltic herring. PAH concentrations in water and sediments were measured by HPLC. From studied sites, the most polluted were Tallinn Bay and Muuga Bay, and fish in these areas had more abnormalities than in other sites. We were able to see some pollution also in Nõva Bay and Käsmu Bay, nevertheless, fish in these areas had good condition. In the coastal area at the mouth of Purtse River, signs of oil shale pollution were seen (elevated content of pyrene metabolites in fish bile). In this site we also found sediments most polluted with PAHs, the second most polluted sediments were near the Pakri islands. The highest geno- and cytotoxic abnormalities in fish blood erythrocytes were seen in Muuga area. Surprisingly some geno- and cytotoxicity was seen in perch from Lake Peipsi. The study was supported by the Estonian Environmental Investment Centre.



# **Pilot estimation of species biodiversity of macroalgae on some water areas of the creating strict nature reserve "Ingermanlandsky"**

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## **ORAL**

The creating strict nature reserve "Ingermanlandsky" is situated on Eastern Deepwater & on Brackish water hydrological regions of The Gulf of Finland (Ostov, 1971) on quite big distance from cities, towns, centers of agricultural & industrial activity, and other sources of anthropogenic pressure & eutrophication of eastern part of the Gulf of Finland. This PA belongs to the cluster type and consist of nine isolated parts: islands and water area adjoining the islands as well as the water area along the northern coast of the Gulf of Finland, from Finland's border to The Chistopolskaya Bay. Total area of the PA "Ingermanlandsky" is 17,901 hectares, 16980 of which are the water area.

In time of our field works, algological samples was taken on water areas near islands Rotshid, Yuzhny Virgin, Dolgy Reef, Seskar & Bolshoy Fiskar archipelago. Along sea shore of the island habitats with bed rocks & stony bottom presented in many places. In some places water areas with sandy bottom are presented. Many localities are situated in exposed places, some localities is situated in semi exposed places. And it is possible to find some sheltered places too. High diversity of habitats and maximal for Russian part of the Gulf of Finland values of salinity create a good condition for macroalgae in coastal zone of PA "Ingermanlandsky".

In time of field works 27 species of macroalgae was found. Nine species from them related to Chlorophyta. Charophyta are presented by two species only. Phaeophyta are presented by 11 species, and Rhodophyta are presented by 5 species.

Five species of brown (Dictyosiphon foeniculaceus, Elachista fucicola, Fucus vesiculosus, Pseudolithoderma subextensum, Stictyosiphon tortilis) and one species of red macroalgae (Hildenbrandtia rubra) are included in the Red Data Book of Nature of the Leningrad region.

Two species of green macroalgae (Pringsheimiella scutata, Syncoryne reinkei), 1 species of brown macroalgae (Chorda filum) and 1 species of red alga (Furcellaria lumbricalis) are recorded in water area of the PA "Ingermanlandsky" for the first time. The finding of the brown alga Chorda filum in the water areas of the PA is of great interest. In the Russian sector of the Gulf of Finland this species was earlier recorded only at Gogland island: at the end of the 19th century (Gobi, 1877) and in 1931 (the species was found by Professor Ilmari Vaelikangas (Häyren, 1940)). A little later, in 1939, this species could not be found in coastal water area near Gogland (Häyren, 1940). And in the 1980s this species was not found at the coastal waters of Gogland island and a conclusion was made that this species had disappeared from the algal flora of the island because of the increased eutrophication of the Gulf of Finland open waters (Kukk, 1988).

# How accurate are estimates of external riverine loads entering into Gulf of Finland?

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Oral

We present the total phosphorus and total nitrogen load estimates of the Vantaanjoki River based on the high-frequency water quality monitoring (hourly data) and traditional grab sampling (10-13 water samples annually) during 2011–2014. High-frequency water quality monitoring of turbidity and nitrate-N has been carried out in the Vantaanjoki River since Oct. 2010. Sensor based "raw" turbidity and NO<sub>3</sub>-N concentrations were calibrated against water sample -based values. The calibrated turbidity values were transformed into P<sub>tot</sub> concentrations according to linear regression equations between (the water sample -based) turbidity and P<sub>tot</sub> concentrations.

The Vantaanjoki River flows into the Baltic Sea in Helsinki and brings a varying amount of nutrients into the northern coastline of the Gulf of Finland. The annual total phosphorus and nitrogen loads have been 23 – 66 tonnes and 600 – 1500 tonnes respectively during 2011 – 2014. Thus, the Vantaanjoki River brings less than 10 % of the total Finnish riverine load into the Gulf of Finland.

The results indicate that the uncertainty of load estimates based on traditional sampling is quite large. The difference between the annual loads calculated from high-frequency data and monthly water samples were observed to be as high as  $\pm 20$  %. The study demonstrates that the uncertainty related to monthly and annual riverine load estimates into Gulf of Finland can be reduced by applying a high-frequency monitoring sensors in those rivers that contribute substantially to the national nutrient inputs.

# Some of the latest actions to improve maritime safety in the Gulf of Finland waters

Jorma Rytönen<sup>1</sup>, Tarmo Kõuts<sup>2</sup> and Sergey Aysinov<sup>3</sup>

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## Oral

Gulf of Finland is one of the most dense marine traffic areas in the Europe. Last year close to 38 000 crossings were reported in the Gulf of Finland (GoF), ie. sailings across the predefined line between Finnish Hanko Peninsula and Estonian coastline close to Saarenmaa island. The highest number of calls of ships in the Gulf of Finland waters were in 2008 when more than 43 000 ships were crossing the same predefined line as shown above.

During the last 15 years Gulf of Finland has been known about the most important route for Russian crude oil to the international markets. In 2015 alone the oil transport volume of the Gulf of Finland was over 160 million tons, where the most significant share was due to the Russian oil terminals. In a short time span the oil transport volume is expected to increase due to Russian policy to close the transit routes through the Baltic states. Also the increase of the alternative fuels such as biofuels, marine diesel oil and LNG will change the oil transport view in the coming years.

This paper will highlight the recent status of the quo of oil transportation in the Gulf of Finland area. The development of local terminals as well as recent accidental statistics will be discussed. Novel risk control options, VTS and GOFREP will be highlighted as well as certain new studies related to the maritime safety in the target area. Finally the preparedness against the oil spill accidents will be described based on the HELCOM's latest data and national oil combating authorities of the GoF area.

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# Developing a holistic assessment of ecosystem health in the Baltic Sea

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HOLAS II will give an update on the overall state of ecosystem health in the Baltic Sea through the development of the 2nd HELCOM Holistic Assessment of the Baltic Sea. The project develops common concepts and methods for status assessment and performs assessments at regional scale. HELCOM core indicators form the basis for the assessment of environmental status. Aggregated results are produced using assessment tools, which are developed and tested as part of HOLAS II and supporting projects. A first version of the “State of the Baltic Sea” report will be produced by mid-2017 and an updated report will be produced by mid-2018.

The main building blocks are:

- Environmental status of the Baltic Sea based on HELCOM core indicators. Integrated assessments, using assessment tools, will be carried out for biodiversity, Eutrophication, Hazardous substances.
- Pressures and human activities acting on the environment in the Baltic Sea. Cumulative impacts are assessed using the Baltic Sea Pressure and Impact Index. Trends in key pressures will be included.
- Economic and social analyses to support regional assessments of the use of marine waters and cost of degradation.
- Measures to reach good environmental status.



**Gulf of Finland  
Co-operation**

## Posters

# Karyotype analysis of amphipod *Gmelinoides fasciatus* in the population from the Gulf of Finland

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Baikal amphipod *Gmelinoides fasciatus* can be used as a unique biological model for investigation of natural adaptation mechanisms due to its successful introduction as an alien species into aquatic biosystems of North-West regions of Russia. Long time span, which elapsed since this species was moved into new environment, allows to propose the existence of genetic mechanisms that underly the adaptation process. Cytogenetic comaparison of karyotyopes in initial and invasive populations could be used for revealing possible structural and functioanal changes in their genomes.

Chromosome localization of telomeric repeats and nuclear organizing regions (NOR, 18S rDNA) in amphipod population from the Gulf of Finland by means of fluorescent in situ hybridization (*FISH*) was performed in this study. The rDNA/*FISH* revealed that major ribosomal cistrons are located on one pair of chromosomes. (TTAGG)<sub>n</sub> repeats mainly hybridize to chromosome ends although interstitial locations were also observed in this material. DAPI staining allowed to reveal bright fluorescing Adenine-Thymine base-pair (A-T) rich pericentromeric regions. Preliminary analysis of conventionally and DAPI stained metaphase plates, as well as prophase nuclei, made it possible to define diploid chromosome number as 2n=52, which is consistent with earlier published results (Timoshkin et al., 2001). 18S rRNA gene fragment, used in this study as a probe, was earlier reported to contain slow and fast evolving sites (Sherbakov et al., 1998). Further sequencing of the same gene fragment, amplified using DNA of crustaceans from initial Baikal population and that of the alien species from the Gulf of Finland, could give an idea of whether ecological specialization took place along with invasion process.

Scientific research was performed at the Research park of St.Petersburg State University «Chromas» and supported by RFBR grant 15-29-02526.

# **Influence of heavy metals on littoral communities due to the dredging work in Saint-Petersburg water zone**

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poster

To study the impact of the muddy water tail on littoral communities due to the dredging work performance the samples of water and bottom sediments were regularly taken along with benthic samples in order to analyze the concentrations of heavy metals, which are the top contaminants of the environment.

The maximum lead concentration was detected in water at Gorskaya sampling station, it was 80 times higher than maximum permissible concentration for lead. At this time, the benthic community consisted mainly of oligochaetes, which may be resistant to adverse environmental conditions, oligochaetes are able to survive even in such stressful situations, where other hydrobionts can't survive. Such exceedance in the studied time period was observed only once and only for the lead. But already one month after the total number of animals reduced by more than 4 times, biomass reduced a little, which was not observed at other sampling stations.

No clear correlation is visible between the concentration of heavy metals in water and in soil with the quantitative indices of macrozoobenthos. Probably, the found concentrations of heavy metals are not so high to have a noticeable effect on benthic communities. Search of the relationship between the environment pollution and communities characteristics requires more data for further study.

# The Great Cormorant (*Phalacrocorax carbo sinensis*) in the Eastern part of the Gulf of Finland, Russia

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Observations were carried out in the eastern part of the Gulf of Finland, Baltic Sea (Russia) in 1994-2016. Among the dominant and abundant colonial sea birds the Great Cormorant demonstrates the most expressive long-term trend of intensive growth of population. Cormorants appeared for the first time in 1991-1994 near Russian shoreline (Kurgalsky peninsula (Fig.1)) as a result of expansion to the East from eastern regions of Baltic countries. The first two breeding colonies were discovered on rocky islands in 1994 – the Dolgy Reef and the Bolshoy Fiskar. Presumably they formed within the period 1985 - 1990 and they amounted 1000-1300 nests by 1994 (Gaginskaya, 1995). The Great Cormorant widely spread by now everywhere in the Gulf. 3900 nests were recorded in 2006, in 2010 - 5000 nests (Gaginskaya, Rychkova, 2011), in 2012 - 6400 nests, in 2013 – 8200 nests; in 2014 - 9500 nests (Bublichenko, Kouzov, 2016), but several large colonies were abandoned. Presently species is extending eastward. The most remote eastern breeding colony appeared in 2014 in the Vyborg Bay (78 nests). The newest colony appeared on Hitamatala sand-bank in spring 2016 and consisted of 85 nests. Nowadays more than 9500 Great Cormorant pairs are nesting in the Russian part of the gulf. According to temperature data analyzing, rapid cormorants expansion is could be owing to climate warming (Fig.2:[www.infoeco.ru/index.php?id=1091](http://www.infoeco.ru/index.php?id=1091)).

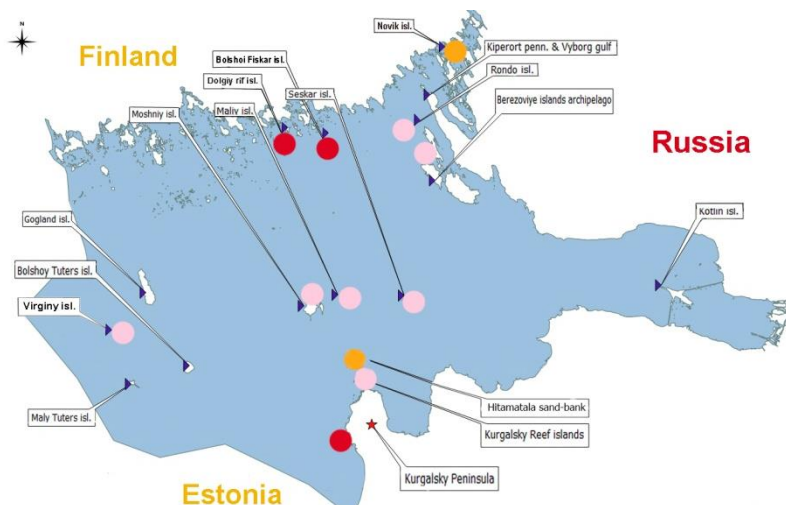


Fig.1. Investigated area: red – first colonies, rose – the largest colonies, yellow – newest colonies.

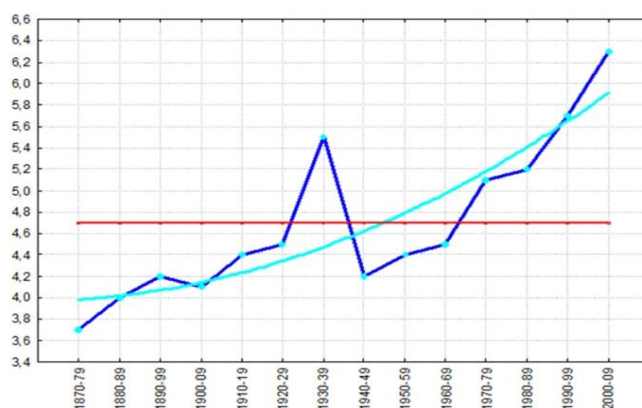


Fig.2. Average annual temperature in Saint-Petersburg vicinities during 1870-2009: red line - average annual temperature rate; dark blue line - annual temperature dynamic changes; blue line – trend line



# INPUT OF NUTRIENTS TO THE GULF OF FINLAND FROM RUSSIAN AND TRANSBOUNDARY RIVERS

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On November 15, 2007 in Krakow (Poland) HELCOM member countries (Finland, Sweden, Denmark, Russia, Germany, Poland, Latvia, Lithuania and Estonia) adopted the Baltic Sea Action Plan (BSAP), which is a long-term strategic document. Its aim is to reduce marine pollution and to restore the safe ecological status of the Baltic Sea to the year 2021. BSAP provides for pollutant reduction of nitrogen and phosphorus compounds into the Baltic Sea to 135,000 t and 15,250 t respectively to the year 2016 (Helcom, 2007). This data set has then been used for calculating the revised nutrient reduction scheme which was adopted by the 2013 HELCOM Copenhagen Ministerial Meeting (HELCOM 2013a) (Table 1).

Table 1. Allowable inputs and needed reduction of nutrients to the Gulf of Finland

Maximum allowable inputs		Needed reduction	
Total nitrogen (TN), tons	Total phosphorus (TP), tons	Total nitrogen (TN), tons	Total phosphorus (TP), tons
101,800	3,600	14,452	3,909

Nitrogen and phosphorus are the main growth limiting nutrients - high nutrient concentrations in the aquatic environment stimulate the growth of algae, which leads to an imbalanced functioning of the ecosystem. The aim of this research was to assess dynamic of input of nutrients to the Gulf of Finland from some Russian (the Neva River, the Luga River) and transboundary rivers (the Narva River, the Selezneva River) (Table 2).

Table 2. Catchment area and discharge

River	Catchment area, km <sup>2</sup>	The average discharge, m <sup>3</sup> /s
Neva	281,000	approximately 2,510
Narva	56,200	approximately 470
Luga	13,200	approximately 100
Selezneva	623	approximately 4.19

Primary data were taken from the materials yearbooks of the State Organization of St. Petersburg regional centre for hydrometeorology and environmental monitoring with regional functions.

Fluxes of total phosphorus and total nitrogen are calculated on an annual basis concentrations by multiplying annual mean discharge:

$$Q = 0.031536 \cdot C_i \cdot R_i$$

where Q is input of TN or TP, tons;  $C_i$  is average annual concentration,  $\mu\text{g} \cdot \text{L}^{-1}$ ;  $R_i$  is annual mean discharge of water,  $\text{m}^3 \cdot \text{s}^{-1}$ . Results of calculations are given in Table 3.

Table 3. Mid-annual input of nutrients to the Gulf of Finland, tons

River	Period covered	Average input	
		Q(TN)	Q(TP)
The Neva River and its branches	2004-2015	55,495	2,728
The Narva River	2004-2015	13,640	396
The Luga River	2004-2015	5,223	650
The Selezneva River	2011-2015	478	15
Sum		77,843	3,603

The results show that the input of total phosphorus to the Gulf of Finland (3,603 tons) higher than the maximum allowable input (3,600 tons).

# Invasive vascular plant species in the flora of the Russian islands in the Gulf of Finland

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Poster

Coastal and water plant communities of the islands in the Gulf of Finland are vulnerable to the introduction and rapid spread of alien species due to (1) a constant drift of plant diaspores to the islands, mainly by means of anthropochoria, hydrochoria, and ornithochoria, and (2) the fact, that open seashores are very favorable for alien species, where they meet little competition from native species. Nevertheless, a number of invasive species in aquatic and coastal phytocenoses of the Gulf of Finland is rather small, because most of the islands are uninhabited and anthropogenic impact on their ecosystems is insignificant.

As a result of our research of the flora of the Russian islands in the Gulf of Finland, 24 invasive vascular plant species have been recorded, namely: *Aster salignus* Willd., *Bidens frondosa* L., *Conyza canadensis* (L.) Cronq., *Helianthus tuberosus* L., *Lepidotheca suaveolens* (Pursh) Nutt., *Impatiens glandulifera* Royle, *I. parviflora* DC., *Bunias orientalis* L., *Lepidium densiflorum* Schrad., *L. latifolium* L., *Erucastrum gallicum* (Willd.) O.E. Schulz, *Saponaria officinalis* L., *Calystegia spectabilis* (Brummitt) Tzvel., *Echinocystis lobata* (Michaux) Torr. & A. Gray, *Hippophaë rhamnoides* L., *Lupinus polyphyllus* Lindl., *Elodea canadensis* Michx., *Juncus tenuis* Willd., *Epilobium adenocaulon* Hausskn., *E. pseudorubescens* A. Skvorts., *Puccinellia distans* (Jacq.) Parl., *Rosa rugosa* Thunb., *Sorbaria sorbifolia* (L.) A. Braun, *Asparagus officinalis* L.

Some species (*Calystegia spectabilis*, *Erucastrum gallicum*, *Hippophaë rhamnoides*, *Elodea canadensis*) have invaded only Kotlin Island (where the town of Kronstadt is located), and the mainland coast, the others have spread and completely naturalized on many islands. The most active invasive species are of the North-American origin - *Conyza canadensis*, *Juncus tenuis*, *Epilobium adenocaulon*, *E. pseudorubescens*, *Lepidotheca suaveolens*, as well as some species originated from Asia (e.g., *Rosa rugosa* and *Impatiens glandulifera*).

Several alien species have just recently reached the islands and started invasion to coastal plant communities. Thus, a very aggressive North-American invasive species *Bidens frondosa*, invaded and even transformed natural plant communities in a great part of the Eastern Europe, was found for the first time in the North-West Russia on the seashore of Kotlin Island in 2004 (Glazkova, 2005, 2006) and spread rapidly through the island, but still has not reached the mainland coast or other islands in the Eastern Gulf of Finland. Another species *Lepidium latifolium*, native on the seashores of Atlantic Europe, but alien in the North-West Russia, was found in 2005 on Kotlin Island in ruderal places (Glazkova, Tzvelev, 2006), and in 2012 it was recorded already in plenty on a small island Khanheloda in the Gulf of Finland, where it was brought probably by birds and has naturalized on seashore meadows (Glazkova, Doronina, 2013). In 2016 we found *Lepidium latifolium* also on Severny Berezovy Island and Kurgalsky Peninsula, in both localities abundant on seashores.

Among invasive species of the island flora, 11 ones (*Aster salignus*, *Helianthus tuberosus*, *Impatiens glandulifera*, *Saponaria officinalis*, *Asparagus officinalis*, *Calystegia spectabilis*, *Echinocystis lobata*, *Hippophaë rhamnoides*, *Lupinus polyphyllus*, *Rosa rugosa*, *Sorbaria sorbifolia*) are naturalized escapees of cultivation, introduced to the islands of the Gulf of Finland as ornamental or food plants.

The only aquatic invasive vascular plant species in the island flora is *Elodea canadensis* which was recorded only on Kotlin Island, and has not yet reached other islands in the Russian sector of the Gulf of Finland.

# **“Green tides”: regulating factors and main consequences for the coastal zone in the eastern Gulf of Finland, Baltic sea.**

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Poster

Our long-term study was carried out at permanent monitoring sites along northern and southern shorelines of the Gulf of Finland between the latitudes 59°49' and 60°00' N and the longitudes 28°36' and 30°08' E. Studied area is suffered by massive macroalgal blooms during the last two decades (Bäck et al., 2002; Gubelit, 2015). We analyzed the long-term data on the biomass dynamics of opportunistic macroalgae. The factors regulating the biomass accumulation as well as its consequences were defined. Our study has shown that in 2014-2015 the biomass dispersion and its maximum had increased at Primorsk, however ANOVA didn't show significant difference. Nevertheless in 2014-2015 the macroalgal biomass exceeded 1200 gDWm<sup>-2</sup>, when in previous years (2004-2011) it was not higher than 500 gDWm<sup>-2</sup>. Observed average biomass at Petrodvoretz in 2014 also exceeded the maximum biomass, which was reported for this site previously but was near maximum of 2005. Traces of hypoxic conditions had a presence in Primorsk under thick layer (until 20 cm) of alive macroalgae. In Koporskaya bay conditions of hypoxia varied from strong, caused by mass of decaying algae near the shore, to the traces under the scattered and unconsolidated alive algal biomass with areas of clean bottom. At the second monitoring site in Koporskaya Bay (Grafskaya Bay) we had observed conditions of strong hypoxia with thick (30cm) continuous layer of decaying macroalgae that had created some difficulties for quantitative assessment of the algal biomass at this site. Since statistical analysis shown significant correlations between algal biomass and climatic factors (wind speed, air temperature, NAO – index) we have proposed that, besides of anthropogenic impact, the rise of macroalgal biomass in Primorsk and Petrodvoretz may be caused by climatic factors. This assumption requires confirmation by further observations. Long-term observations together with investigation of concentrations of metals in surface sediments, macroalgal biomass and water in the coastal zone, allowed to define negative consequences of macroalgal blooms. As a rule, in the published literature about “green tides” the main recorded consequences are substitution of perennial algal species, hypoxia, mass mortality and migration of benthic animals, accumulation enterobacteria in algal biomass (Valiela et al. 1997; Berger et al. 2003, etc.). All these consequences were also confirmed for the eastern Gulf of Finland. Our recent study also confirmed a high degree of metal bioaccumulation in macroalgal biomass. Since the coastal eutrophication is significant problem for the eastern Gulf of Finland, the mass development of these algae in the coastal area may contribute to accumulation of organic matter, nutrients and associated metals. On the other hand decomposition of this biomass may promote anoxic conditions and contribute to remobilization of adsorbed metals. In our study the highest metal concentrations in sediments were found at sites with dense and continuous layer of fresh or decaying macroalgal biomass accompanied by hypoxic conditions. However we had not found the correlation between metal concentrations in algae and sediments and also between algal biomass and metals in sediments. Perhaps, aside from the sediment type (fine-grained gray-beige sand without silt), the scattered and unconsolidated distribution of algal biomass with areas of clean bottom had decreased this anticipated effect. It seems that for marked effect on sediment contamination, the algal matter should form dense and continuous layer, which covers a considerable area of the bottom. Nevertheless our study has shown that accumulated biomass may be a significant source of nutrients in the coastal ecosystem. Concentrations of main nutrients in algae *Cladophora glomerata* and *Ulva* sp. were 1.65±0.22 and 1.38±0.52 mg gDW<sup>-1</sup> for phosphorus, 8.3±0.71 and 11.33±2.40 mg gDW<sup>-1</sup> for sulfur, 20.69±1.81 and 9.20±1.81 mg gDW<sup>-1</sup> for nitrogen, 303.11±11.93 and 310.14±5.05 mg gDW<sup>-1</sup> for carbon, respectively. According to defined nutrient concentrations in algal biomass, we estimated that nutrient loading to the coastal zone from algal biomass may reach 0.8-2.51 g m<sup>-2</sup> for phosphorus, 4-12 g m<sup>-2</sup> for sulfur, 9-27 g m<sup>-2</sup> for nitrogen and 147- 443 g m<sup>-2</sup> for carbon. In recent years so-called “green tides” has become a widespread phenomenon, reaching a great scale. Thick layer of opportunistic macroalgae may cover hectares of the coastal area of seas and lakes (Smetachek and Zingone, 2013). In view of this large-scale problem there is a need in further and more detailed studies of the effect of accumulated algal biomass on biogeochemistry and health of the coastal ecosystems.

# **The bioindication of chronic pollution of littoral vegetation and soil using terrestrial molluscs *Bradybaena fruticum* Mull.**

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## **Poster**

Using method of noninvasive registration of cardiac activity (HR) shown that the dynamics of changes in HR is an effective biomarker of pollution. The usual coastal snail species *Bradybaena fruticum* (age 3-4 years) was chosen as test- animal to indicated the soil contamination. The mollusks striped morphs for modeling experiments collected from the water's edge of the Gulf of Finland in the clean and probably contaminated biotope. Along with physiological experiments were collected samples of water, soil, vegetation and molluscs tissue, which for those investigated by Atomic absorption spectrophotometry (AAS). Excess concentration of neavy metals (HM): Ni, Cd and Cu in soil and mollusc digestive gland has been found in Staryi Petergof and Lomonosov shores by comparison with the reference point (Novaya Ropsha). Both groups of animals were placed in a plastic cage with a heater, allowing quickly raise the temperature of the air. High temperature is maintained automatically and was  $50 \pm 0,5$  C °. The mollusks the same genotype from clean and contaminated sites have different thermoresistant values, which was defined by the size and shape of the HR response. Both groups of mollusks had about the same initial value of HR, is 30-35 beats per minute. During the first presentation of the thermal impact snail sharply (3-5 minutes) increased HR, to 80 a120 beats/min. Animals from pure habitat held high value of HR all time of heat exposure and HR begins to decline within a few minutes after turning off the heater ( high level of thermoresistant value). Snails from contaminated site exhibit a low level of thermoresistant value. They could not long hold high HR and reduced it before turning off the heater. Thermal effects lead to the synthesis of heat shock proteins (HSP) chaperones, which restore damaged by external influence (high temperature) proteins and trigger a cascade of biochemical defense reactions. This system operates normally in mollusks from clean habitats. It quickly restores damaged by heat the structure of proteins, helping to maintain the HR at a high level. The animals were born and nourished in areas with chemical pollution (by TM in our case) of soil, water and vegetation occur, the violations in a protective system that was activated by HSP. This damage reduces their ability to recover heat-denatured proteins, including cardiac contractile proteins, which leads to a drop in HR. Therefore, testing of mollusks that live in coastal areas, allows us to control the chronic pollution caused by, among others, aerosol pollution particulate emissions from ships engine adsorbed on the solid phase of the HM and polycyclic compounds.

The work is done with scientific equipment of the Resource Center « Ecological Safety Observatory» Research Park of St. Petersburg State University.

# **Bivalve mollusks of eastern part of the Gulf of Finland as a tool for ecosystem health bio-indication**

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Poster

The physiological status of aquatic animals is an important for assessment of water quality and ecosystem health. Objective of research: assessment healthy condition of the local mussels by testing of reaction to functional load; using of cardiac activity of mollusks for comparative assessment of ecological status of selected sites of eastern part of the Gulf of Finland (GoF).

Method is based on the assessment of the compensatory response of test organisms to rapid changes in water salinity (addition of 6 g/l NaCl for 1 hour), used as functional load. We estimate heart rate (HR) in the several species of freshwater bivalves (*Unio pictorum*, *U. tumidus*, *Anodonta cygnea*, *A. anatina*, *Dreissena polymorpha*) collected in shallow waters from the Neva River estuary. Time of organism recovery ( $T_{rec}$ ) calculated as the time (minutes) needed for HR to recover to individual background specific patterns after a stress-test.  $T_{rec}$  of individual HRs of tested mussel used as biomarker of functional state, health of mussels and ecosystem pollution level.

We found significant differences in the heart rate of mussels from contaminated and reference sites.  $T_{rec}$  of mussels from reference site was 20-30 min and reached several hours in contaminated sites. The Dubki (Sestroretsk) site was chosen as a reference because mussel in this place had the highest density of population and had a minimal recovery time.

The cardiac activity of mollusks could be used for assessment of health, management and conservation of freshwater ecosystems. The time of heart rate recovery of freshwater bivalves after hyperosmotic test (6 g/l NaCl) is a good physiological biomarker for assessment of ecological state of freshwater ecosystems.

# EVALUATION OF THE MONITORING RESULTS OF MICROBIAL AND VIRAL CONTAMINATION OF WATERS OF THE NEVA BAY AND THE GULF OF FINLAND

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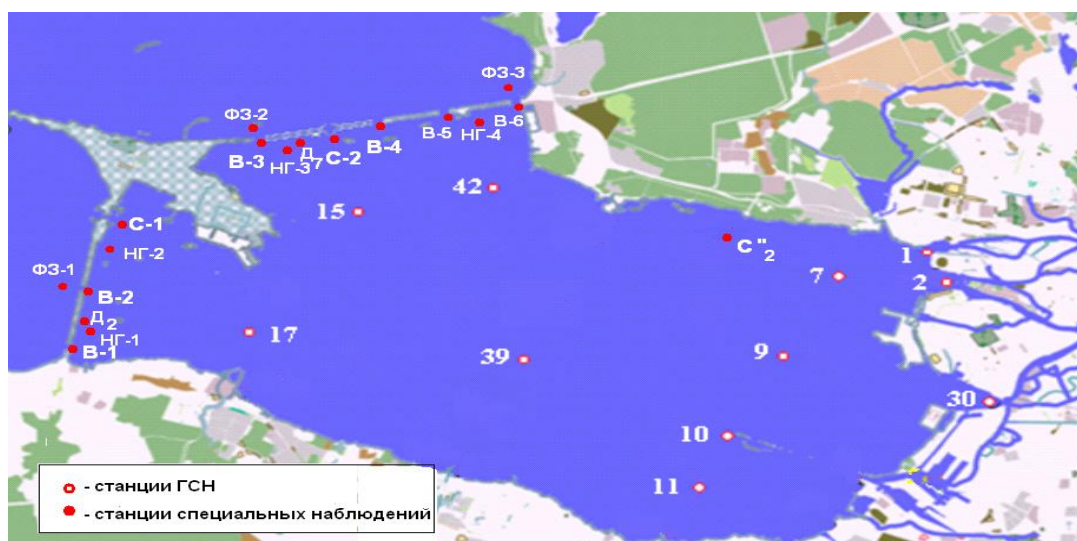
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Water system lake Ladoga - the Neva river - the Neva Bay - Eastern part of the Gulf of Finland is important for the North-West region of Russia: fisheries, transportation, recreation, water treatment. Monitoring in these areas for the presence of bacteria and viruses indicate that different microbial contamination of water, including pollution and viral pathogens hepatitis A and rotavirus infections.

Analysis of the results of laboratory studies (2010-2015) evidence of redistribution of contaminants due to the construction of port complexes in the district of bronchi and University. In addition, there is beach nourishment, on a plot of Fox Nose and Sestroretsk. Conducting of high volume hydraulic engineering works, entails a considerable technogenic impact on the area. In addition, there is the pollution through discharges of the wastewater treatment facilities, where there were findings of intestinal microorganisms and intestinal viruses.

Modern methods of mechanical and biological purification do not ensure complete release of sewage from pathogenic enteric bacteria and enteric viruses in treated wastewaters, and they constitute the main reservoirs of enteric bacteria and viruses in nature.



Sampling of water for sanitary-bacteriological and sanitary-virological parameters was carried at 17 stations FKP "Management KZS Minregiona of Russia": the target KZS at 10 stations (b-1, b-2, b-3, B-4, B-5, b-6, D2, s-1, D7-2), at a distance of 500 m from the GLC on the part of the Neva Bay at 4 stations (NG-1, NG-2, NG-3 and NG-4), at a distance of 500 m from the GLC side of the Gulf of Finland on 3 stations (FZ-1, FZ-2 and FZ-3), one background station in the Neva Bay (2") and at 11 stations of the GOS (1, 2, 30, 7, 9, 10, 11, 39, 42, 15, 17).

Tested parameters: total coliform bacteria, including coli bacteria; coliphages; pathogens of bacterial intestinal infections; Salmonella; the viral pathogens of intestinal infections hepatitis "A"; rotaviruses.

The obtained results again indicate the need for comprehensive measures to reduce and technogenic and anthropogenic load on the Neva Bay and the Eastern part of the Gulf of Finland, which should lead to the prevention of further deterioration of the ecological status of the studied areas. The waters in the area of the GLC and the Neva Bay during the period of observation December are characterized by a medium level of faecal contamination. However, of great concern the South-Western part of the Neva Bay, which are large in volume, dredging and port construction, but also has revenge contamination inadequately treated fecal wastes, or unauthorized discharges of sewage from cottages and gardens.

# Phytoplankton long-term monitoring in the Gulf of Finland

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Poster

Phytoplankton species composition is one of the key parameters for detecting environmental changes in the GOF. The total summertime phytoplankton biomass in the GOF has increased during the past four decades (Suikkanen et al. 2013). At the community level, the changes have been more complex; the shifts taken place in the plankton community are probably caused by interactions between warming up of seawater, eutrophication, an increased top-down pressure, and the resulting trophic cascades.

In a study for this assessment, the two monitoring periods in August were compared; 1980/1993–2005 (depending on the station / area), and 2005–2014. The trends were diverse, indicating 20 to 100 % increase of the total phytoplankton biomass in the western and the easternmost GOF, while in the southern and central parts the biomass decreased by 30 to 50 %.

The cyanobacterial biomass increased during the last decade mainly in the western GOF, but also in the north-east part, and in the Koporye and the Luga bays. In contrast, the blooms of *Nodularia spumigena* have become less intensive at least in the southern and central GOF, compared to the late 1990's and the early 2000's. More generally, a decrease in the cyanobacterial biomass is observed in the central offshore area and in the Narva Bay, but also in the shallow water area of the eastern GOF. To wrap up these somewhat contradictory trends, the proportion of cyanobacteria increases towards the west, and the proportions of diatoms and green algae towards the east.

# Water dynamics and variability of thermohaline structure during the dangerous sea level rises in the Gulf of Finland.

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The data of sea level, currents, temperature and salinity in the Gulf of Finland during the dangerous level rises is analyzes. Based on the data of ship measurements, moorings and reanalysis data “myocean” shown that in periods of floods in the Gulf of Finland is maintained stable stratification and low-frequency waves, forming floods in the east of the Gulf of Finland identified as baroclinic topographic waves. Using numerical experiments on hydrodynamic model INMOM, the spatial structure of low-frequency waves, forming a dangerous level rises in the east of gulf of Finland and the Gulf of Riga is investigated. Amplitude-phase characteristics of flood waves are estimated. These results show that the low-frequency waves, forming dangerous sea level rises are progressive-standing waves, the nodal area which is noted in the Gotland Basin and antinodes in the east of gulf of Finland and the Gulf of Riga.

Poster



# Feeding of three-spined stickleback (*Gasterosteus aculeatus* L.) in Eastern Gulf of Finland

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poster

Coastal shallow waters of the eastern Gulf of Finland keep being the important spawning and nursery area for many species of food and noncommercial fish. On the other hand, coastal fish community is closely related to shallow water biotopes, which are very vulnerable to different threats. In this study based on two years of observations, we report characteristics of stickleback diet during active feeding in the coastal zone of the Gulf of Finland. Presently, three-spined stickleback *Gasterosteus aculeatus* one of the most abundant fish in the Gulf of Finland. Bergström (2015) has analyzed offshore and coastal data for the last 30 years and concluded that stickleback has increased fourfold in the Bothnian Sea, 45-fold in the Central Baltic Sea and sevenfold in the Southern Baltic Sea. The recent increase in stickleback populations in different basins of the Baltic Sea in combination with negative spatiotemporal patterns and previously observed interactions between stickleback and coastal predatory fish suggests that this species may have gained a key role in the coastal food webs of the Baltic Sea (Bergström, 2015). Studies of stickleback feeding are necessary for a better understanding of the trophic relationships of this species in the Gulf of Finland.

In the Baltic Sea, stickleback spends a large part of its life cycle in the open sea, but reproduces in shallow coastal habitats (Bergström, 2015), where they should noticeably influence local food webs in coastal communities. Based on observations from 2014-2015, present study reports quantitative and qualitative characteristics of stickleback diet during periods of active feeding in shallow coastal habitats (depths from 0 to 1.5 meters).

The samples were collected with help of beach-seine, in selected habitats on northern and southern shores of the eastern Gulf of Finland, from Neva Bay to the western Russian border (Vyborg and Luga bays). Food organisms from stomachs were identified to the lowest possible taxonomic rank (usually species or genus) and counted (N), except for some Chironomidae taxa. The best-preserved specimens were measured with a micrometer eyepiece scale (up to 0.03 mm) for additional calculations of their biomass, which was estimated as a sum of weights based on allometric equations (Alimov 2013; Balushkina, 1979; Chislenko, 1968) or ready-average mass (Pertzova, 1967). We examined the role of a particular prey components in the feeding patterns of fish using its frequency of occurrence ( $F$ ) and relative wet mass ( $I_i$ ) (Hyslop, 1980).

In the stomachs of fishes from the eastern Gulf of Finland, we found organisms from 6 major taxonomic groups: crustaceans (Copepoda, Cladocera, Ostracoda and Amphipoda), molluscs (Gastropoda), and insects (Chironomidae). Dominant taxa in the stomachs were Chironomidae, *Eurytemora* sp, *Cyclopoida* sp and *Polyphemus pediculus* (Linnaeus 1761), in conjunction accounting for more than 90% of the food biomass and appearing in more than 85% of stomachs. Other prey organisms were also presented in stomachs, but their cumulative contributions never exceeded 10–20% of total food items. The copepods *Eurytemora* sp, *Cyclopoida* sp and cladoceran *P. pediculus* formed a dominant group of zooplankton species in stomach contents. In 2014, they were found in high abundance reaching about 90% of the food biomass ( $I_i$ ) and were recorded in 70% of stomachs per sample ( $F$ ). In 2015, plankton organisms were not so abundant in stomachs contents. Benthic organisms Chironomidae (*Cricotopus* sp etc.) and Amphipoda (*Pontogammarus robustoides* (Sars, 1894) and *Gammarus* sp.) became the main components in fish feeding. These taxa were presented ( $F$ ) on average in 90% and 70% of stomachs, respectively, and comprised about 90% of the total weight of stomach contents ( $I_i$ ).

## Cyanotoxins Occurrence in Gulf of Finland, 2012-2015

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poster

Anthropogenic pressure and eutrophication leads to a shift in the dominant species from diatoms to cyanobacteria in a different water bodies. It is known that cyanobacteria produce secondary metabolites; some of them could be highly toxic to humans and animals.

Since the 2000s cyanobacterial blooms (HAB) have been observed in the Baltic Sea from the Gulf of Finland to the southern Baltic annually. In the Gulf of Finland cyanobacterial blooms were recorded mainly in the Vyborg Bay and near the Primorsk (the sampling carried out within TOPCONS project 2012-2013). In summer period 2014-2015, HAB events did not observe and other algae species were dominant (including diatoms and green algae) in the phytoplankton. However, in the autumn of 2015, cyanobacterial bloom events were recorded in coastal waters near Komarovo and Zelenogorsk, when the contribution of cyanobacteria was exceeded 90% of the total biomass. *Dolichospermum* spp., *Planktothrix agardhii*, *Aphanizomenon flos-aquae*, *Microcystis aeruginosa* were dominant species. LC-MS / MS - analysis showed the presence of cyanobacterial hepatotoxins, particularly microcystins, and neurotoxic anatoxin-a. The maximum total microcystin concentration in water of coastal zone (49 mkg/L) near Zelenogorsk only once sporadically exceeded the guideline value for recreation water (20 mkg/L) stated by WHO.

Thereby due to the presence of potentially toxic cyanobacterial species further monitoring investigations should be conducted for better assessment of potential risk for water users.

## Hormones as an indicator of anthropogenic pollution of the Baltic Sea (2011-2013)

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### poster

During the past two decades scientists and regulatory agencies have acknowledged pharmaceuticals to be an emerging environmental problem. 17 $\alpha$ -ethinylestradiol (EE2) and 17 $\beta$ -estradiol (E2) were recently added in a watch list by the European Community (COM(2011)876). Also they have been considered as candidates for future control via Environmental Quality Standards (EQS) and as pre-core indicators.

The aim of our research was to analyze the load of hormones, including naturally produced human estrogens Estron (E1), Estradiol (E2) and Estriol (E3), entering and passing through St. Petersburg sewage system. A study of medical and pharmaceutical sales statistics was also carried out with the aim of finding correlation with obtained data of the chemical analysis. For LC-MS/MS analytical detection with careful sample preparation procedure for pre-concentration of target compounds and decreasing of matrix effects were used. Analyses of pharmaceutical sales statistics revealed rather low use of EE2 in the studied region. So the average concentration of EE2 in water leaving St.Petersburg area is not exceed 0.004ng L<sup>-1</sup> that is below the EQS (0.007ng L<sup>-1</sup>). Among naturally produced hormones, only E1 was detected in three out of 31 samples of effluent water, therefore the average concentration in the effluent was judged to be below the detection limit of 10 ng L<sup>-1</sup>. Thus, the concentration of E1 in the water flowing from St.Petersburg into the Gulf of Finland would not exceed 0.1 ng L<sup>-1</sup>. It indicates possible degradation of less stable hormones E2 and E3 during their prolonged travel from the excretion point to WWTP. The obtained data reveal the requirement for additional pre-core indicator of pollution for the Russian part of the Baltic Sea.

# Monitoring of the water feeding of the rivers in Leningrad region

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The runoff from watershed and volume of river runoff depend on number on small rivers and brooks. 15 years monitoring was carried out to study the influence of precipitation and air temperature to water regime of rivers over the drainage swamps in Leningrad region.

Our studies have shown that drainage channels expel water continuously throughout the year. In warm period the volume of runoff depends on sum of precipitation and air temperature. It was noted that the summer period decrease in precipitation and increase in air temperature leads to a decrease in runoff to its termination.

Moreover, with a smaller distance between the drainage channels the flow is interrupted less often. Thus, when the distance between the channels 65 meters, the runoff during 15 years of observations was interrupted 7 times, while increasing the distance between the drainage channels to 205 m an endorheic period marked 10 times.

The duration of the closed periods lasted from 1 to 90 days when location of the channels is 65 m, and at a rare position of drainage channels (205 m) from 5 to 135 days.

15 years of monitoring allows making a conclusion about the trend of deterioration of the water regime of small rivers in the background of modern global warming.

## **Proposals on structure of INPUT and OUTPUT Data for holistic GoF MSP**

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Suggestions for data structures that are exchanged between participating countries during the process of the developing of MSP plans, and at the stage of cross-border consultations on MSP would be done.

Proposals are prepared on the basis of international instruments in the field of MSP, on the existing and planned legislation of the Russian Federation with regard to marine management and marine uses as well as rulers of current system of land planning and comply with the recommendations for the content of Maritime plans defined for the BSR countries (except the Russian Federation) of the EU Directive on MSP 2014/89. The materials are also taken into account the results of the work of Baltic Sea Region MSP Data Expert Sub-Group.

# A modern approach to visualisation of long-term biological monitoring data of the Neva Bay

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Poster

There has been a lot of biological monitoring data collected from the Neva Bay and the Eastern Gulf of Finland over the last 35 years. Combining together all available data is important for solving data mining tasks, analysis of human impact on the water body, research of the dynamics of the Neva Bay ecosystem.

The purpose of this work is to build a web-based GIS tool for exploring some of the biological monitoring data of the Neva Bay and the Eastern Gulf of Finland. The GIS is supposed to provide access to the following databanks:

- photosynthetic pigments (mainly chlorophyll *a* observations);
- phytoplankton species, biomass and abundance;
- zooplankton species, biomass and abundance;
- zoobenthos species, biomass and abundance;
- weather conditions and hydrological data.

For example, web-interface to the photosynthetic pigments databank includes the following types of data access:

- Visual query builder for selecting area of interest, which is based on the Yandex.Maps cartography service with selectable monitoring stations displayed in a separate clickable layer on top of the basemap;
- Heatmap data visualization tool, which can be used to create a colored layer on top of the Neva Bay and Eastern Gulf of Finland basemap. Color intensity is correlated with one of monitored parameters (e.g. chlorophyll *a* concentration) and also depends on the distance from the observation point;
- Report generation tool which is a RESTful web-service that can be used to extract data either in Excel table format to be used by a researcher or in JSON format to be used by other web applications.

The system relies on several mathematical models, which are used for prediction of phytoplankton dynamics, filling blank spaces on the heatmap and geographical data mapping.

Complete GIS system would implement data analysis algorithms and mathematical models to evaluate and predict pollution risks, eutrophication and ecosystem health.

# Heavy metal content in fish and their habitat in the Neva Bay of the Gulf of Finland

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The Neva Bay of the Gulf of Finland of the Baltic Sea is the water area which located within the metropolis and exposed to intense human impacts. By the results of hydrochemical monitoring it was revealed that the heavy metals are in the group of the most important toxicants in the Neva Bay. The samples analysis for heavy metals content was carried out by atomic absorption method in 2012-2015. By the results of investigation it has been found that the concentrations of heavy metals in the water of the Neva Bay varies from values below the detection limit to 0,131 mg/l (13MPC) for zinc, 0,004 mg/l for cadmium, 0,020 mg/l (near 3MPC) for lead and 0,026 mg/l for copper. Manganese content varies from 0,001 to 0,270 mg/l (27MPC). Cadmium concentrations do not exceed the MPC. The largest percentage of samples with the concentration exceeding the MPC (84%) was observed for copper. Heavy metal content in the bottom sediments of the Neva Bay was up to 312.7 mg/kg for the zinc, 3.2 mg / kg for the cadmium, 31,0 mg/kg for the lead, 66,3 mg/kg for the copper and 232,9 mg/kg for the manganese. According to the Dutch Lists the lead content was not above the permissible concentration, the portion of samples with metal content above the permissible concentration amounts to 5% for zink, 3% for copper and 20% for cadmium. The cadmium accumulation in the sediments was observed on the background of its low concentrations in the water. The heavy metals content was quantified in the muscle tissue of roach, perch, ruffe and bream. The average concentration for fish of Neva Bay was 14,7 µg/g of wet weight for zinc, 0,74 for copper, 0,002 for cadmium, 0,13 for arsenic, 0,23 for mercury The portion of fish samples with metal concentration was above the standard of EC Regulation amount to 5% for mercury and 20% for lead.

# Assessment of nonstationarity in seasonal variability of thermohaline structure in the Gulf of Finland

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*Poster*

In this work presents the seasonal variability of temperature and salinity in the Gulf of Finland from 1989 to 2013 which were investigated in the stationary approach and taking into account the non-stationary processes for the three stations of the Gulf of Finland, in which have the most shipboard measurements (DAS <http://nest.su.se/das/>). Missing data were replaced by the values of temperature and salinity obtained in the framework of the hydrophysical fields reanalysis “Myocean” (<http://marine.copernicus.eu>). Estimated trends in the obtained series showed a tendency to decrease the salinity of the surface layer, and its rise in the horizon of 50 m. Comparison the dispersions of the original series and the dispersions of stationary approximation showed the proximity of these values. This result indicates that seasonal variations make a decisive contribution to the total dispersion of long-term temperature fluctuations. The dispersion of series salinity estimated thus, on the contrary, shows that the seasonal component makes a less significant contribution to long-term oscillations in this parameter, and the dominant role is the interannual component. Analysis of variability in thermohaline structure, which was carried out taking into account the non-stationary processes, revealed a sharp freshening of the surface layer in the spring of 2006, which was accompanied by increased salinity of the deep layer. The annual harmonic amplitude of water temperature variations in the surface layer is much higher than the amplitude of the its overtones and has a significant positive trend, which indicates an increase the intensity of seasonal temperature fluctuations in recent decades. The evaluation phase of the annual harmonic suggests that the onset of its maximum since 1989 has shifted to 1 month - from July to August. Evaluation of the annual harmonic amplitude and its overtones in saline fluctuations in the surface layer indicate approximately the same their contribution to the seasonal variability of salinity. At the same time, the negative trend evident in interannual changes of the amplitude of the annual harmonic. While interannual changes in the semiannual harmonics pronounced the positive trend. The annual harmonic amplitude in salinity changes in the layer 50 m far more of its overtones amplitude. The annual harmonic amplitude in salinity changes in the layer 50 m is far more than amplitude of its overtones. Well expressed positive trends in interannual changes of the annual harmonic and its semi-annual and third-of-the-annual overtones, which indicate an increase in the amplitude of salinity fluctuations in recent decades.



# Present state food supply for fish in the eastern Gulf of Finland

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Poster

The data about food supply for planktivorous, bentofagous and young fishes have been collected in the eastern Gulf of Finland from Kotlin to Gogland islands in 2015 and have been compared with investigation of zooplankton and zoobenthos for 15 years. This area consists of Shallowwater and Deepwater regions and Luga, Koporskaia and Vyborg bays. All investigations have been made and complied of the basic hydrological seasons. There is transitional season from spring to summer (June), summer (August) and transitional season from autumn to winter (October-December).

Zooplankton. The Shallow-water region and second order bays have hydrological conditions more favorable for eurythermal and thermophil zooplankton forms development. The fish food supply is formed not only blackish species but and freshwater species too. The lasts have high reproductive potential and provide the quick biomass growth in the warm water, but during cooling water its biomass fast reduce. In the Deepwater area the fish food supply is generally formed by eurythermal and psychrophilic large-size organisms (*Limnocalanus*, *Acartia*, *Eutymora*) which are present in plankton during all open-water period and part of them has all-year presenting. It has supported stable biomass characteristics of zooplankton during several years with different climatic conditions.

In 2015 the zooplankton abundance characteristics were situated within the scope of several years standing series. The zooplankton number and biomass varied: in June - from 12 to 257 thousand ind./m<sup>3</sup> and from 0,07 to 2,99 g/m<sup>3</sup>, in August - from 42 to 264 thousand ind./m<sup>3</sup> and from 0,17 to 3,13 g/m<sup>3</sup> and in autumn - from 4 to 52 thousand ind./m<sup>3</sup> and from 0,06 to 0,78 g/m<sup>3</sup>.

In June and August, with significant differences in the local abundance of zooplankton level of the all surveyed water area was high. The most productive zooplankton was in the Shallow areas and Luga Bay. In the autumnal period on the level of values of zooplankton numbers and biomass the least productive area was Koporskaia Bay. The most productive areas were Vyborg Bay (deepwater), Luga Bay and Shallowwater areas.

Minimum long-term average number and biomass of zooplankton in the eastern Gulf of Finland in the period from 2000 to 2015 were observed in the Deepwater area (31 thousand ind./m<sup>3</sup> and 0,45 g/m<sup>3</sup>), the maximum were observed in Shallow-water areas (55,78 thousand ind./m<sup>3</sup> and 0,849 g/m<sup>3</sup>).

The dominance of crustacean in the biomass has provided favorable conditions for the feeding of fish for 2015 as well as in other years.

Zoobenthos. The investigation areas were described by a large number of oligochaete species and omnipresent polychaete occurrence. There was a very low diversity of crustaceans' species in 2015. In all areas were noted the relict amphipods *Monoporeia affinis*, and in addition, in shallow areas and Luga Bay were find *Saduria entomon*. The Deepwater area due to hydrological features (depth, a relatively high salinity, oxygen deficiency), and the predominance of clay soils, characterized by depleted species composition, due to unfavorable conditions of the oxygen regime for the most benthic organisms.

The benthic abundance was changed from area to area, assemble maximal benthic number in June (0,5-38,9 thousand ind./m<sup>2</sup>) and autumn (0,1-25,8 thousand ind./m<sup>2</sup>) and maximal benthic biomass in August (0,1-123,9 g/m<sup>2</sup>) and autumn (0,1-111,2 g/m<sup>2</sup>).

In 2015 the average number and biomass of macrozoobenthos was 2,72 thousand ind./m<sup>2</sup> and 6,9 g/m<sup>2</sup>. More than 30% of total benthic invertebrates were "soft" forage benthos or eating by fish. Hence it appears the state food supply for bentofagous fish was relatively high.

For the last years the increase of alien species has continuously occurred and importance this species in the bottom communities have been going up. The ability increment since 2008 was associated with extension polychaetes *Marenzelleria sp.* in the eastern Gulf of Finland.

The highest levels of fish forage base were characterized by Deepwater area, south-eastern part of Shallow-water area and open parts of Koporskaia and Vyborg bays. In 2015 bottom communities quantity characteristics were on the basic level for the eastern Gulf of Finland in the last decades, when the fish forage base attributes increased due to the growth of crustacean ability and increase of benthic species number.

# Strategic and Operational Risk Management for Wintertime Maritime Transportation System (STORMWINDS)

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Poster

Abstract

STORMWINDS contributes to operational and strategic management of ecological risks to the Northern Baltic Sea, emerging from maritime transportation incidents and accidents. Focus is on wintertime conditions as most accidents in the area occur in the ice season. To achieve these aims, advances are made to support operational risk management in two ways.

First, a holistic cross-border and cross-sector analysis of the vessel traffic control and emergency response services is performed, using a systems-theoretic approach. This analysis is further placed in context with maritime spatial planning, leading to policy-relevant recommendations. The systems-theoretic approach is furthermore applied to probabilistic, indicator-based safety management modelling for vessel traffic services operation and training. Second, specific tools for operational risk management are developed. Accident prevention is enhanced through the development of e-navigation services related to ship routing and ship performance in ice. Accident response is enhanced through the development of smart response services for shipping accidents. STORMWINDS addresses strategic risk management through the development of a risk management model for spill response effectiveness in wintertime conditions, resulting in recommendations regarding fleet organization. Both the operational and strategic risk management work require scientific advances in various fields, which are used in parallel to achieve the overall aims.

# MODELLING OF THE SUBMESOSCALE FLOWS IN THE GULF OF FINLAND (GOF)

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We used state-of-the-art modeling framework NEMO initially developed for the open ocean to build an eddy resolving model of the GOF. To evaluate the model skill and performance two different solutions were obtained: commonly used 2 km grid and 0.5 km eddy resolving fine grid. With the resolution of 0.5 km the model starts to resolve submesoscale eddies. In the ocean, submesoscales are scales of motion equal or less than the baroclinic Rossby radius of deformation. It was shown that submesoscale motion affects the plume propagation caused by salty water intrusion to the GOF from the Baltic Sea. Generally speaking this process had found to be dominated in formation of shape of thermocline through the summer season, while the depth of UML was formed by an intensive mixing during spring upwelling. In both cases advective processes act as the main “driving force”. Presented model demonstrates a substantial improvement in the basin stratification compared to previous numerical studies. Refinement of the model resolution below the level of 0.5 km would be of limited benefit in a hydrostatic model. For the purpose of deep investigation of submesoscale processes in GOF such as transport across the UML and on/offshore the nonhydrostatic formulation is needed. It lets us avoid “artificial smoothing” of the velocity field. Other possible improvements of the model performance, which we are planning for the next steps, will include sensitivity tests for the different boundary conditions with higher spatial resolution at the open boundary and surface and utilisation of recently available data. This work was supported by the Federal Targeted Programme for Research and Development in Priority Areas of Development of the Russian Scientific and Technological Complex for 2014-2020, the unique identifier RFMEFI57414X0091.

# **APPLICATION OF THE REMOTE SENSING and IN-SITU DATA FOR CHLOROPHYLL A VARIABILITY SIMULATION IN THE EASTERN PART of THE GULF of FINLAND**

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A prototype of an operational model for monitoring and forecasting of the marine environment of the Russian part of the Gulf of Finland (Baltic Sea) that is being developed by Russian State Hydrometeorological University is capable of simulation of the high resolution hydrology fields that are supposed to be used for simulation of spatial values and vertical profiles of chlorophyll concentrations. The biological module lacks information on vertical profiles of chlorophyll concentrations for both initial conditions and validation.

Modern research shows that the vertical profiles of bio-optical characteristics such as concentrations of chlorophyll could be parameterized with the use of high resolution hydrological data.

The regional algorithm has presented stable correlation with the in-situ data; therefore it was used to estimate the variability of the chlorophyll a in the summers over the whole period of 2004-2016. Both in-situ data and the remote sensing data have shown the variations in chlorophyll concentrations through the last 11 years agreeable with the in-situ data.

Recent findings for 2012-2013 show that for the Eastern part of the Gulf of Finland the parameterization of vertical profiles bio-optical characteristics such as concentrations of chlorophyll provides good results for stable stratification conditions of the upper layer with pronounced warming of the surface. Well mixed waters had shown little to no fitting to the parameterization curves and are subjected to further study..

The work was performed as part of the federal target program "Research and development on priority directions of scientific and technological complex of Russia for 2014-2020" the Ministry of Education of Russia, the unique identifier RFMEFI57414X0091.

# ***Fucus vesiculosus* morphology and its associated fauna along southern coast of the Gulf of Finland**

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This study is focused on small spatial scale (150 km). *Fucus vesiculosus* samples were collected by SCUBA diving in 2013 along the salinity gradient. Nine morphological characteristics were measured from each *F. vesiculosus* individual. *F. vesiculosus* morphology and epifauna variety between four sites (Kunda, Pakri, Vergi and Viinistu) and two seasons (summer and autumn) were analysed using different statistical methods.

Our results show that *F. vesiculosus* morphology and its appearance vary significantly on small spatial scale and between two seasons. We found that *F. vesiculosus* thalluses with bigger biomass have longer and more branched fronds, shorter thalluses have wider fronds and midribs.

All together 12 macrozoobenthic species were found from 93 thalluses. In summer *F. vesiculosus* associated fauna was more abundant and included more species than in autumn. *T. fluviatilis* contributed most to seasonal differences. According to our study the abundance and species richness of *F. vesiculosus* epifauna depends on the seaweed morphology. We found that thalluses with longer fronds and bigger biomass host greater numbers of invertebrates. Also the higher coverage of *F. vesiculosus* at the site influences positively the abundance of associated fauna on each *F. vesiculosus* thallus. Sites with higher *F. vesiculosus* coverage, Vergi and Viinistu, had thalli with more abundant epifauna than Pakri and Kunda, where the coverage of *F. vesiculosus* was at least 1.5 times lower. This indicates the significance to prevent the loss of *F. vesiculosus* belts for the conservation of the important coastal habitats for numerous organisms from different trophic levels.