CONTENTS

PRESENTATIONS 2019

Gulf of Finland Co-operation

Click the presentation to navigate

This is part 1/2 of the presentations

Changing climate of the Gulf of Finland region

Kirsti Jylhä
Weather and Climate Change Impact Research
Finnish Meteorological Institute

The Gulf of Finland Science Days
“Facing our common Future”
The House of Estates, Snellmaninkatu 9-11, Helsinki
13th -14th November, 2019

ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

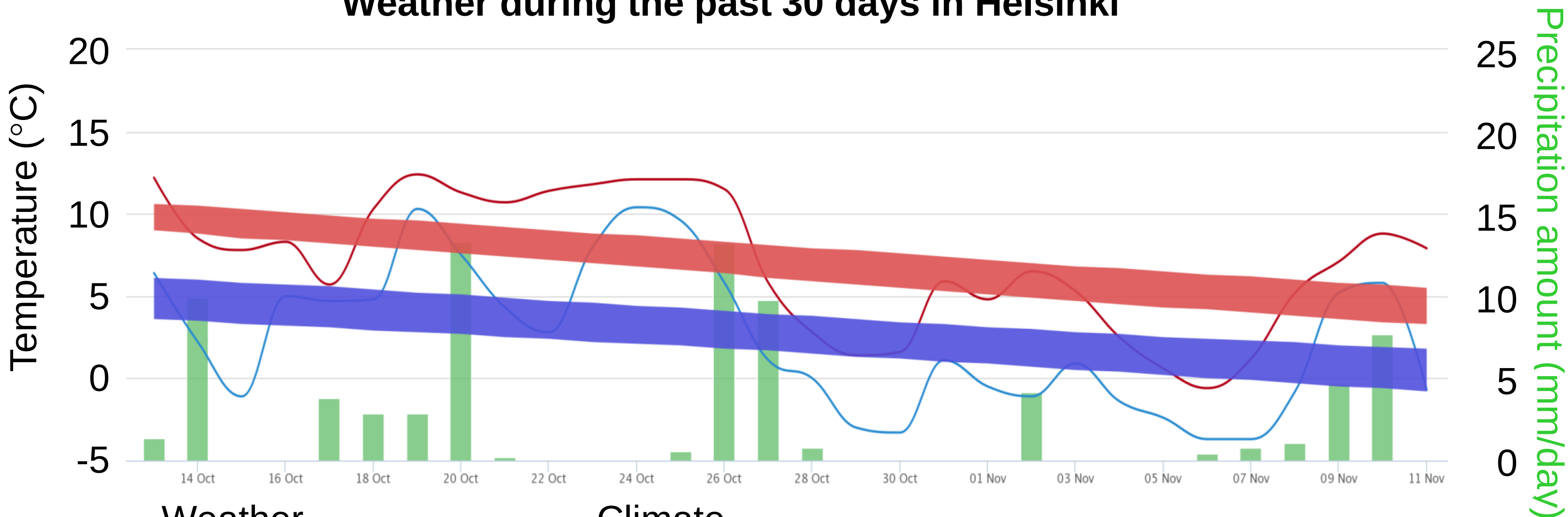
Outline & main messages

- Climate of the Gulf of Finland region is changing.
- The rate of changes will strongly depend on the near-future actions of the mankind.
- The level of confidence, or the lack of certainty, in future projections vary between climatic variables, seasons and areas.

ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

Climate is the long-term (~ 30 year) statistics of weather

Weather during the past 30 days in Helsinki



Weather

Daily
max
min
temperature

Climate

Typical daily
max
min
temperature

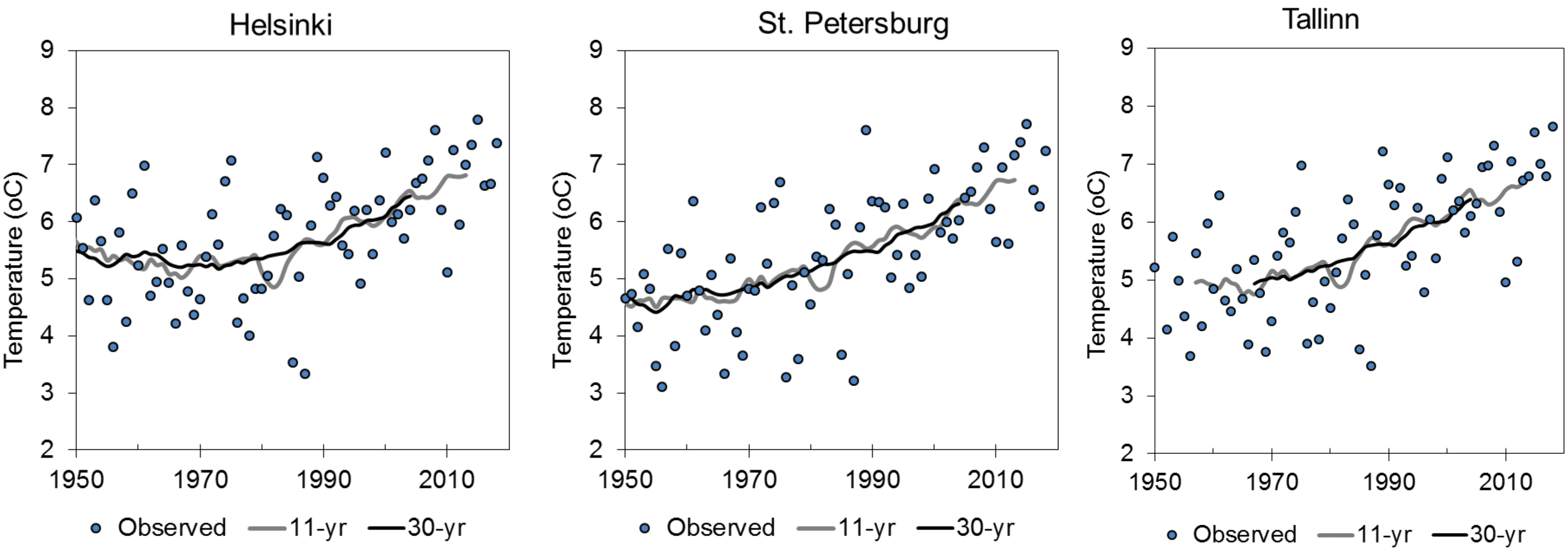
Precipitation amount

The period 13 Oct – 11 Nov in 2019 and typically in 1981-2010

http://en.ilmatieteenlaitos.fi/past-30-day-weather

Increasing annual mean temperatures

over the period 1950–2018



- ✓ Recordings of the annual mean temperature over the period 1950-2018 show linear trends of 0.3-0.4°C decade^{-1}
- ✓ Fluctuations from year to year

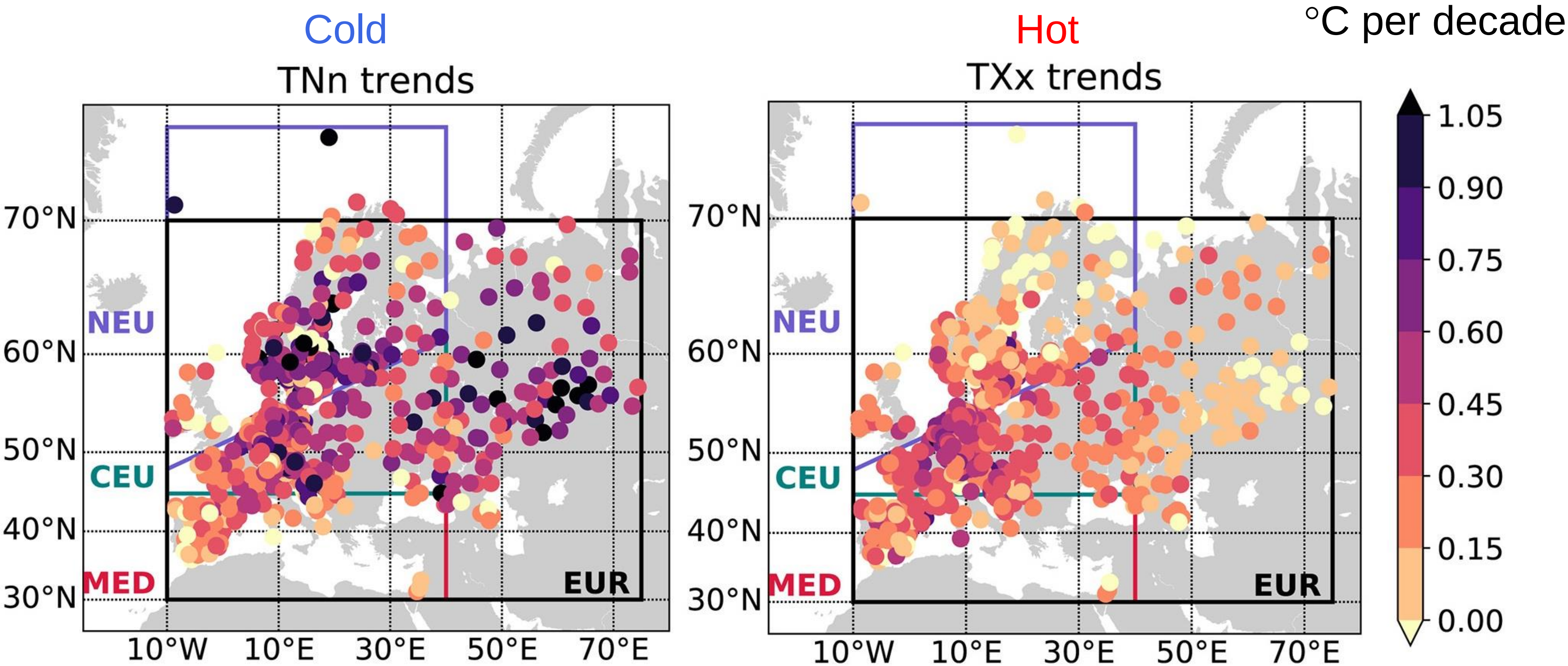
How does the future climate look like
in the Gulf of Finland region
within one, two or three generations?

ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

Data source: https://www.ecad.eu//download/millennium/millennium.php

Stronger warming of cold than hot extremes

over the period 1950–2018



TNn: Yearly minimum of daily minimum temperature

TXx: Yearly maximum of daily maximum temperature

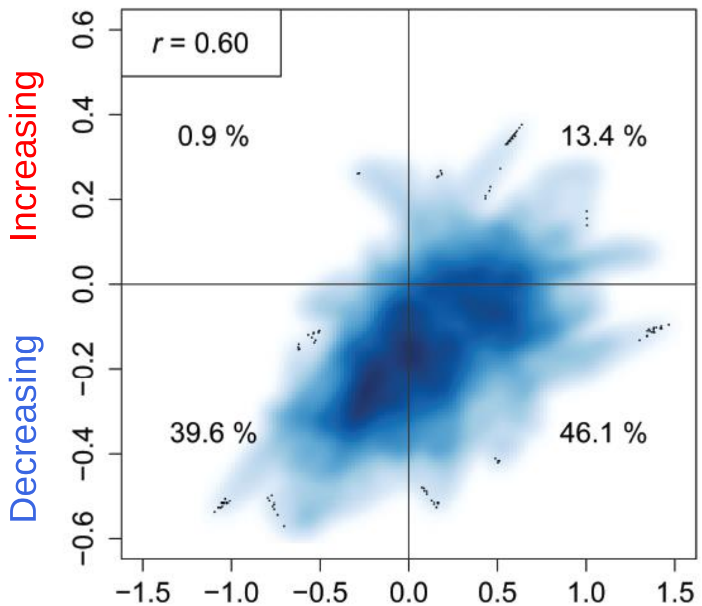
ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

Ref: Lorenz et al. (2019); https://doi.org/ 10.1029/2019GL082062

Complex responses of snow conditions to climatic variability and changes

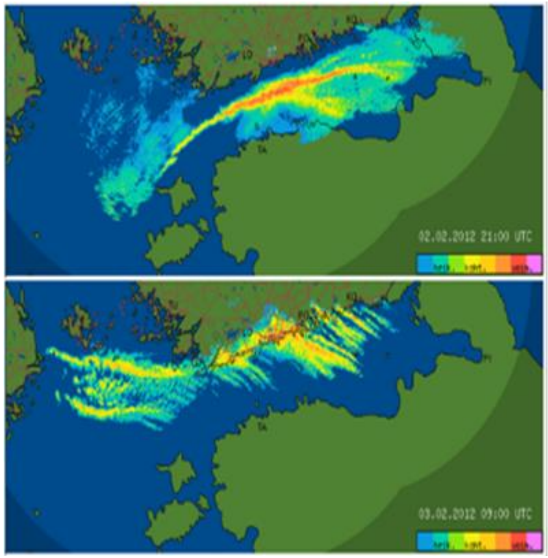
Finland in 1961-2014

Trend in annual maximum snow depth (cm/decade)



Decreasing Increasing

Trend in snowfall (mm/decade)



Radar images of a high impact **sea-effect snowfall case** over GoF on 2-3 Feb 2012

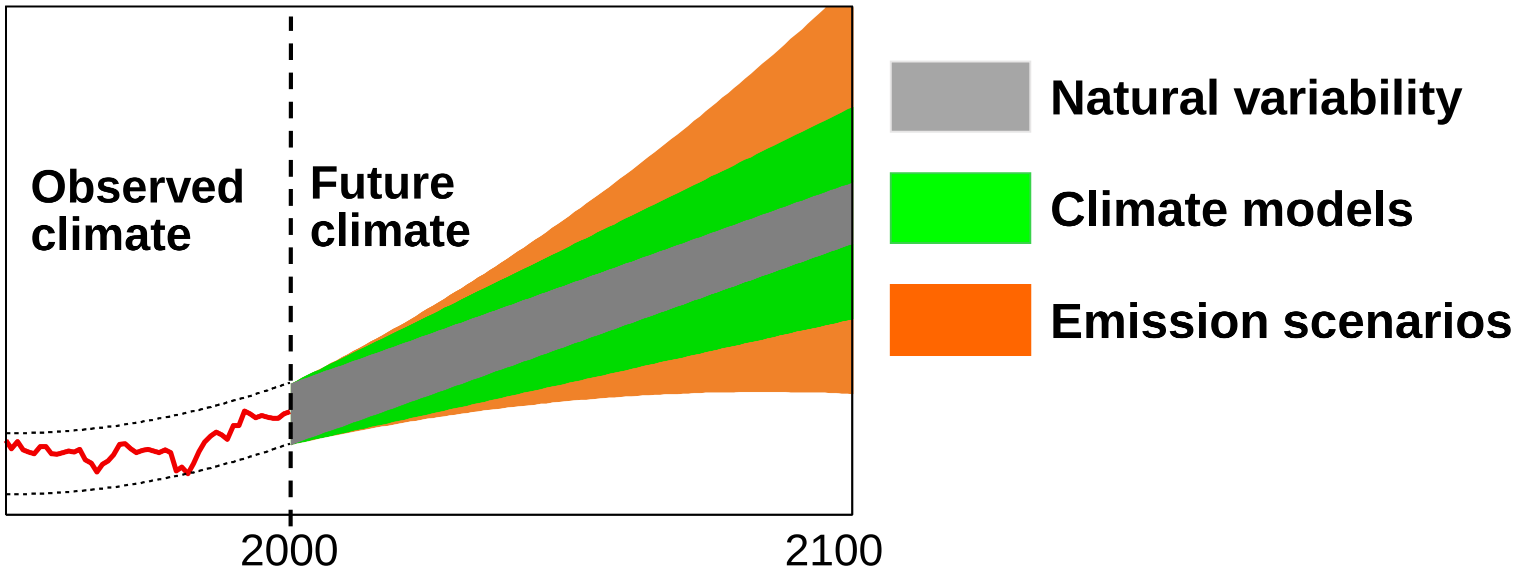
❖ Decreasing sea ice cover

- ✓ Increasing fraction of wintertime rainfall in southern Finland
- ✓ Decreasing annual maximum snow depth in ~ 85% of the country.
- ✓ In almost half of Finland's area, the decrease in max snow depth occurred despite increasing snowfall.
- ✓ Increasing annual snowfall amounts in ~ 60% of Finland.

ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

Ref: Luomaranta et al. (2019), DOI: 10.1002/joc.6007
Taru Olsson (personal communication)

Uncertainties in climate change projections schematically

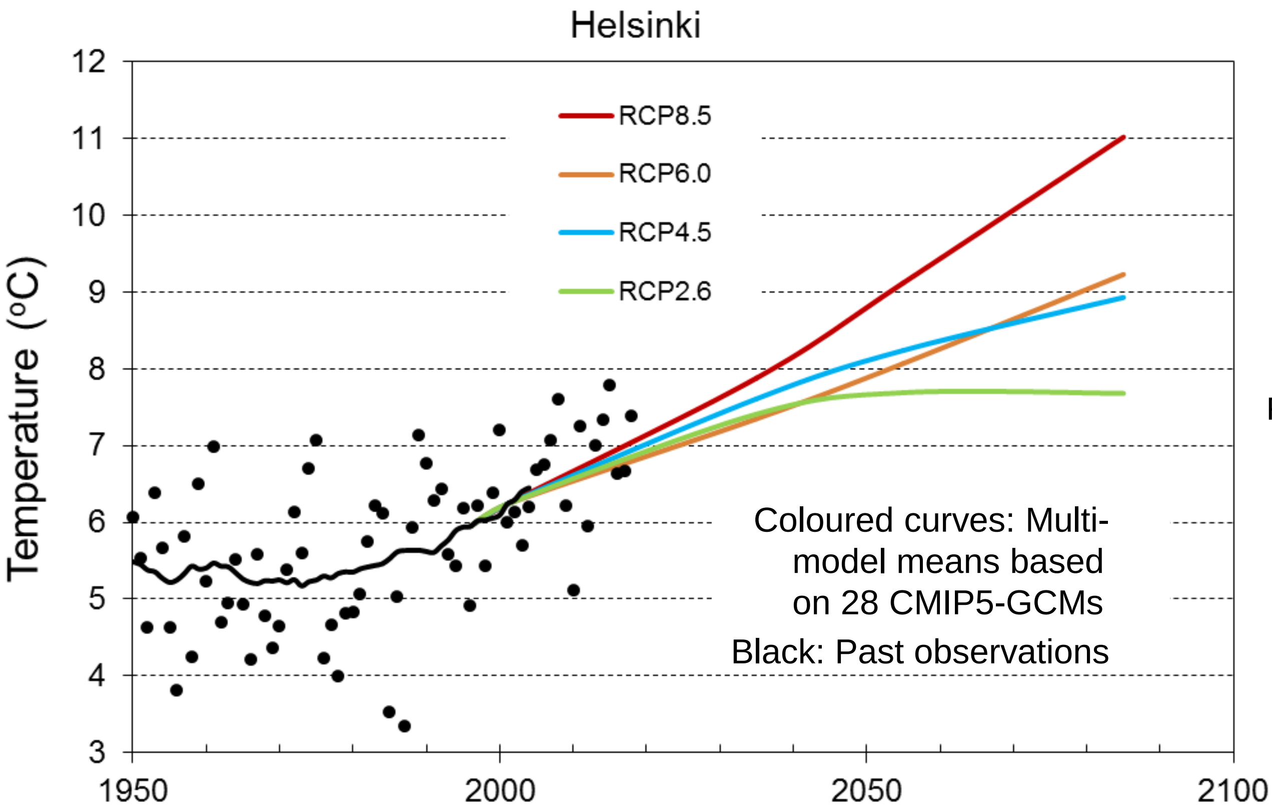


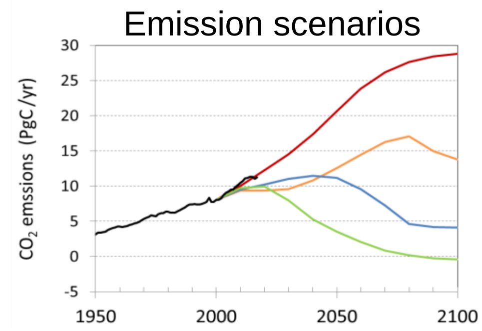
LEVEL OF UNCERTAINTY	Near future	End of the century
Natural climate variability	+	+
Climate model sensitivity	(+)	++
Emission scenarios		++

ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

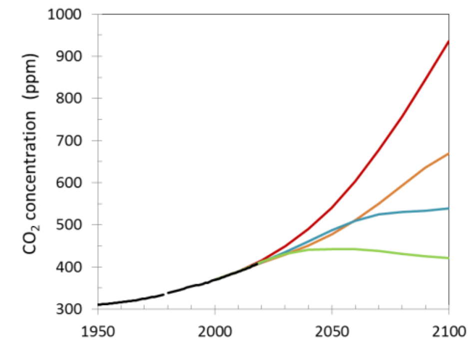
Source: J. Räisänen (Univ. of Helsinki)

The rate of warming depends on future greenhouse gas emissions





Representative Concentration Pathways



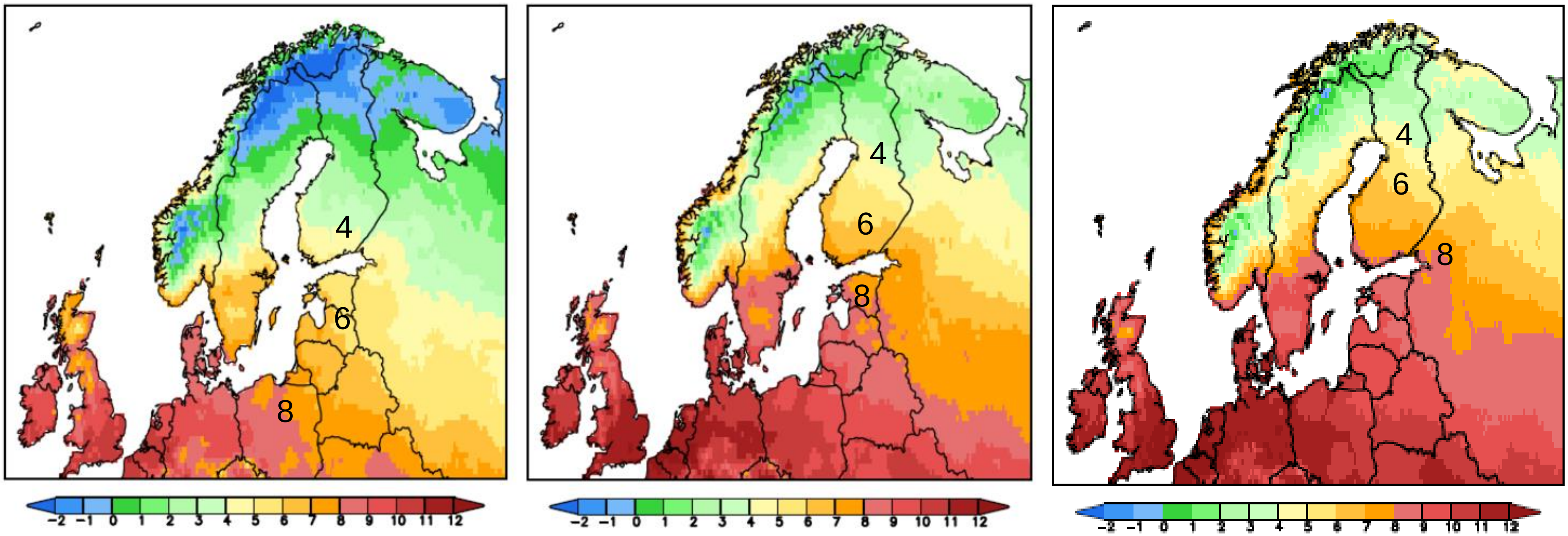
- Beyond 2050, uncertainty in climate change increases substantially due to **uncertainties in emission scenarios**.
- **Adaptation** to climate change is needed alongside **mitigation**

ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

Data sources: IPCC (2013); ECA&D; ICOS Carbon Portal; NOAA ESRL; CDIAC: Ruosteenoja et al. (2016)

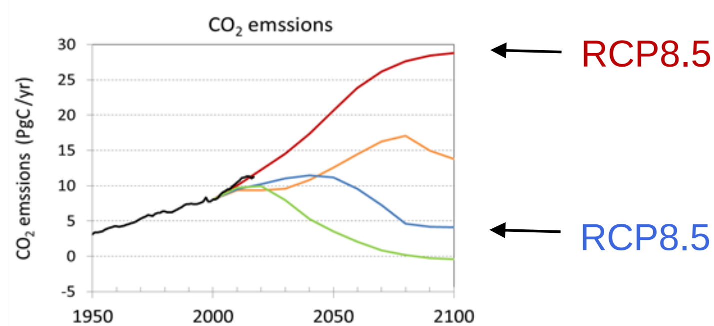
Northward migration of temperature zones

1981-2010 | 2050s under RCP4.5 | 2050s under RCP8.5



Annual mean temperatures (°C)

Multi-model means based
on 28 CMIP5-GCMs



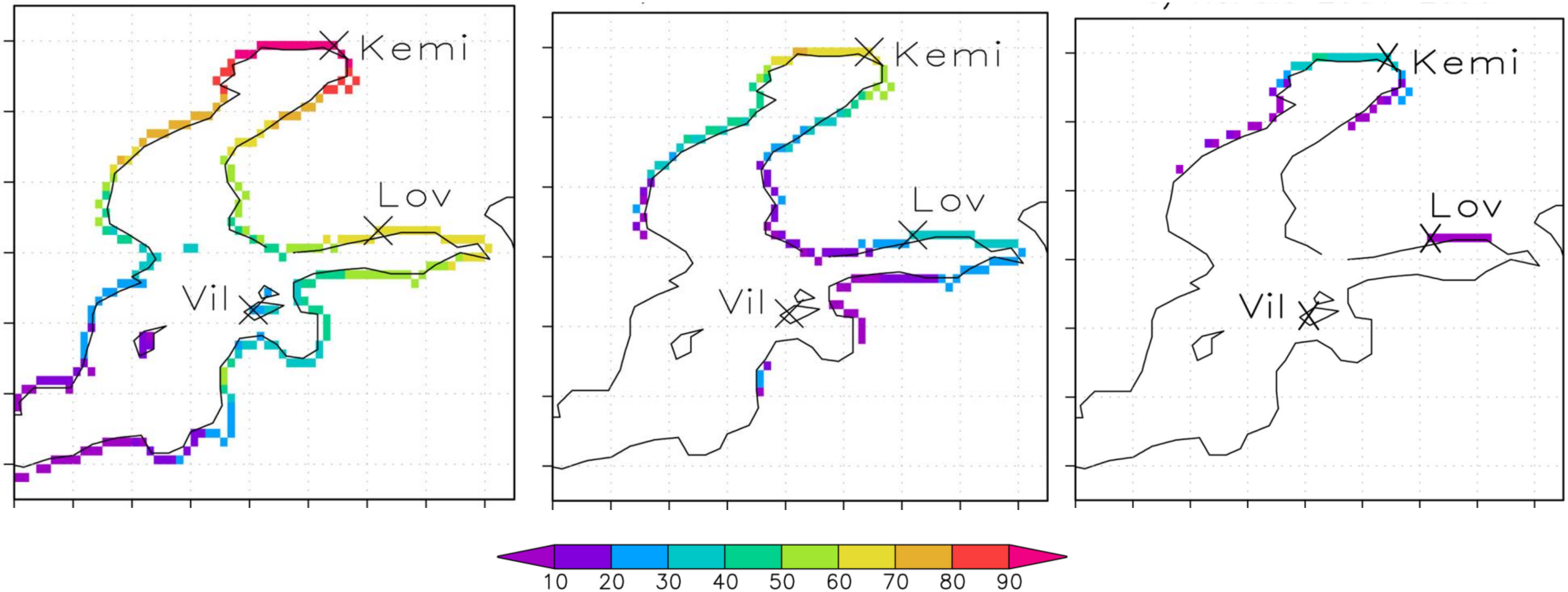
Emission scenarios

ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

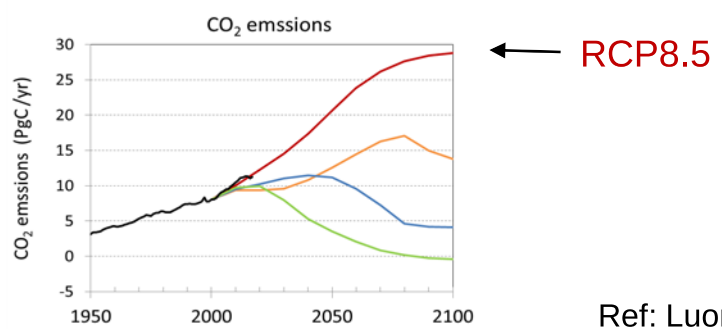
Ref: Jylhä (2018)

Decreasing coastal sea ice thickness

1971-2000 | 2040s under RCP8.5 | 2080s under RCP8.5



Annual maximum coastal sea ice thickness (cm) in **typical** past and future winters.



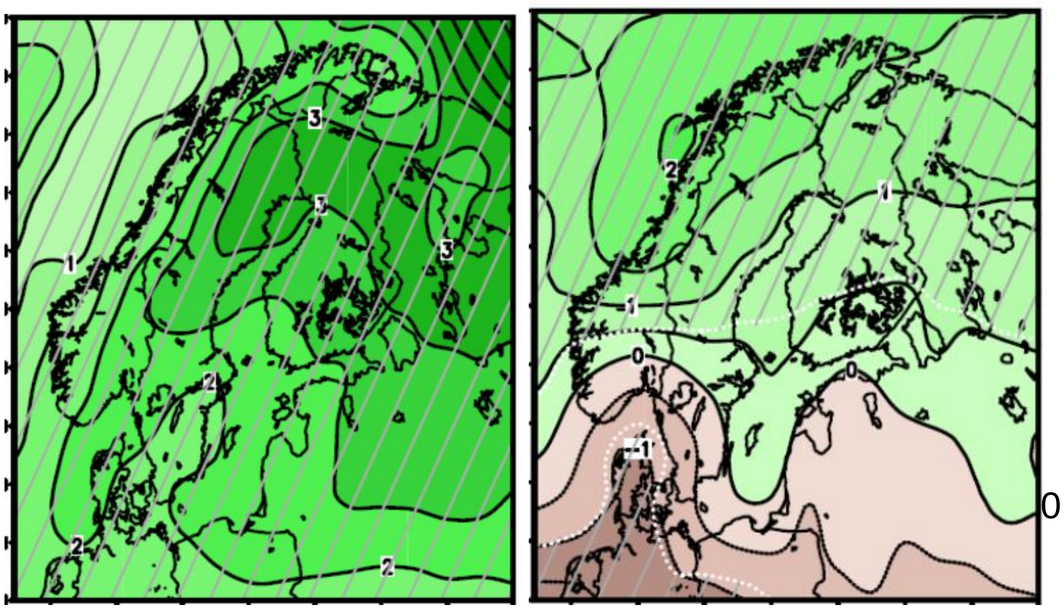
Emission scenarios

ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

Ref: Luomaranta et al. (2014),
DOI: 10.3402/tellusa.v66.22617

More precipitation in winter
- uncertain sign of the change in summer

Dec-Feb Jun-Aug



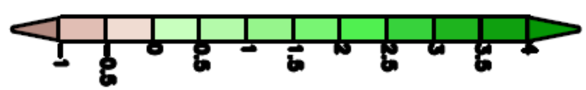
GoF in winter

- High agreement on an increasing trend
- Best-estimate for the rate of change: ~ 2.5% /10yr

GoF in summer

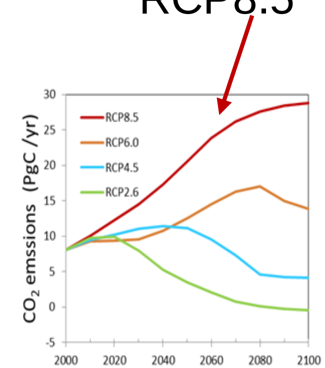
- Small/uncertain changes in precipitation totals
- Heavier rain events

Trends in seasonal precipitation sum (% / decade)



Hatching: more than 75 % of the **climate models agree** on the **sign of change**

RCP8.5



ILMATIETEEN LAITOS
METEOROLOGISKA INST
FINNISH METEOROLOGI

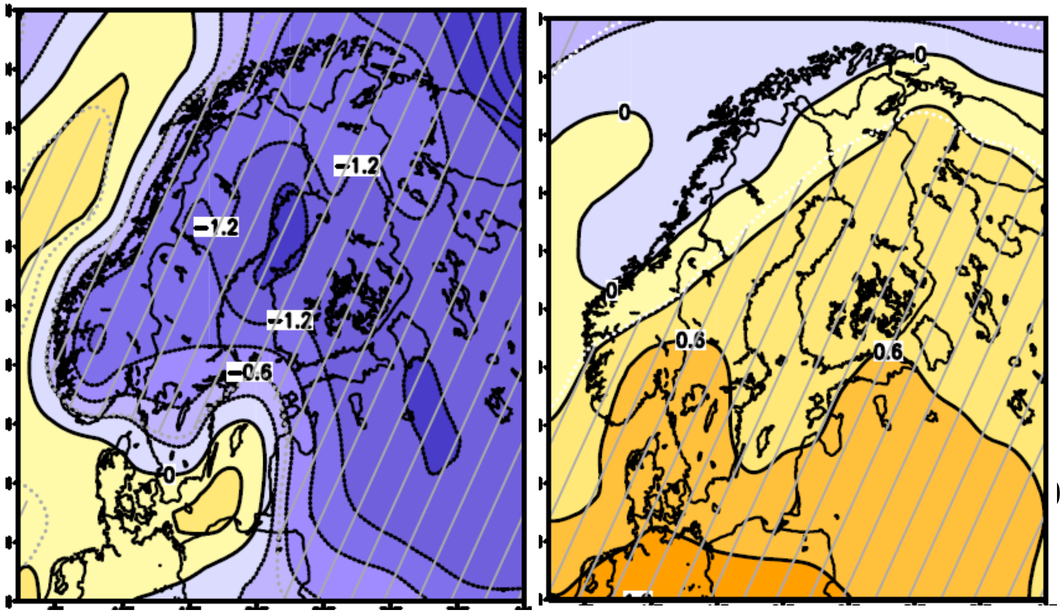
From 1981-2010 to 2035-2064, RCP8.5,
multi-model means (28 GCMs, see Ruosteenoja et al. 2016)

Even less solar radiation in winter
- somewhat more sunshine in summer

Dec-Feb | Jun-Aug

GoF in winter

- High agreement on a decreasing trend
- Best-estimate for the reduction rate: 1-1.5% /10yr



Trends in incident solar radiation (% / decade)

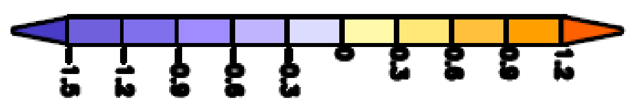
GoF in summer

- High agreement on an increasing trend
- Best-estimate for the growth : ~0.5% /10yr

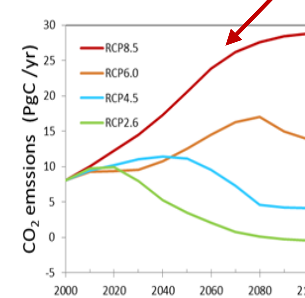
GoF in autumn

- Increases by ~1% /10yr

Hatching: more than 75 % of the **climate models agree** on the **sign of change**



RCP8.5



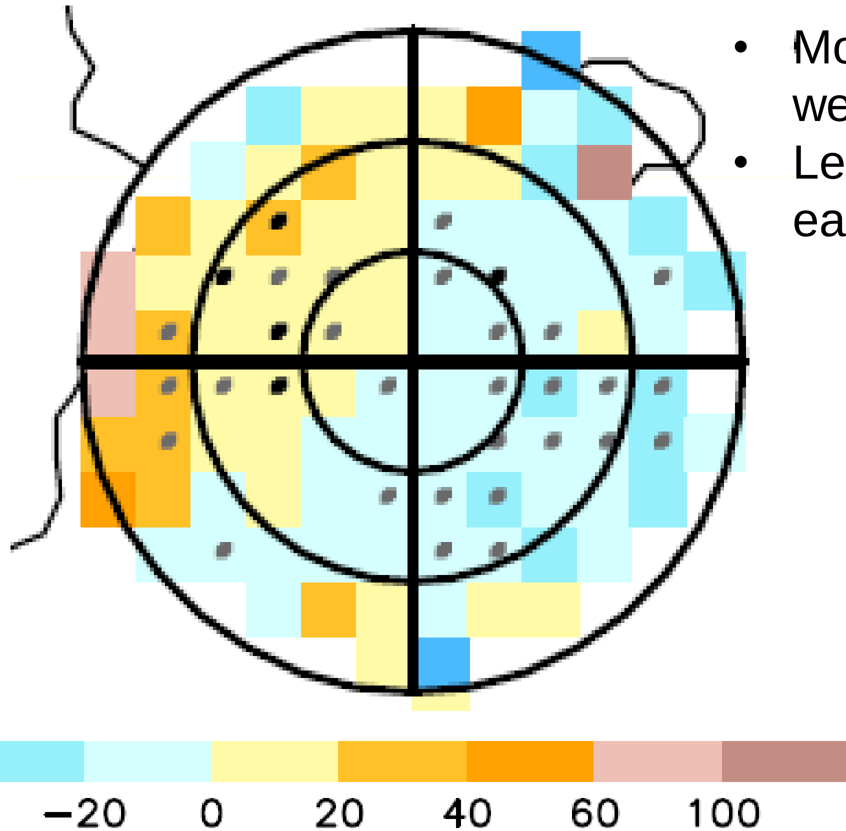
ILMATIETEEN LAITOS
METEOROLOGISKA INST
FINNISH METEOROLOGI

From 1981-2010 to 2035-2064, RCP8.5,
multi-model means (28 GCMs, see Ruosteenoja et al. 2016)

More frequent strong westerly winds in autumn

- Mean scalar wind speeds: no pronounced changes (in autumn to strengthen by a few percent per century in GoF).

Sep-Nov



- More common westerly winds
- Less common easterly winds

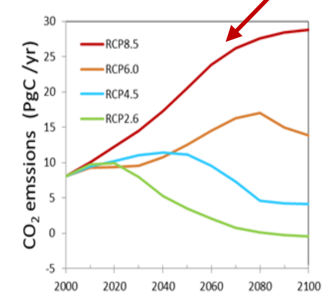
Black dots: > 80% of the climate models agree on the sign of change

Grey dots:> 66% of the climate models agree on the sign of change

Projected changes (in percent) in the bivariate frequency distribution of geostrophic wind components

From 1971-2000 to 2070-2099, RCP8.5, multi-model means (21 GCMs)

RCP8.5



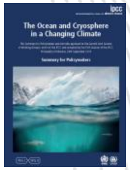
ILMATIETEEN LAITOS
METEOROLOGISKA INSTIT
FINNISH METEOROLOGICAL INSTITUTE

Ref: Ruosteenoja et al. (2019), DOI: 10.1175/JCLI-D-19-0023.1

Main messages

- Climate of the Gulf of Finland region is changing.

- The rate of changes will strongly depend on the near-future actions of the mankind.
  - Beyond 2050, uncertainty in climate change increases substantially due to uncertainties in emission scenarios.
  - Global sea level will continue to rise beyond 2100 even if the Paris Agreement is followed. (SROCC, 2019)



- The level of confidence, or the lack of certainty, in future projections vary between climatic variables, seasons and areas.

ClimateGuide.fi

- Information about climate and climate change
- For citizens, decision makers, etc.
- Available in three languages:

- Hosted by FMI together with the Finnish Environmental Institute (SYKE)
- Many forms:
  - Background articles
  - Sector-specific mitigation and adaptation articles
  - Tools
  - Visualizations, researcher video interviews, bite-size videos, infographics, quiz
  - Learning assignments for upper secondary schools
  - News section + Facebook

Joint procurement of solar power plants to cover 34 Finnish municipalities

Currently the joint procurement encompasses 81 solar power plants to be installed on the roofs of properties owned by the municipalities, such as schools, day care centres, service centres and city halls. Joint procurements are an efficient way to create markets for renewable energy and climate-friendly new technologies.

Read more

Policy - 4.7.2016 - SYKE

Climate change forces birches to adapt to new conditions

A project called BETUMICS led by the University of Eastern Finland is currently studying how different birch species adapt to new climate and light conditions. Climate change makes days warmer, not longer.

Read more

Research - 30.6.2016 - University of Eastern Finland

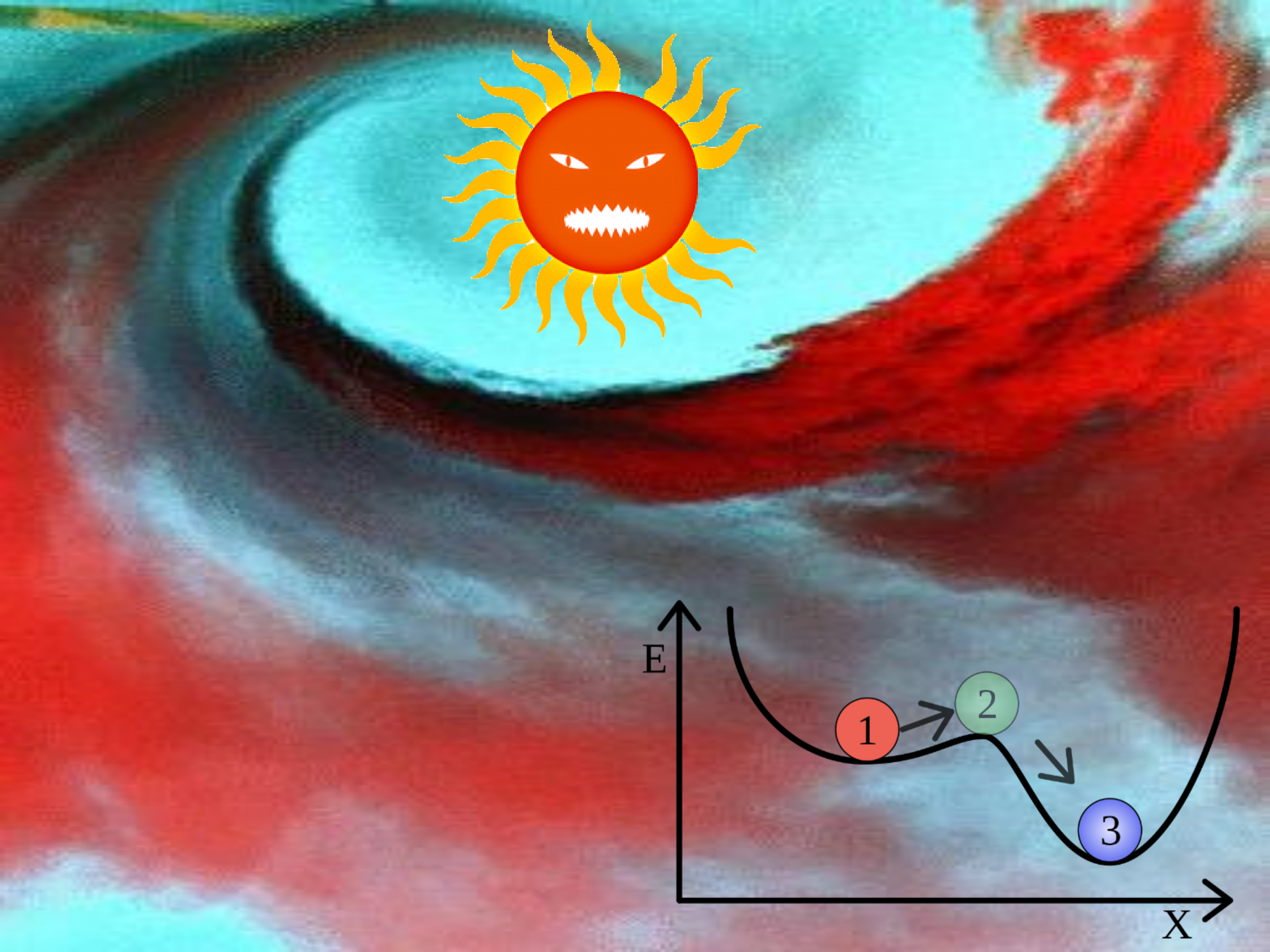
ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

Thank you for listening!

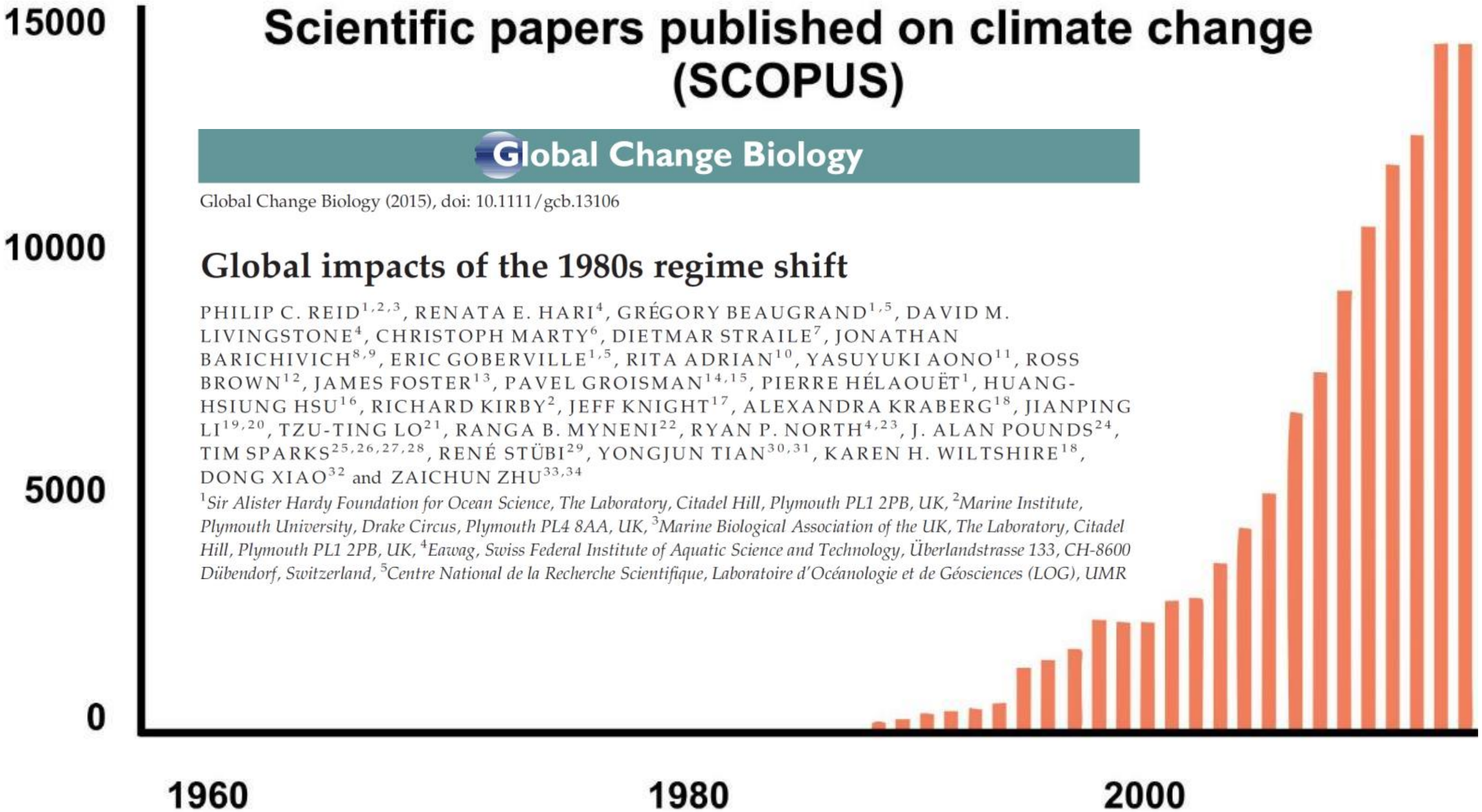
kirsti.jylha@fmi.fi

CLIMATE CHANGE, HUMAN IMPACTS AND MARINE ECOSYSTEMS

Jonne Kotta



E
1
2
3
X



Global Change Biology

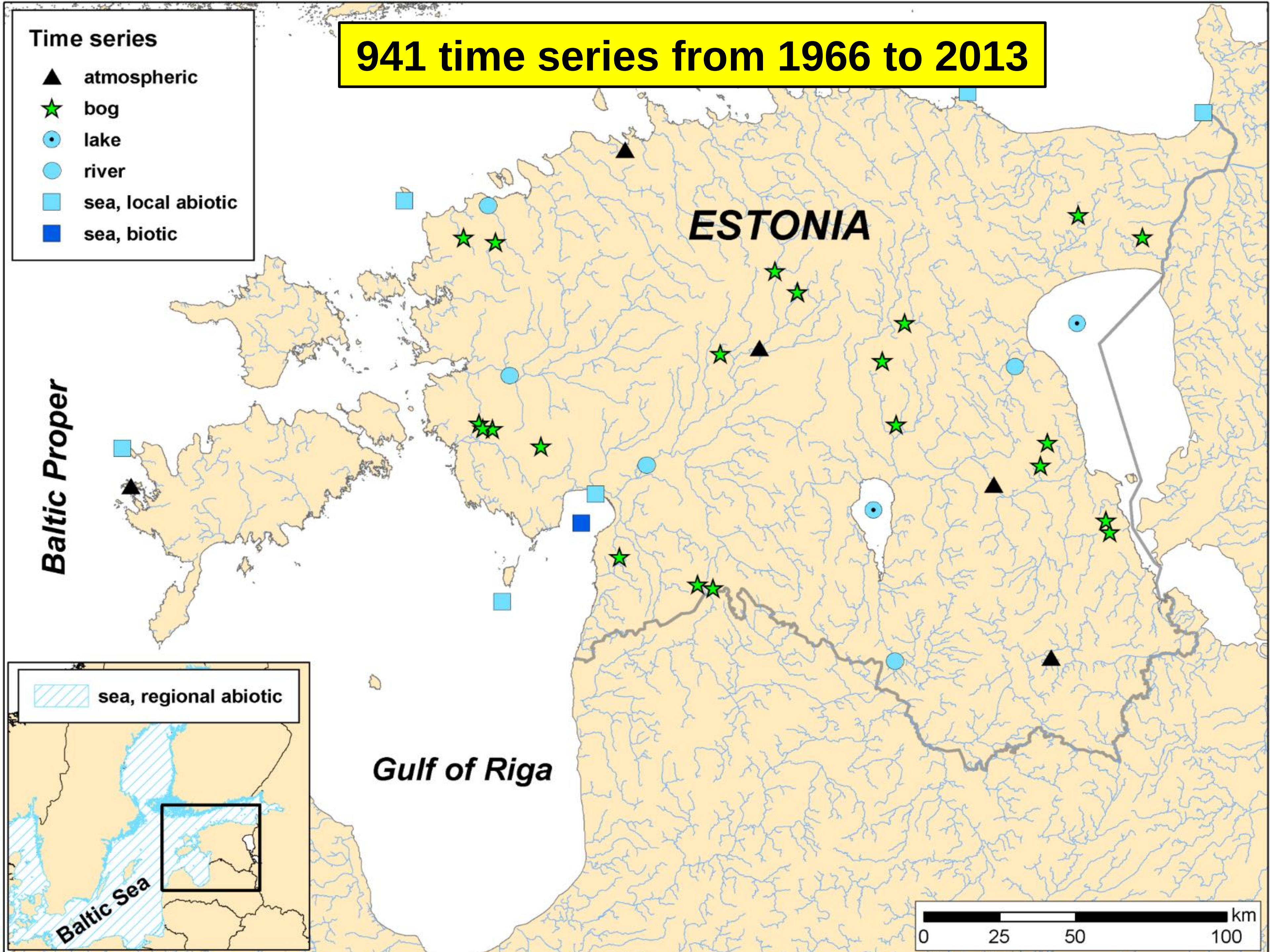
Global Change Biology (2015), doi: 10.1111/gcb.13106

Global impacts of the 1980s regime shift

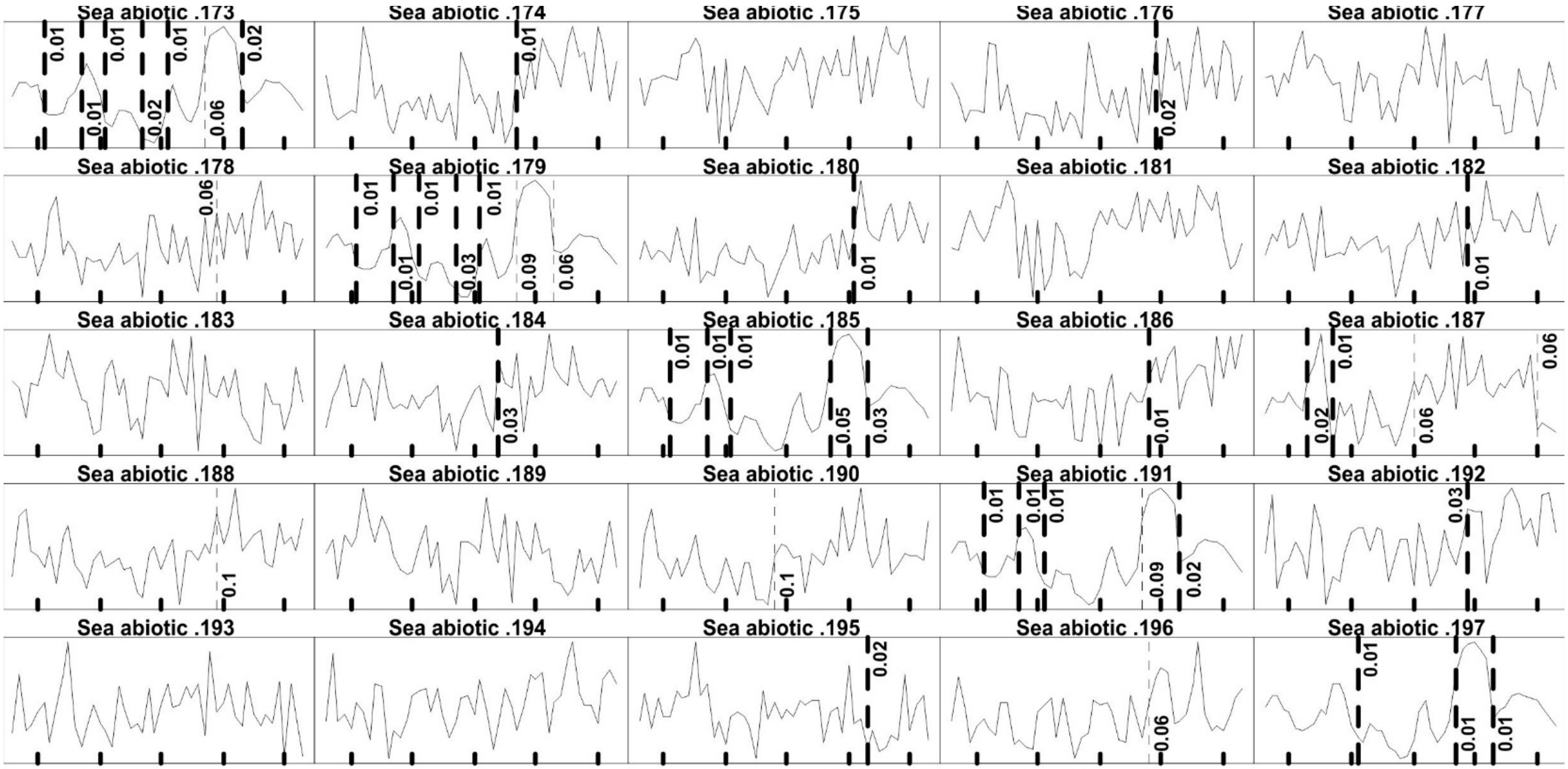
PHILIP C. REID[1,2,3], RENATA E. HARI[4], GRÉGORY BEAUGRAND[1,5], DAVID M. LIVINGSTONE[4], CHRISTOPH MARTY[6], DIETMAR STRAILE[7], JONATHAN BARICHIVICH[8,9], ERIC GOBERVILLE[1,5], RITA ADRIAN[10], YASUYUKI AONO[11], ROSS BROWN[12], JAMES FOSTER[13], PAVEL GROISMAN[14,15], PIERRE HÉLAOUËT[1], HUANG-HSIUNG HSU[16], RICHARD KIRBY[2], JEFF KNIGHT[17], ALEXANDRA KRABERG[18], JIANPING LI[19,20], TZU-TING LO[21], RANGA B. MYNENI[22], RYAN P. NORTH[4,23], J. ALAN POUNDS[24], TIM SPARKS[25,26,27,28], RENÉ STÜBI[29], YONGJUN TIAN[30,31], KAREN H. WILTSHIRE[18], DONG XIAO[32] and ZAICHUN ZHU[33,34]

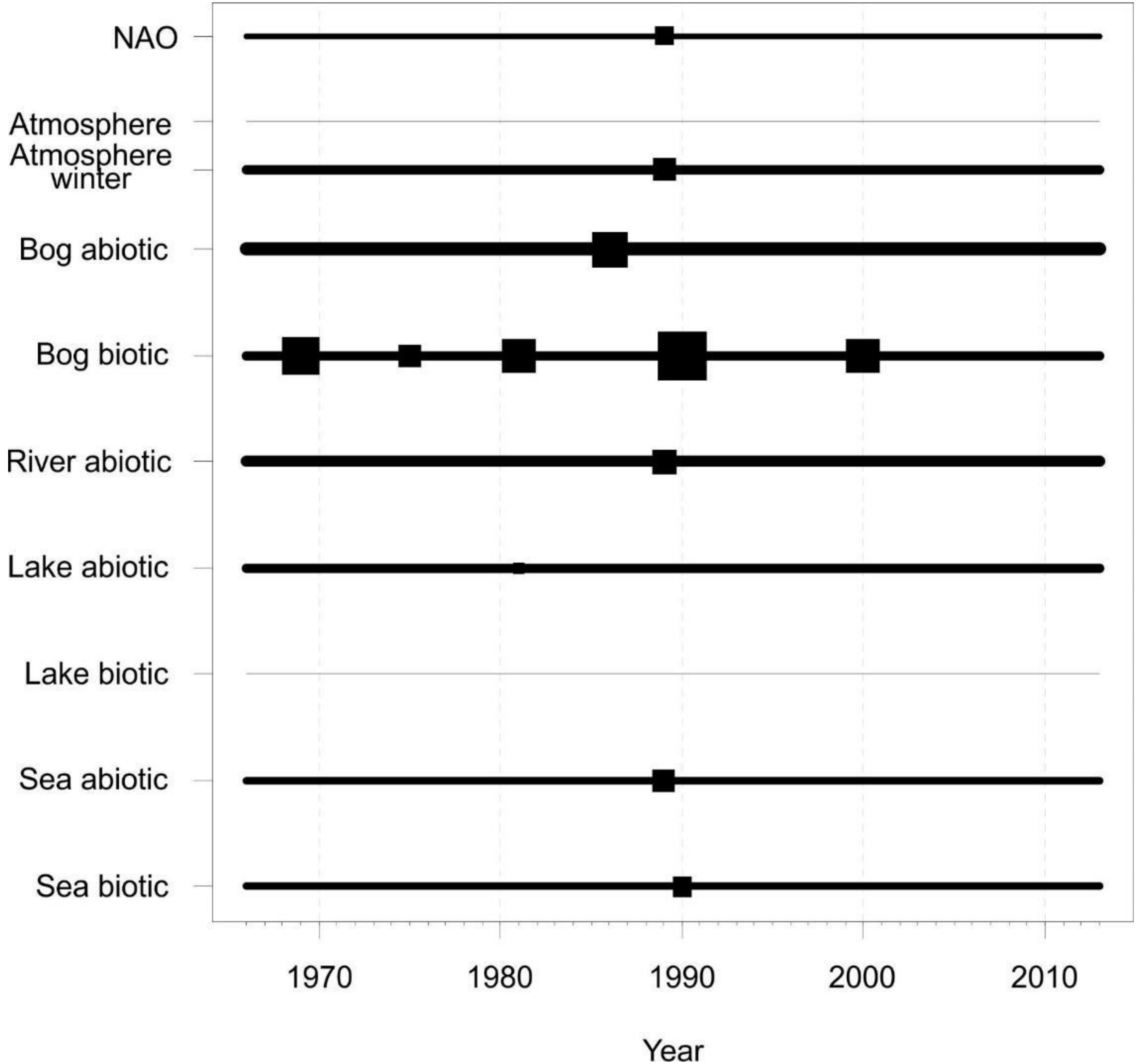
[1]*Sir Alister Hardy Foundation for Ocean Science, The Laboratory, Citadel Hill, Plymouth PL1 2PB, UK,* [2]*Marine Institute, Plymouth University, Drake Circus, Plymouth PL4 8AA, UK,* [3]*Marine Biological Association of the UK, The Laboratory, Citadel Hill, Plymouth PL1 2PB, UK,* [4]*Eawag, Swiss Federal Institute of Aquatic Science and Technology, Überlandstrasse 133, CH-8600 Dübendorf, Switzerland,* [5]*Centre National de la Recherche Scientifique, Laboratoire d'Océanologie et de Géosciences (LOG), UMR*

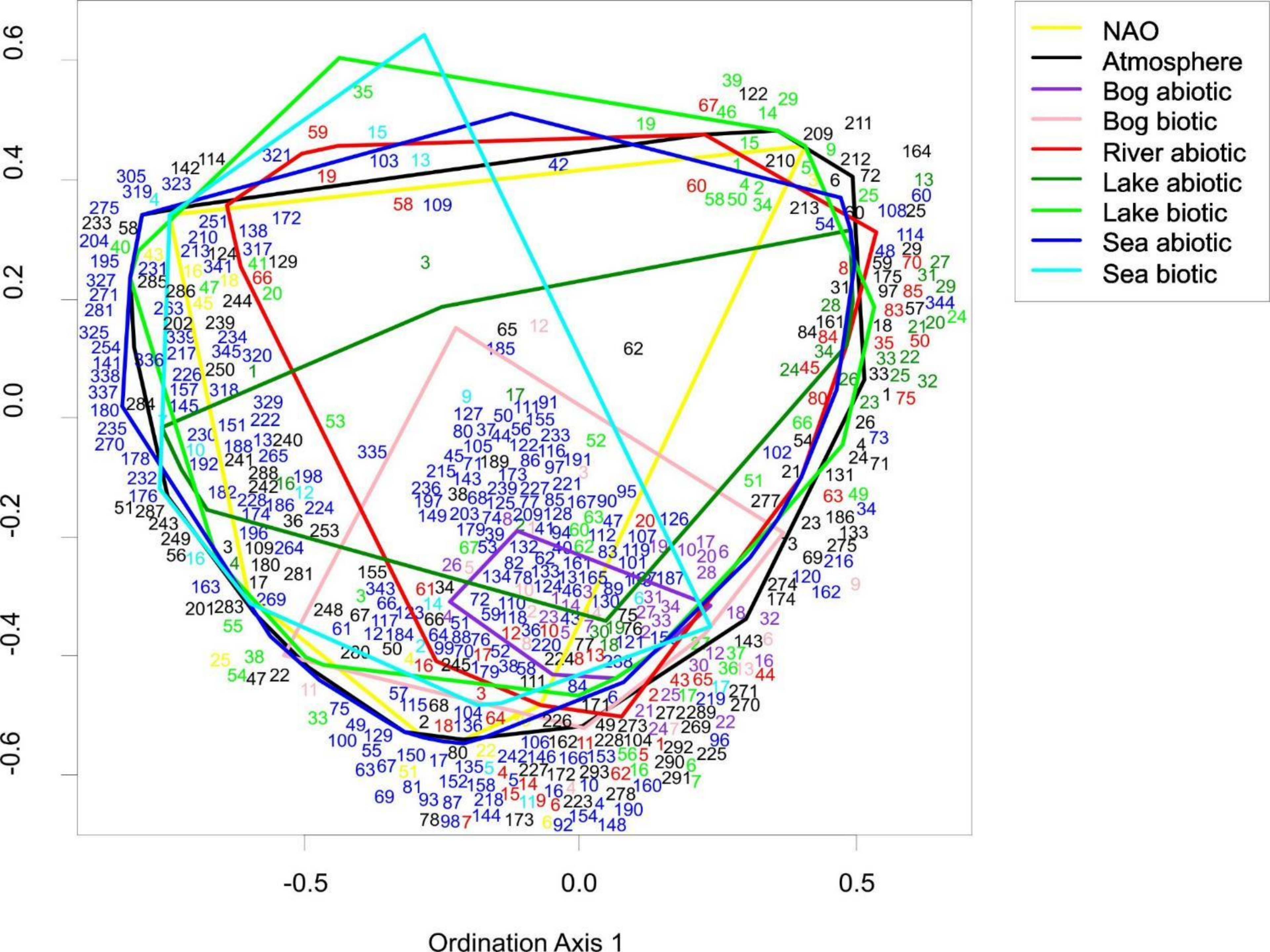
FROM GLOBAL TO REGIONAL TO LOCAL
ESTONIA


941 time series from 1966 to 2013
Time series
atmospheric
bog
lake
river
sea, local abiotic
sea, biotic
ESTONIA
Baltic Proper
Gulf of Riga
sea, regional abiotic
Baltic Sea
km
0
25
50
100

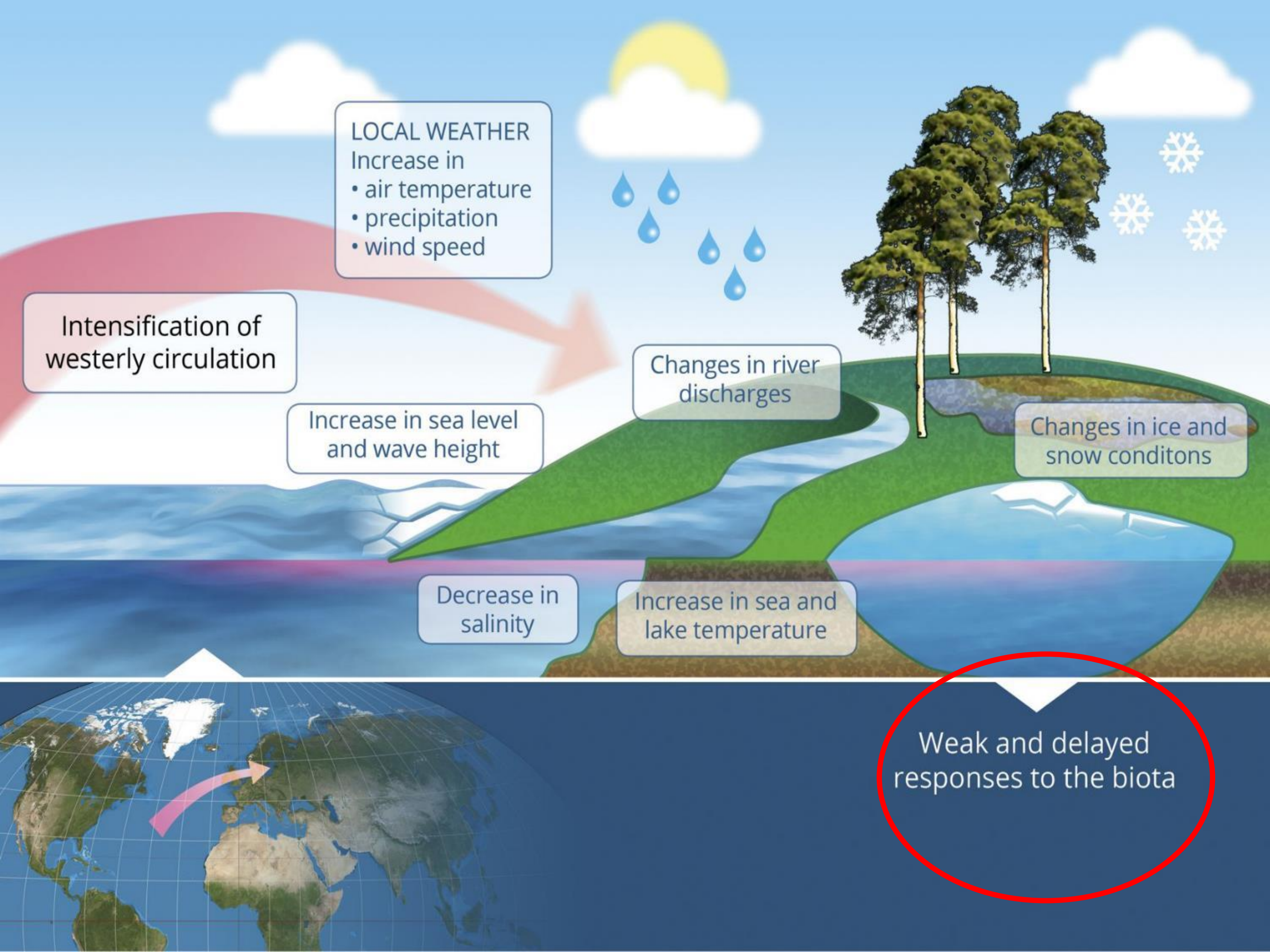
SHIFTS IN TIME SERIES



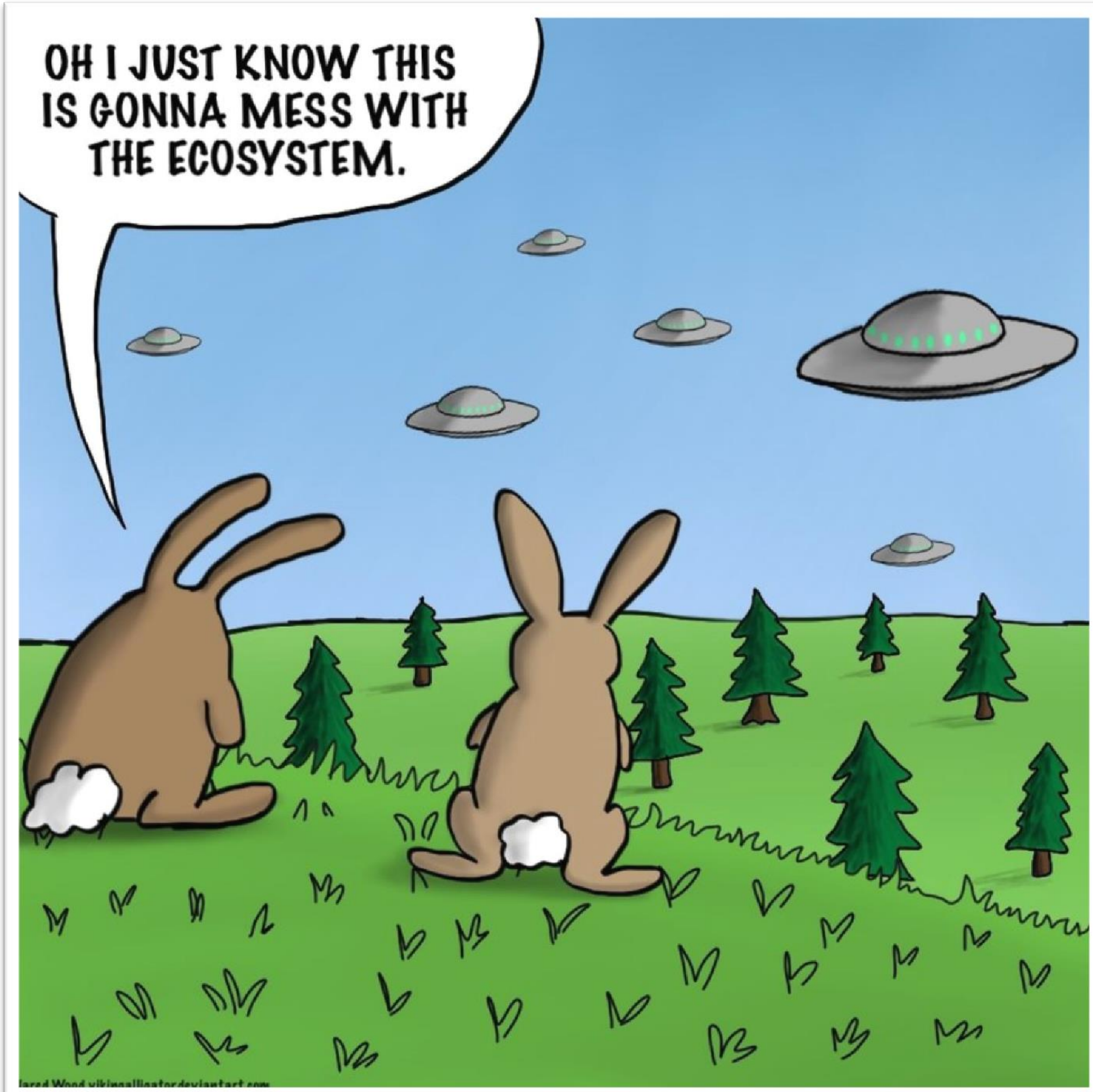

NAO
Atmosphere
Atmosphere winter
Bog abiotic
Bog biotic
River abiotic
Lake abiotic
Lake biotic
Sea abiotic
Sea biotic
1970
1980
1990
2000
2010
Year



NAO
Atmosphere
Bog abiotic
Bog biotic
River abiotic
Lake abiotic
Lake biotic
Sea abiotic
Sea biotic
Ordination Axis 1

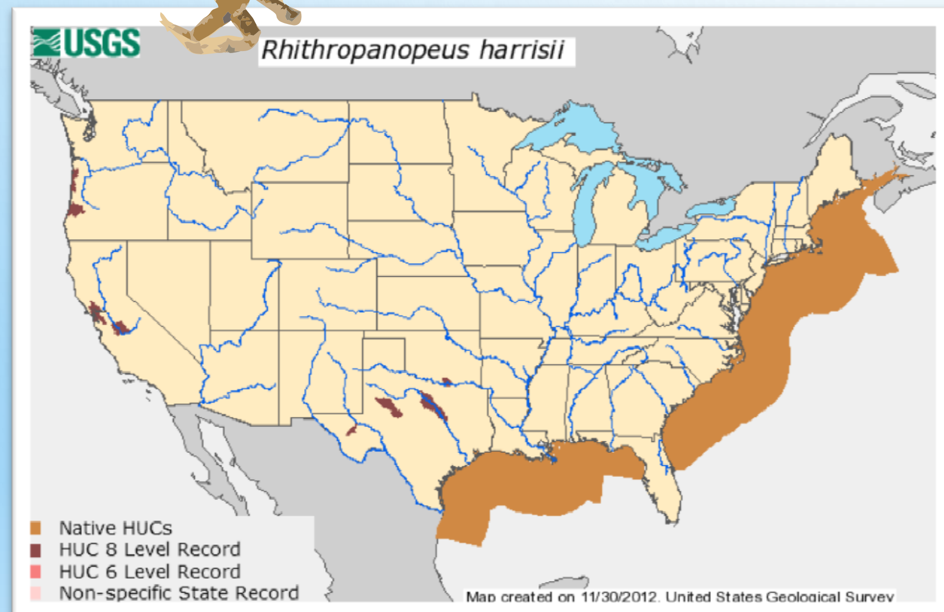


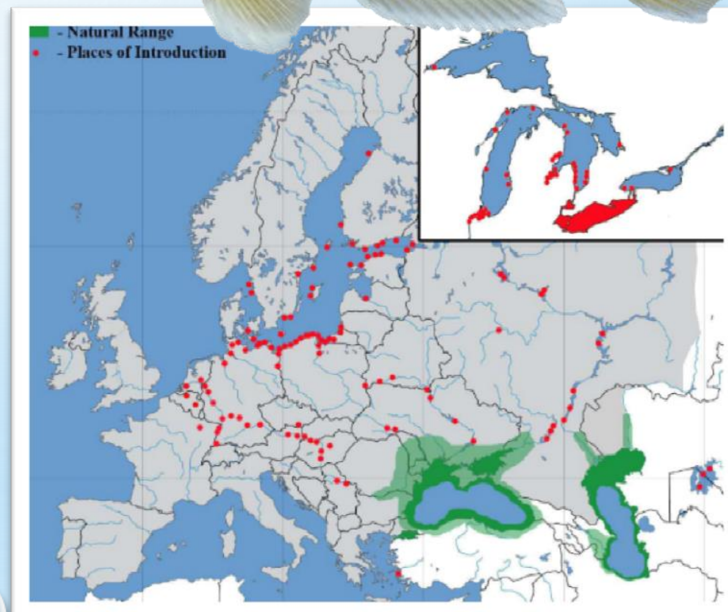
LOCAL WEATHER
Increase in
• air temperature
• precipitation
• wind speed
Intensification of westerly circulation
Changes in river discharges
Increase in sea level and wave height
Changes in ice and snow conditons
Decrease in salinity
Increase in sea and lake temperature
Weak and delayed responses to the biota


OH I JUST KNOW THIS IS GONNA MESS WITH THE ECOSYSTEM.

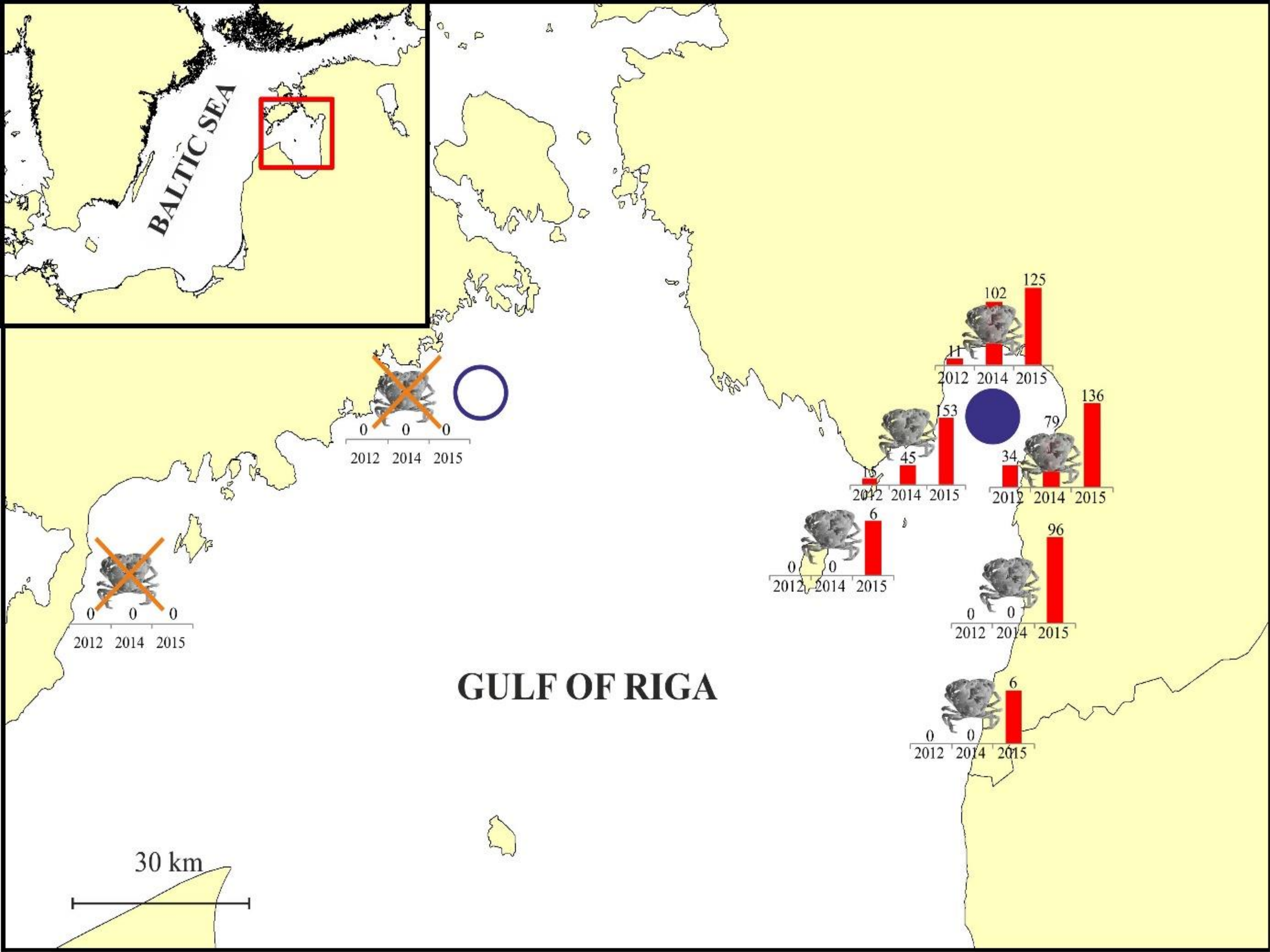
BALTIC SEA

MUD CRAB AND ROUND GOBY

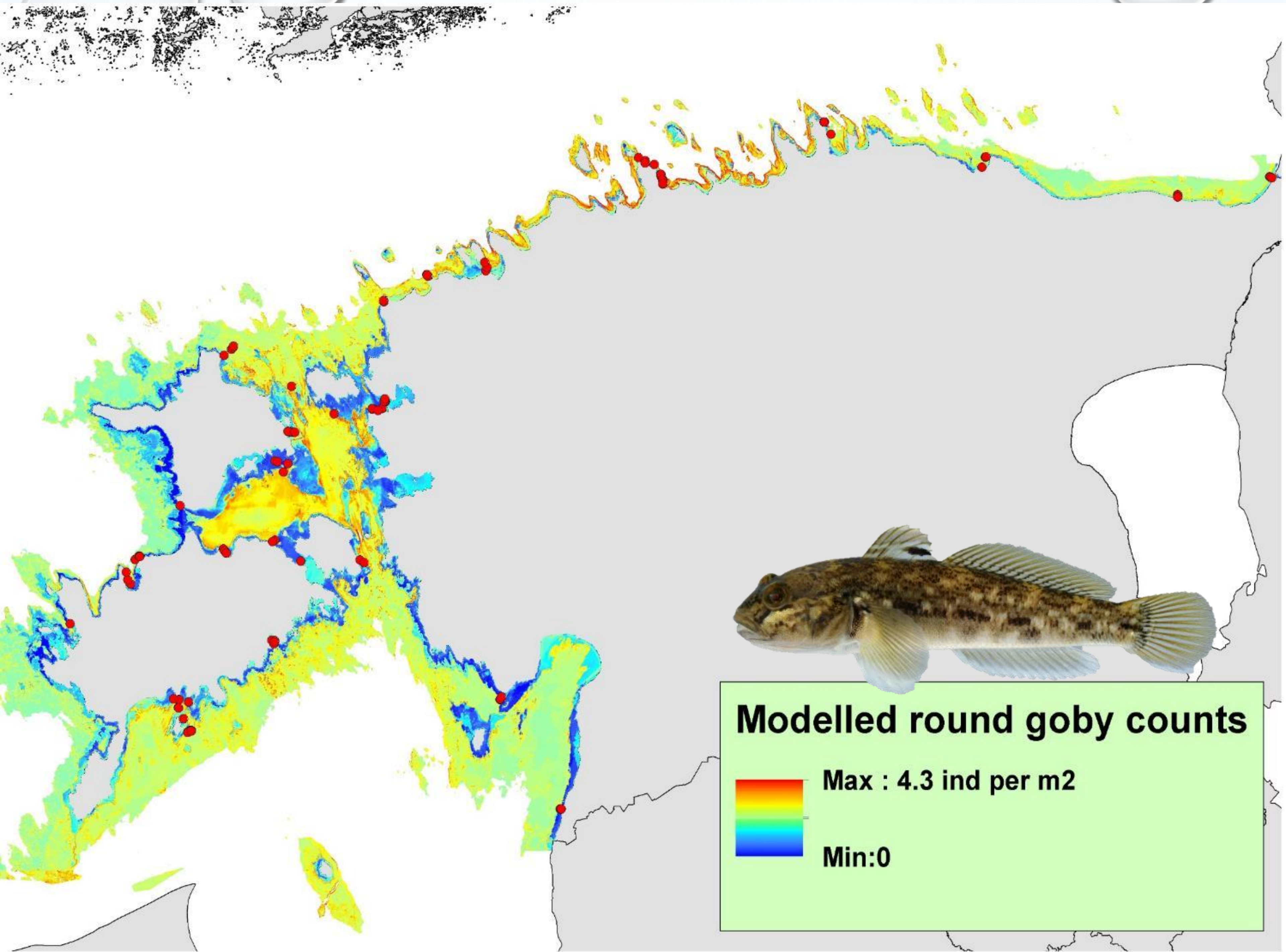




NEED FOR NEW MONITORING METHODS



BALTIC SEA
GULF OF RIGA
30 km
0 0 0
2012 2014 2015
0 0 0
2012 2014 2015
11 102 125
2012 2014 2015
15 45 153
2012 2014 2015
34 79 136
2012 2014 2015
0 0 6
2012 2014 2015
0 0 96
2012 2014 2015
0 0 6
2012 2014 2015


Modelled round goby counts
Max : 4.3 ind per m2
Min:0

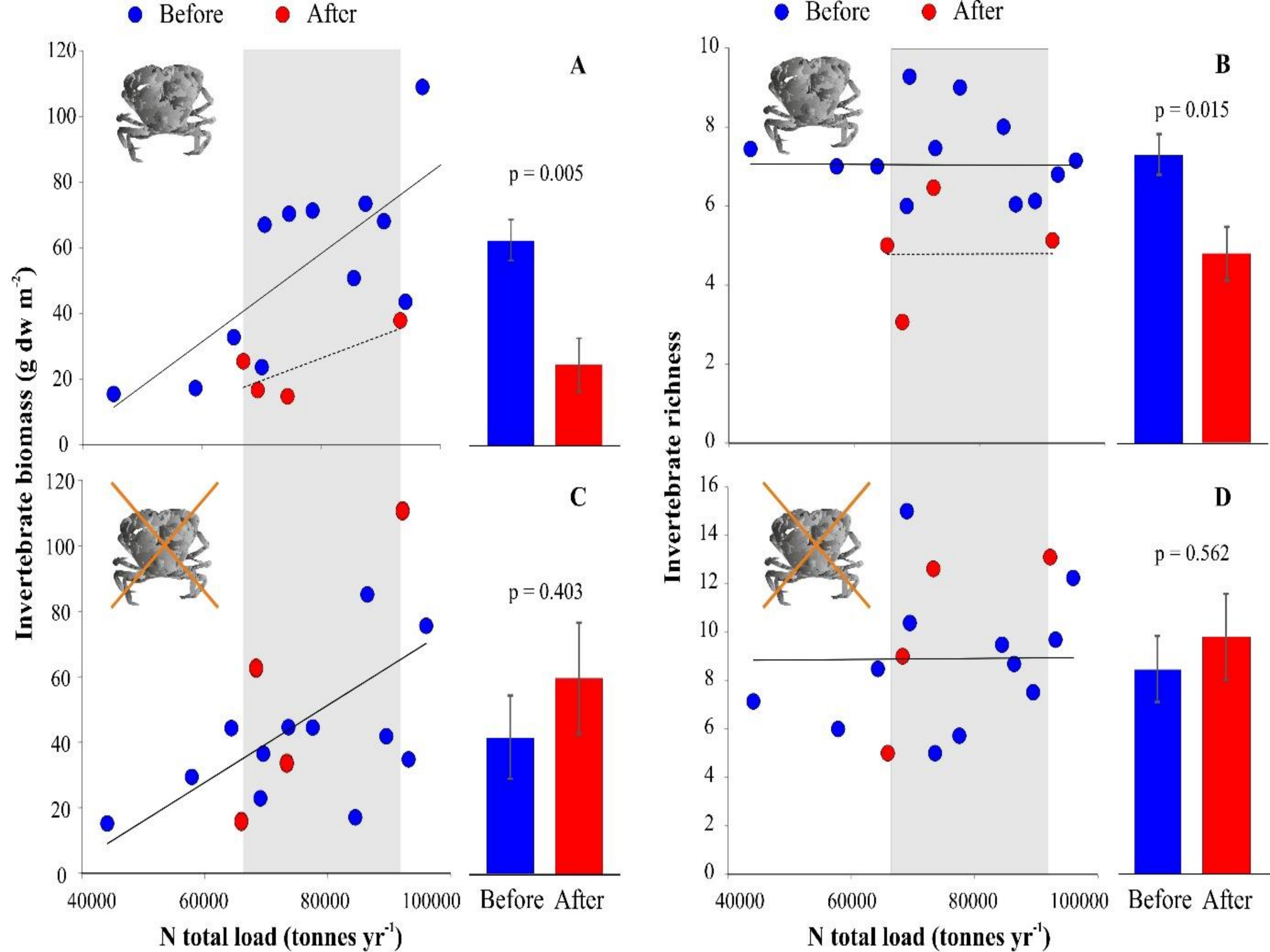
EXPERIMENTS ON DIET

Laboratory experiments

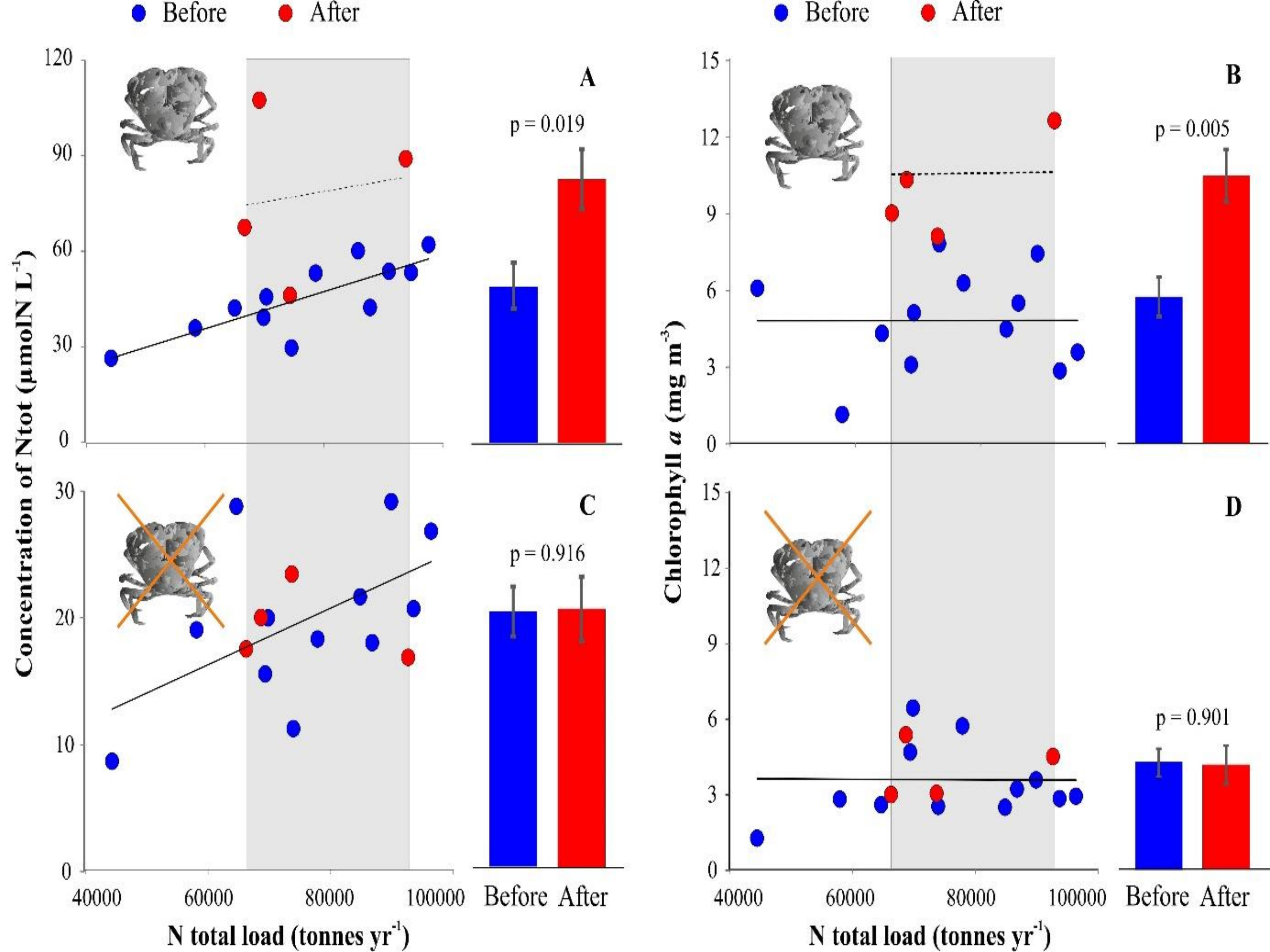
1 m² of benthic prey in 10 days
no prey species preference

Field experiments

1 m² of bivalves in 30 days



Before
After
A
B
C
D
p = 0.005
p = 0.015
p = 0.403
p = 0.562
Invertebrate biomass (g dw m-2)
Invertebrate richness
N total load (tonnes yr-1)
Before
After



Before
After
Concentration of Ntot (µmolN L-1)
A
p = 0.019
B
p = 0.005
Chlorophyll a (mg m-3)
C
p = 0.916
D
p = 0.901
N total load (tonnes yr-1)
Before
After

BOTTOM UP CONTROL

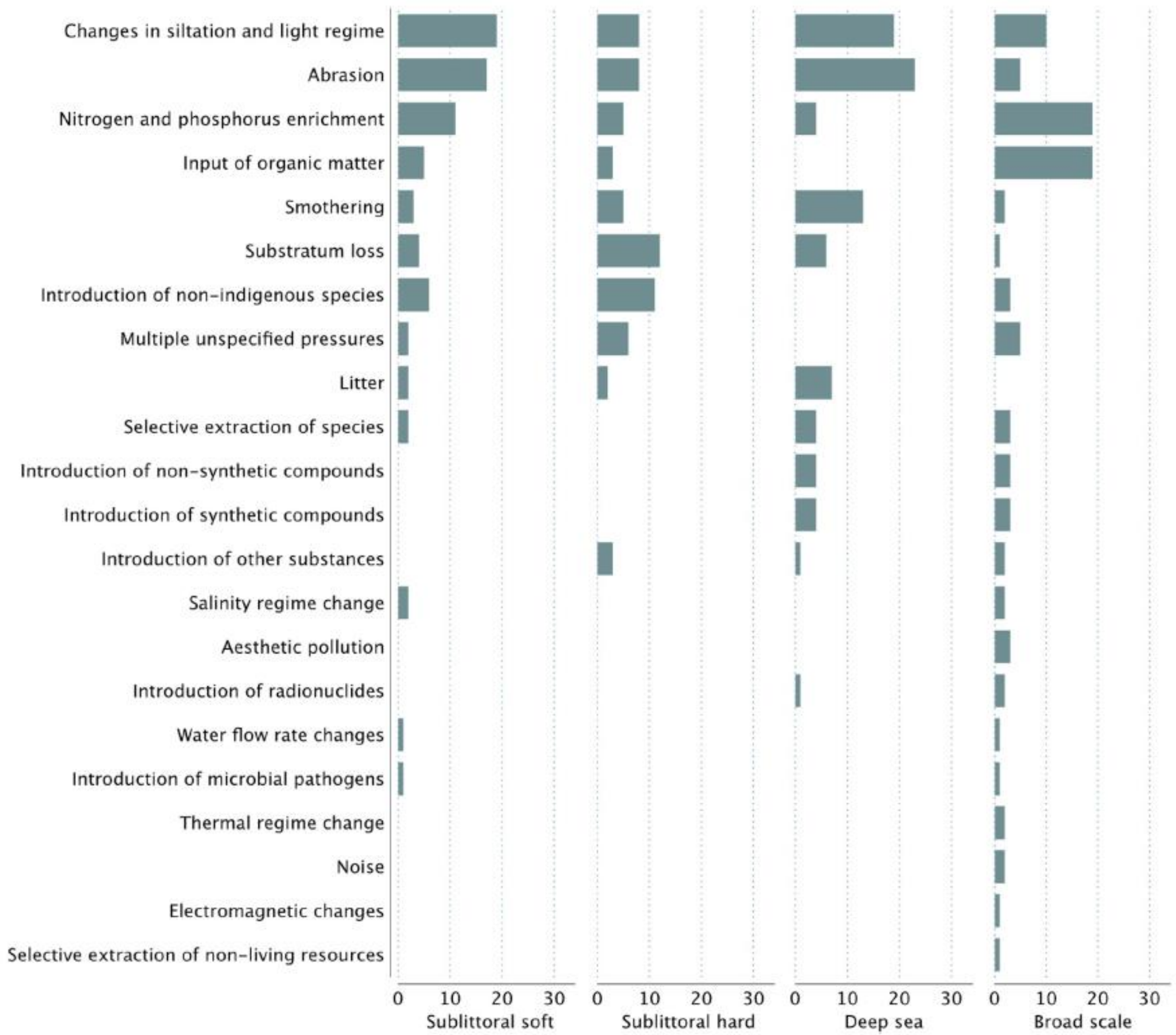
APPEARANCE OF NOVEL FUNCTIONS (TOP-DOWN PREDATION, EFFICIENT BURROWING)

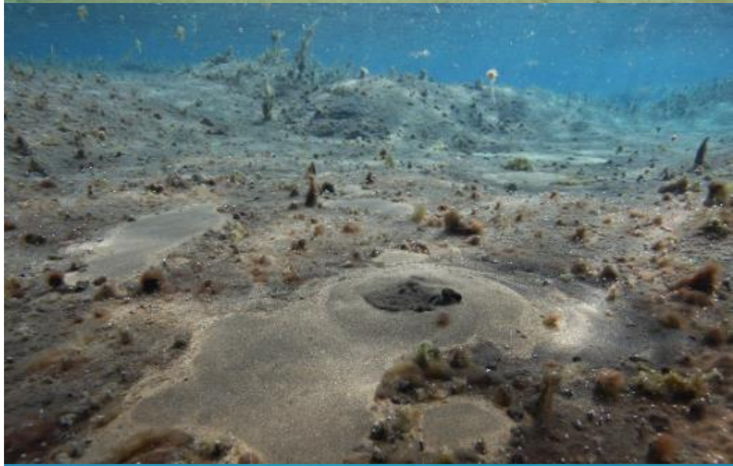
TOP DOWN CONTROL

EFFECTS ARE PROPAGATING BEYOND THE NIS HABITAT!

CONSEQUENCES OF IMPACTS

- Intensification and diversification of human induced pressures
- Increasing loss of habitats





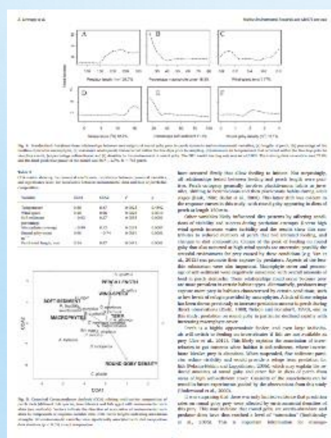
Need for data and analysis demanding assessment schemes.

But there are disconnections of flow from science (too specific) to policy (too large scale).


FEATURE ARTICLE

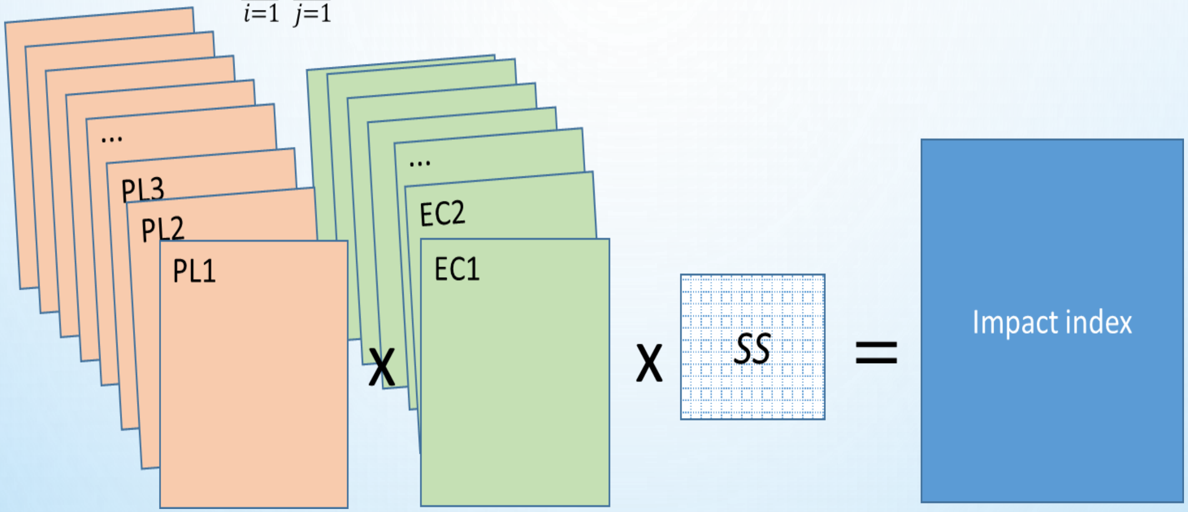
Gradients of disturbance to an algal canopy and the modification of an intertidal community

David R. Schiel*, Stacie A. Lilley

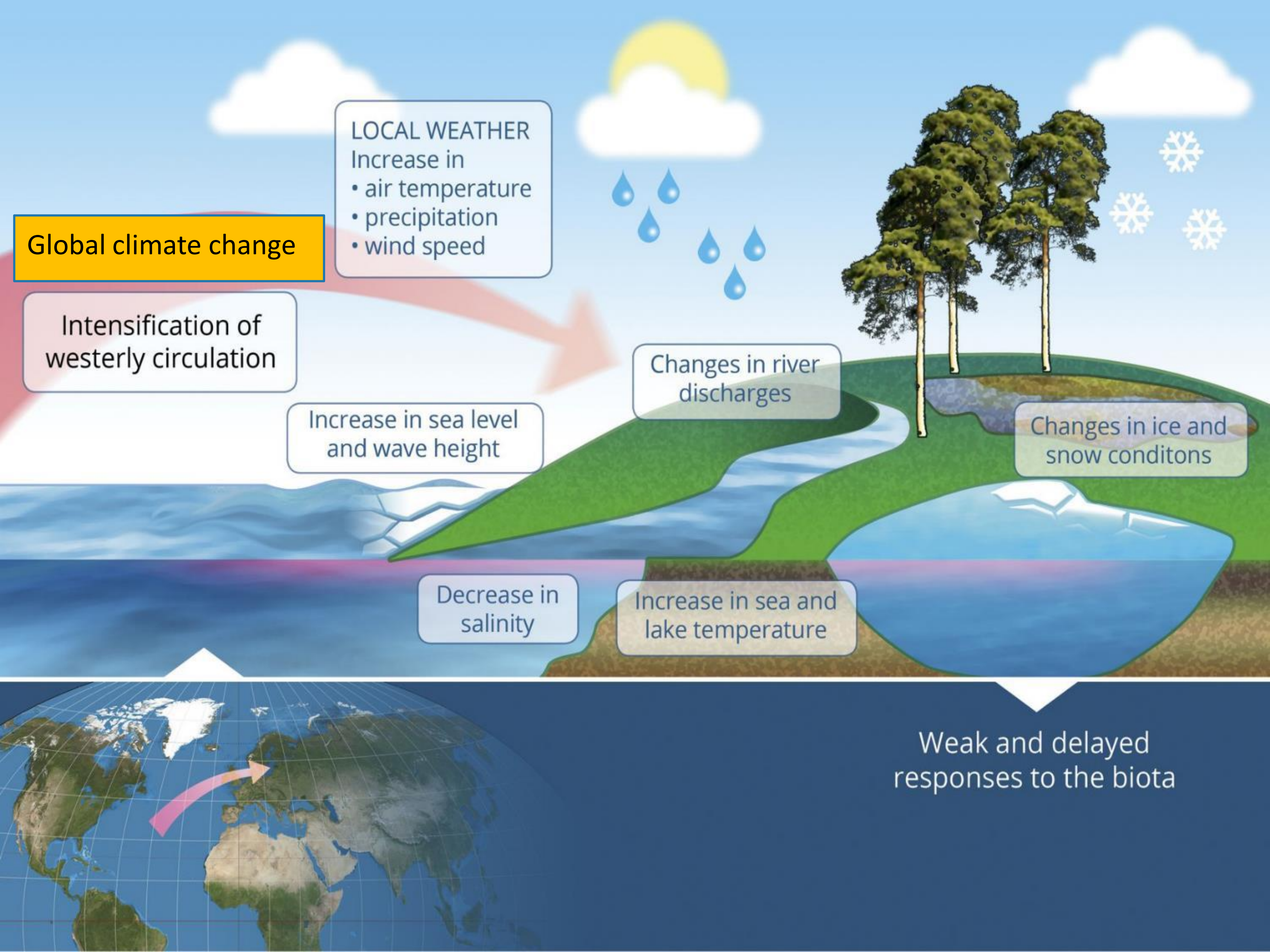


HELCOM (The Baltic Sea)

$$\sum_{i=1}^{n}\sum_{j=1}^{m} PLi(x,y) * ECj(x,y) * SSi,j$$



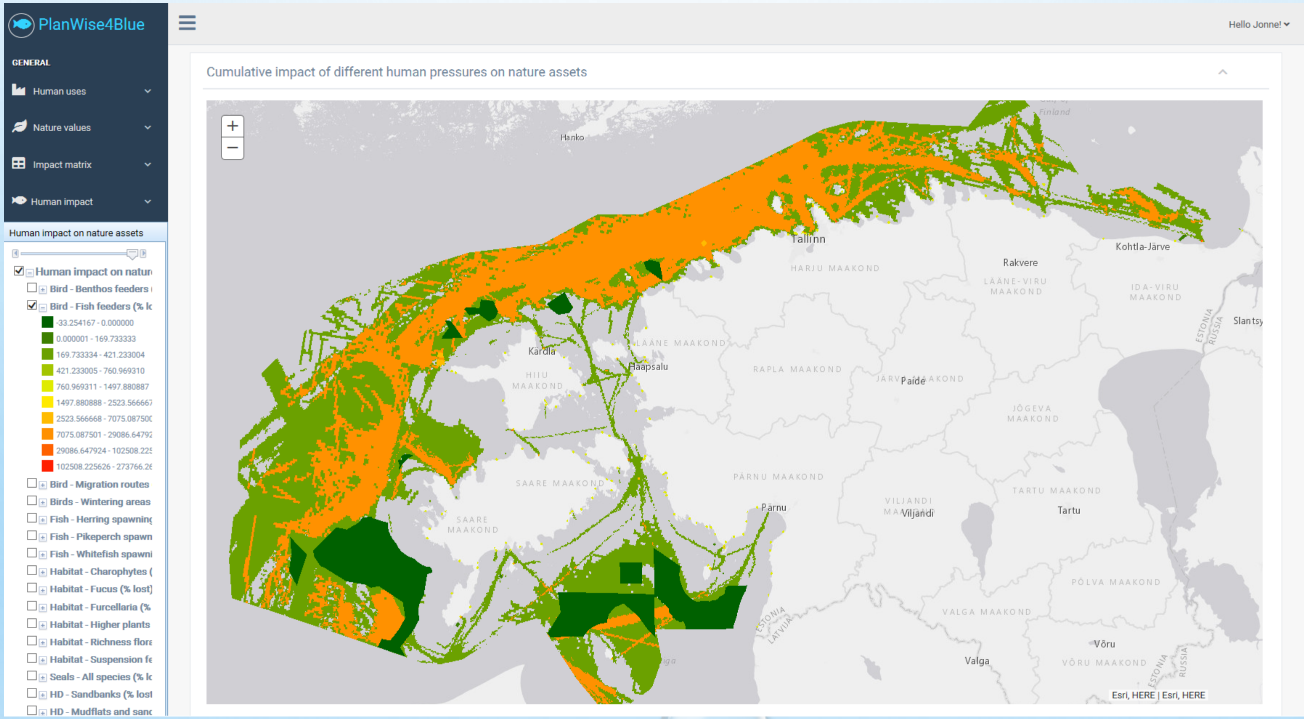
- Too simple to capture the existing complexity of the real world examples.


Global climate change
LOCAL WEATHER
Increase in
• air temperature
• precipitation
• wind speed
Intensification of westerly circulation
Changes in river discharges
Increase in sea level and wave height
Changes in ice and snow conditons
Decrease in salinity
Increase in sea and lake temperature
Weak and delayed responses to the biota

SOLUTION

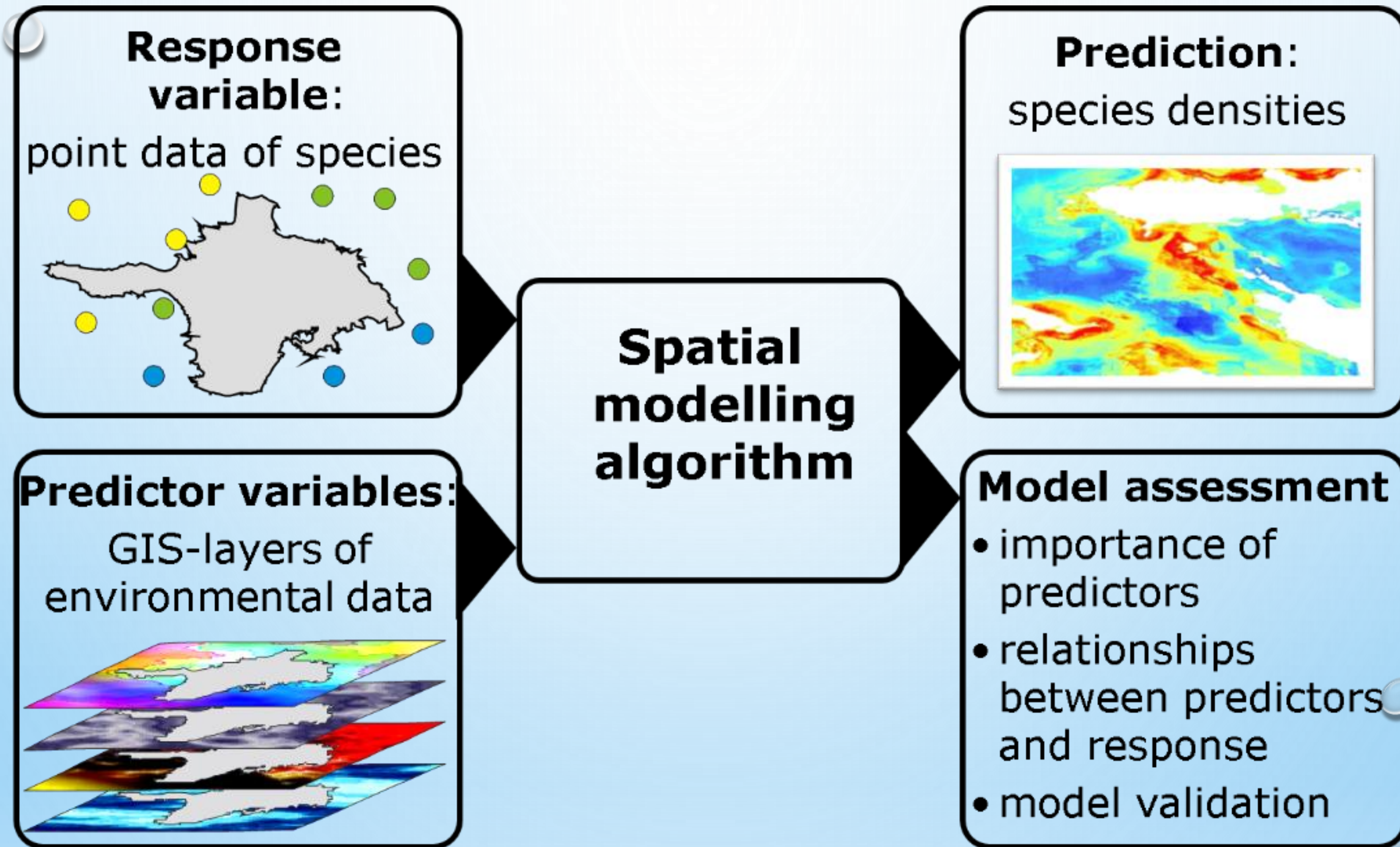
Simple-to-use online tool

THE TOOL QUANTIFIES INTERACTIVE EFFECTS OF ALL HUMAN IMPACTS ON KEY ECOSYSTEM ELEMENTS AT LOCAL SPATIAL SCALE.



Including nature assets that have geography data but taking into account a changing world of pressures and the biota.

MAP AND MODEL DISTRIBUTIONS



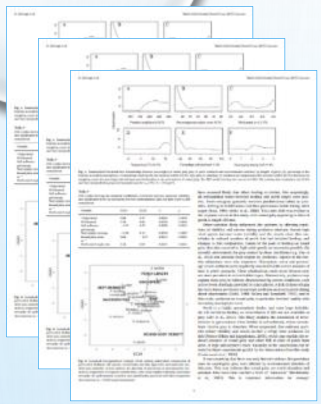
THE TOOL

1. COMBINES LAYERS OF KEY **NATURE ASSET VALUES**.

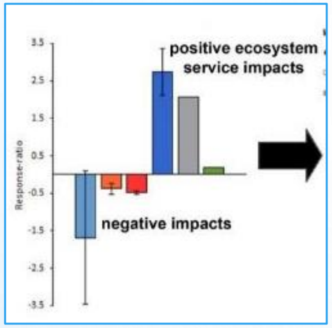
2. CONTAIN RULES (KNOWLEDGE) ON HOW DIFFERENT HUMAN PRESSURES AFFECT DIFFERENT NATURE ASSETS.

3. USERS CAN **UPLOAD POLYGONS OF HUMAN USE** AND THEN PORTAL INTERACTIVELY **QUANTIFIES ENVIRONMENTAL IMPACTS OF THESE PRESSURES AT LOCAL SPATIAL SCALES** BASED ON THE CURRENT BEST AVAILABLE KNOWLEDGE.

CUMULATIVE IMPACT ASSESSMENT

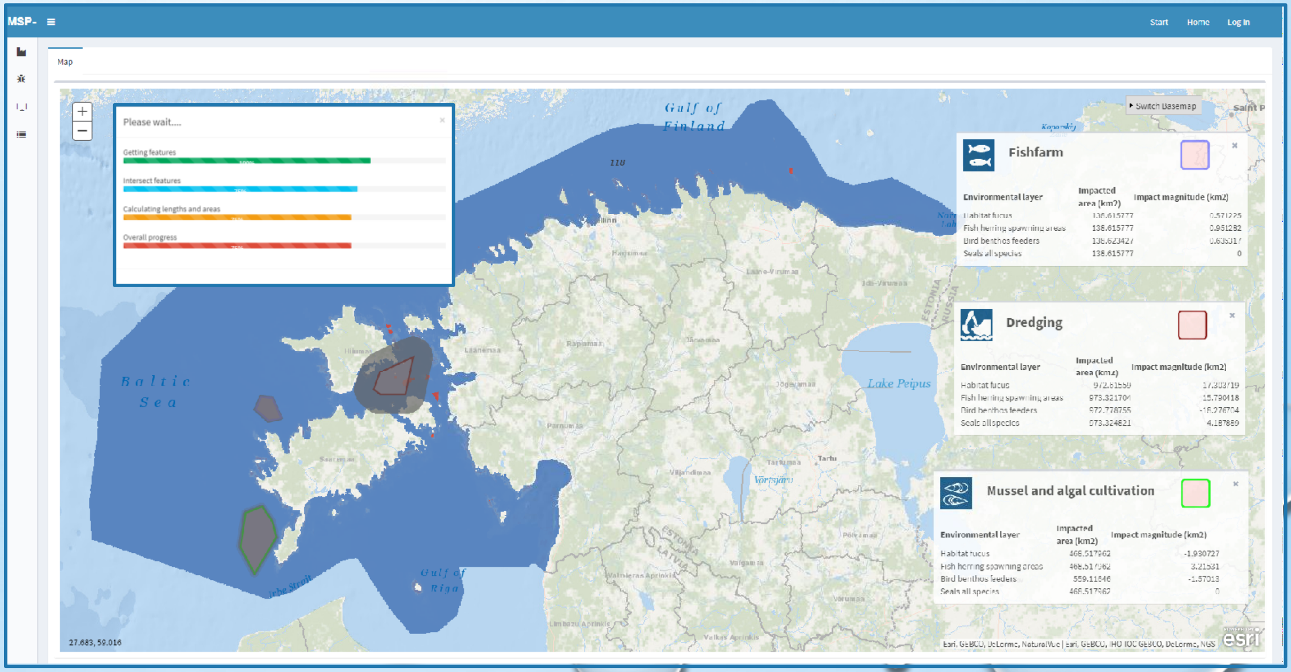


Extract data from relevant publications



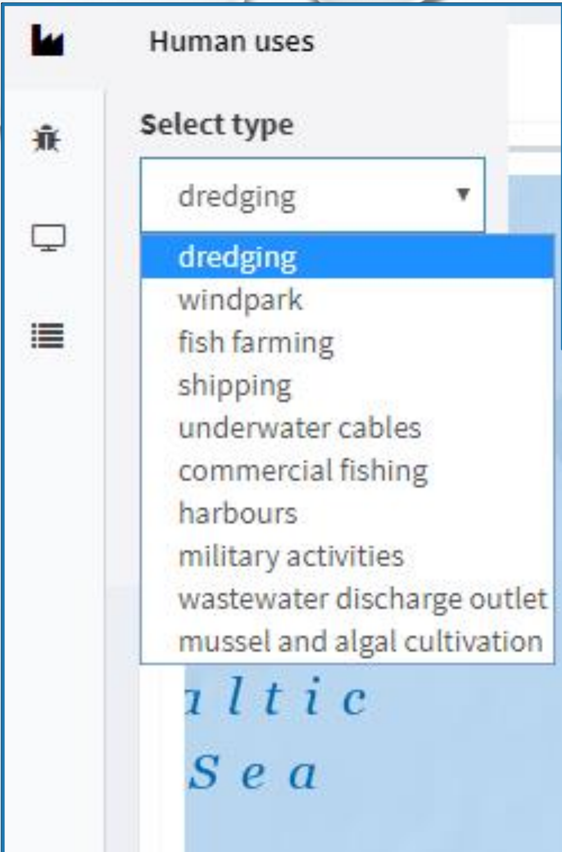
Meta-analyses and calculation of effect sizes

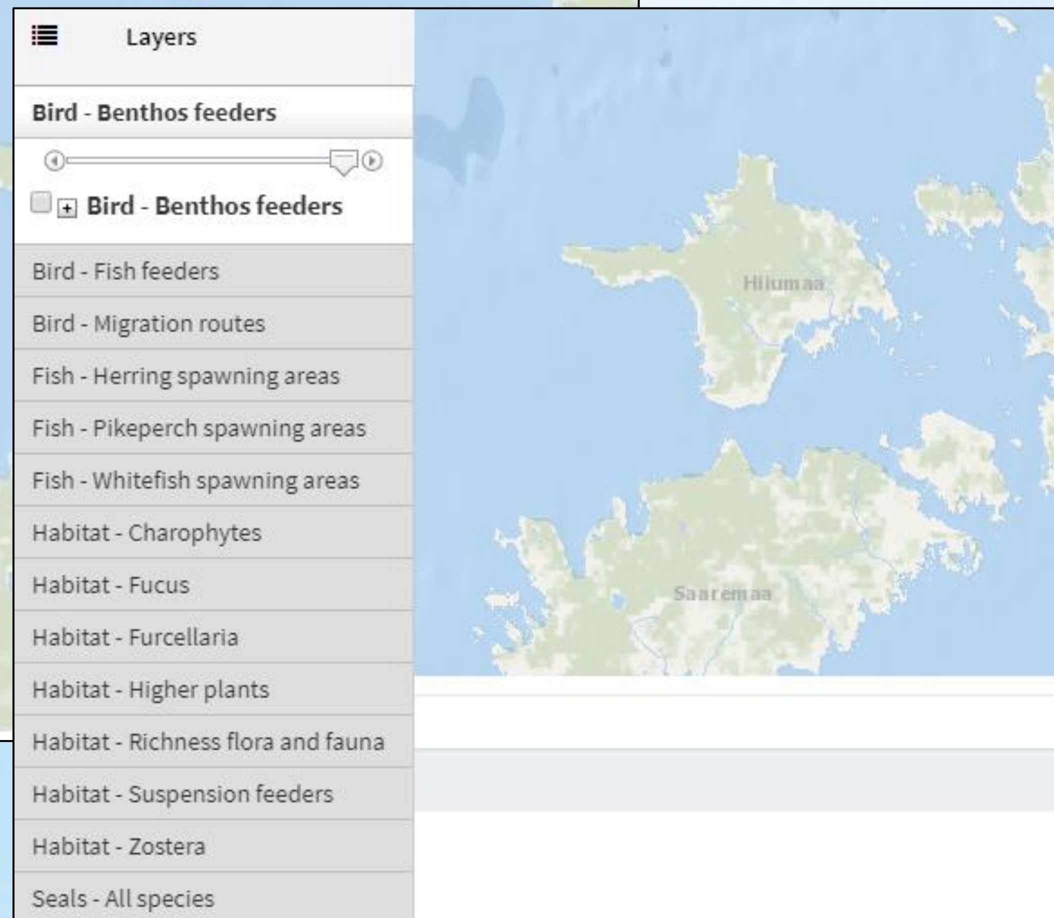
Combine effect coefficients with distributions in impact assessment tool

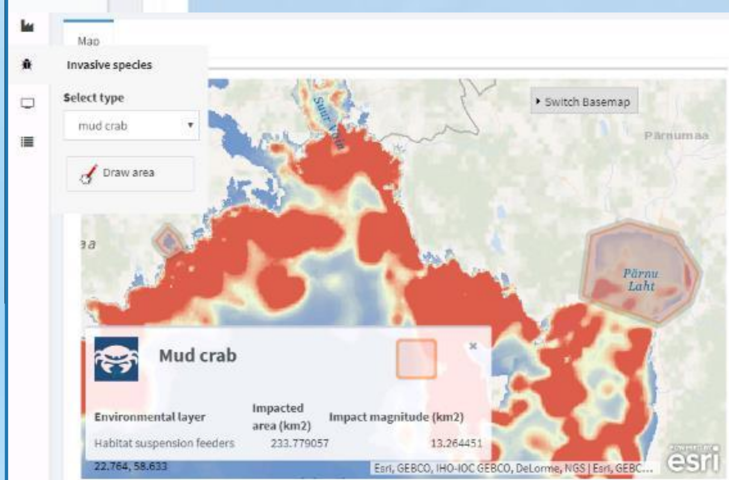


APPLICATION 1: SELECTION OF THE BEST SCENARIO

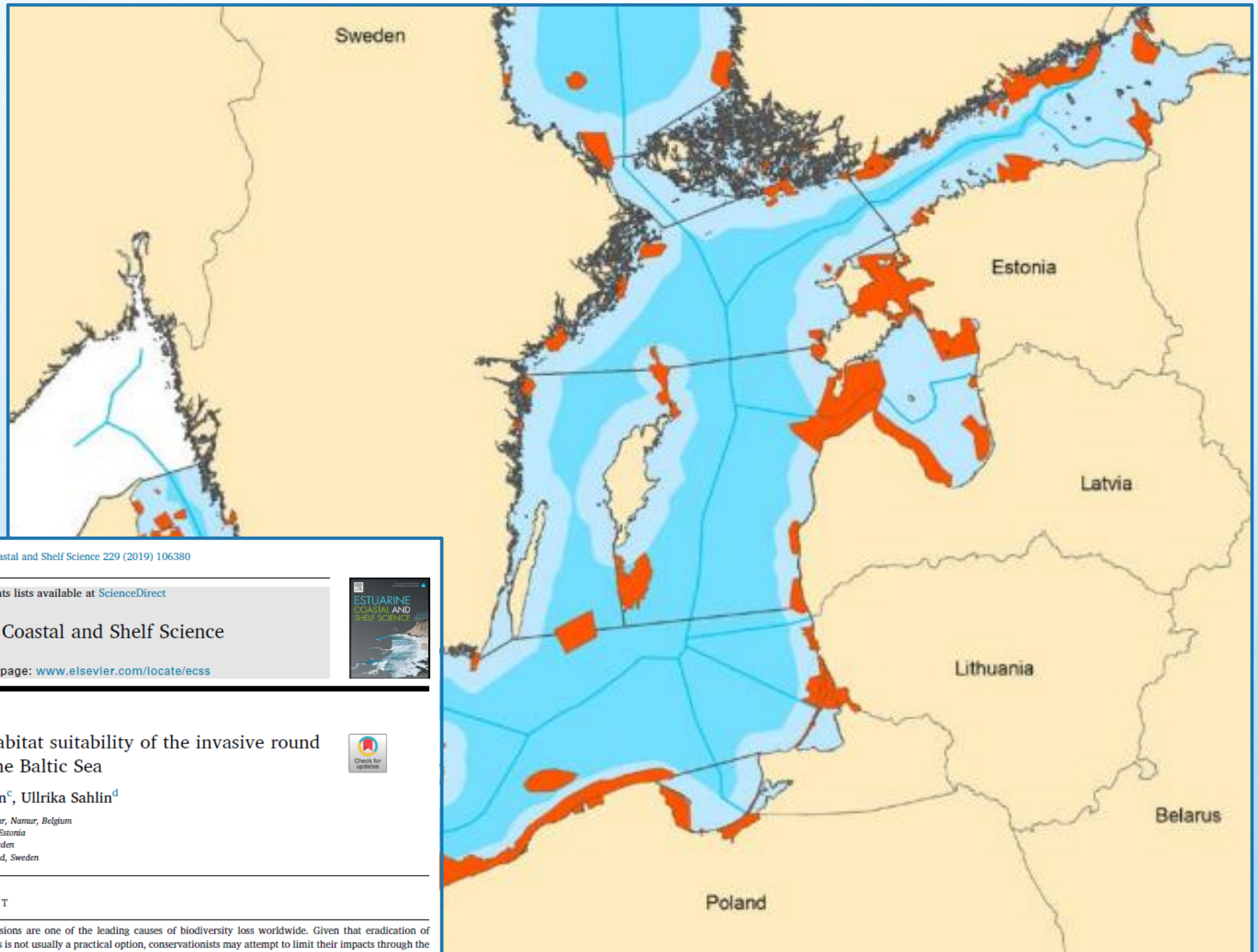
Assessment of the cumulative impacts considers manageable pressures (e.g. windpark construction) in the context of the impacts of unmanageable pressures (invasive species)

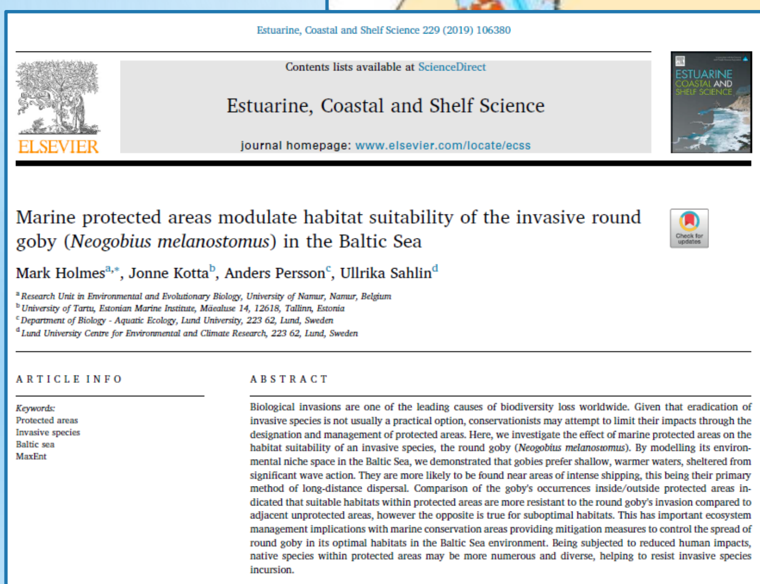






APPLICATION 2: CONSERVATION PLANNING





Estuarine, Coastal and Shelf Science 229 (2019) 106380

Contents lists available at ScienceDirect

Estuarine, Coastal and Shelf Science

journal homepage: www.elsevier.com/locate/ecss

ELSEVIER

Marine protected areas modulate habitat suitability of the invasive round goby (*Neogobius melanostomus*) in the Baltic Sea

Mark Holmes[a,*], Jonne Kotta[b], Anders Persson[c], Ullrika Sahlin[d]

[a] *Research Unit in Environmental and Evolutionary Biology, University of Namur, Namur, Belgium*
[b] *University of Tartu, Estonian Marine Institute, Mäealuse 14, 12618, Tallinn, Estonia*
[c] *Department of Biology - Aquatic Ecology, Lund University, 223 62, Lund, Sweden*
[d] *Lund University Centre for Environmental and Climate Research, 223 62, Lund, Sweden*

ARTICLE INFO

Keywords:
Protected areas
Invasive species
Baltic sea
MaxEnt

ABSTRACT

Biological invasions are one of the leading causes of biodiversity loss worldwide. Given that eradication of invasive species is not usually a practical option, conservationists may attempt to limit their impacts through the designation and management of protected areas. Here, we investigate the effect of marine protected areas on the habitat suitability of an invasive species, the round goby (*Neogobius melanostomus*). By modelling its environmental niche space in the Baltic Sea, we demonstrated that gobies prefer shallow, warmer waters, sheltered from significant wave action. They are more likely to be found near areas of intense shipping, this being their primary method of long-distance dispersal. Comparison of the goby's occurrences inside/outside protected areas indicated that suitable habitats within protected areas are more resistant to the round goby's invasion compared to adjacent unprotected areas, however the opposite is true for suboptimal habitats. This has important ecosystem management implications with marine conservation areas providing mitigation measures to control the spread of round goby in its optimal habitats in the Baltic Sea environment. Being subjected to reduced human impacts, native species within protected areas may be more numerous and diverse, helping to resist invasive species incursion.

APPLICATION 3: IMPACT MITIGATION

balticeye.org/en/pollutants/policy-brief-advanced-wastewater-treatment/

ADVANTAGES

Sophisticated, factual and up-to-date...

...but easy-to-use for environmental managers, planners and policy makers.

New data and impact types

Impact matrix

1st Condition | 2nd Condition | 3rd Condition

Multiple coefficients for the same combination of pressures

Nature Value	Human pressure combination	Coefficient	Reference
Habitat - Fucus	dredging, harbours	0.25	Sillamäe sadama aruanne 2018
HD - Mudflats and sandflats	harbours	0.48	Sillamäe sadama aruanne 2018
HD - Mudflats and sandflats	dredging, harbours	0.48	Sillamäe sadama aruanne 2018
HD - Reefs	dredging, harbours	0.25	Sillamäe sadama aruanne 2018

New regions


THANK YOU

Geological records of the past - clue to understanding of the Gulf of Finland environment and climate change

Daria Ryabchuk

A.P.Karpinsky Russian Geological Research Institute (VSEGEI), St. Petersburg, Russia

ВСЕГЕИ

Outline

Introduction. Geology and climate change

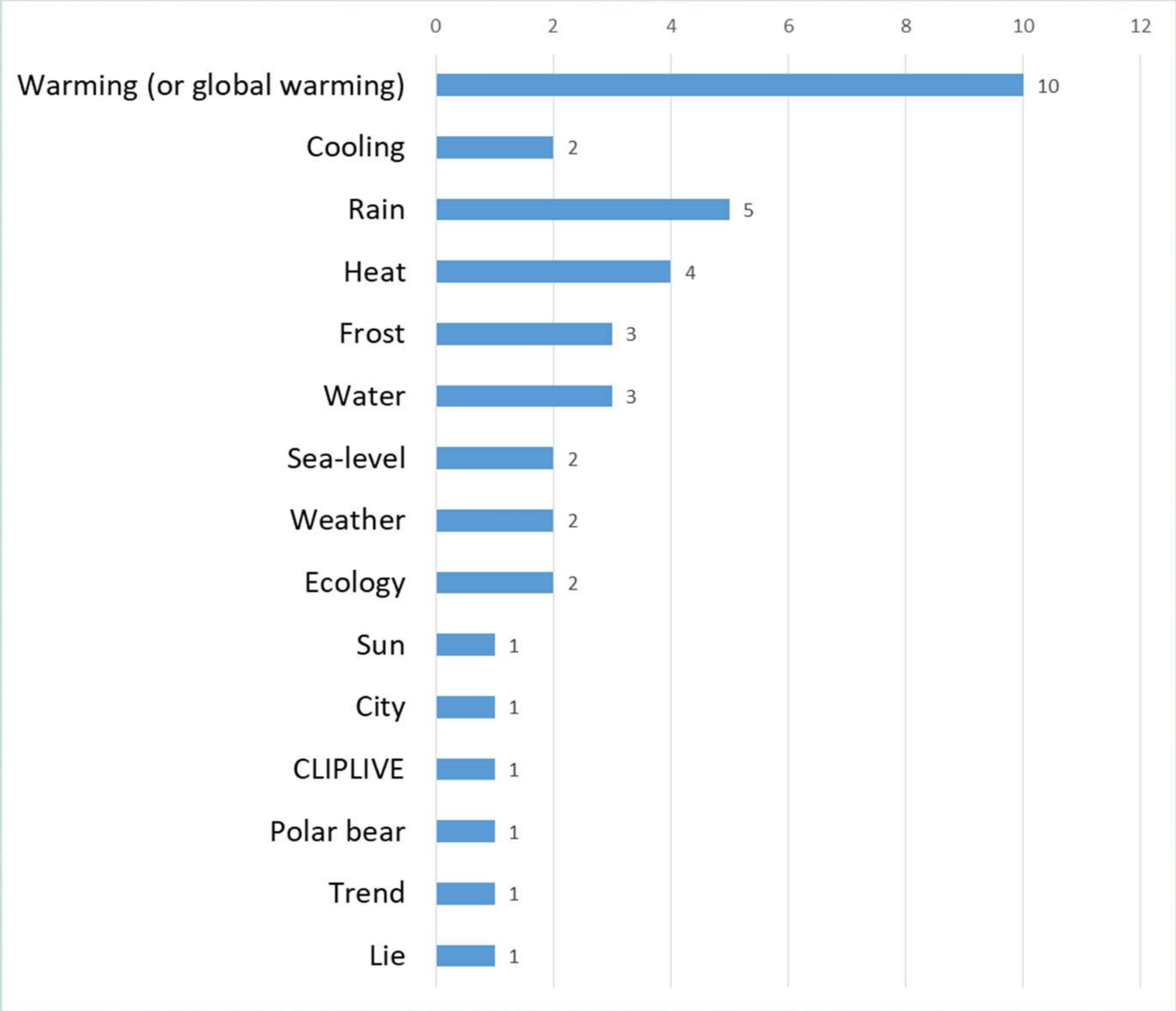
Marine sediment archives – research goals, methods and outcomes

The Baltic Sea – natural laboratory for environment and climate change study

Conclusions and future work

Introduction. Geology and climate change

Climate change .....?



ВСЕГЕИ

Introduction. Geology and climate change

HELCOM
List of parameters in the climate change fact sheet

Primary parameter (effects)
Temperature (air) and heatwaves
Temperature (sea) and heat waves
Large Scale Atmospheric Circulation (e.g airpressure, AMO, NAO)
Sea ice and extreme events
Salinity and saltwater inflows
Stratifica
Changes
Sea leve
Wind an
Solar rad
Precipita
Waves a
Sedimen
Run-off
Riverine

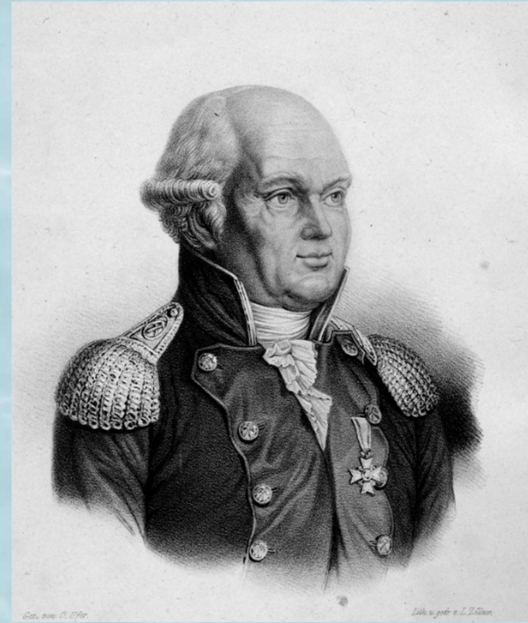
Secondary parameter (impact)
Microbial community and -processes
Pelagic habitat
Benthic habita
Fish
Waterbirds
Marine Mamm
Non Indigenou
Acidification
Oxygen concen
Ecotoxicology
Ecosystem fun

Shipping
Tourism
Built structures (incl. offshore renewable energy constructions and maintenance)
Fisheries
Aquaculture
Nutrient concentrations and eutrophication
Harmful algal blooms (HABs)
Pollution and hazardous substances
Human health
Patogens
Flooding
Erosion and sedimentation
Ecosystem services
Marine Protected Areas (MPA's)
Blue Carbon storage capacity, biological carbon pump etc

ВСЕГЕИ

Introduction. Geology and climate change

"Great Geological Controversy"



Abraham Gottlob Werner

James Hutton

Neptunism is a theory of late 18th century, proposing that rocks formed from the crystallization of minerals in the early Earth's

Plutonism is the geologic theory that the igneous rocks forming the Earth originated from intrusive magmatic activity, with a continuing gradual process of weathering and erosion wearing away rocks, which were then deposited on the sea bed, reformed into layers of sedimentary rock by heat and pressure, and raised again

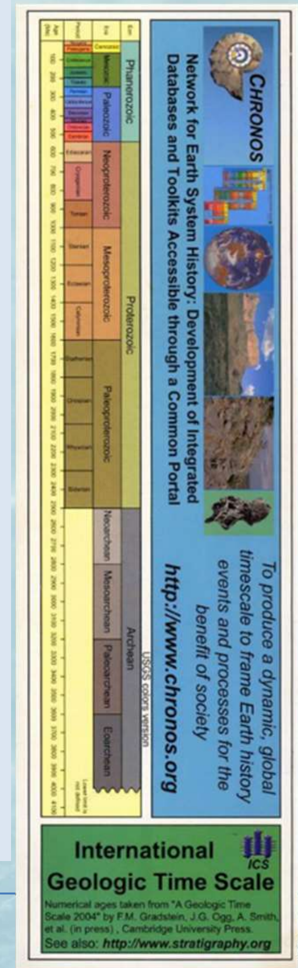
ВСЕГЕИ

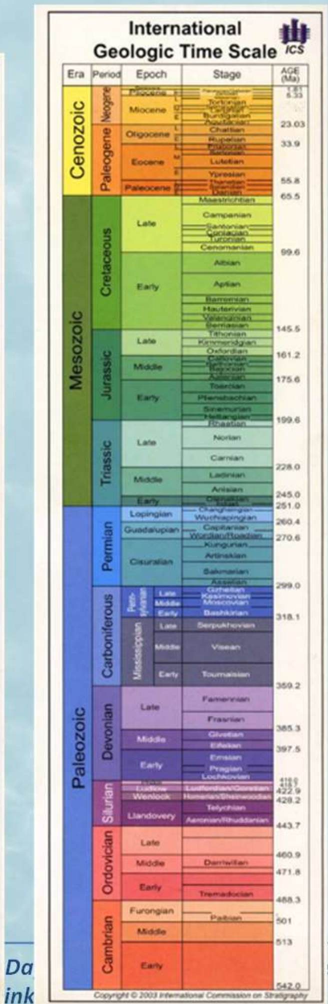
Introduction. Geology and climate change

Geological time
4 billion years of Earth history = 1 year

January 1, 00:00 – formation of Earth,
March 28 – first bacteria,
December 12 – golden age of dinosaurs,
December 26 – dinosaurs' extinction,
December 31, 01:00 – first common ancestor of man and monkey;
December 31, 17:30 – first Australopithecus,
December 31, 23:56 – first Neanderthaler,
December 31, 23:59:56 – Christmas

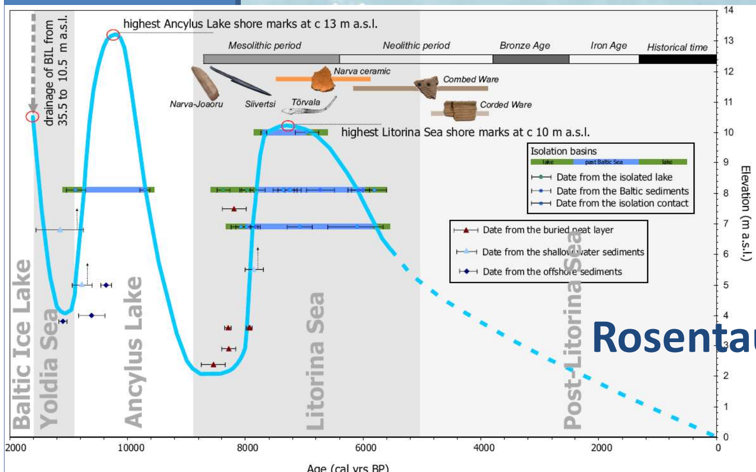
Prof. Sergey Romanovsky, VSEGEI



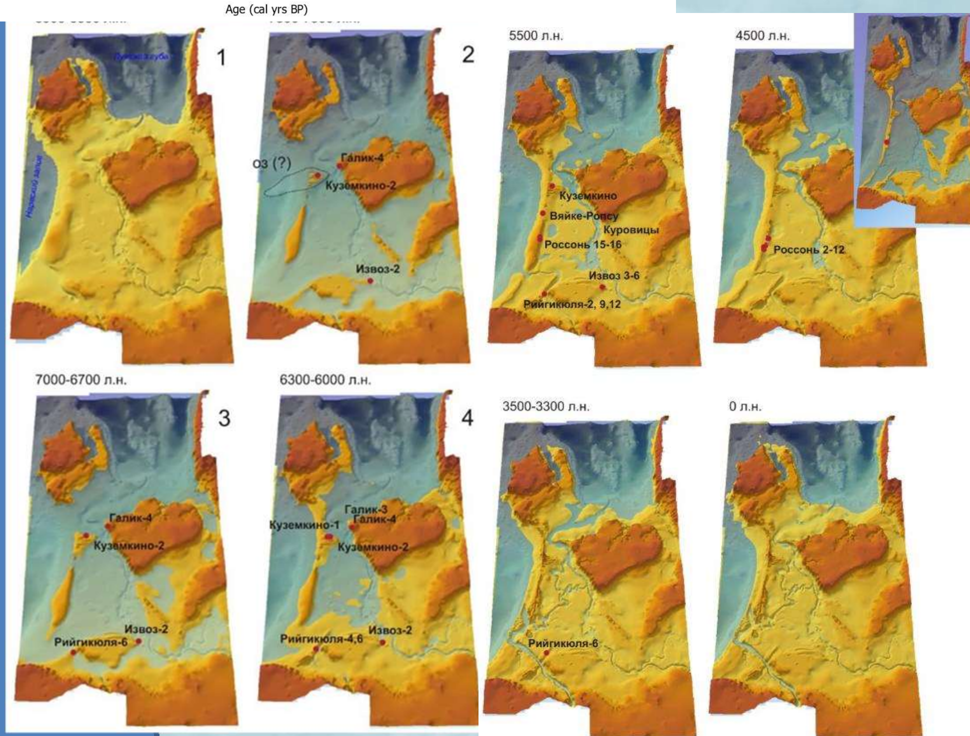


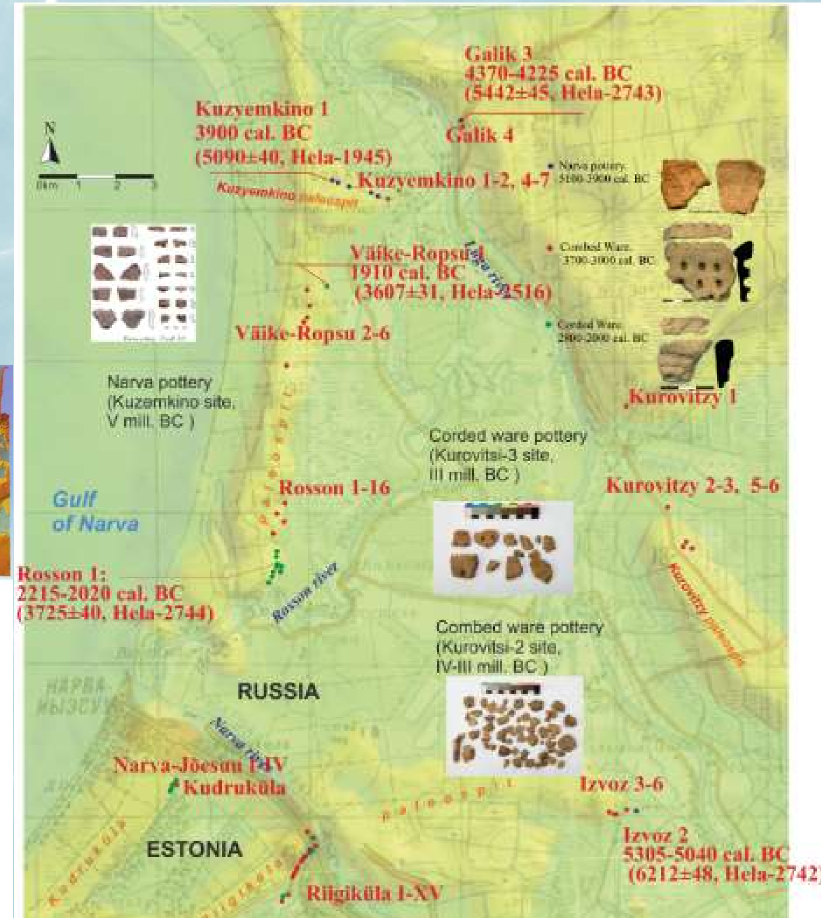
ВСЕГЕИ

Introduction. Geology and climate change



Rosentau et al., 2013

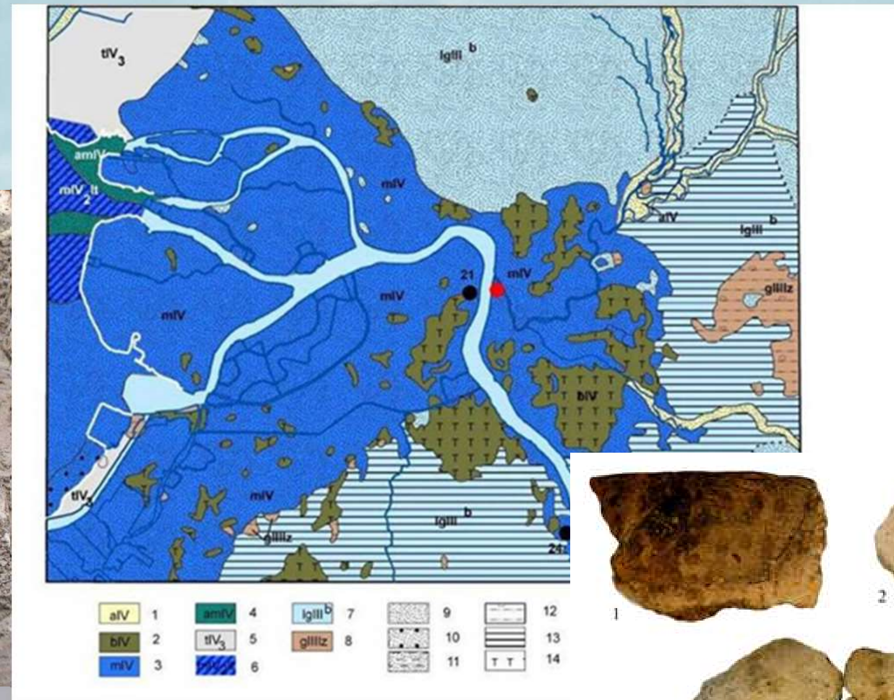


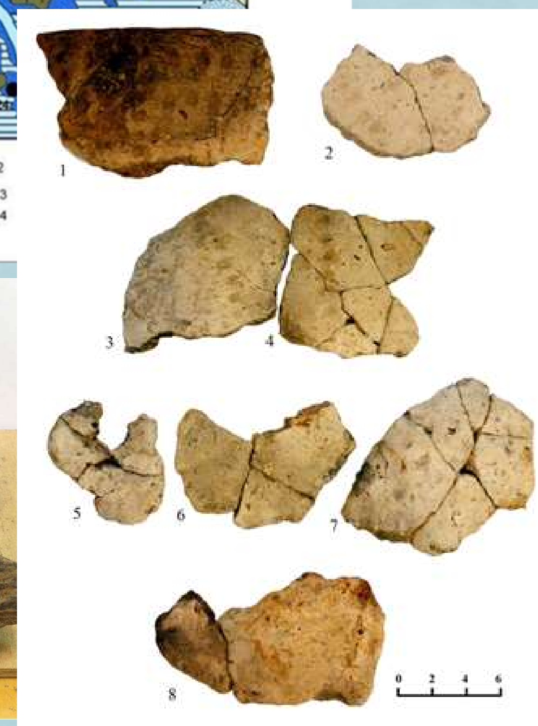


Gerasimov et al., 2013

Introduction. Geology and climate change

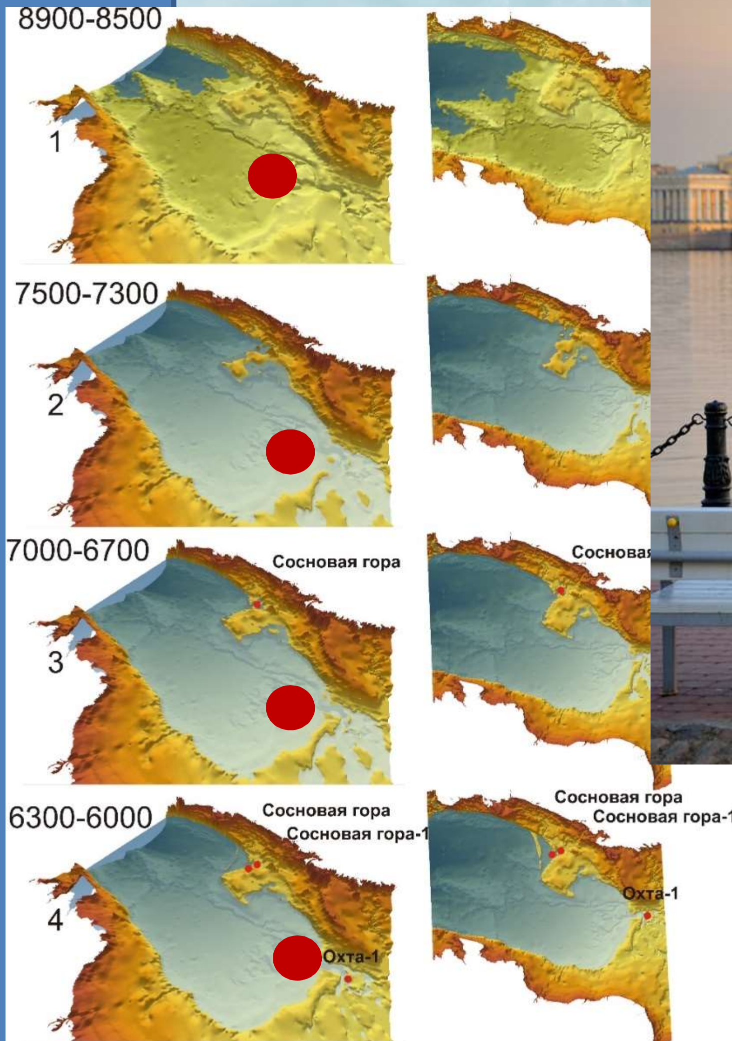
St.Petersburg

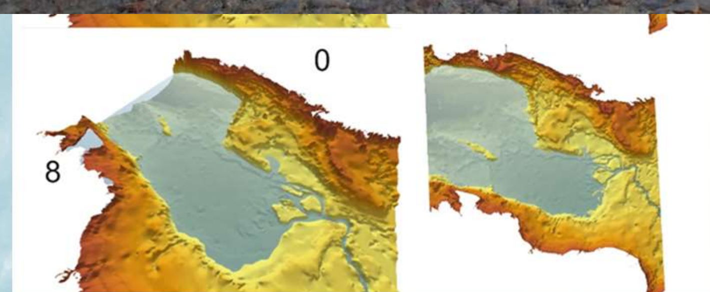




About 12,000 items

Introduction. Geology and climate change





Marine sediment archives – research goals

Palaeoenvironment (e.g. paleoclimate) records

1. Tree-Rings

Record changes in temperature and precipitation, as well as more localized changes such as fire, insect attacks, and earthquakes over last 14, 000 years

2. Ice cores

Provide information on yearly changes in temperature, precipitation, atmospheric composition, volcanic activity, wind patterns, and atmospheric greenhouse gases for last 800, 000 years)

3. Speleothems

(formations that result from deposition of minerals from groundwater) Indicate climate changes (mostly precipitation) over thousands to hundreds of thousands of years

4. Corals

Records past temperature and salinity, impact of short-term climate events such as El Niño and La Niña

https://www2.usgs.gov/landresources/lcs/paleoclimate/archives.asp

Marine sediment archives – research goals

Palaeoenvironment (e.g. paleoclimate) records

Sediments of lakes, sea and ocean (e.g. sedimentary rocks)

Transported by wind, water, ice, and, less commonly, biologic agents. Various proxies for past climate and environment are preserved, such as pollen and plant remains, molecular fossils, algae, charcoal, and planktic and benthic organisms. Provide a means to study past climates throughout most of Earth's history (since 3.9 billion years old)

Ocean

1 cm sample in long cores – 1000 to 10000 years

The Baltic Sea

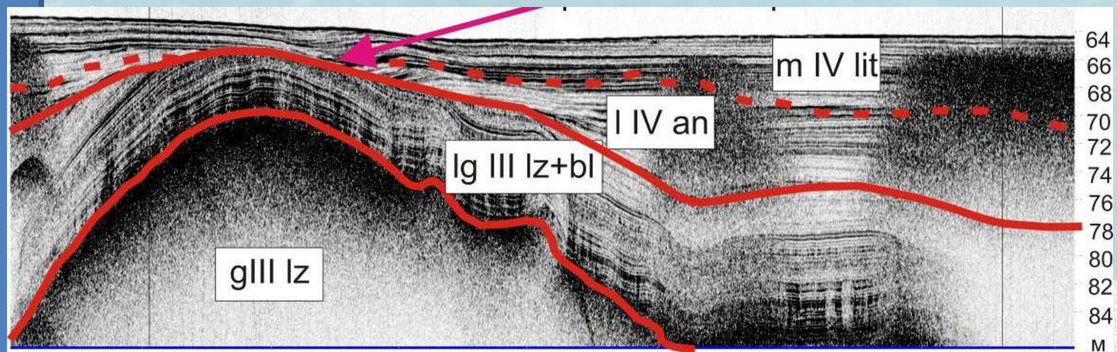
1 cm sample in long cores – about 10-15 years in long cores

1 cm sample in surface sediment – about 1-2 years

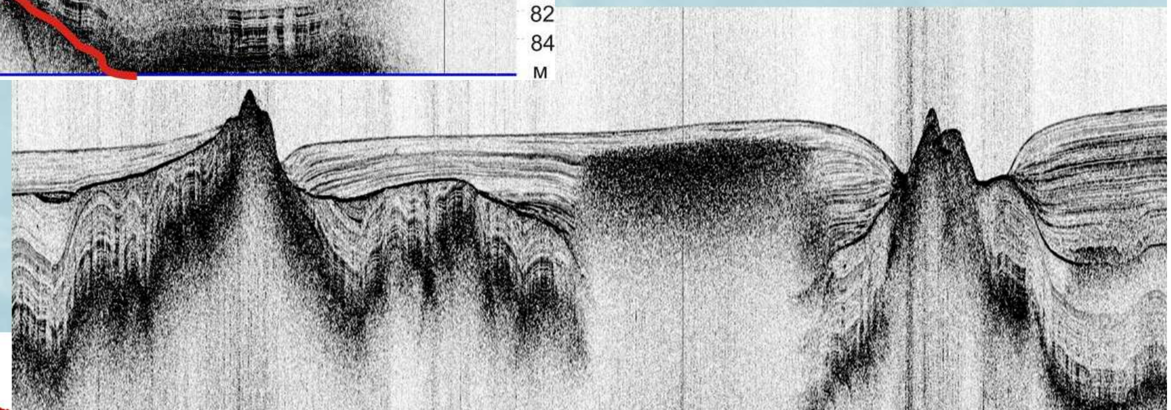
1 cm within technogenic depressions (sand mining) – several months

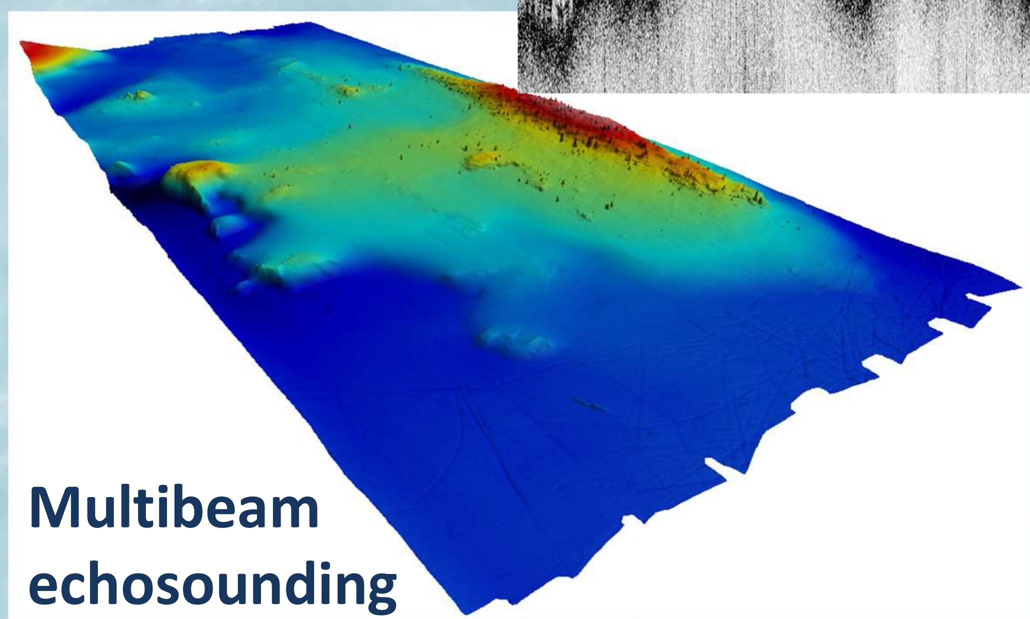
ВСЕГЕИ

Marine sediment archives – methods. Field work

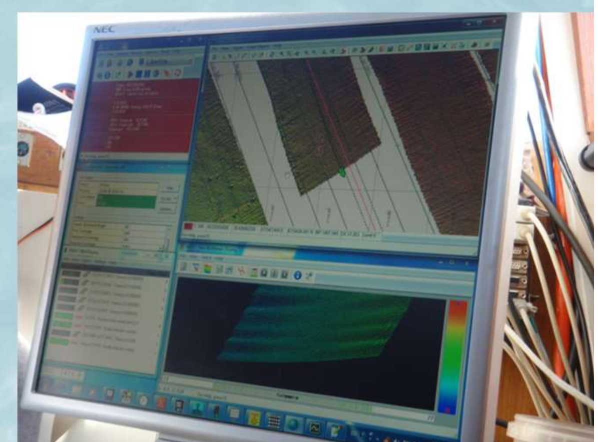


Subbotom (acoustic-seismic) profiling





Multibeam echosounding



Marine sediment archives – methods. Field work

Niemisto corer
Gemini corer
Multicorer

Marine sediment archives – methods. Field work

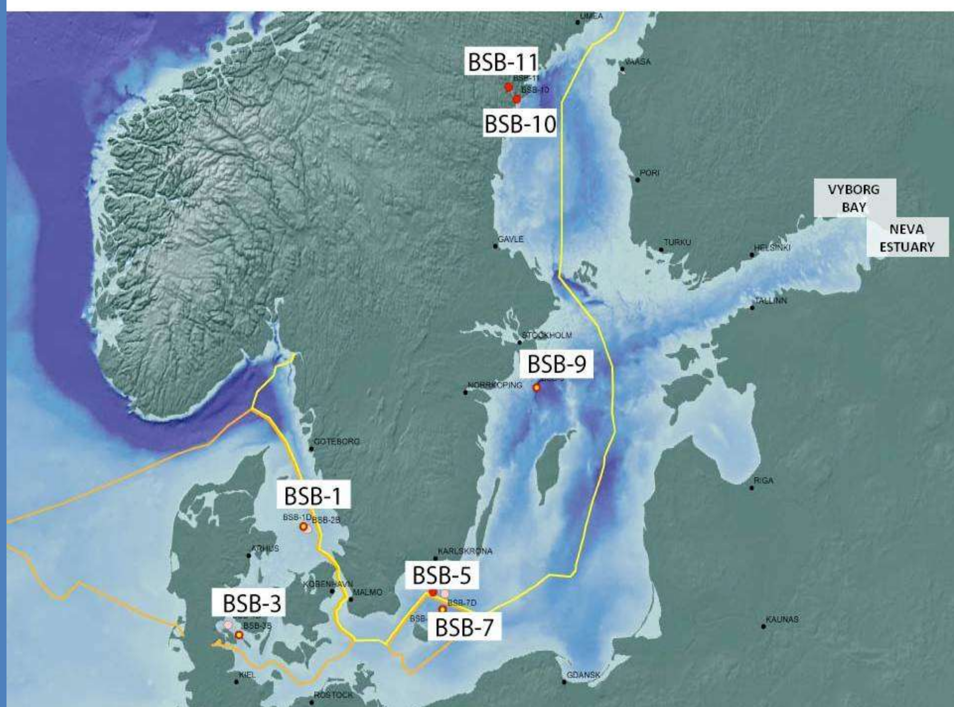
SN-1303 (VSEGEI), 2018

Poseidon (IOW), 2005

Aranda (SYKE, GTK), 2009

ВСЕГЕИ

Marine sediment archives – methods. Field work



IODP Expedition 347: Baltic Sea basin

IODP
INTERNATIONAL OCEAN DISCOVERY PROGRAM

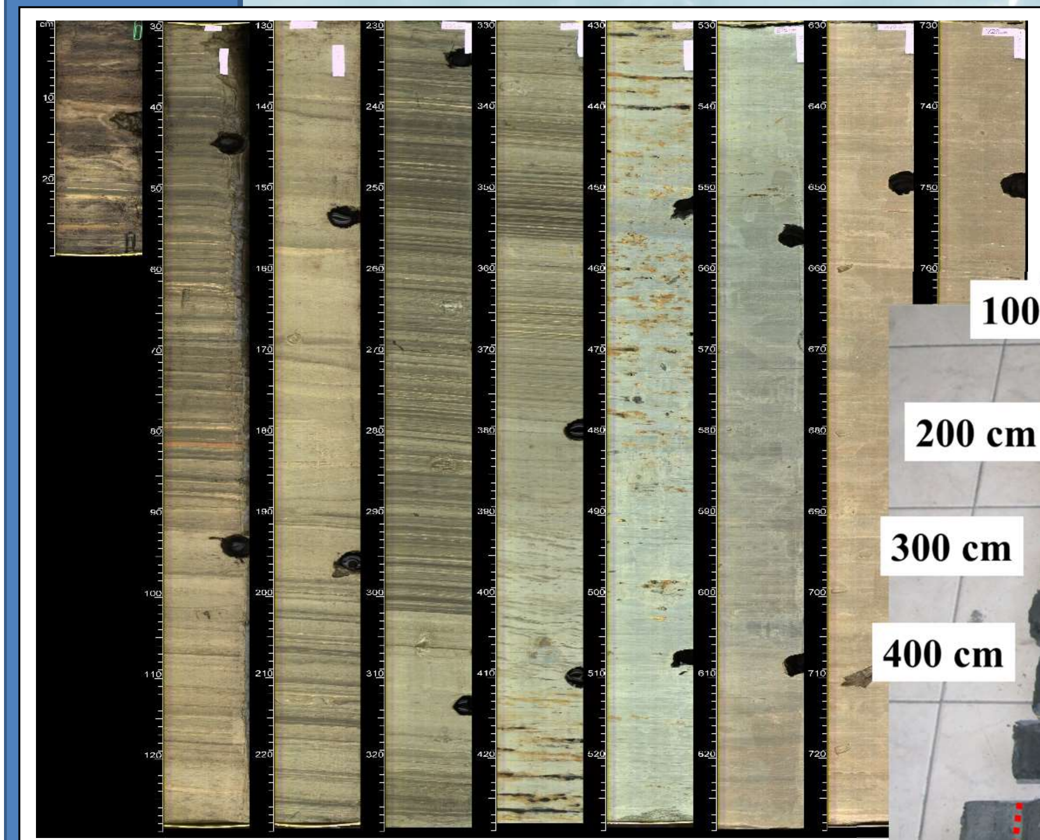
ACADEMY OF FINLAND

ECORD
EUROPEAN CONSORTIUM FOR OCEAN RESEARCH DRILLING

ВСЕГЕИ

Marine sediment archives – methods

Color Scan Gotland Basin Core 211660-5



Core F40
Sampled during „Aranda“ cruise (2009) in frame of BONUS INFLOW project

Courtesy to Jan Harff

Marine sediment archives – research goals, methods and outcomes

On-board measurements and subsampling

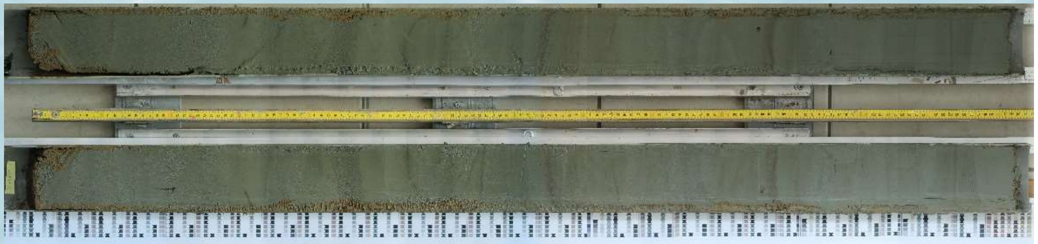
ВСЕГЕИ

Marine sediment archives – research goals, methods and outcomes

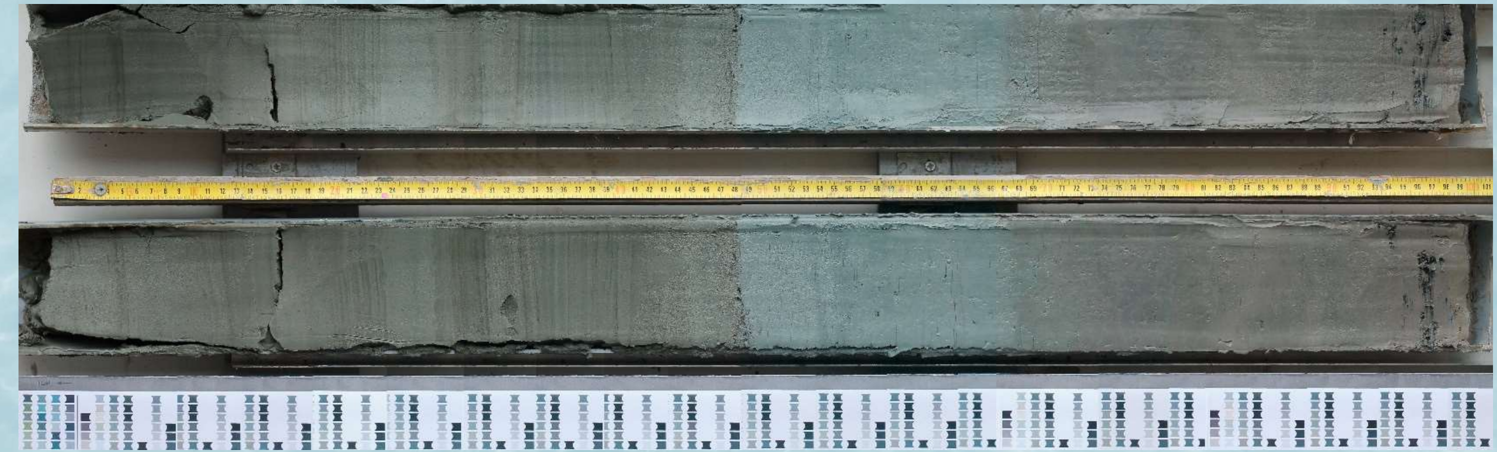
Facies/ sediment fabric and grain-size compositon

Provide information on processes that produce the fine structure (fabric) of muds

- Physical processes
- Chemical processes
- Biogenic disturbance

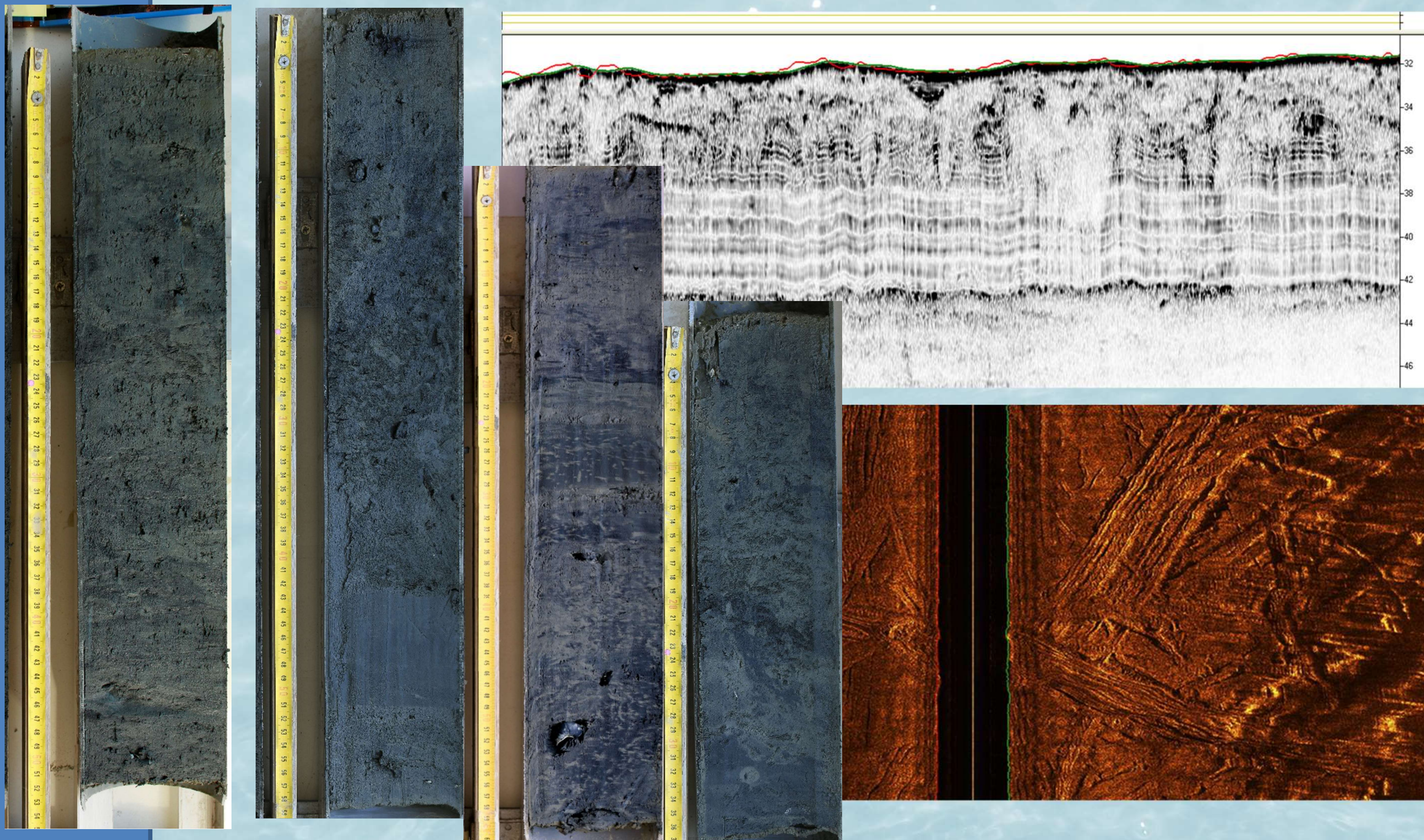


Core 17-COM-1



Core 18-MI-2

Marine sediment archives – research goals, methods and outcomes

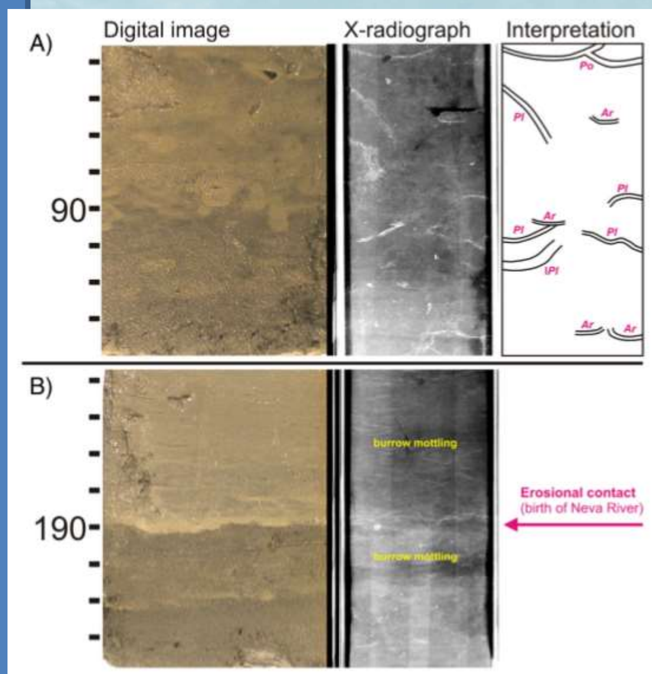


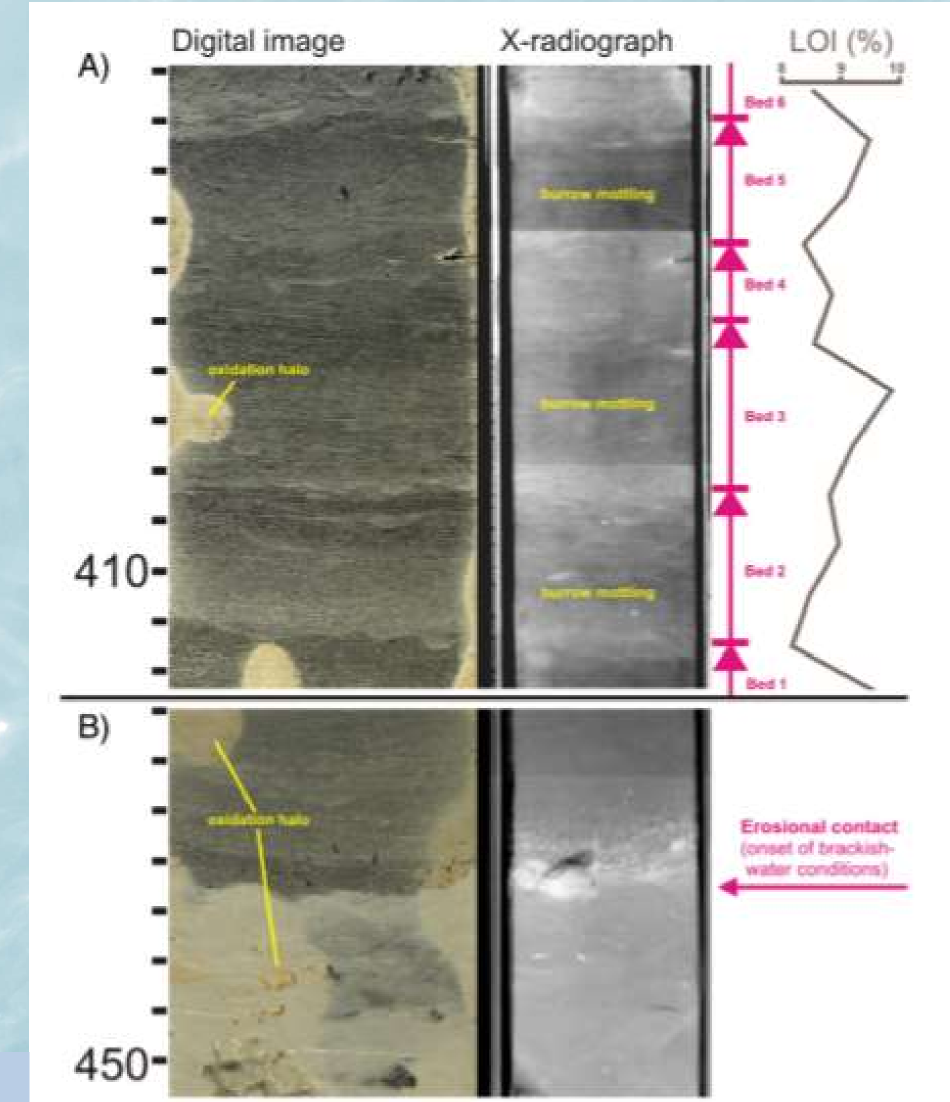
ВСЕГЕИ

Marine sediment archives – methods and outcomes

Facies

- Sharply laminated
- Biodeformed
- Burrow-mottled
- Sedimentation event





Digital images, negative X-radiographs and an interpreted drawing

Virtasalo et al., 2014

Marine sediment archives – methods and outcomes. Geochemistry

Niemisto corer

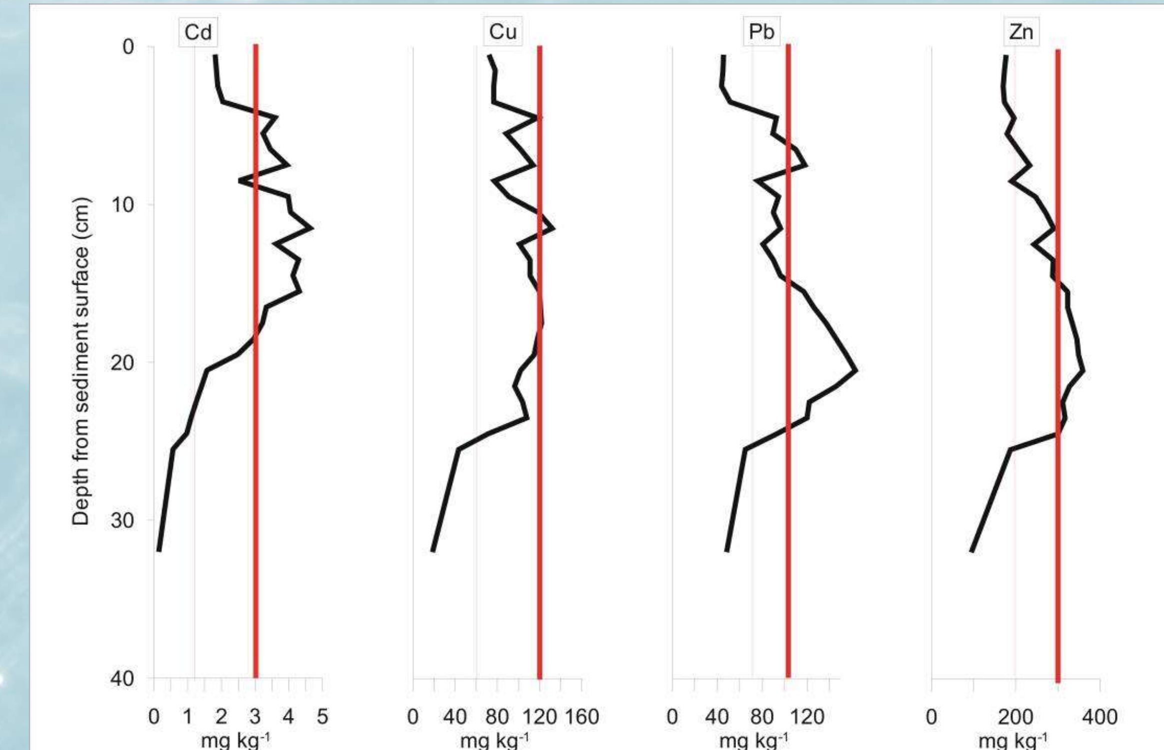
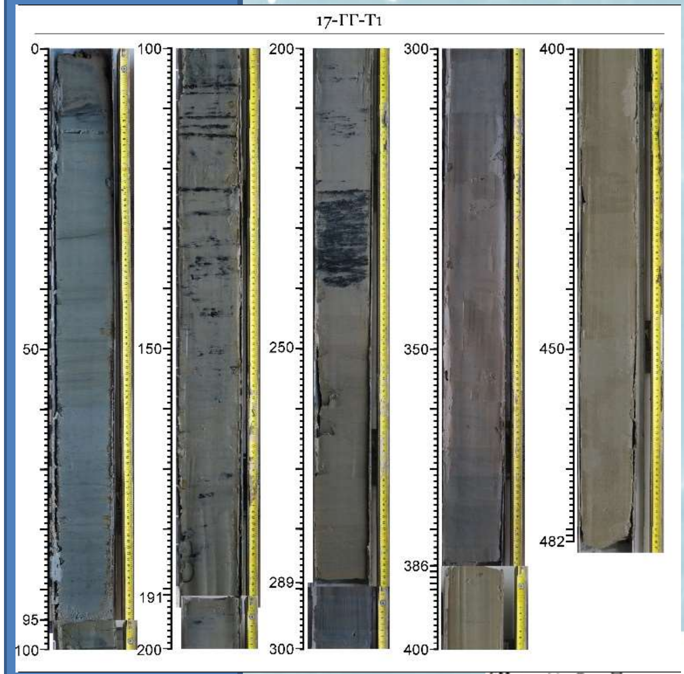


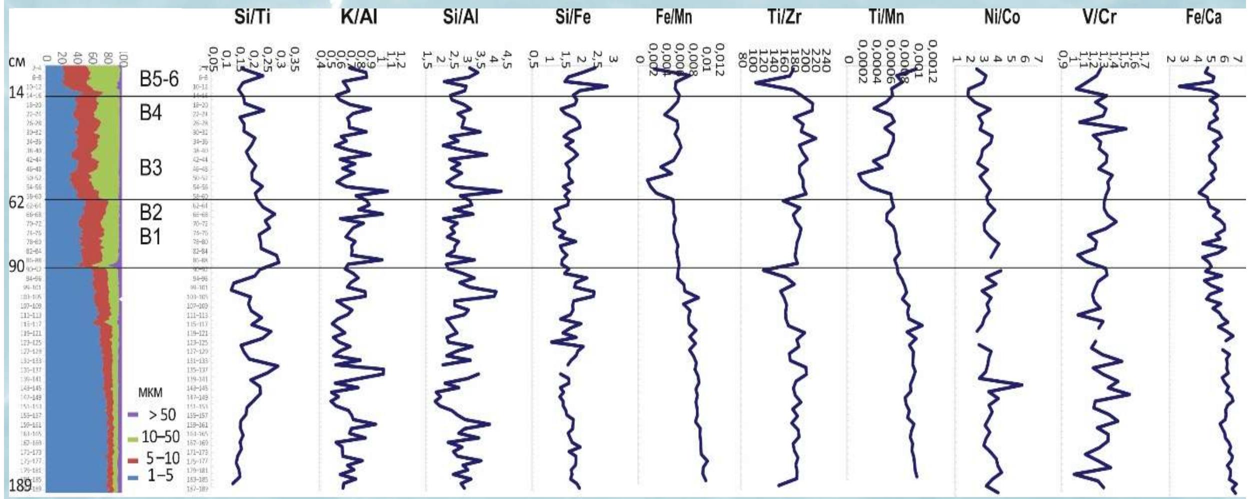
Figure 3. Heavy metal concentrations in vertical profiles of site 05-NG-9. Thin red line represents level of large contamination and thick red line the level of very large contamination (Swedish EPA, Vallius and Leivuori 2003).

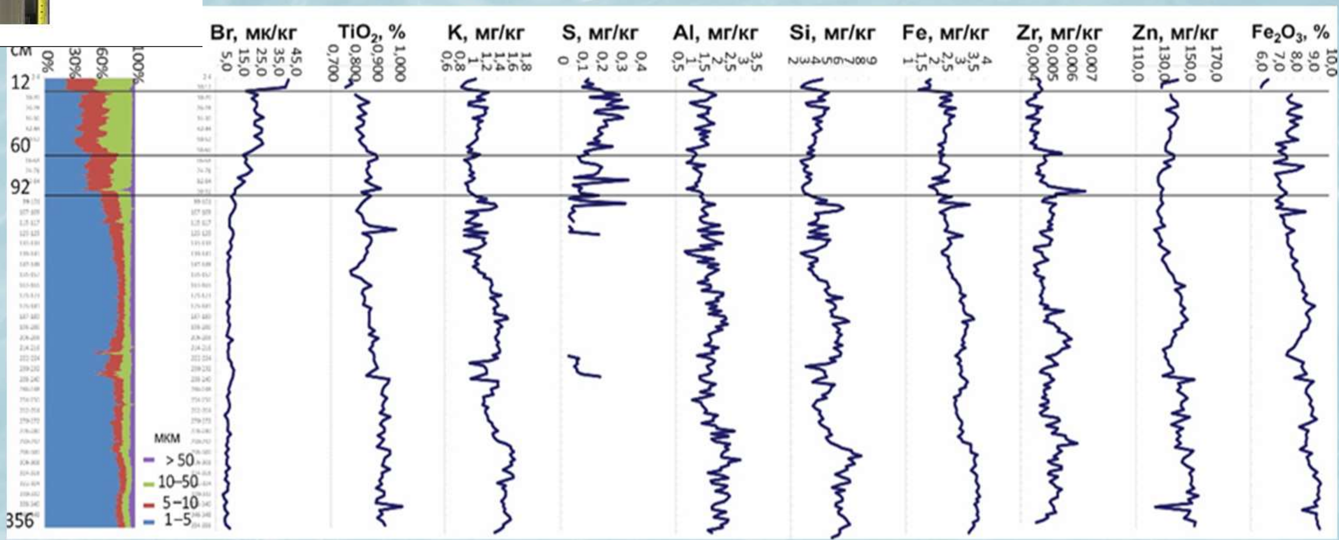
Ryabchuk et al., 2017

ВСЕГЕИ

Marine sediment archives – methods and outcomes. Geochemistry



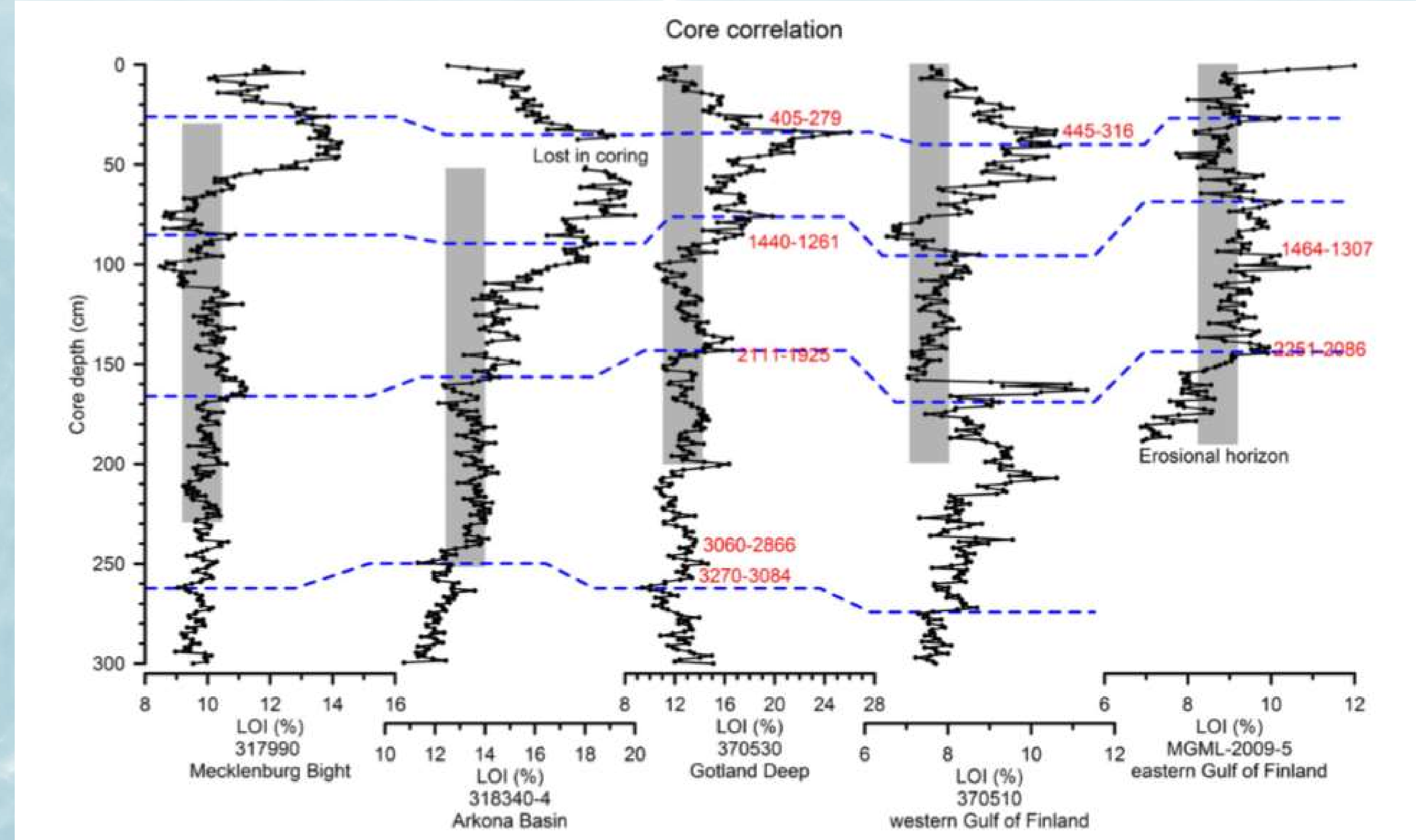




ВСЕГЕИ

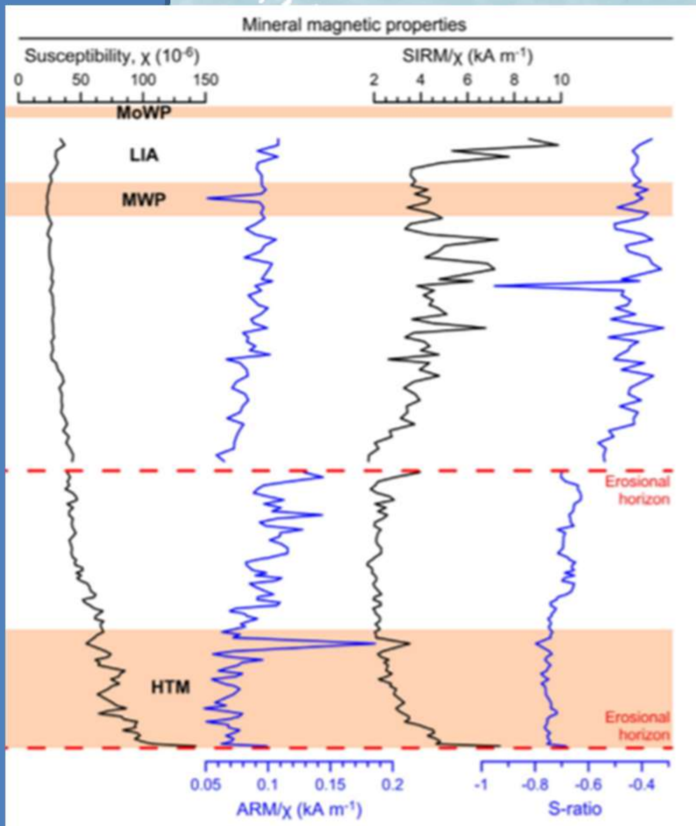
Marine sediment archives – outcomes

The Baltic Sea sediments



Virtasalo et al., 2011

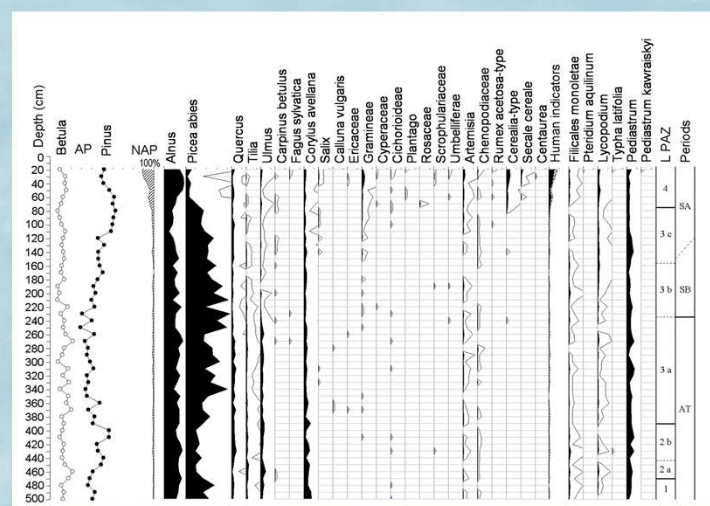
Marine sediment archives – methods and outcomes.

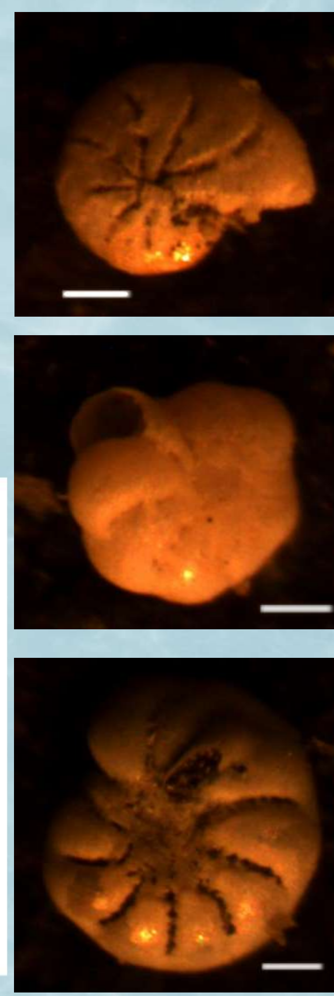


Marnetic mineral properties

TEX$_{86}$-paleothermometery (SST)

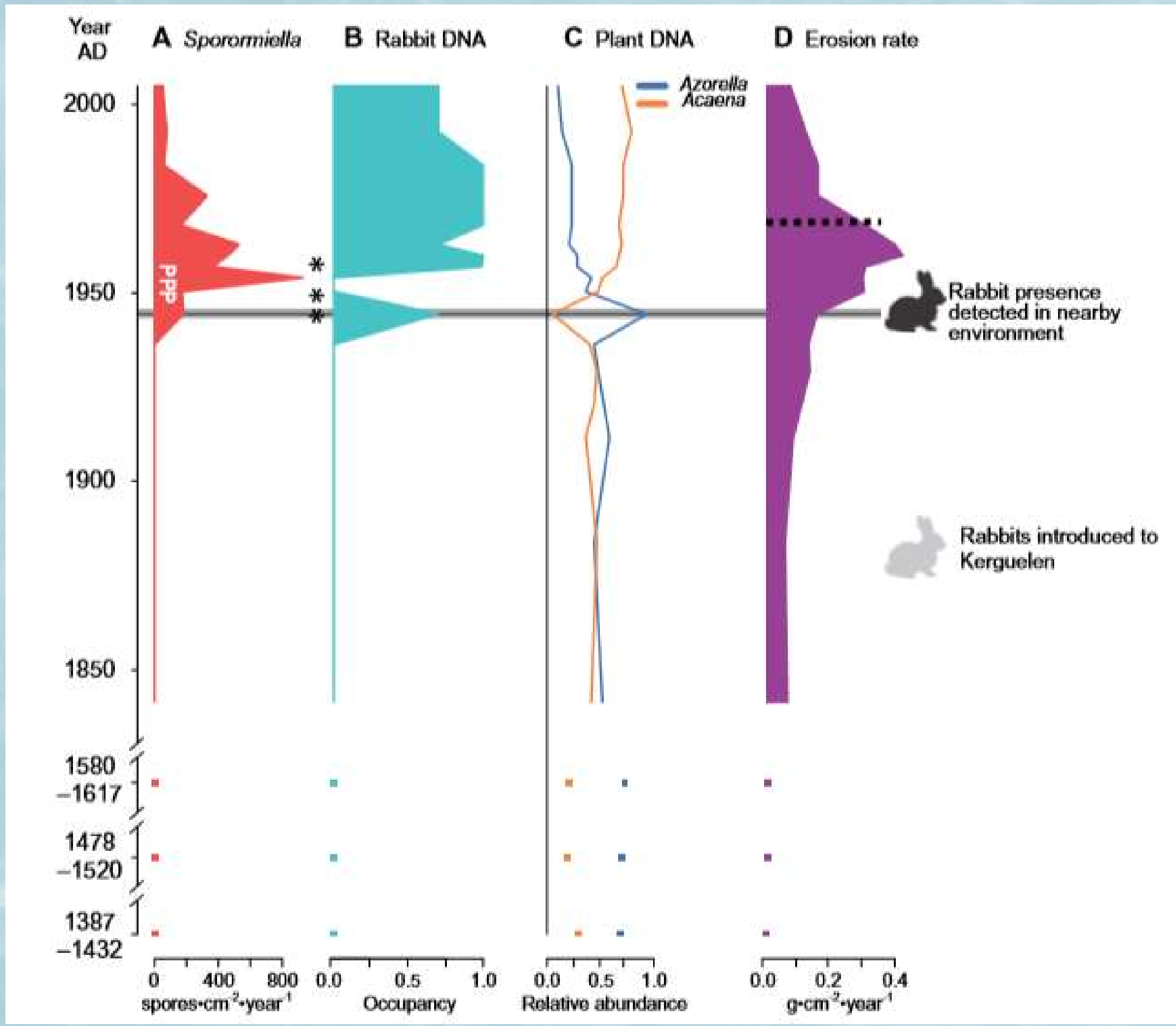
Pollen analyses
Diatoms
Foraminifera
Isotopic analyses





Core 14-3T (Litorina Sea)

Marine sediment archives – research goals, methods and outcomes



G.F. Ficetola et al., 2018
DNA from lake sediments reveals long-term ecosystem changes after a biological invasion

Temporal variation of biological and sedimentological proxies

Marine sediment archives – methods and outcomes

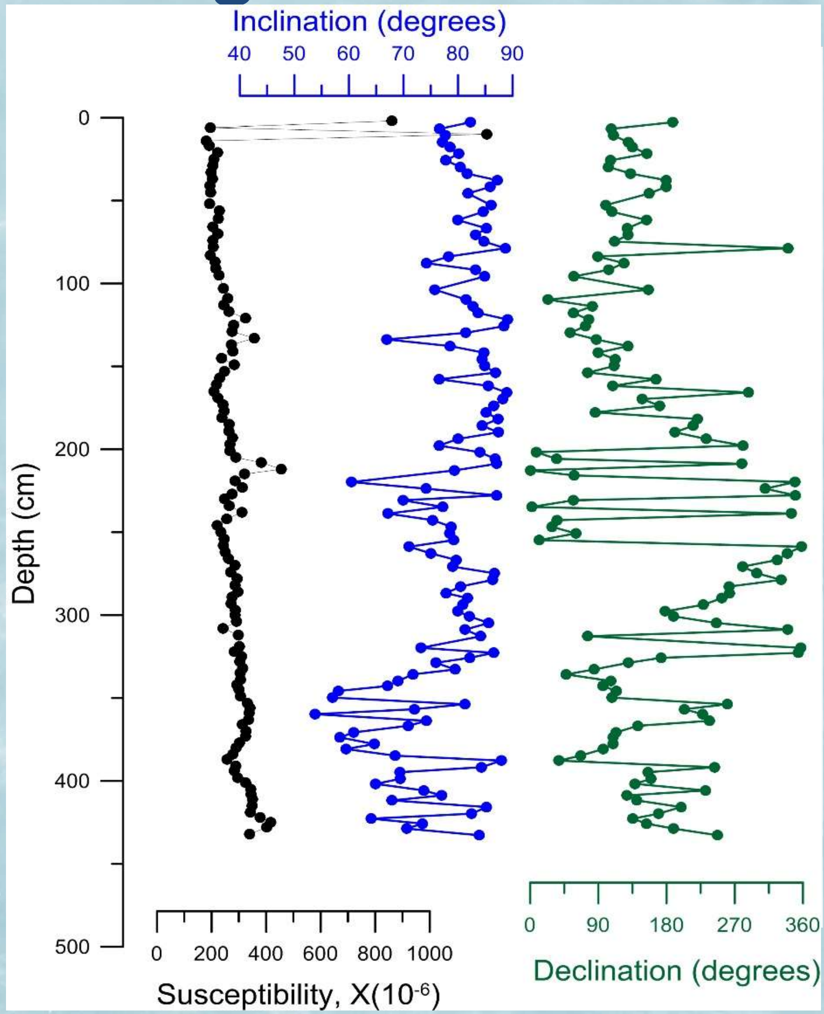
Chronostratigraphy - Dating

Surface sediments

- ^{210}Pb
- ^{137}Cs
- AMS ^{14}C

Long sediment cores

- AMS ^{14}C
- Palaeomagnetic
- OSL

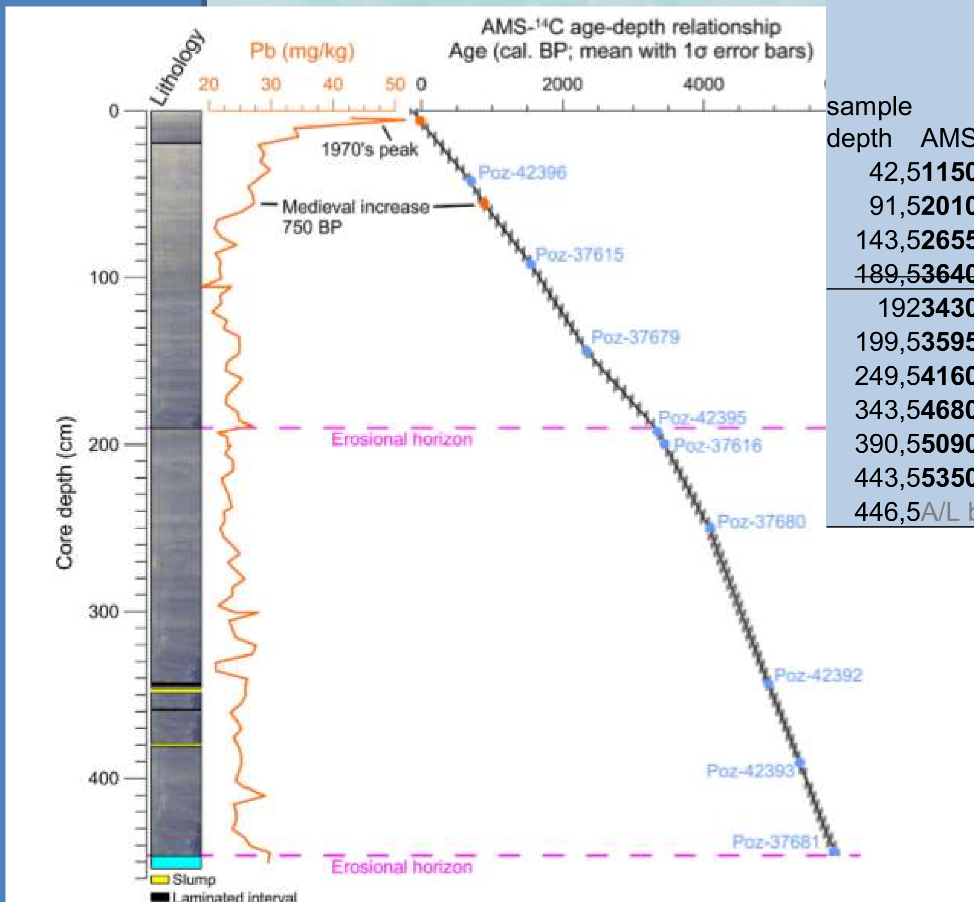


Kotilinen et al., unpublished results of CISU project

ВСЕГЕИ

Marine sediment archives – methods and outcomes

Chronostratigraphy - Dating



sample depth	AMS-14C age	calibrated mean age	mean difference from averge 14C age	calibrated older limit	calibrated younger limit	linear sedimentatio rate (mm/a)	reservoir effect
42,5	**1150 ± 30 BP**	615	95	710	520	0,691	100 +- 50
91,5	**2010 ± 30 BP**	1457,5	139,5	1597	1318	0,628	100 +- 50
143,5	**2655 ± 30 BP**	2203,5	141,5	2345	2062	0,651	100 +- 50
~~189,5~~	~~**3640 ± 35 BP**~~	~~3440~~	~~150~~	~~3590~~	~~3290~~	~~0,551~~	100 +- 50
192	**3430 ± 35 BP**	3171,5	170,5	3342	3001	0,605	100 +- 50
199,5	**3595 ± 35 BP**	3387	154	3541	3233	0,589	100 +- 50
249,5	**4160 ± 35 BP**	4092,5	189,5	4282	3903	0,610	100 +- 50
343,5	**4680 ± 35 BP**	4775,5	178,5	4954	4597	0,719	100 +- 50
390,5	**5090 ± 50 BP**	5333,5	207,5	5541	5126	0,732	100 +- 50
443,5	**5350 ± 35 BP**	5604,5	139,5	5744	5465	0,791	100 +- 50
446,5	A/L boundary						

Age constraints for the core MGML-2009-5.

Name	Core depth (cm)	AMS-^{14}C age BP (before 1950)	Age uncertainty (± 1σ)
Pb peaks			
1970s	5.5	−20[a]	10
Medieval	55.0	750[a]	100
AMS-^{14}C dates			
Poz-42396	42.5	1150	30
Poz-37615[b]	91.5	2010	30
Poz-37679[b]	143.5	2655	30
Poz-42395	192.0	3430	35
Poz-37616	199.5	3595	35
Poz-37680	249.5	4160	35
Poz-42392	343.5	4680	35
Poz-42393	390.5	5090	50
Poz-37681	443.5	5350	35

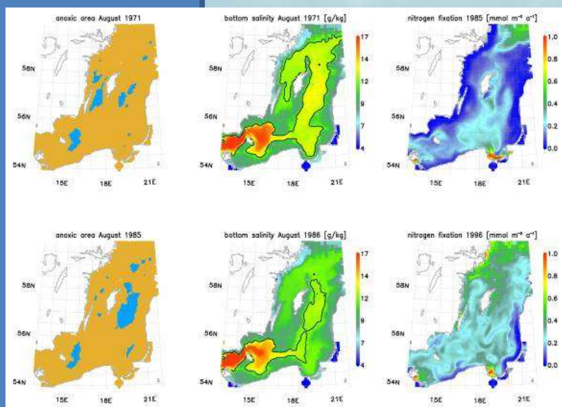
[a] From Renberg et al. (2002) and Zillén et al. (2012).
[b] From Virtasalo et al. (2011b).

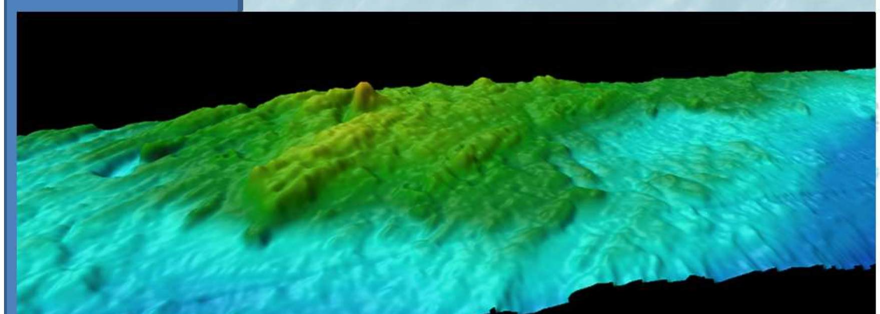
Virtasalo et al., 2014

ВСЕГЕИ

Holocene saline water inflow changes into the Baltic Sea, ecosystem responses and future scenarios

INFLOW project





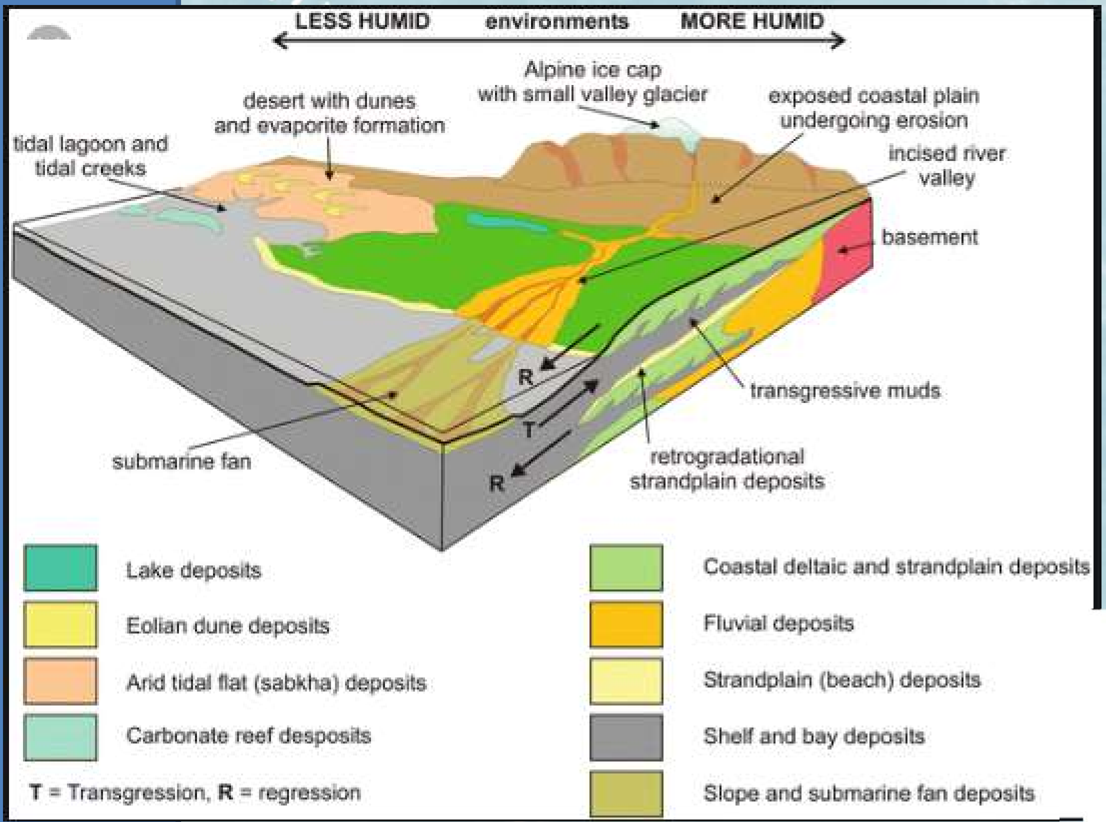
Work Area	Proxy methods: surface water conditions	Proxy methods: deep water conditions	Dating method
A (western Baltic)	diatom (TF)	foraminifera (stable isotopes/trace elements), Sr-isotopes, grain size	$^{210}Pb/^{137}Cs$; AMS^{14}C (calcareous fossils)
	* Geochemical: TOC/N/S, XRF, Phosphorous, biogenic opal		
B (central Baltic)	diatoms and dinoflagellates (TF), $\delta^{13}C$, *Sea-ice cover:* diatoms, IP-25	benthic diatoms, Sr-isotopes, grain size, DNA on foraminifera test linings, trace fossils	$^{210}Pb/^{137}Cs$, OSL, paleomagnetic, AMS^{14}C (calcareous fossils, "soil approach" on bulk material, test linings)
	* Geochemical: TOC/N/S, XRF, Phosphorous, Ca/Mn, biogenic opal		
C (northern Baltic)	diatoms and dinoflagellates (TF), $\delta^{13}C$, *Sea-ice cover:* diatoms, IP-25	benthic diatoms, grain size, trace fossils, Sr-isotope	$^{210}Pb/^{137}Cs$, OSL, paleomagnetic, AMS^{14}C ("soil approach" on bulk material)
	* Geochemical: TOC/N/S, XRF, Phosphorous, Ca/Mn, biogenic opal		

Kotilainen, 2010

BONUS
Baltic Organisations Network for Funding Science EEIG

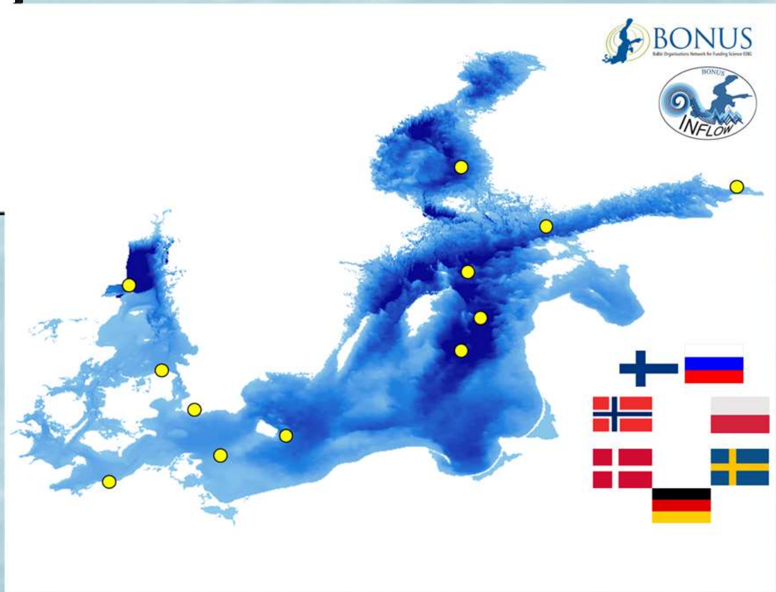
ВСЕГЕИ

Marine sediment archives – outcomes

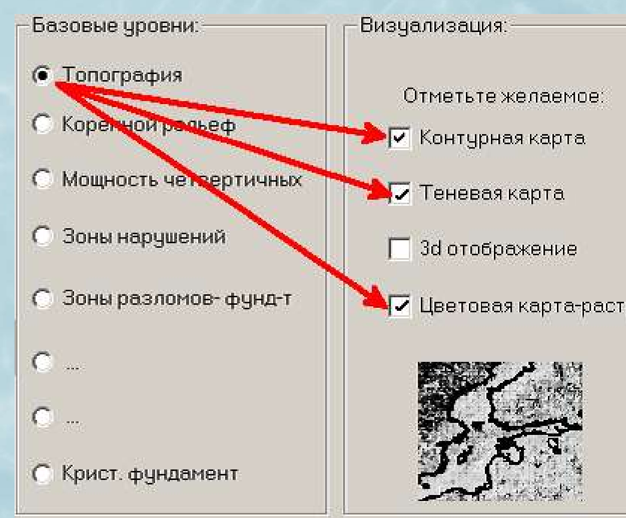


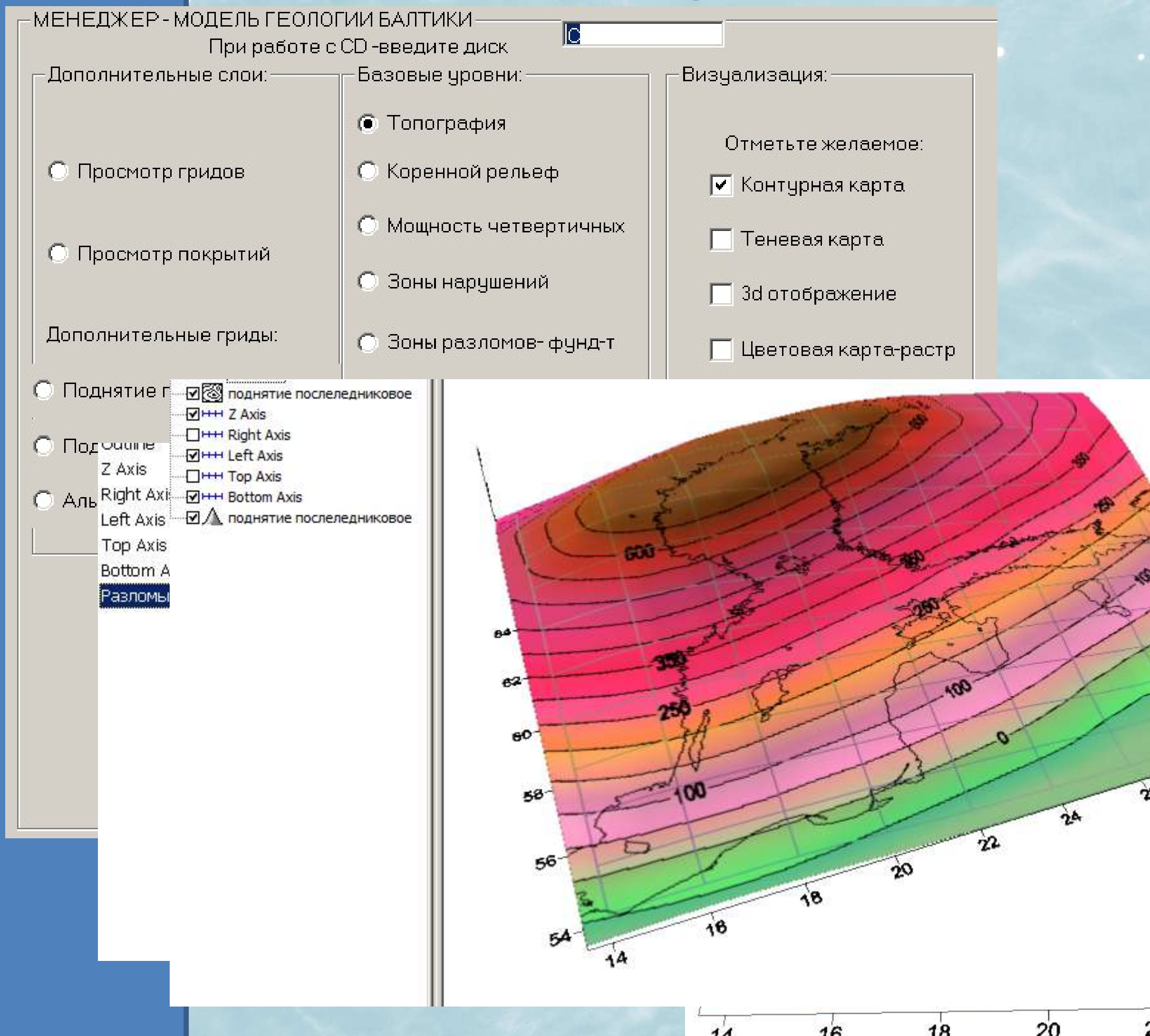
Andrew D. Miall, 2017

Sedimentation is a very complicated process depended on regional geological, tectonic features and climate parameters, but also by local reaction of basin on tectonic movements and climate change



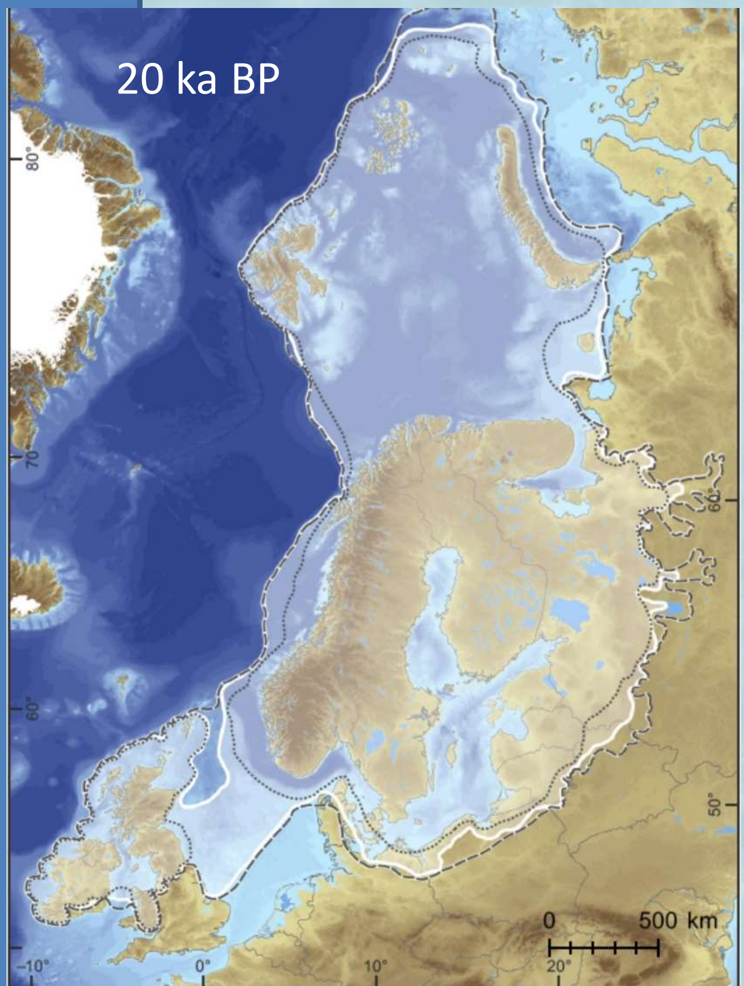
Modeling – combining of tectonics and climate change

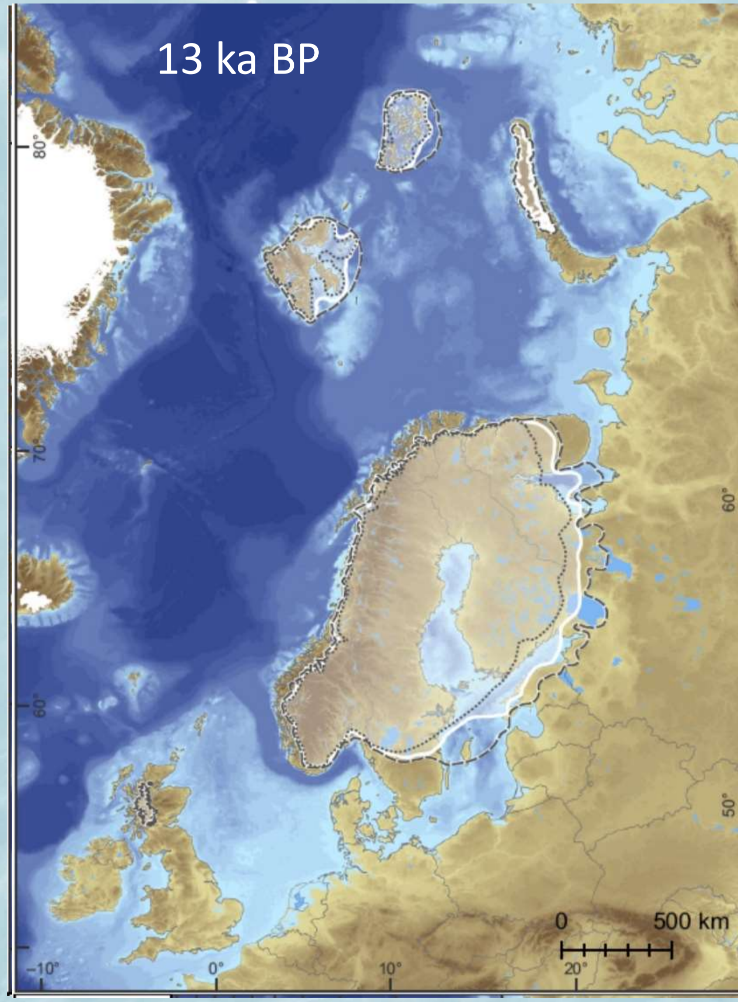




Amantov, Amantova, 2008

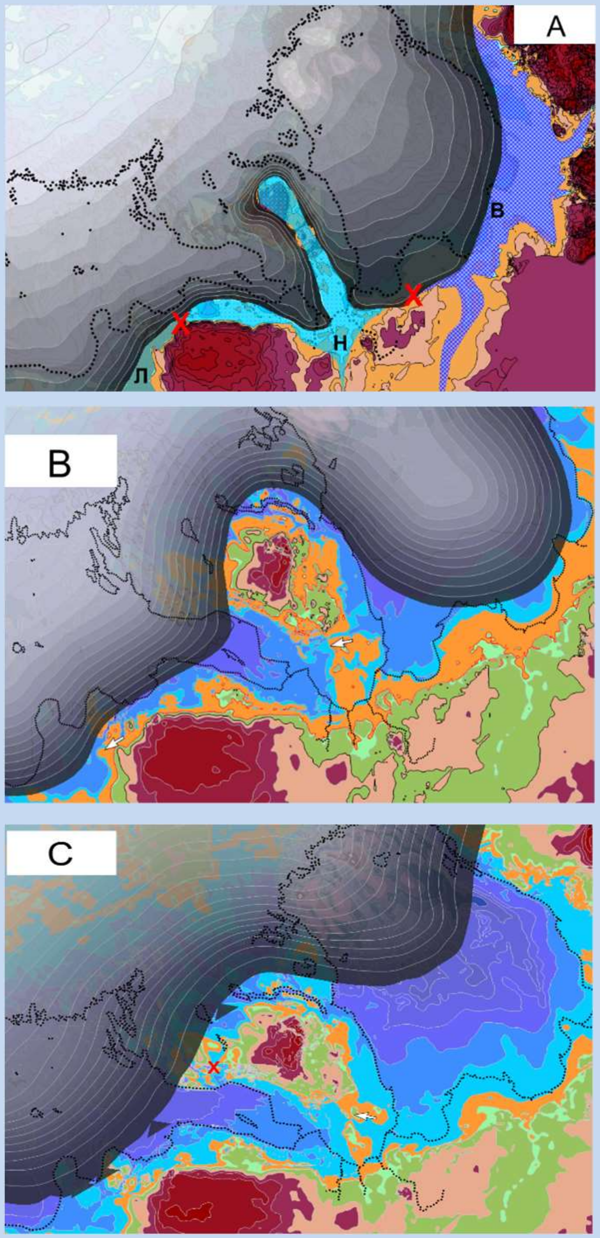
The Baltic Sea – natural laboratory for environment and climate change study





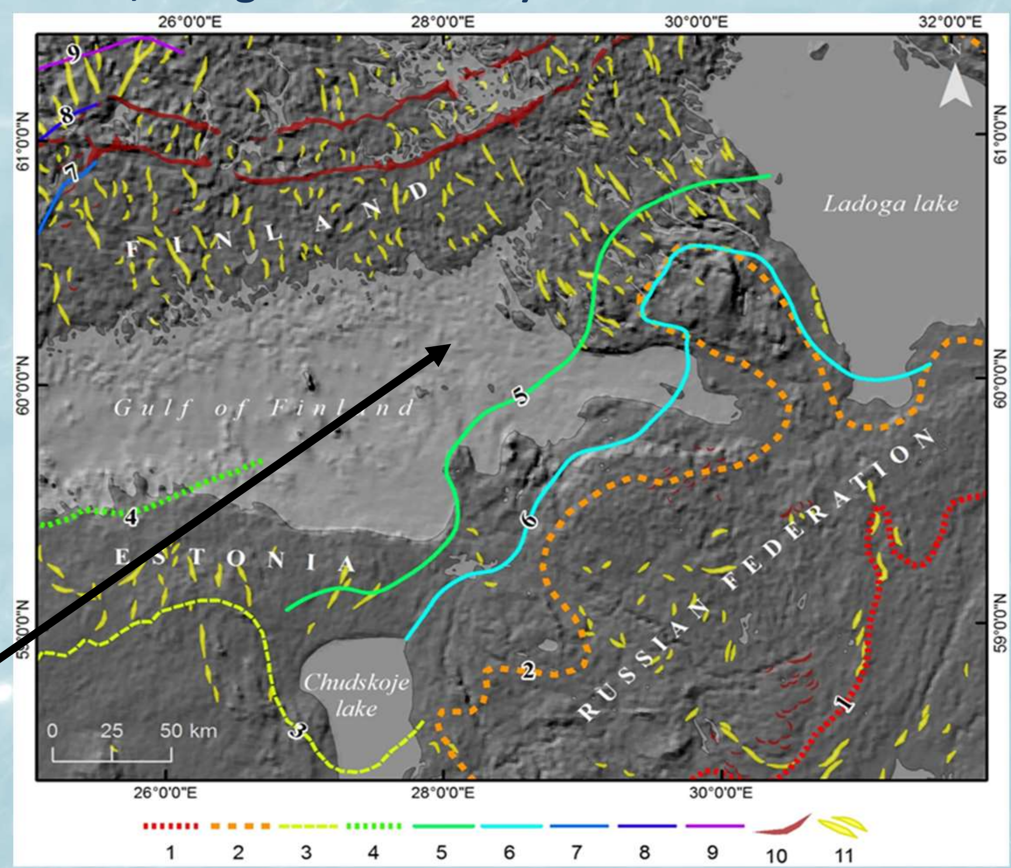
Hughes et al., 2015

ВСЕГЕИ



Amantov, Amantova, 2017

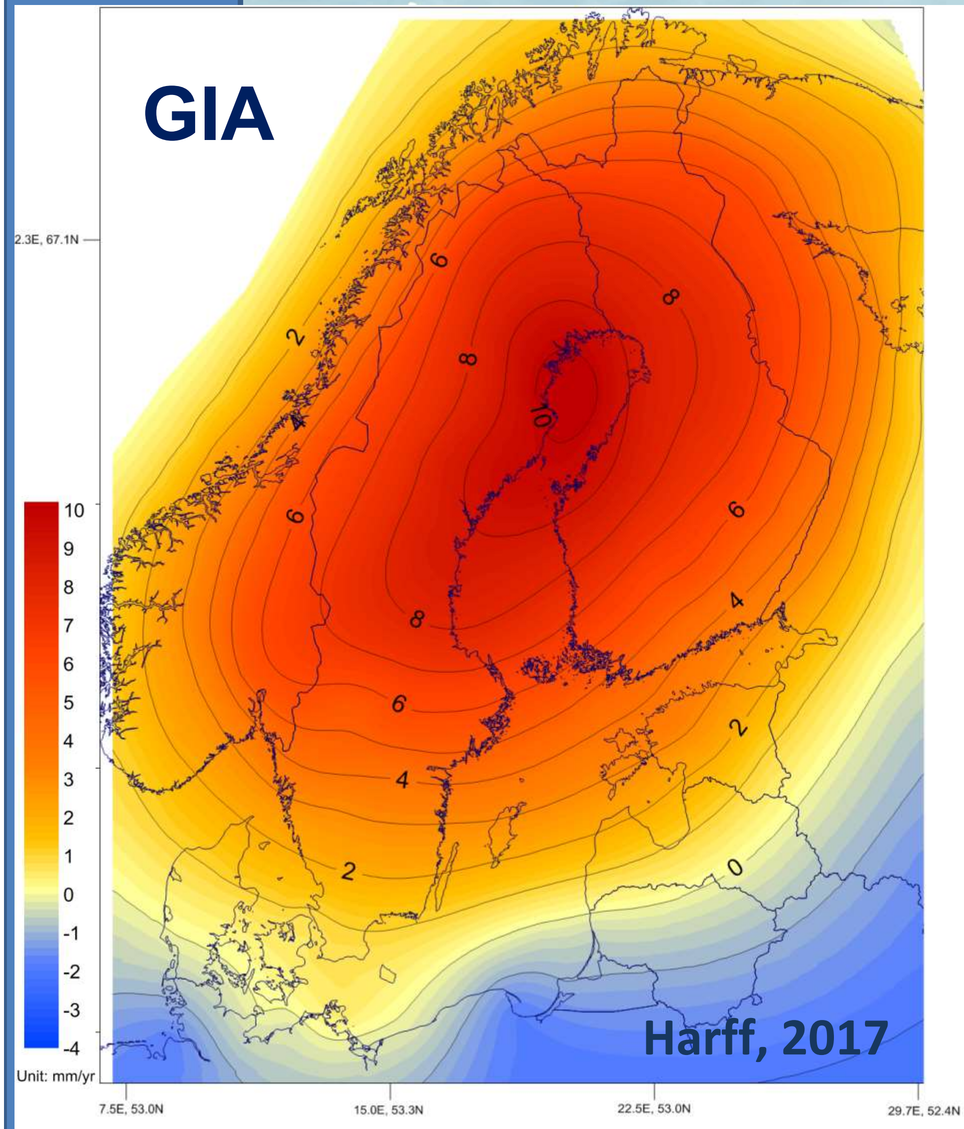
Salpausselkä I (12.25-11.5 ka BP (Saarnisto & Saarinen 2001; Hang 2003; Kalm 2006; Subetto 2009; Hang & Kohv 2013)

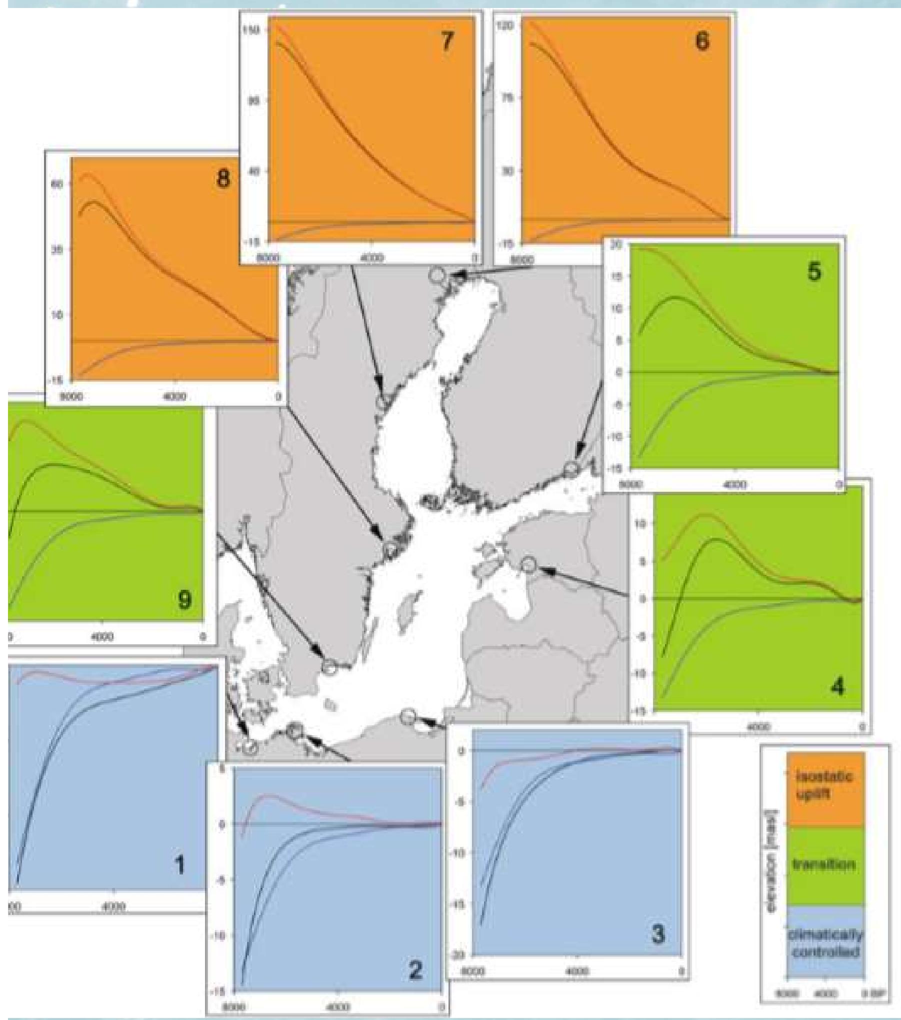


13.3-13.5 ka BP (Vassiljev et al., 2013) or 12.7 ka BP (Vassiljev et al., 2011)

14.5 ka BP or 13.8-13.3 ka BP (Kalm 2006; Vassiljev et al., 2011Vassiljev et al., 2013)

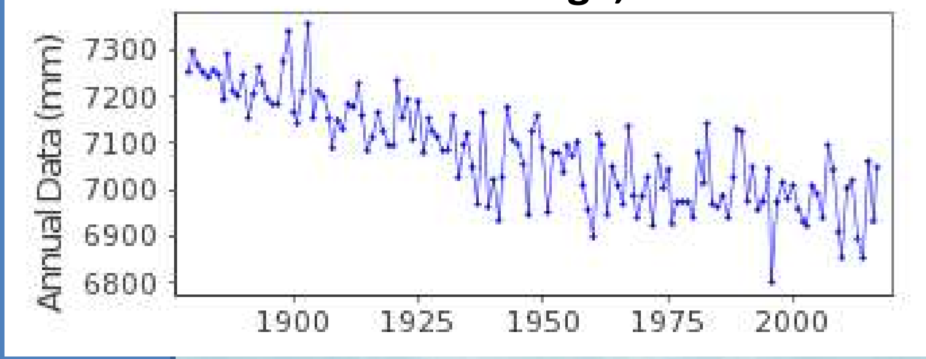
The Baltic Sea – natural laboratory for environment and climate change study

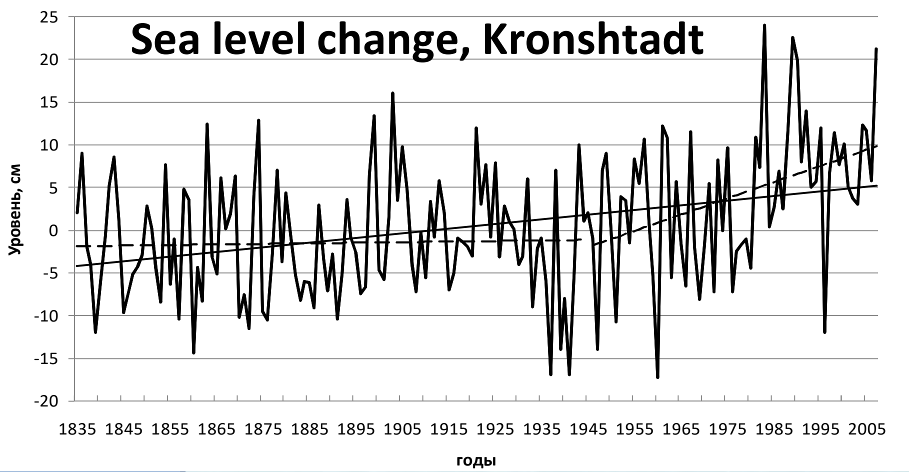


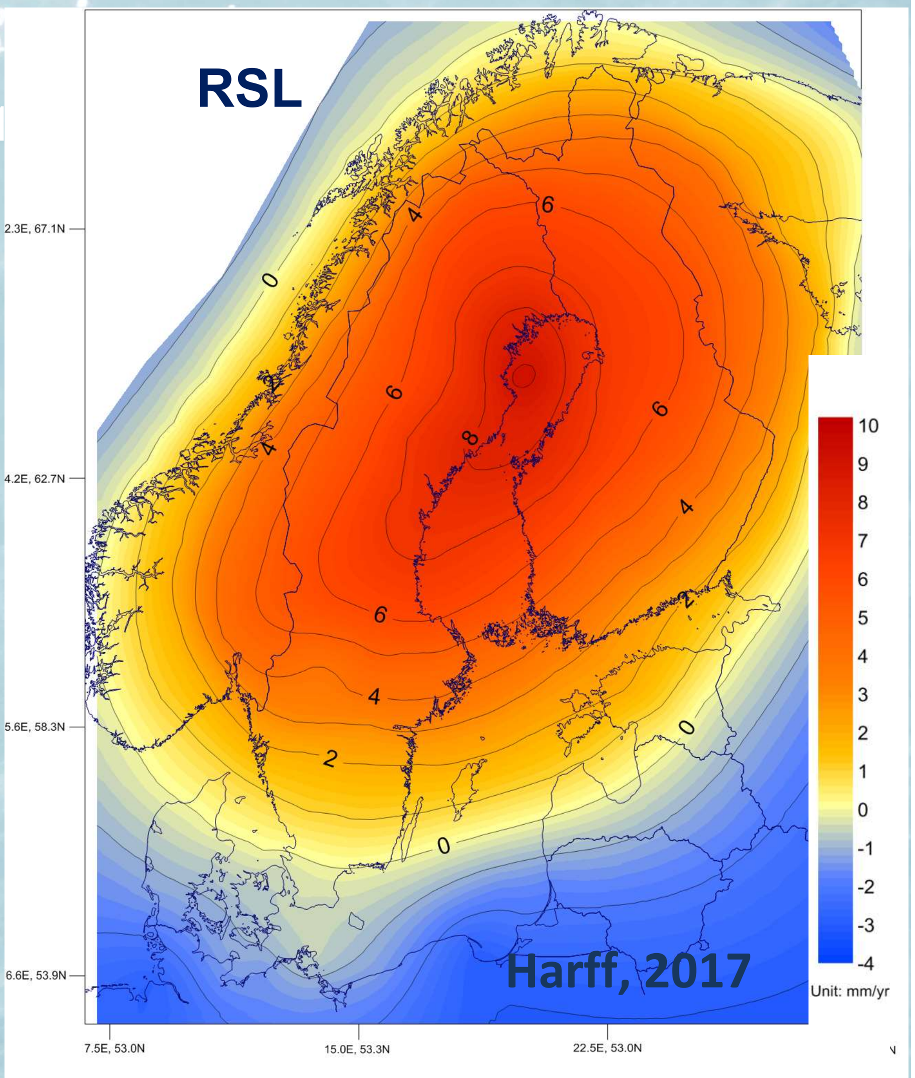


Harff, Meyer, 2011

The Baltic Sea – natural laboratory for environment and climate change study

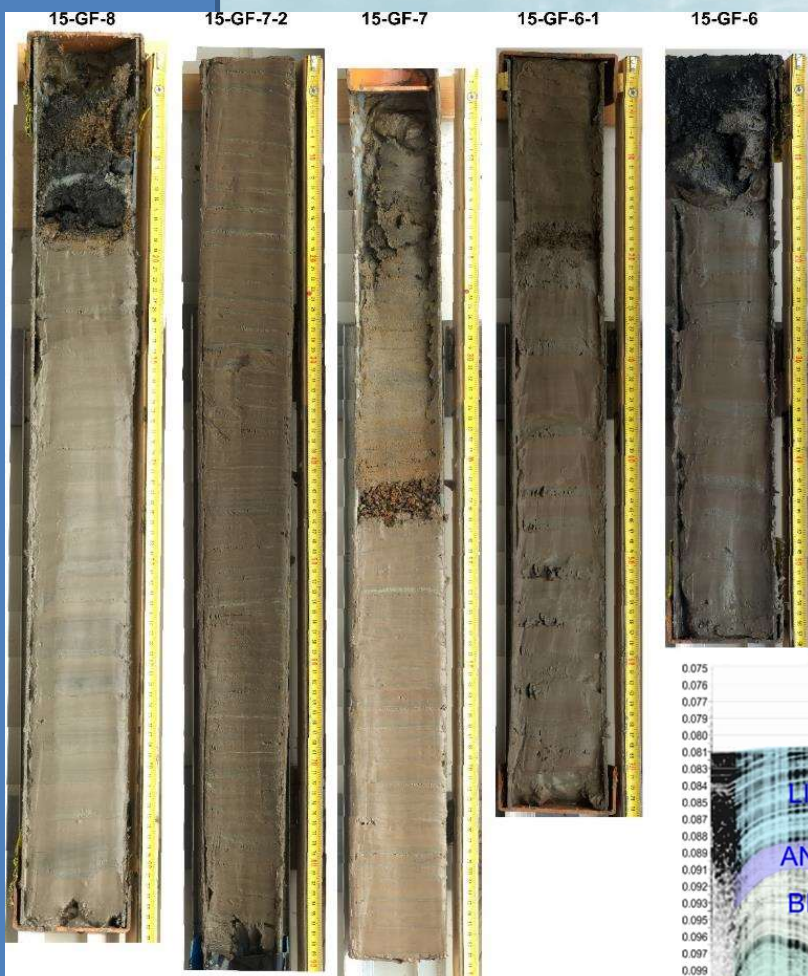






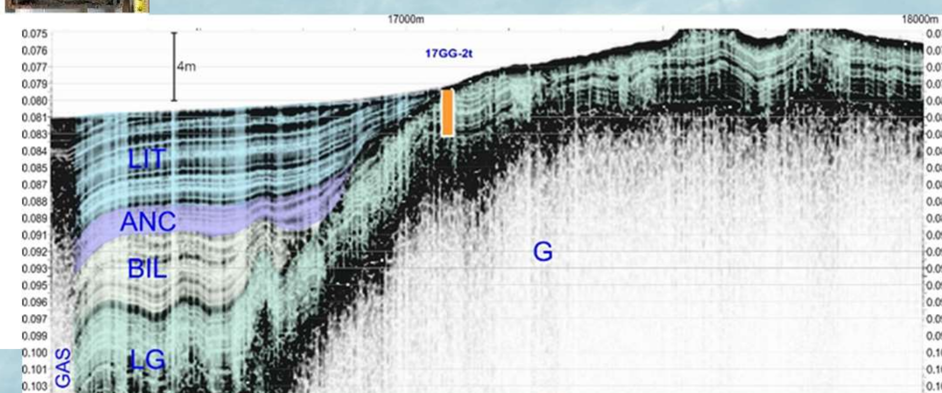
The Baltic Sea – natural laboratory for environment and climate change study

Late Pleistocene Baltic Ice Lake

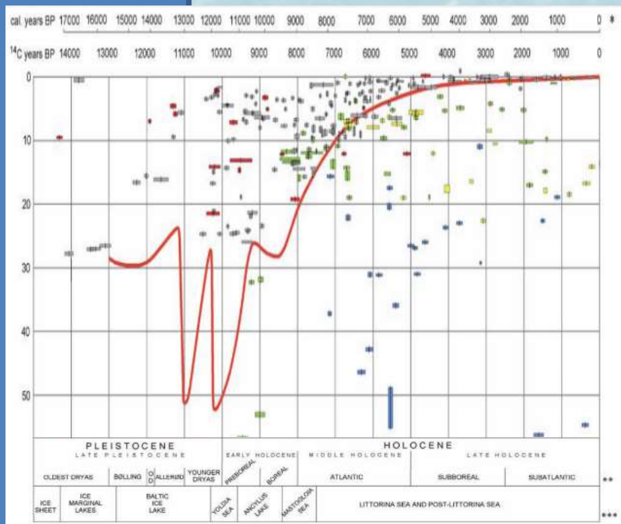


Sedimentation rate of proximal facies of lake-glacial basin varies from 20 to 100 mm/year

Andren et al., 2011

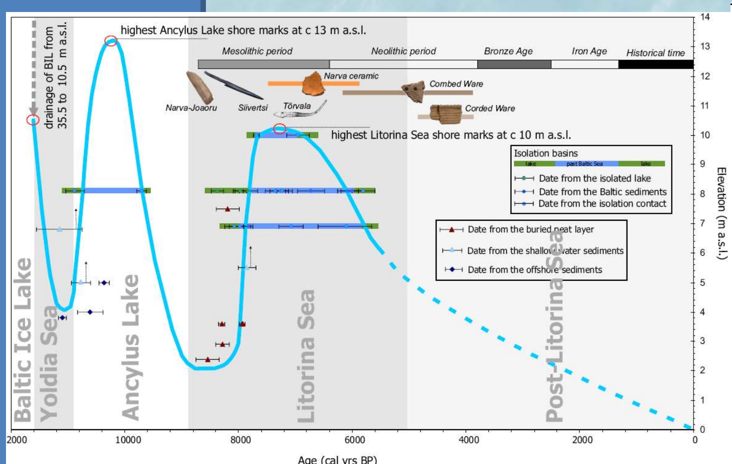


The Baltic Sea – natural laboratory for environment and climate change study

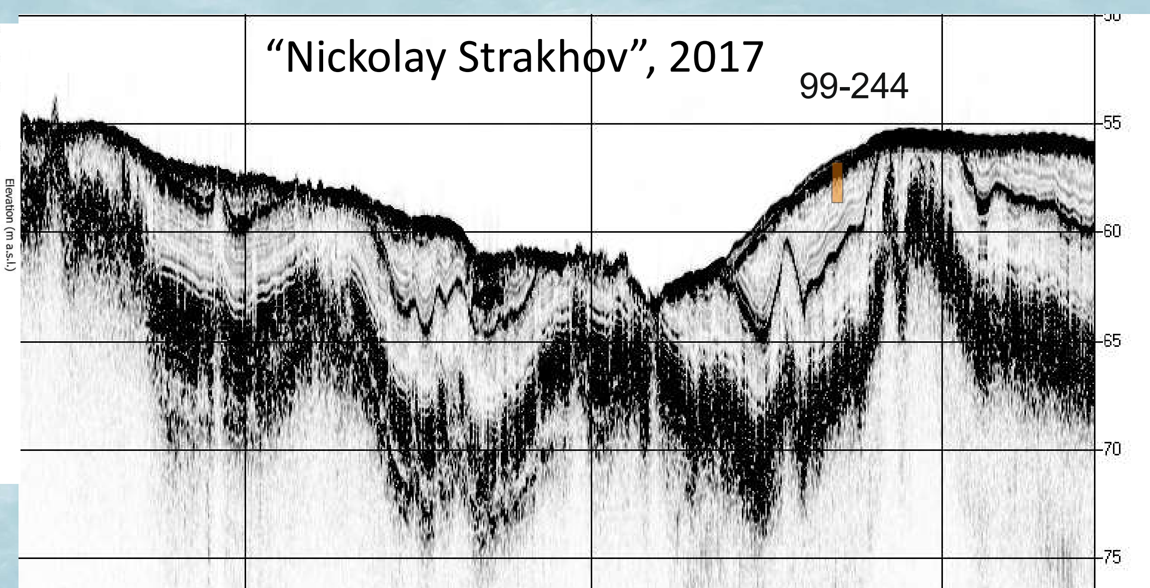


Uścinowicz et al., 2003

Gog024

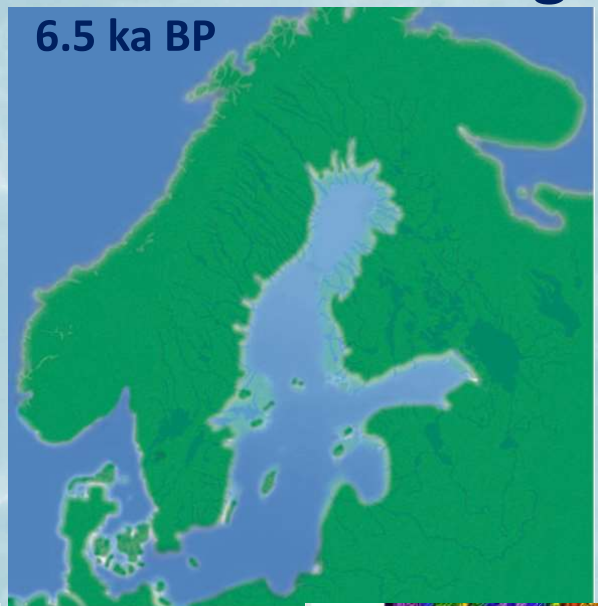


Rosentau et al., 2013



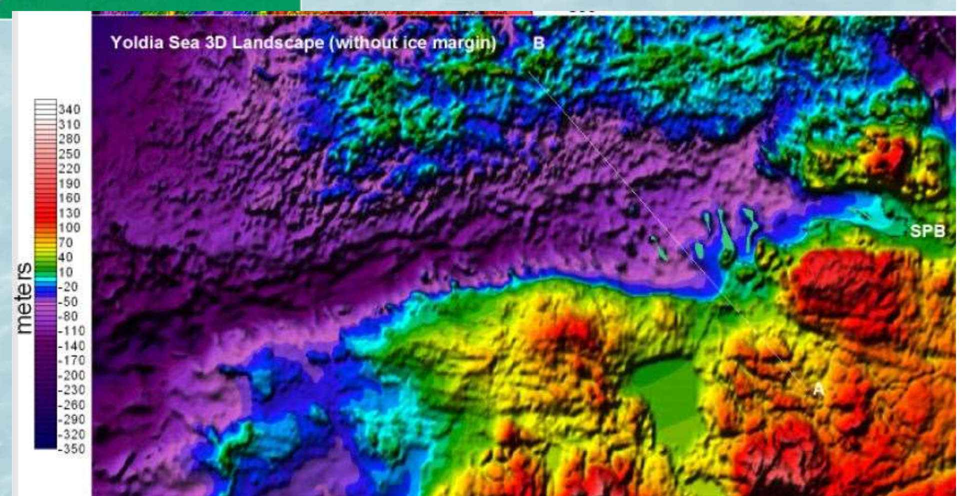
ВСЕГЕИ

The Baltic Sea – natural laboratory for environment and climate change study



Litorina Sea

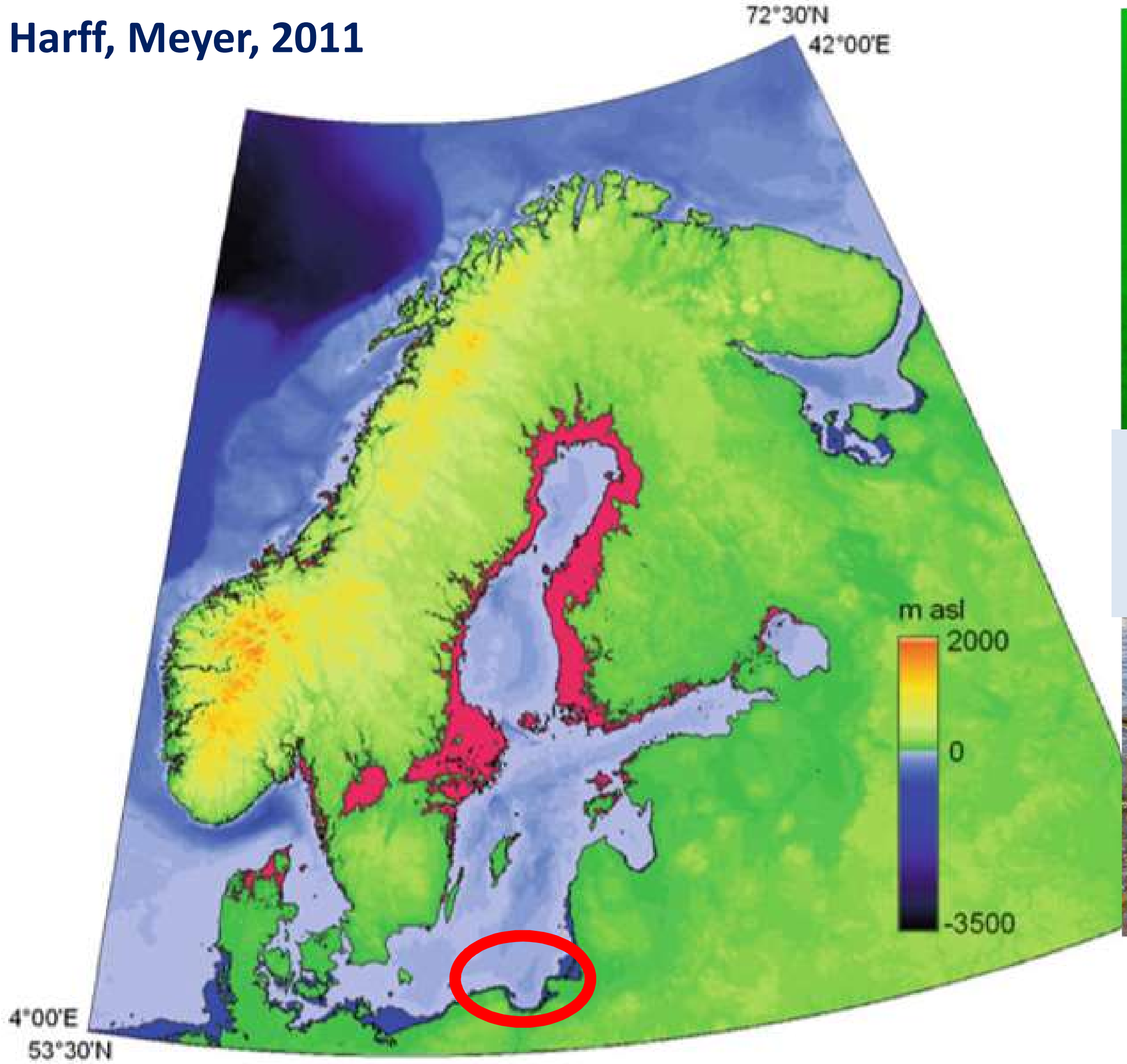
Yoldia Sea landscape according geological modeling by A.Amantov (based on glacioisostasy, hydroisostasy, sedimentoisostasy, geoidal changes, local variations (Amantov et al., 2013)



Relatively deep pre-Holocene water regression

The Baltic Sea – natural laboratory for environment and climate change study

Harff, Meyer, 2011

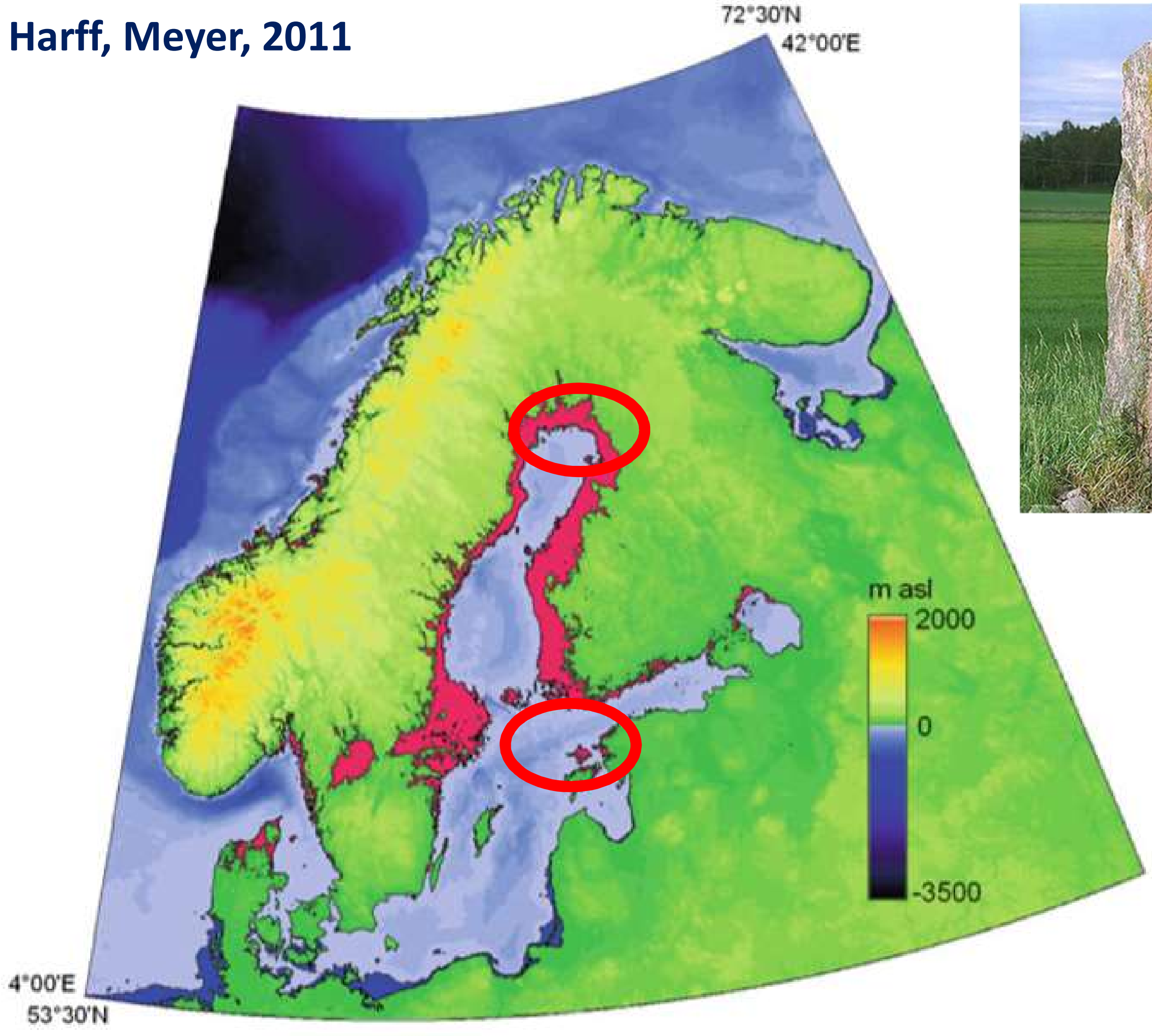


Tree trunks, water depth 10 m; age 7000-9000 cal. BP, Poland (photo by Prof.S.Uscinovich)

Curonian Spit nearshore, tree trunks of 3000 ka BP

The Baltic Sea – natural laboratory for environment and climate change study

Harff, Meyer, 2011

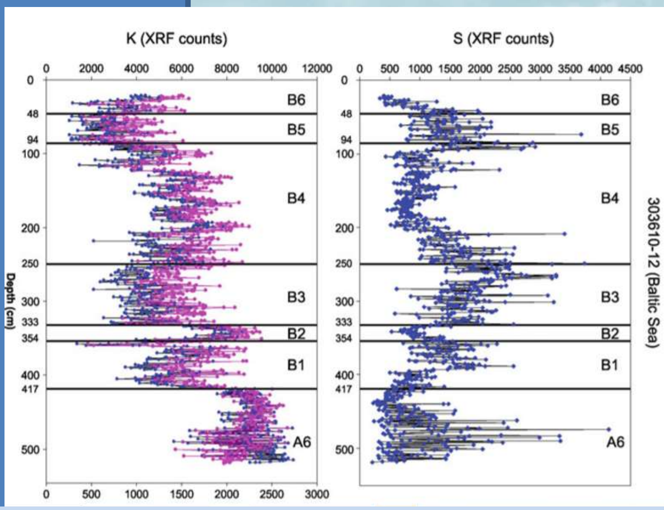


Viking Harbour

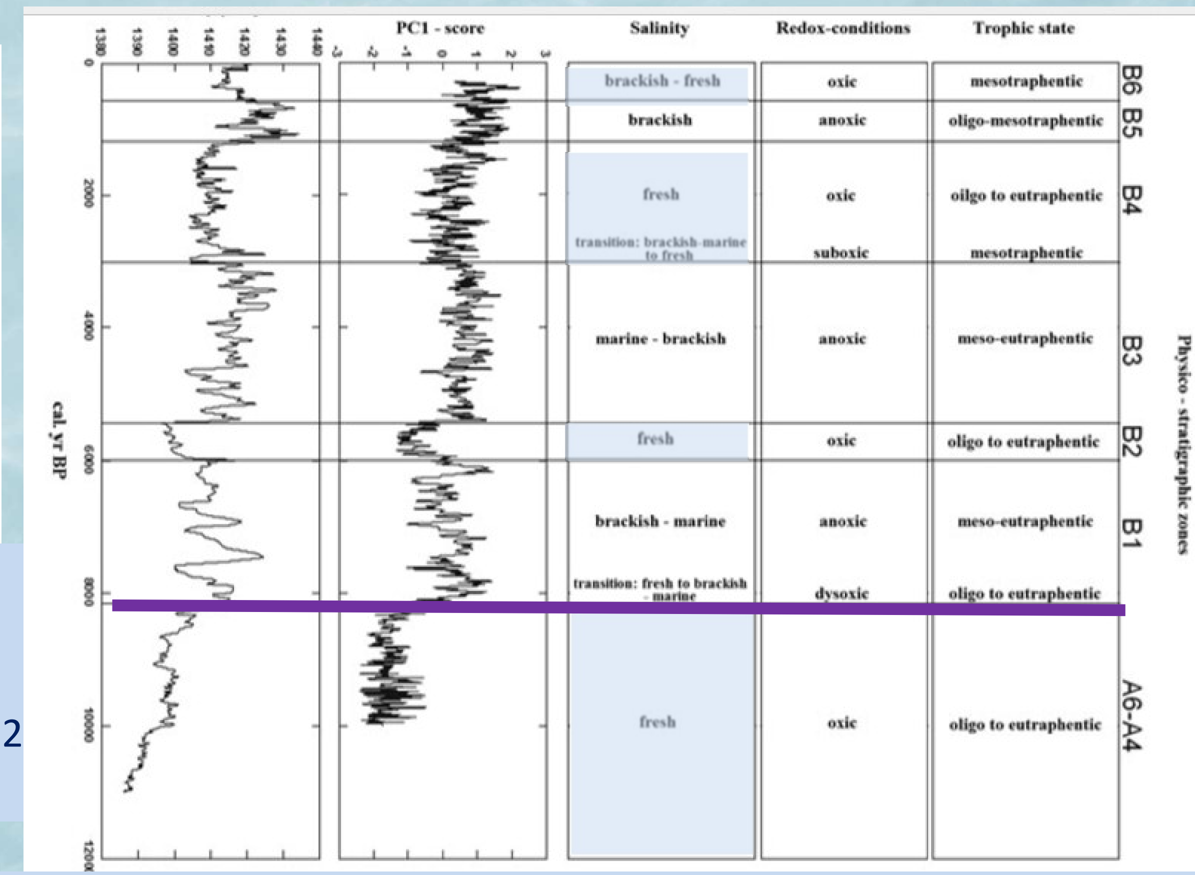
Littorina wave-cut cliff, Estonia

The Baltic Sea – natural laboratory for environment and climate change study

Harff et al., 2011

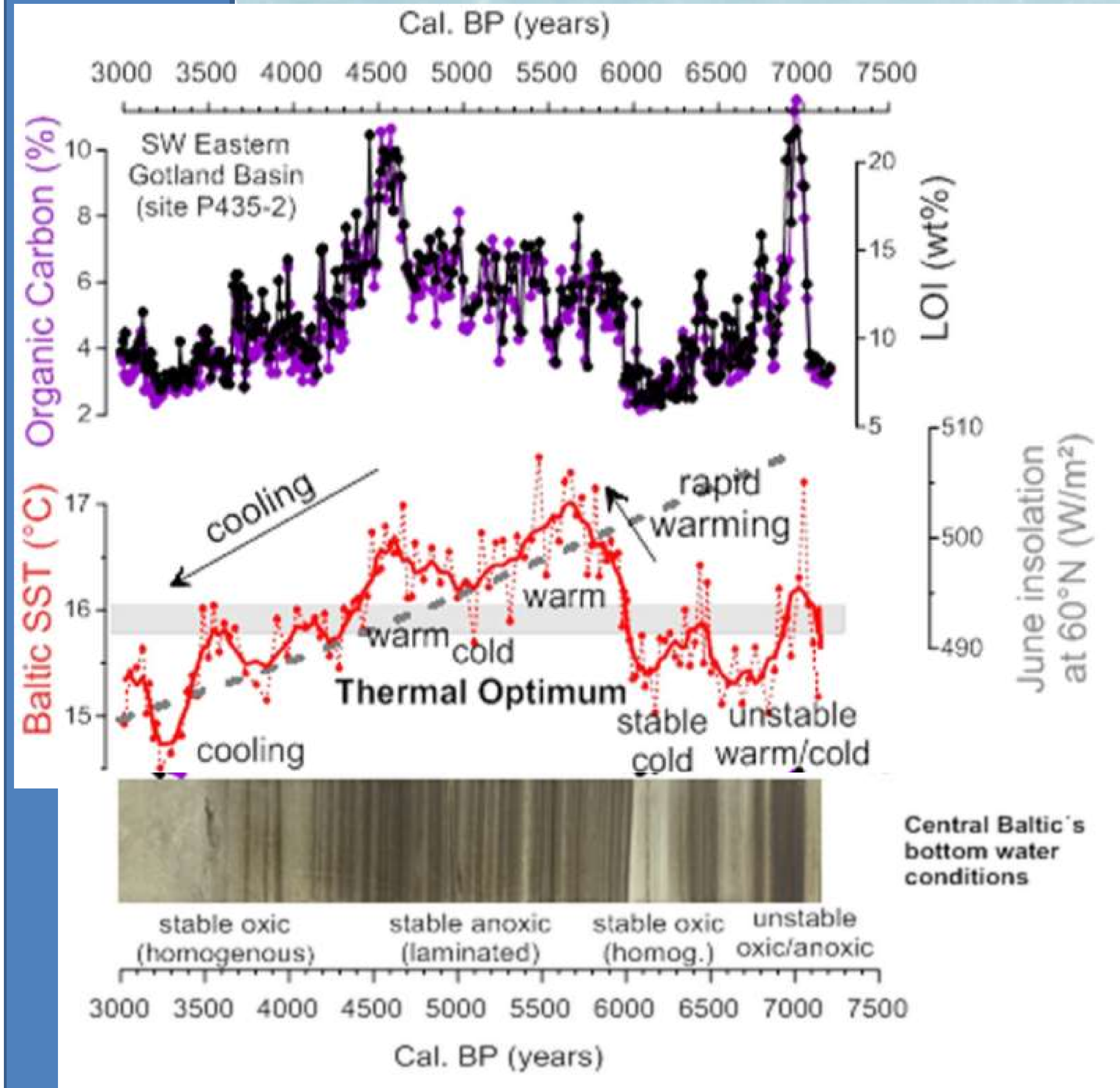


Concentration of K and Ti (left panel) and S (right panel), expressed by XRF counts, and physico-stratigraphic zonation of sediments in core 313610-12 of the Eastern Gotland Basin



Time series analysis of sediment physical and chemical proxies of the depositional environment reveals remarkable periodicities of about 900 and 1500 years. Similar periods are reported from marine sediments from the Northern Atlantic and the Greenland ice cores. According to our hypothesis, these periodicities in Baltic Sea sediments stand for global climate signals.

The Baltic Sea – natural laboratory for environment and climate change study

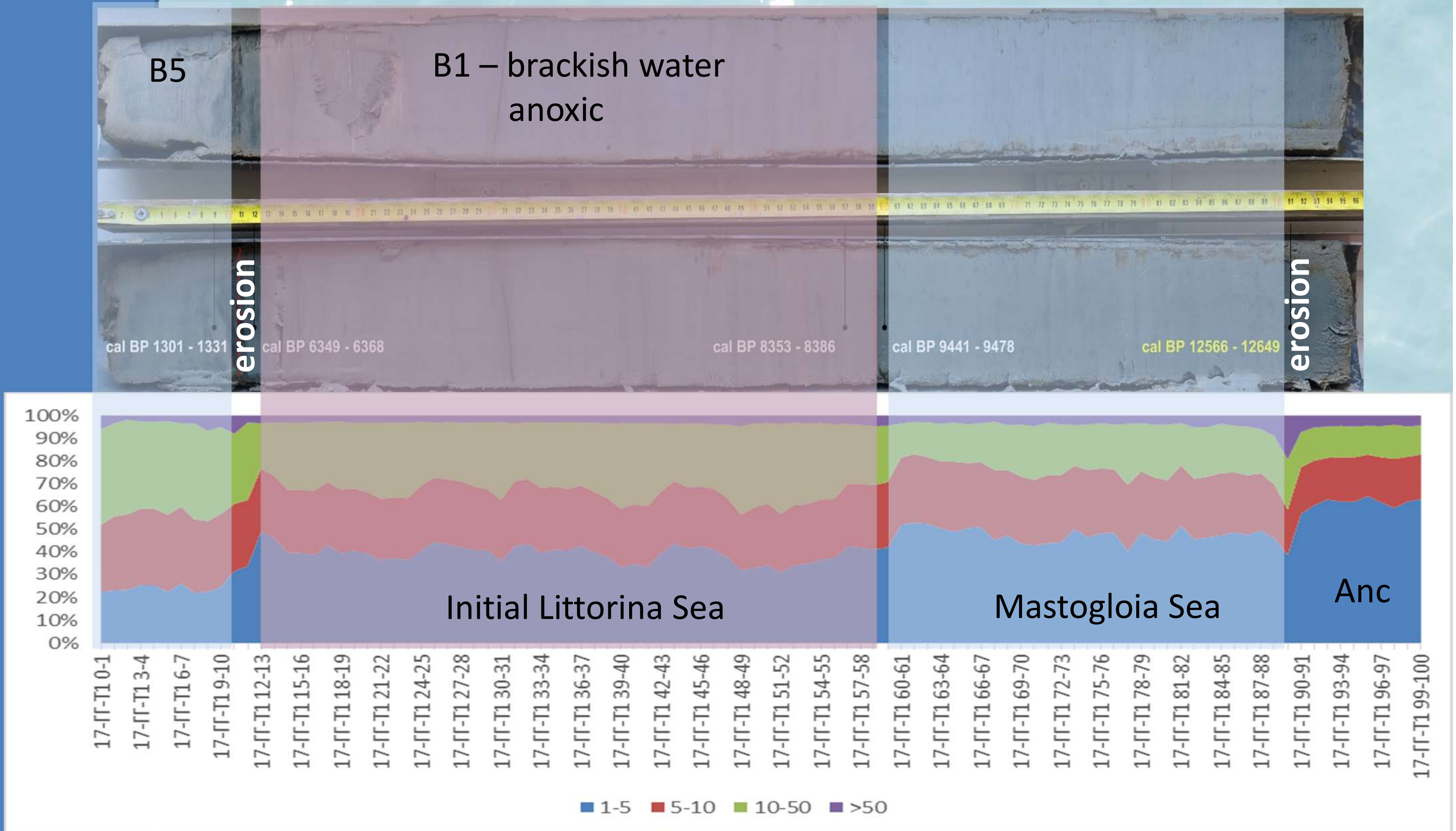


L. Warden, M. Moros, T. Neumann, S. Shennan, A. Timpson, K. Manning, M. Sollai, L. Wacker, K. Perner, K. Häusler, T. Leipe, L. Zillén, A. Kotilainen, E. Jansen, R. R. Schneider, R. Oeberst, H. Arz & J. S. Sinninghe Damsté. Climate induced human demographic and cultural change in northern Europe during the midHolocene. 2017, www.nature.com/scientificreports/

A strong cold phase between 6,300 and 6,000 cal. yr BP
Rapid warming about 6,000 cal. yr BP
Thermal optimum between 5,600 and 4,500 cal. yr BP (with slow cooling)
Oxic conditions between 3,500 and 3,000 cal. yr BP

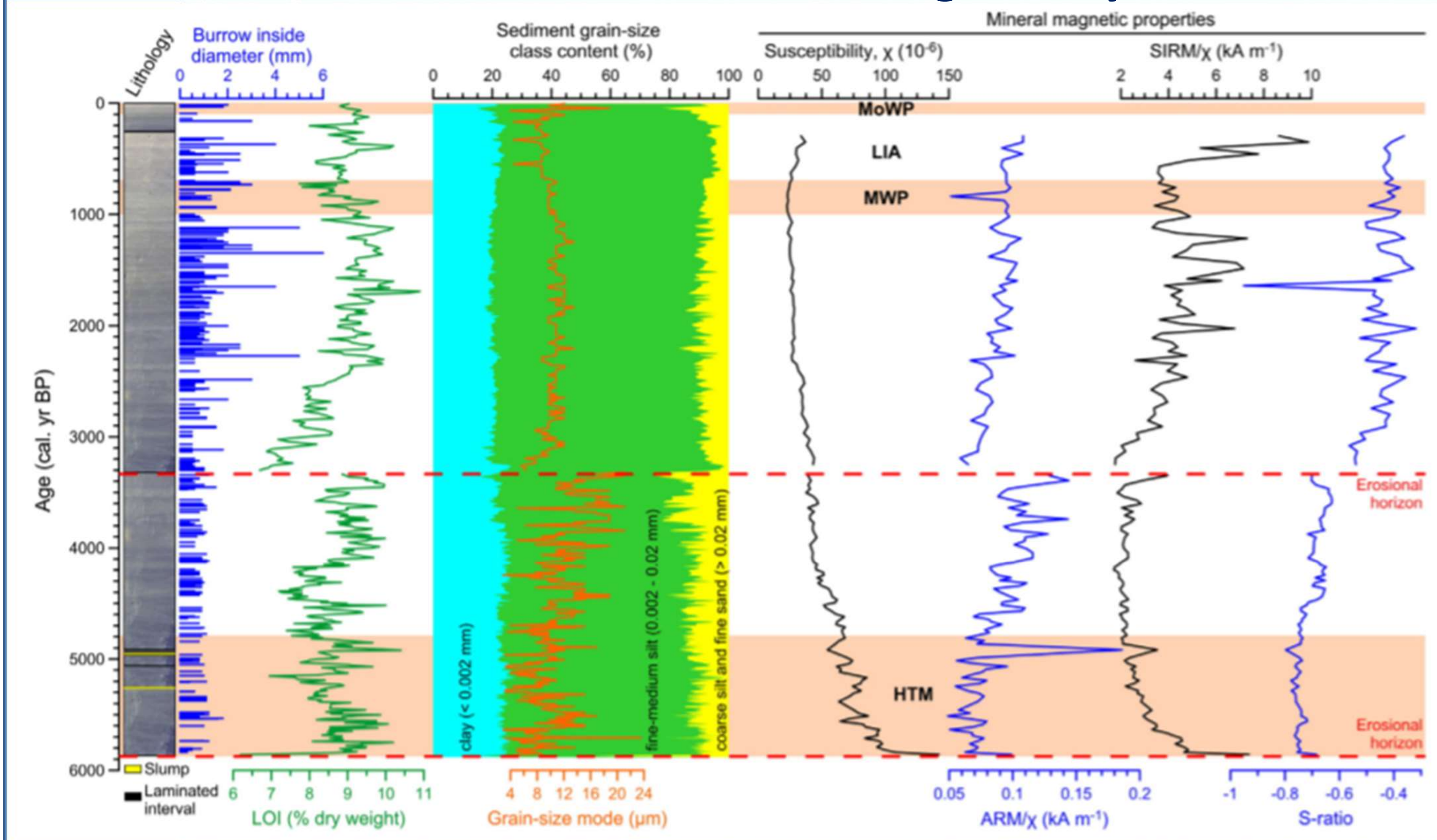
ВСЕГЕИ

The Baltic Sea – natural laboratory for environment and climate change study



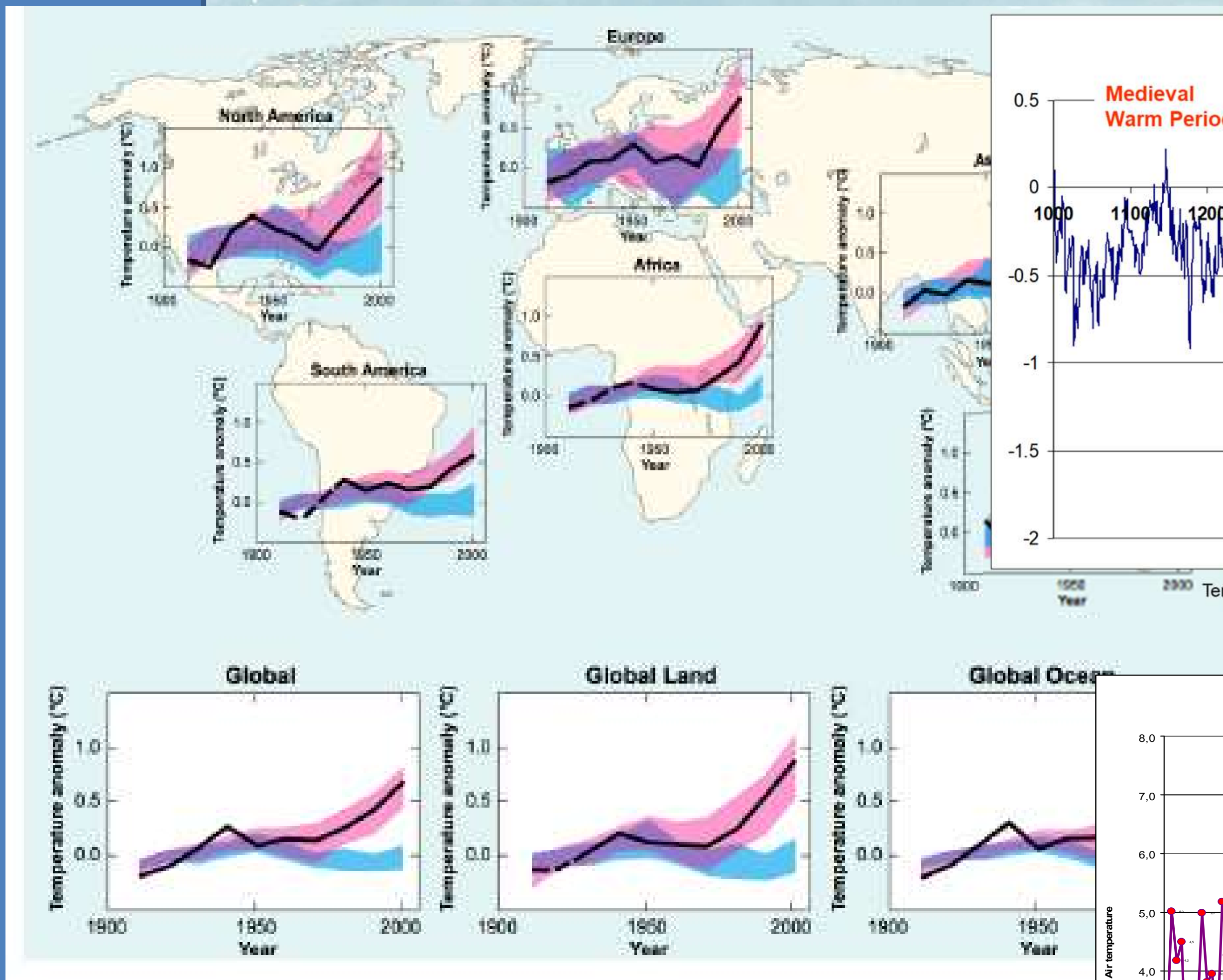
ВСЕГЕИ

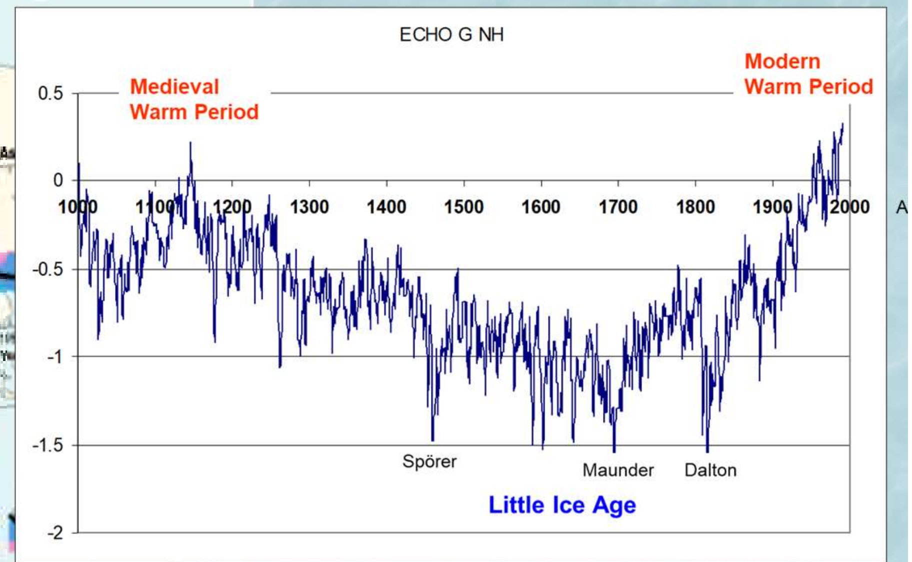
The Baltic Sea – natural laboratory for environment and climate change study



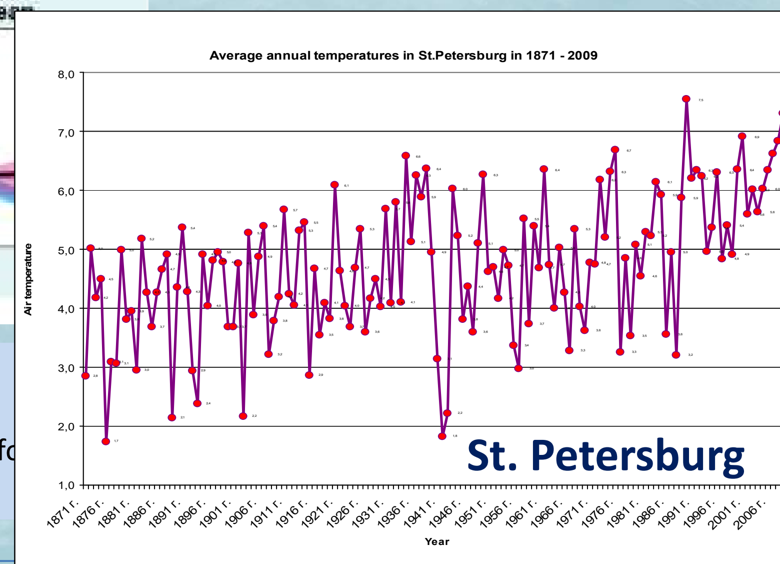
Virtasalo et al., 2014

Global Continental Temperature Change



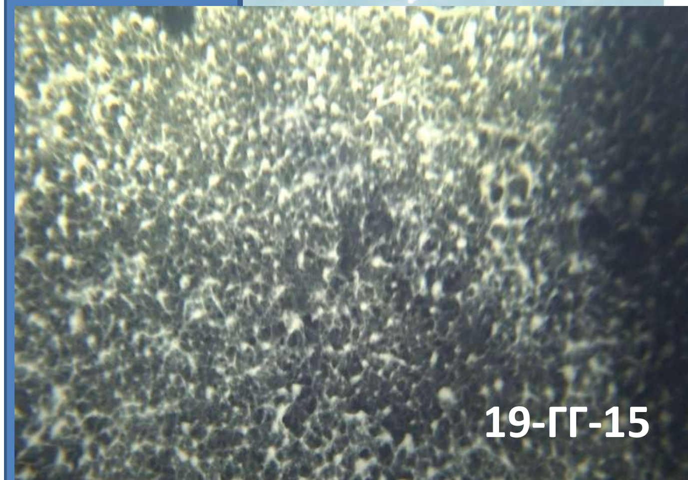


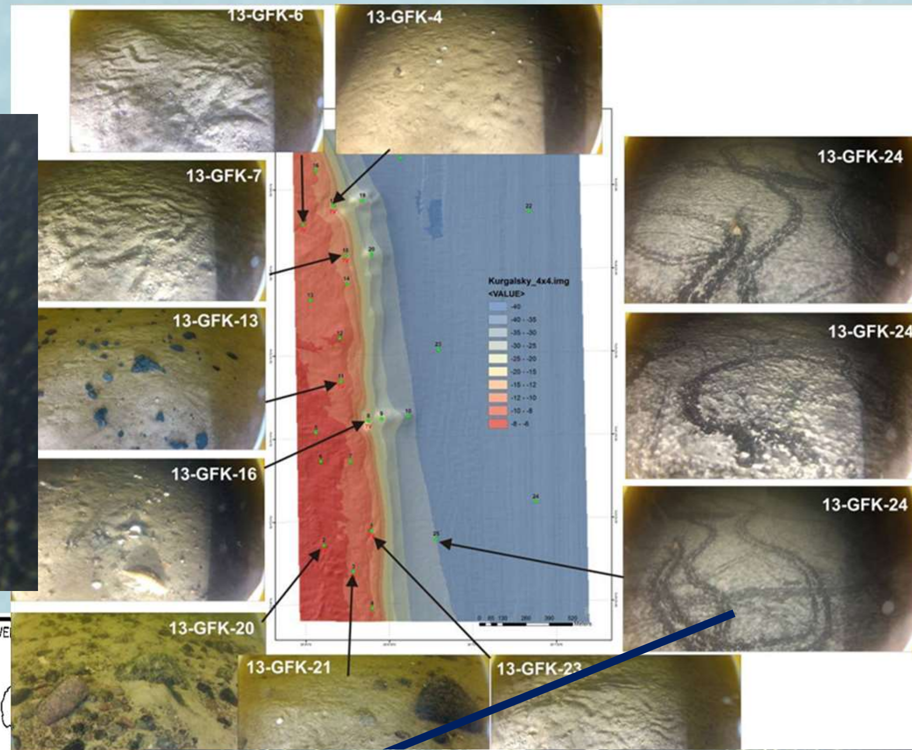
Temperature deviation (K) from the 1900-1980 mean, after Cubasch et al. (2006)

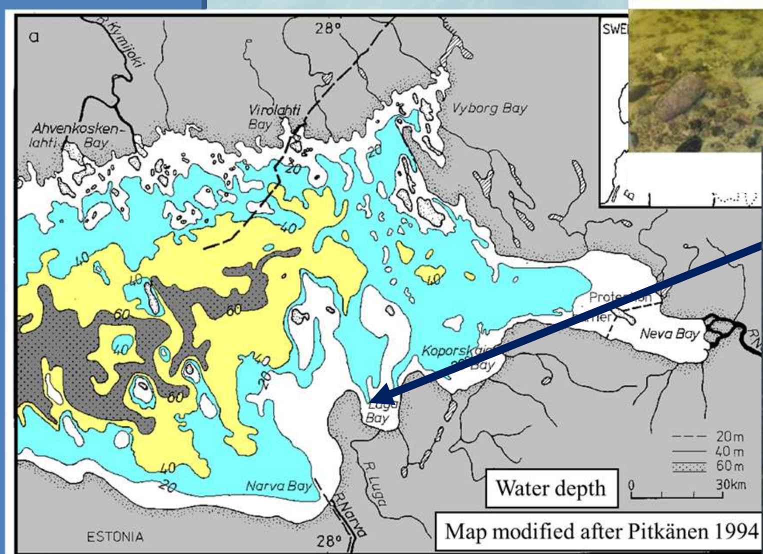


Black line: Decadal avarages of observation 1906 – 2005
Blue shaded bands: 19 simulations form 5 climate models, natural forcing
Red schaded: 58 simulations from 14 climate models, natural and anthropogenic fo
IPCC (2007)

Anoxic environment expansion







Kotilainen et al., 2006

Conclusions and future work

1. The Baltic Sea bottom represents a unique source of information about past changes of environment (e.g. climate change)
2. Fast developing of new methods of sediment archives' decipher, reading and understanding makes an interpretation of these information more and more confident
3. Uncontradicted model of postglacial Baltic Sea development should be based on correlation of sediment cores from different sedimentation basins study and onshore data (geological, geomorphological, landscape, biological, archeological etc.)
4. Geological data should be important part of modeling and future scenarios development


Do not forget geologists when you discuss climate change !
Thank you for attention!

Modeling eutrophication in the Gulf of Finland - oxygen and nutrient dynamics

Mariliis Kõuts, U. Raudsepp, I. Maljutenko, M.-L. Treimann

TAL TECH

The background

- Gulf of Finland (GoF) is estimated to be the most eutrophicated sub-basin of the Baltic Sea
- The reduction of nutrients in river loads have not brought the expected result
- Continuing negative dissolved oxygen trend
- The discrepancy between nutrient input and pool suggests that the internal dynamics of the ecosystem affect the interannual variations in the nutrient pools to a significant degree.
- The aim is to clarify the oxygen and nutrient dynamics on different timescales and in different regions of the GoF in order to evaluate the physical and biogeochemical controls on the system’s response to changes in trophic pressure
- The study is based on a 40-year model simulation with the coupled ecosystem model General Estuarine Transport Model (GETM) - Ecological Regional Ocean Model (ERGOM)

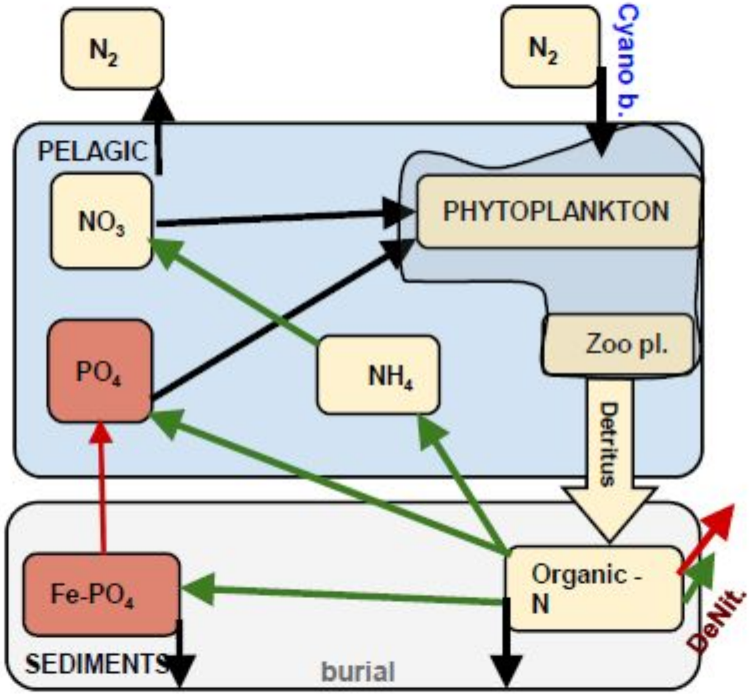
Model description

ERGOM: a N-cycle model with 12 state variables;
3 sources of nutrients: NO_3, PO_4, NH_4;
3 functional groups of phytoplankton + Oxygen, Zooplankton, Detritus, $FePO_4$

Setup for the Baltic Sea: Horizontal resolution 1 nautical mile; Vertical resolution 40 adaptive bottom following layers with temporal adaptation to density stratification.
Timestep 625 s; Timespan 1966 - 2006

Initial fields: Climatic fields from winter observations. S/T/Nutrients; Initial phytoplankton and sediments, set as zero

Forcing: Atmospheric forcing: HIRLAM regionalized ERA40 hindcast (BaltAN65+ dataset); River runoff and nutrient loads: Balt-HYPE 37 largest rivers
Open boundary: Observed sea level; Parametrized S/T; Zero gradient for nutrients

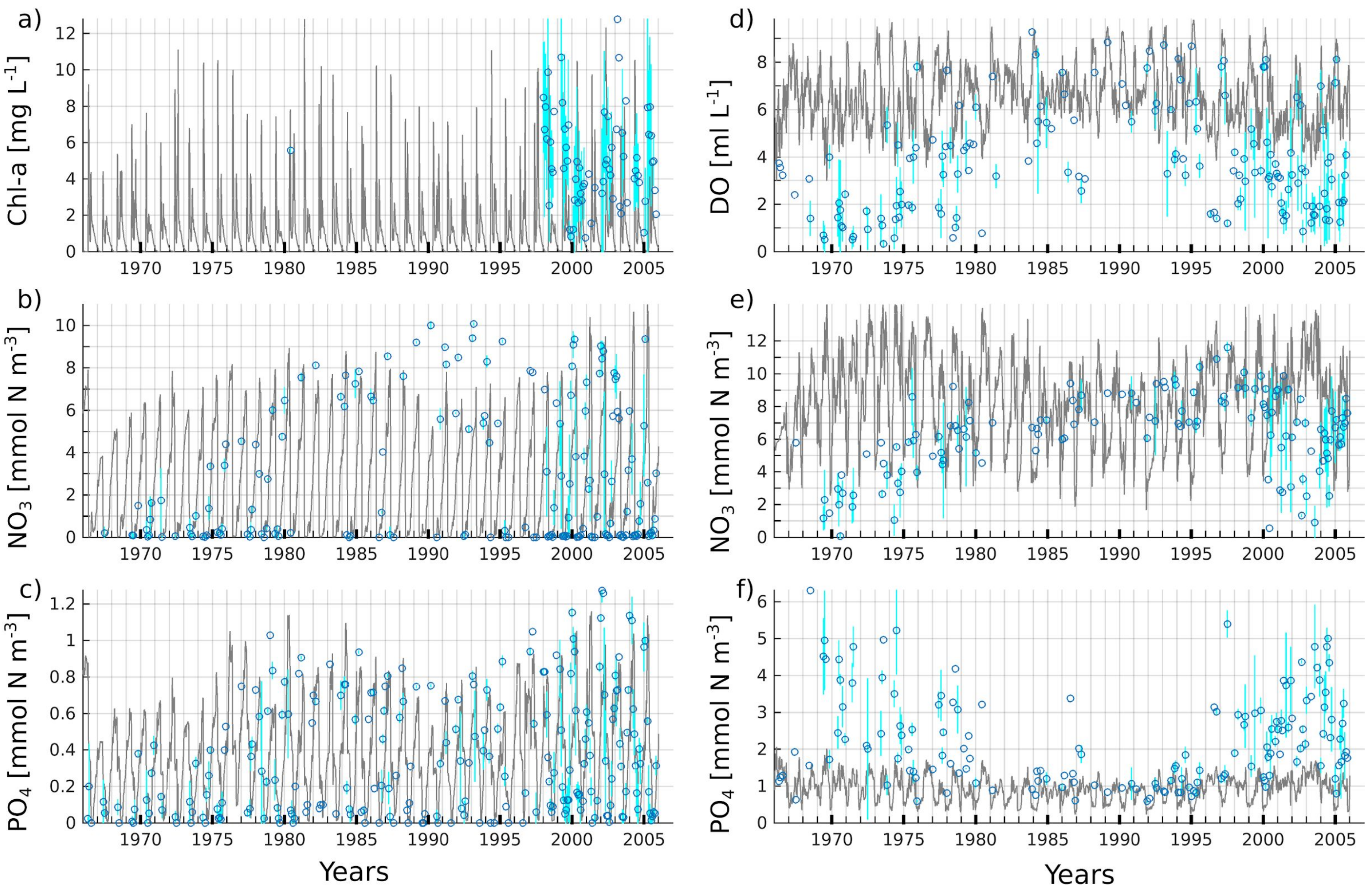


Model validation

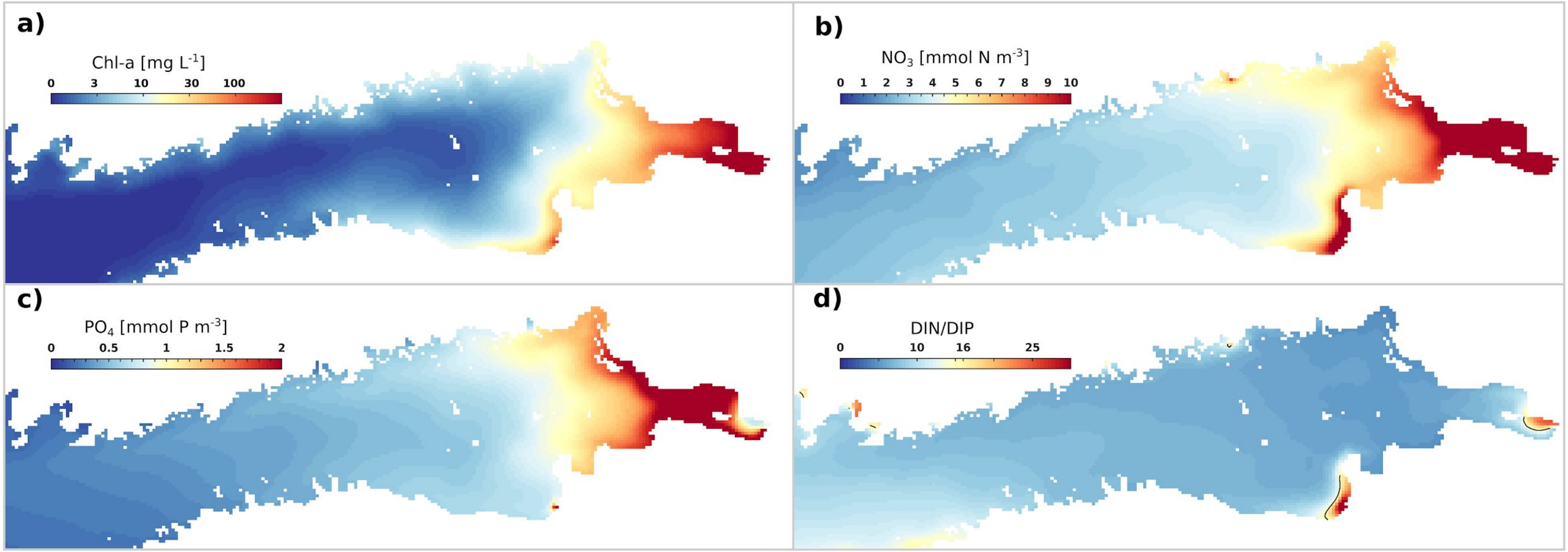
Seasonal cycle of variables is mostly well reproduced

Bottom variables match w. obs during the stagnation period

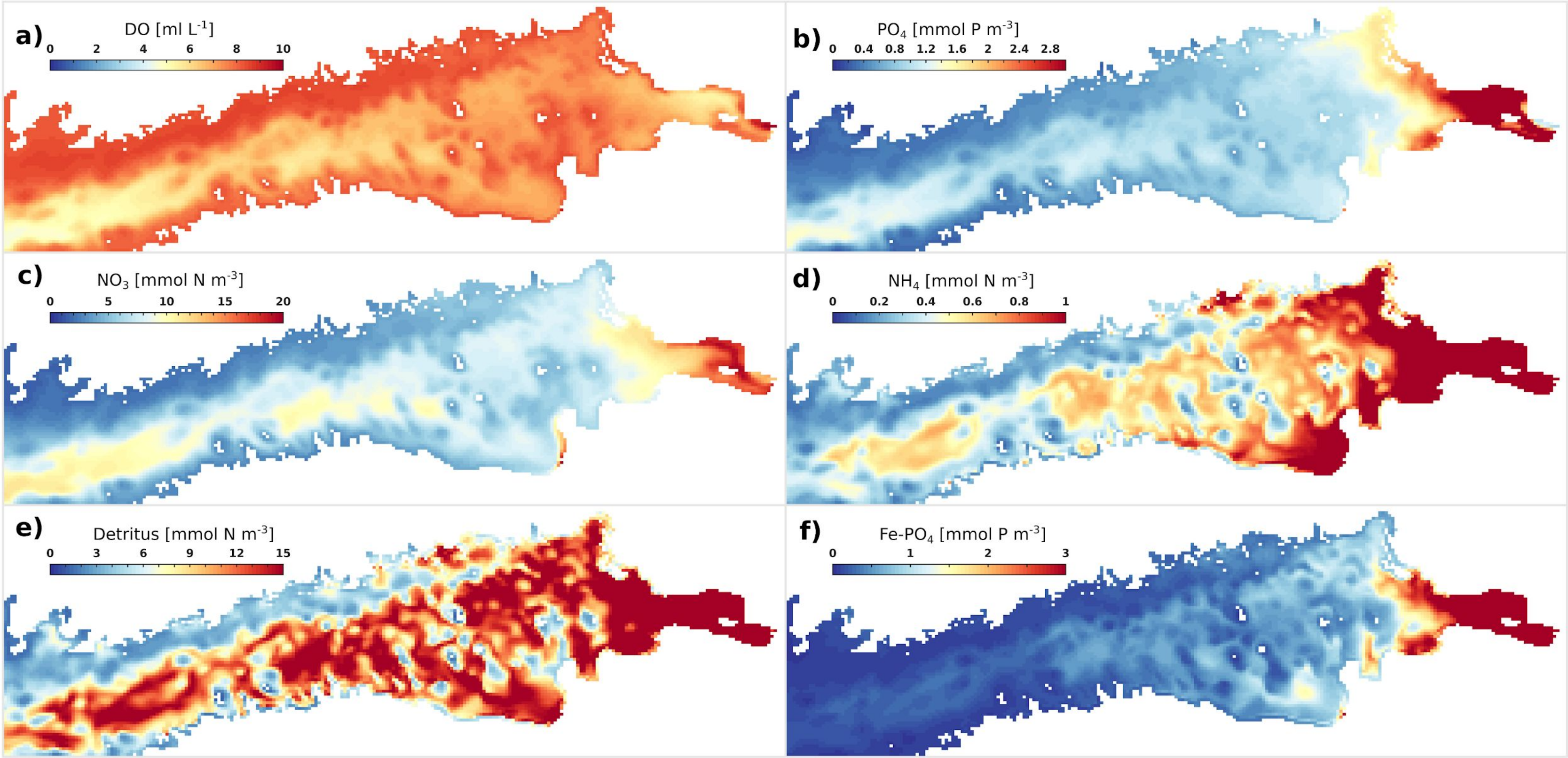
Outside of stagnation, bottom DO and NO_3 are underestimated, while bottom PO_4 is overestimated



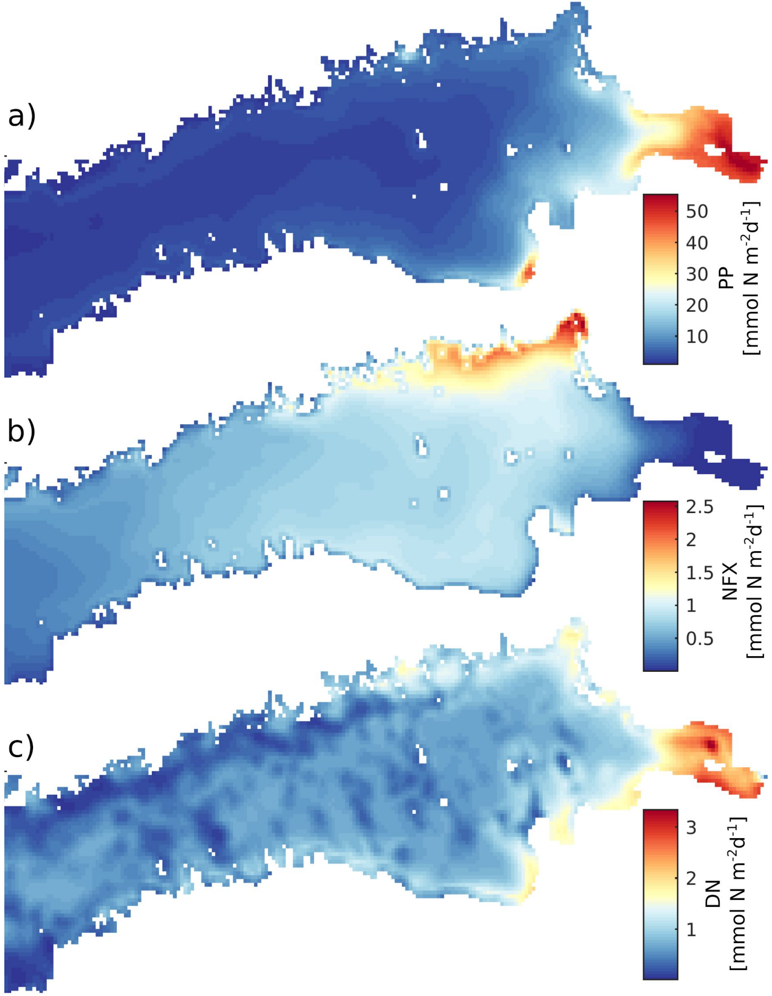
Results and discussion



Surface spatial means of 39-year surface averages of Chl-a concentration, NO_3, PO_4 and DIN/DIP ratio

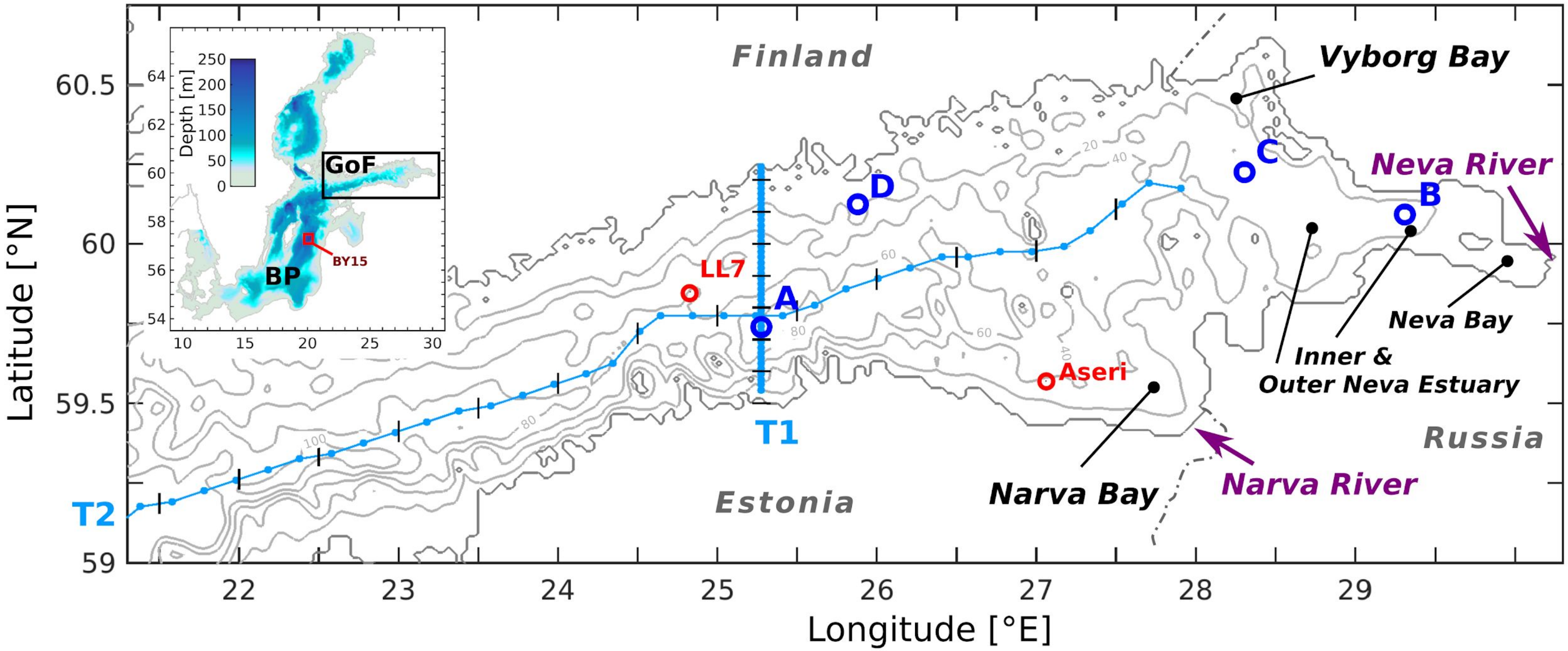


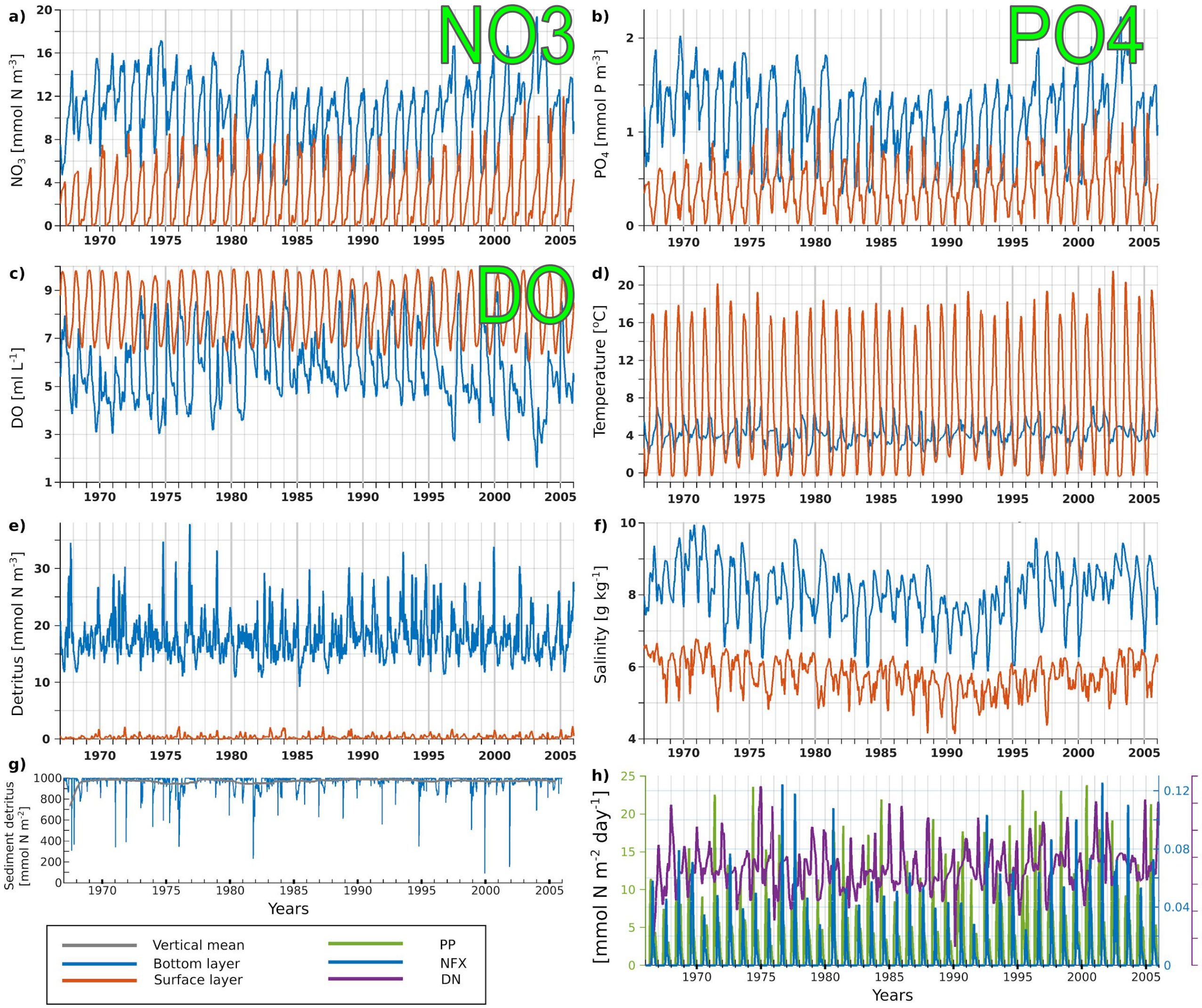
Bottom spatial means of 39-year bottom averages of DO, PO_4, NO_3, NH_4, detritus, Fe-PO_4



Spatial means of processes 39-year averages of primary production (PP) integrated through the water column, nitrogen fixation (NFX) and denitrification (DN)

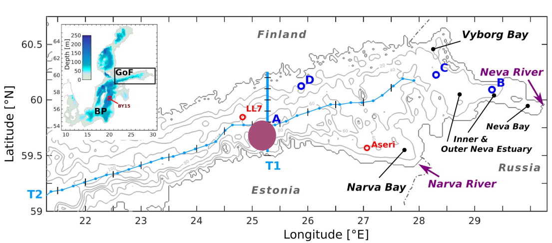
The study area

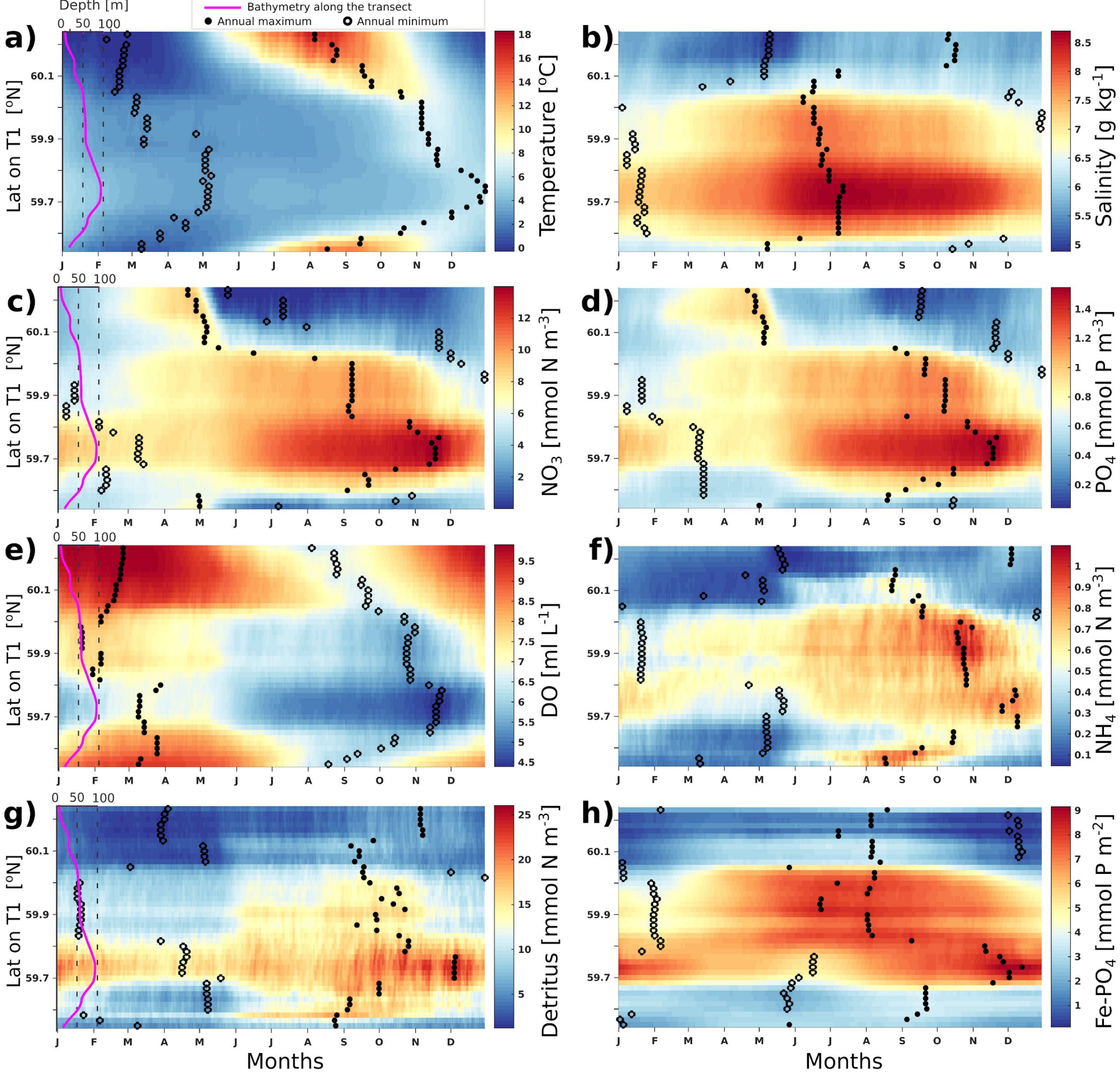




Time series of surface and bottom values of NO_3, PO_4, DO, temperature, sediment detritus, salinity, sediment detritus and biogeochemical processes in the central GoF (Location A)

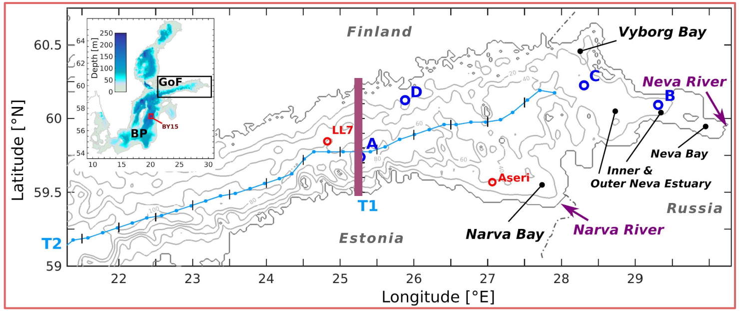
Seasonality dominates the variability of the biogeochemical variables and processes in the entire Gulf of Finland, regardless of depth and location.

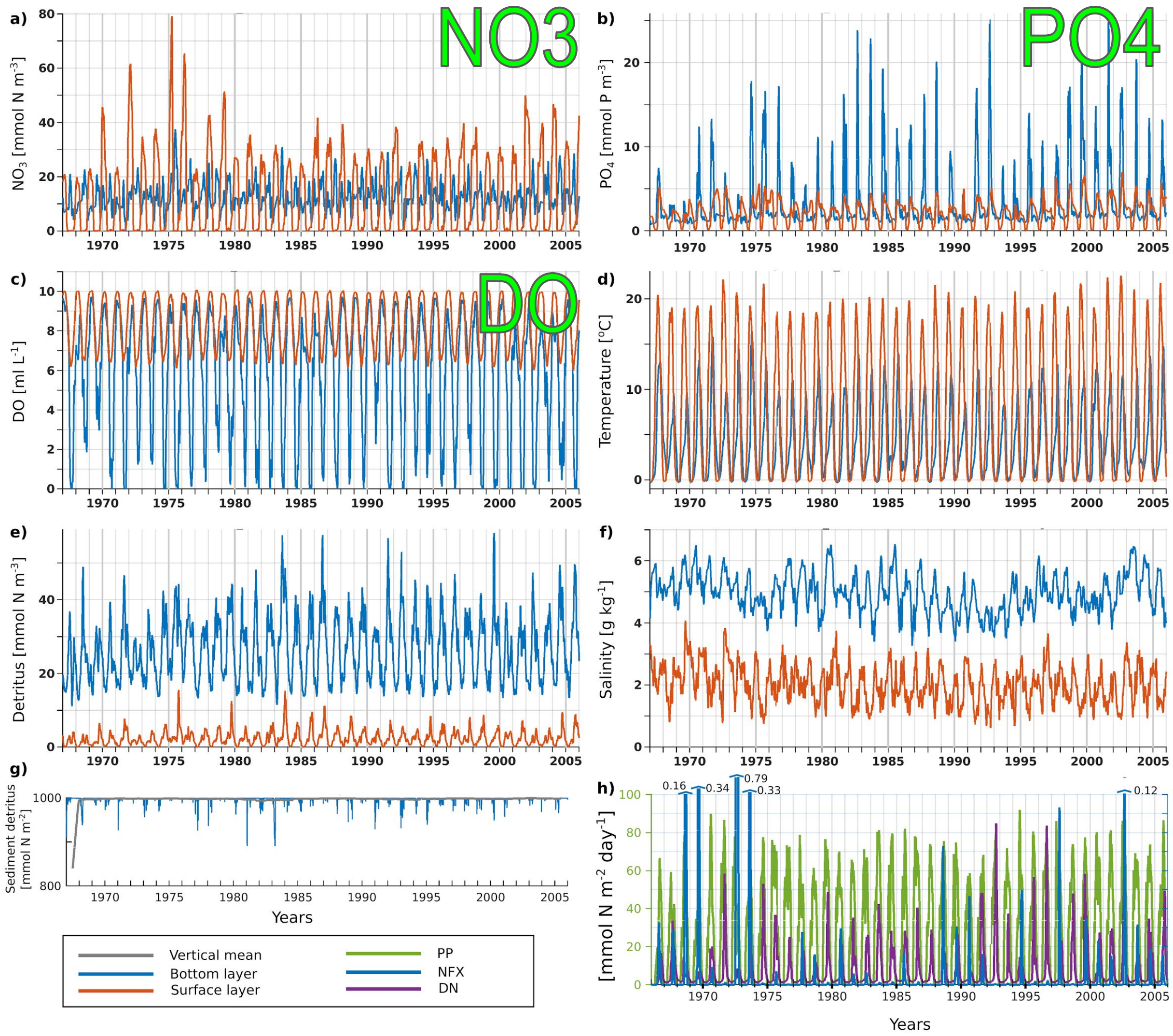




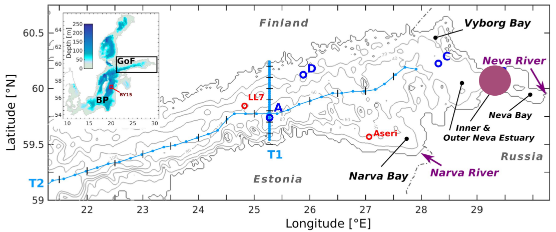
Depending on location the seasonality is controlled by **different factors**. In the central GoF - estuarine circulation largely determines the biogeochemistry. Seasonal water transport from the Baltic Proper brings saline water mass with low DO and high nutrient concentrations into the central deep GoF.

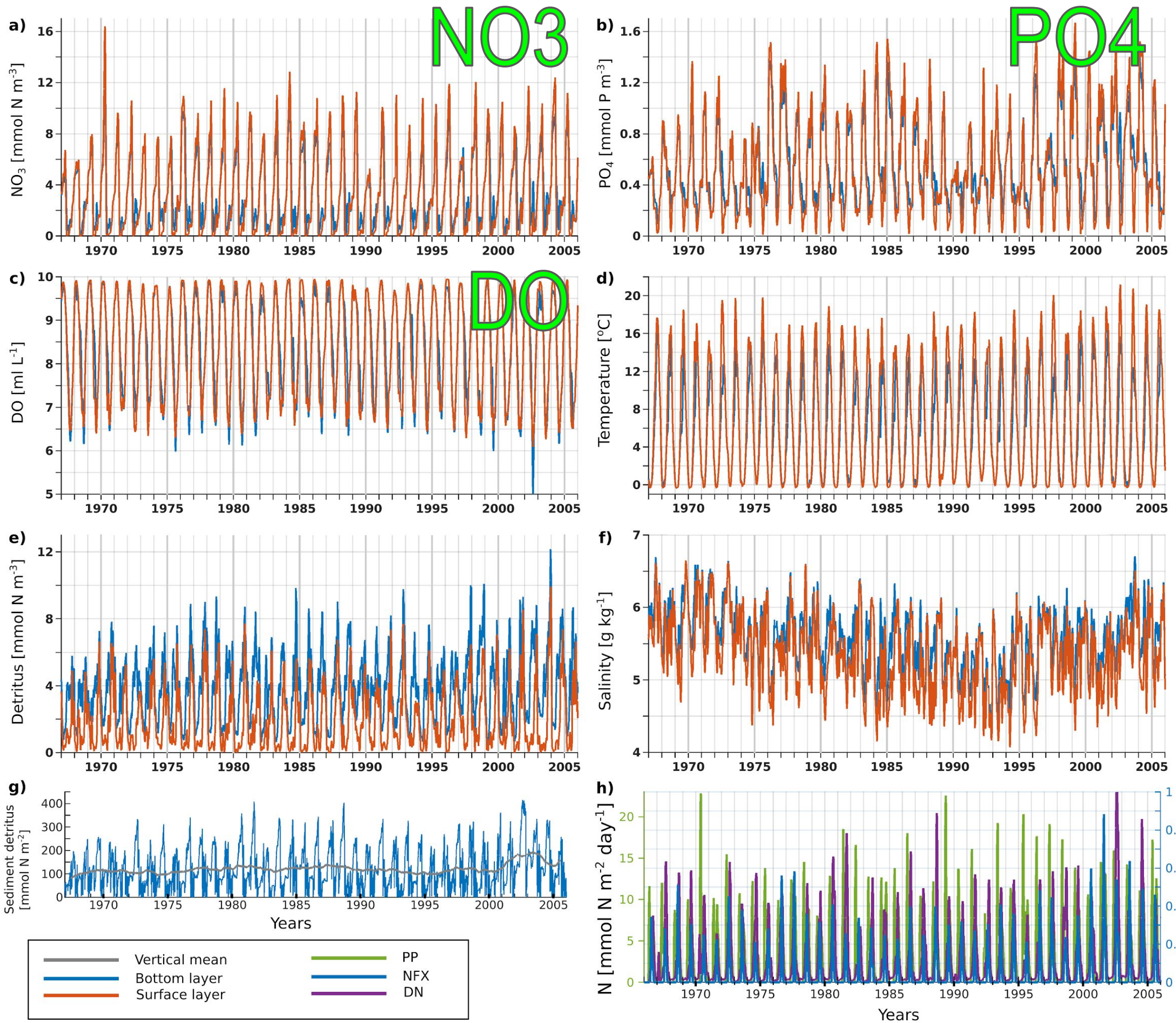
Annual cycle of bottom temperature, salinity, NO_3, PO_4, DO, NH_4, detritus and Fe-PO_4 on the Maardu-Helsinki transect



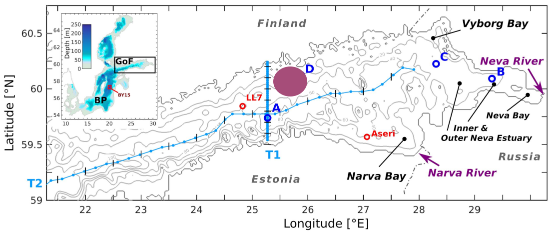


In **shallow** and **river-affected** areas, the seasonality is determined by the river. High nutrient concentrations cause high primary production by diatoms and low bottom DO concentrations, which in turn enhance nutrient turnover processes. PO_4, which mostly remains in the system, if not permanently buried, is easily regenerated from the sediments with DO depletion and fuels primary production.

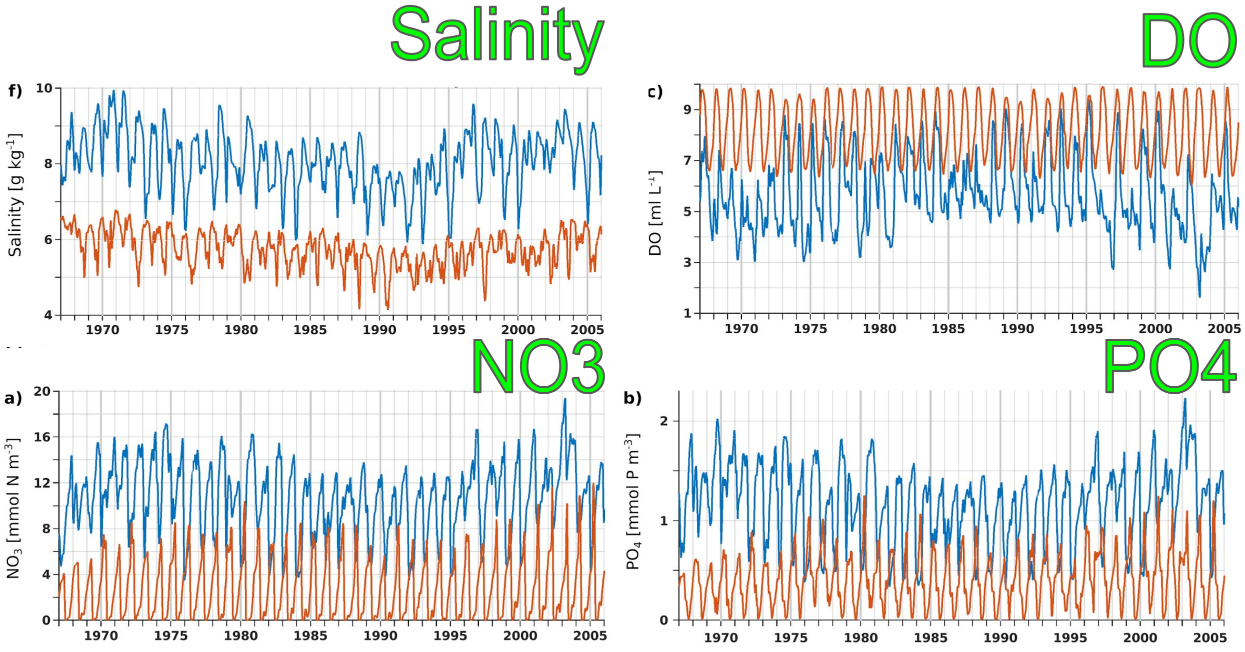




The shallow Finnish coastal area represents “oligotrophic” areas, where DO is always sufficient, excess organic matter is not generated and the benthic-pelagic coupling is strong.



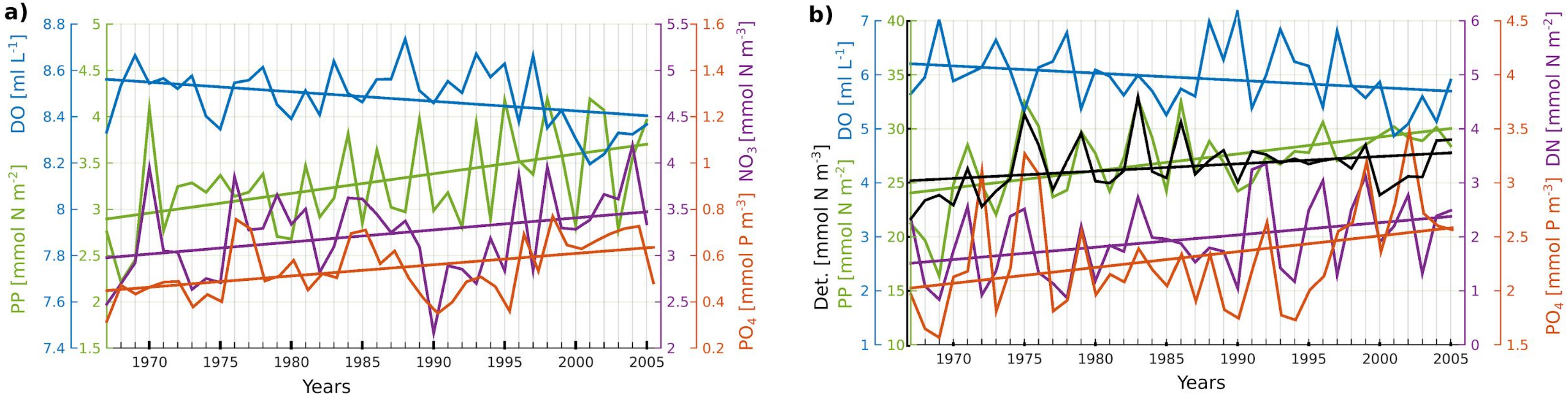
Interannual variability



Biogeochemical variables and processes show a strong **interannual variability**, which is best seen in the deep central area of the GoF. There, the interannual variations of the intensity of estuarine transport, which are in turn affected by the Major Baltic Inflows, cause interannual differences in the levels of the bottom DO and the nutrient concentrations.

Three periods: **1967-1981** with high nutrient and low DO concentrations and strong vertical stratification; **1981-1997** with low nutrient and high DO concentrations and weak stratification; **1997-2006** with high nutrient and low DO concentrations and strong stratification caused by the MBI activity.

Climatic scale



We calculated **positive trends** over the study period for primary production, PO_4 and NO_3 on the surface and a negative trend for bottom dissolved oxygen on the Finnish coast. Hence, the area, which we considered as an example location for “oligotrophic” marine conditions, experiences a worsening eutrophication trend. In the Neva area PP and PO_4 have a positive trend, which also indicate continuous eutrophication.

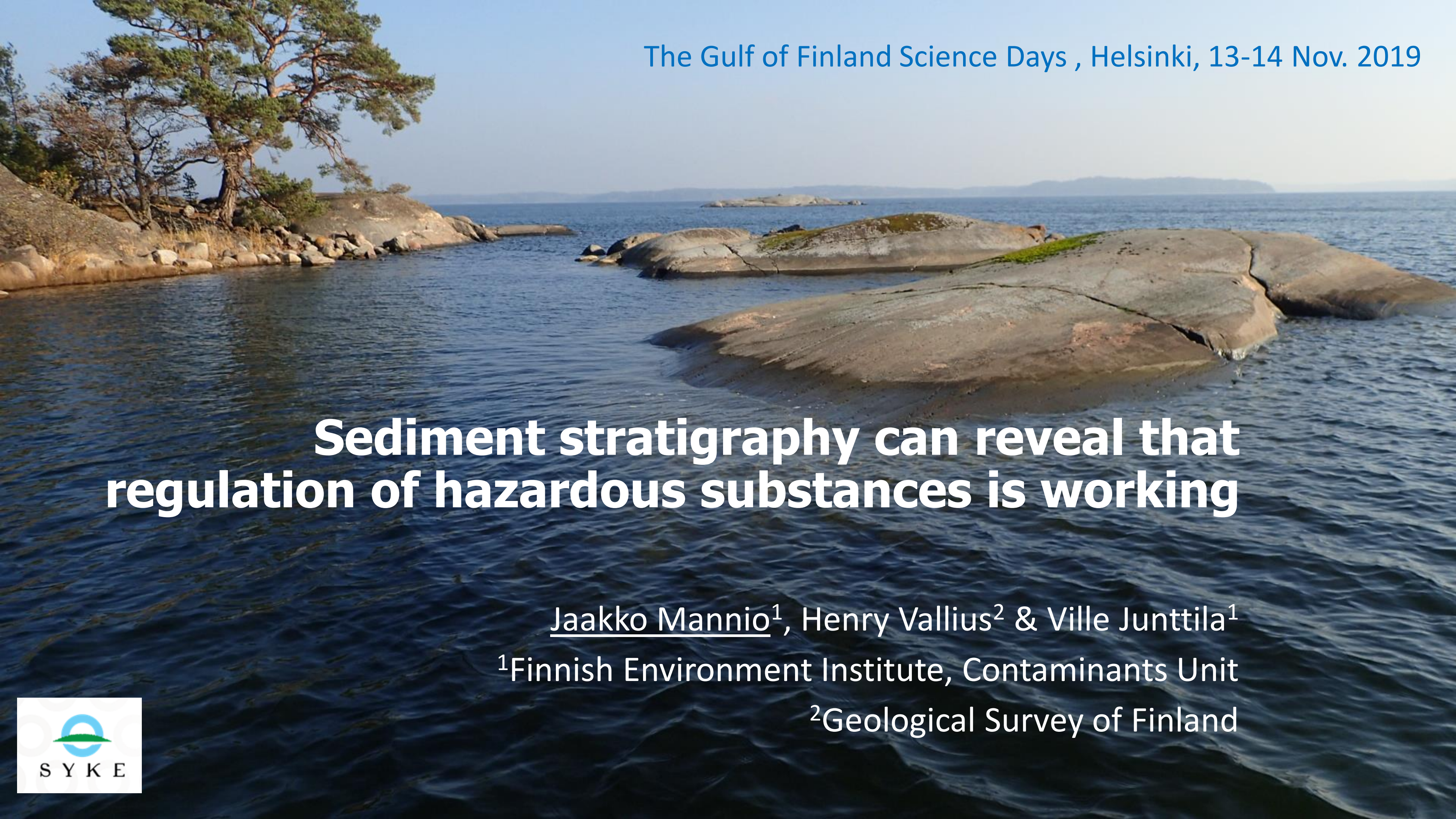
Conclusions

1) The seasonal signal of biogeochemical variables is dominant independent of the location in the GoF, due to either river effect, estuarine transport or local biogeochemistry;

2) Long-term variations of bottom DO and nutrient concentrations in the open GoF are controlled by the frequency and strength of MBIs;

3) There is no improvement of eutrophication state of the GoF over the period of 1966—2006: instead, we calculated a worsening trend of bottom oxygen concentrations in shallow areas and increasing trends in primary production and surface NO_3 and PO_4 concentrations;

Based on these results, it could be discussed whether the GoF ecosystem has shifted into a new biogeochemical stable state, which is largely influenced by internal processes and water exchange with the Baltic Proper.



The Gulf of Finland Science Days , Helsinki, 13-14 Nov. 2019

Sediment stratigraphy can reveal that regulation of hazardous substances is working

Jaakko Mannio[1], Henry Vallius[2] & Ville Junttila[1]

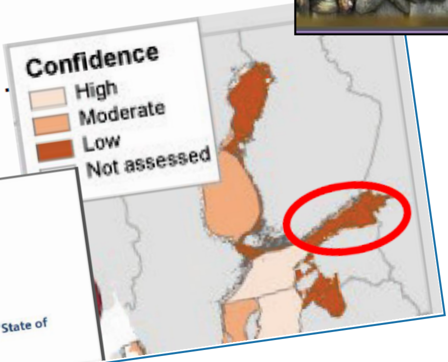
[1]Finnish Environment Institute, Contaminants Unit

[2]Geological Survey of Finland

Mannio et al.
Gulf of Finland tri-lateral Forum
Tallinn, Oct 9-10, 2017

Chemical status is based on BIOTA

- **Threshold values do exist!**
  - For all BSAP Hazardous Substances and their indicators
  - Mostly for fish (biota), few for sediments, some for water
- **Gulf of Finland data lacking!**
  - Compared to other Baltic Sea regions
  - ...ICES database not easy for uploading...
  - ➔ With too little data, **confidence is low**



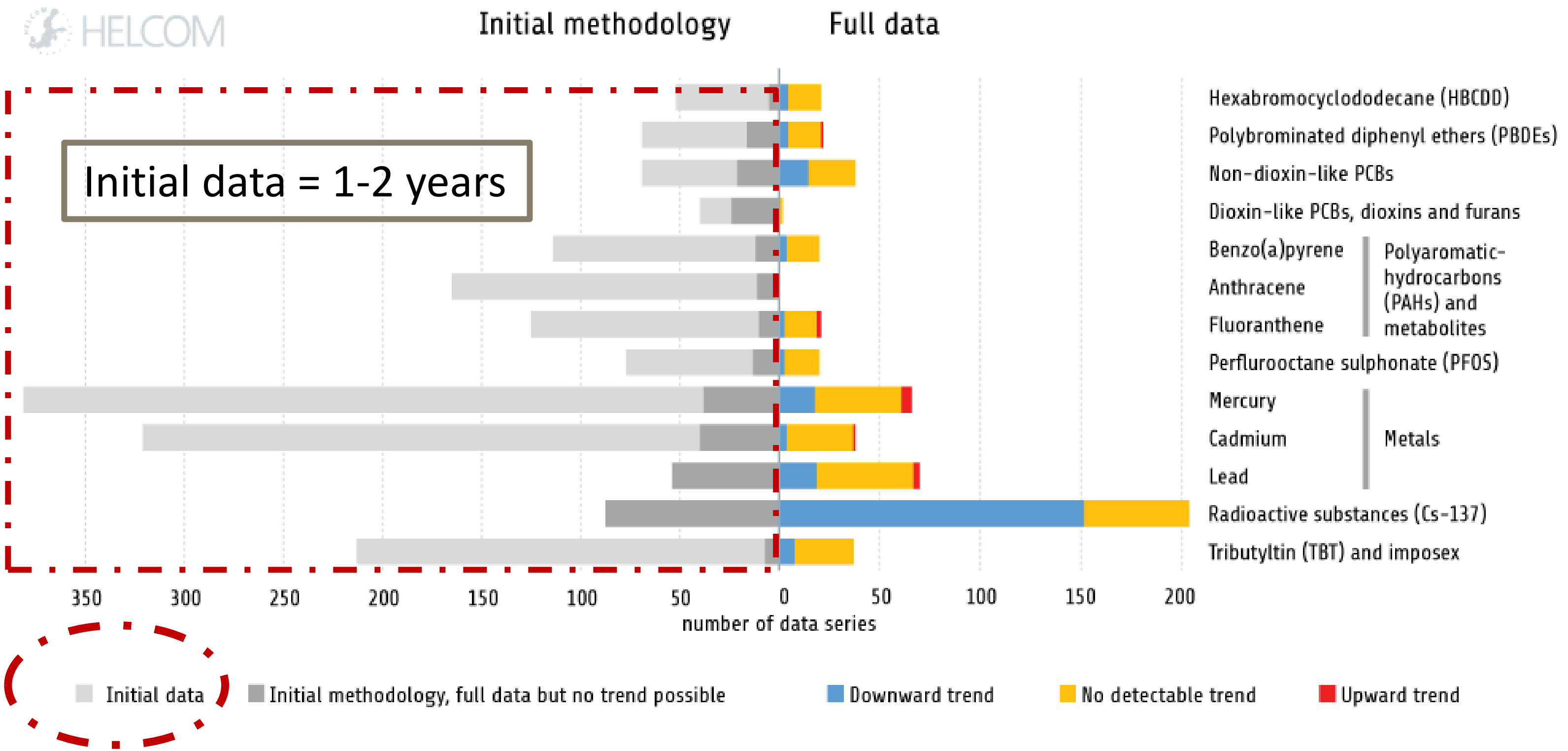
STATE OF THE BALTIC SEA
- HOLISTIC ASSESSMENT -
First version 2017

THE INTEGRATED ASSESSMENT OF HAZARDOUS SUBSTANCES
TO BE UPDATED IN 2018
-Supplementary Report to the First Version of the 'State of the Baltic Sea' Report 2017

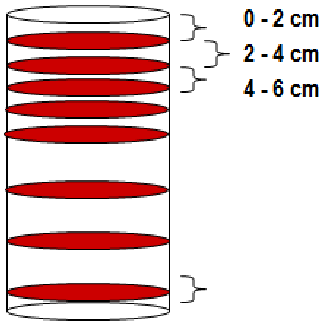
S Y K E

HELCOM HOLAS II Assessment 2018

Hazardous Substances: existing BIOTA trends mostly decrerasing, coastal data waiting to grow to trends…



Manual for Marine Monitoring in the COMBINE Programme of HELCOM (361 pages)

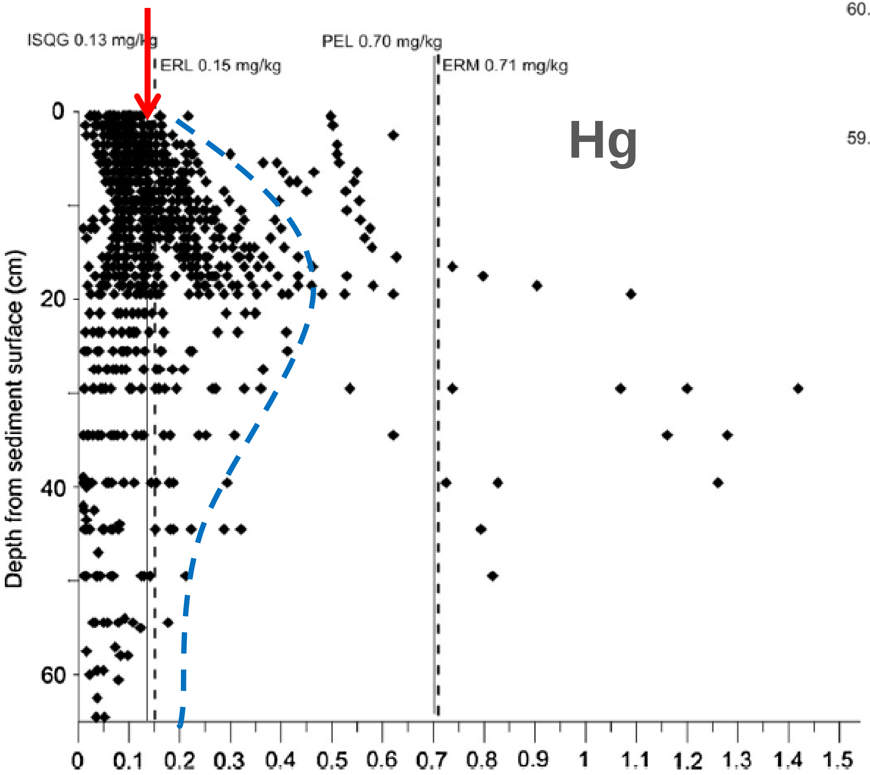


ANNEX B-13 APPENDIX 3. : TECHNICAL NOTE ON
THE DETERMINATION OF HEAVY METALS AND PERSISTENT ORGANIC COMPOUNDS IN MARINE SEDIMENT

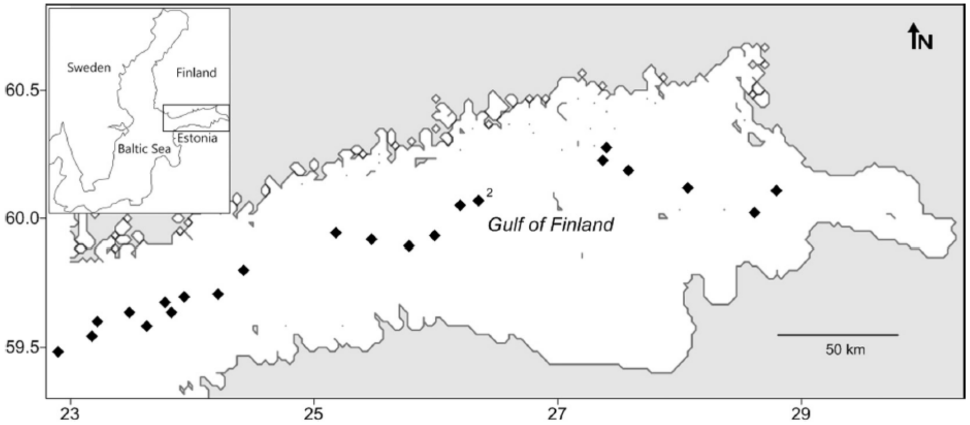
- *The major criterion…. is to guarantee a fairly undisturbed sample stratification…. Reasonable results are obtained by the application of box corer devices or a multiple corer.*
- *…. Immediately after sampling, the first 2 cm of the core is removed and stored. If the entire core is the object of the investigation, it is recommended to dissect the first 10 cm into five 2 cm layers. The deeper part should only be analysed in distinct sections, which cover the ranges: 15–17 cm, 22–24 cm, and 29–31 cm (*Perttilä and Brügmann, **1992**).

SYKE

…we have ”hidden” (= not incl. in HOLAS) regional trends for e.g. metals



H. Vallius / Marine Pollution Bulletin 98 (2015) 314–319



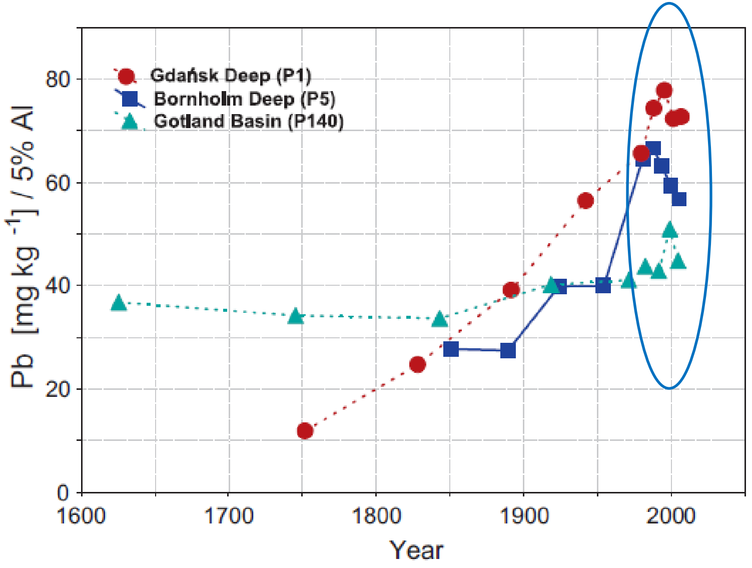
Mercury concentrations with depth in 23 Gulf of Finland sediment cores with sediment quality guidelines indicated

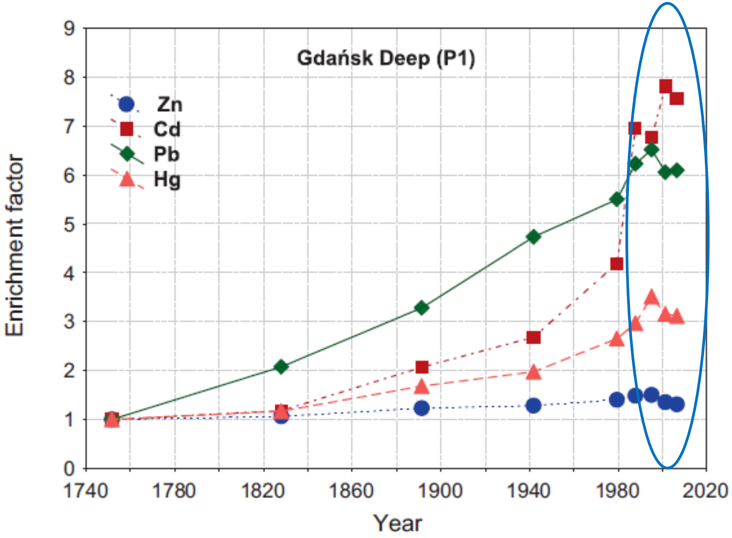
ISQG = interim sediment quality guideline
ERL = effects range-low
PEL = probable effect level
ERM = effects range-medium

H. Vallius, *Mar. Poll. Bull.* 2015

... and we can look temporal trends **over decades** with radiochemistry (^{137}Cs & ^{210}Pb)

... or centuries for background concentration





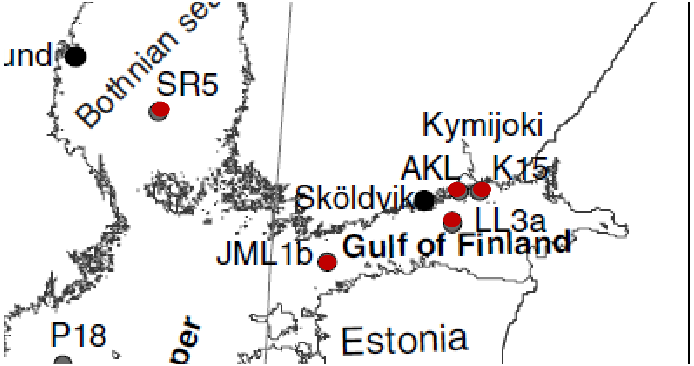
Temporal changes in Hg, Pb, Cd and Zn environmental concentrations in the southern Baltic Sea sediments dated with ^{210}Pb method (Zalewska *et al.* **2015**)

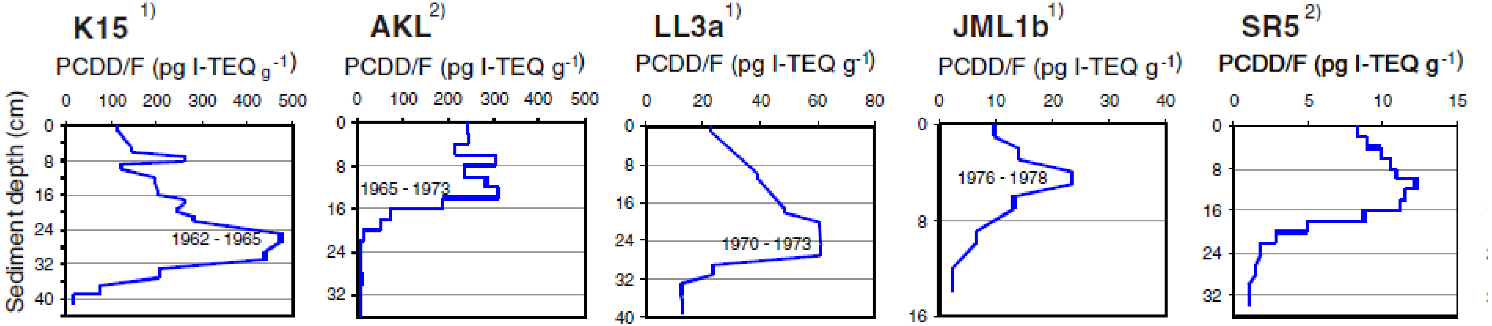
… and compare changes is different regions:

Dioxin concentrations in sediments

of the Baltic Sea

(Verta *et al.* **2007**)





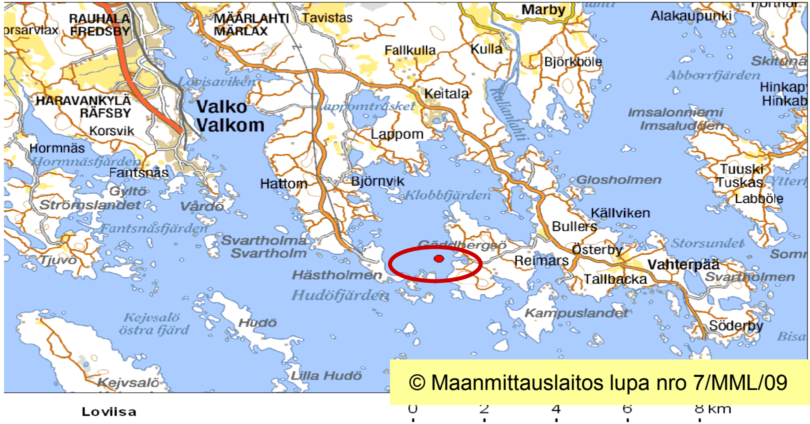
Concentration distribution of selected PCDD/F congeners in sediment profiles.
(1) Isosaari et al., 2002a, (2) Verta et al. 2007 (SYKE)

SYKE

Banning TBT has been effective: concentration in surface sediment started decreasing rapidly

- Degradation
- Clean sedimentation on top
- …but conc. exceeding the HELCOM threshold value (2 µg/kg)

Loviisa

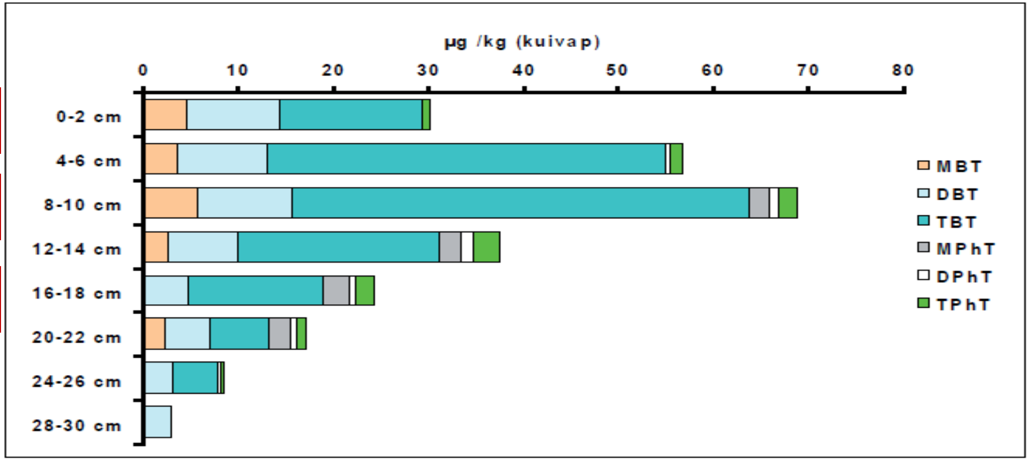


What about now, ten years after?

n. 2005 -07

n. 1995

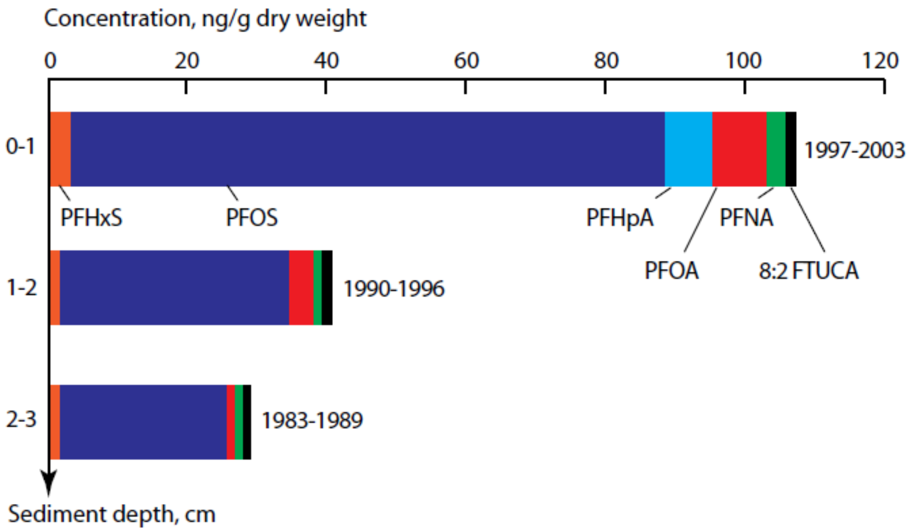
n. 1986



S Y K E

Hallikainen *et al.* **2008**

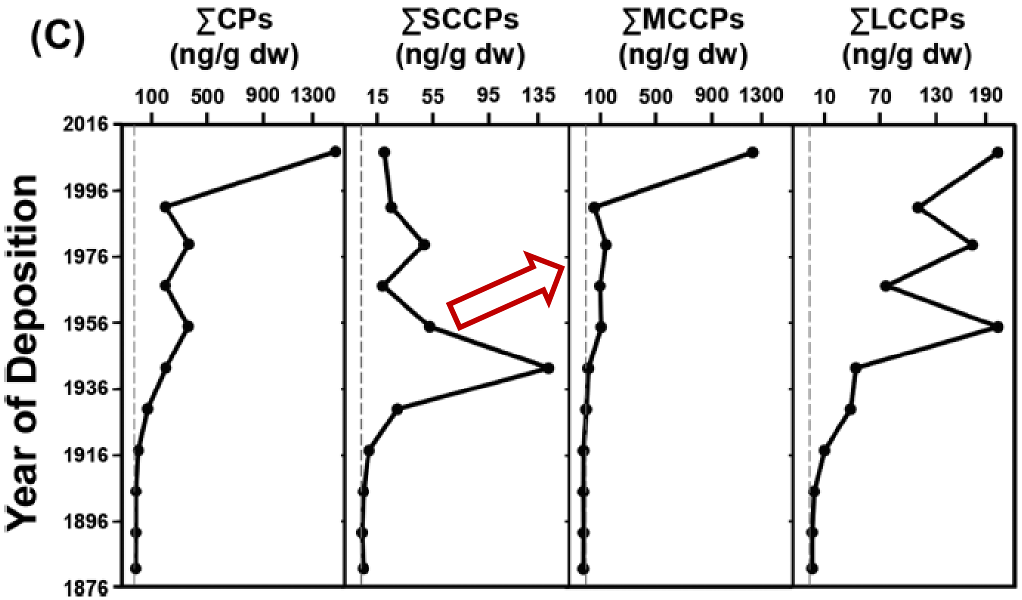
… we would like to know the recent history of perfluorinated compounds (PFAS) in the Baltic /GoF as well!

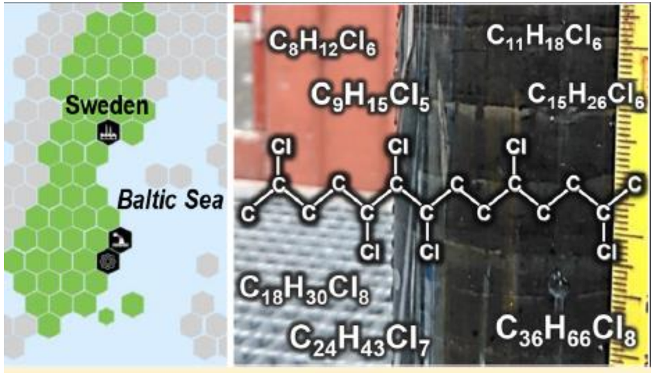


Fluorinated compounds in sediments from an Arctic lake, Canada

Arctic Monitoring and Assessment Programme **2009**

… as well as the Chlorinated Paraffins ? – substitution from SCCP => MCCP





Historical temporal trends of total CP, **SCCP, MCCP, and LCCP** concentrations in coastal sediment core samples **close to (C) a steel factory**. The gray dashed line represents the LODs.

Yuan et al. *Environ. Sci. Technol.* **2017** (51) 14199−14208

A temporal sediment record of microplastics in an urban lake, London, UK

In near future, data from Gulf of Finland sediments?

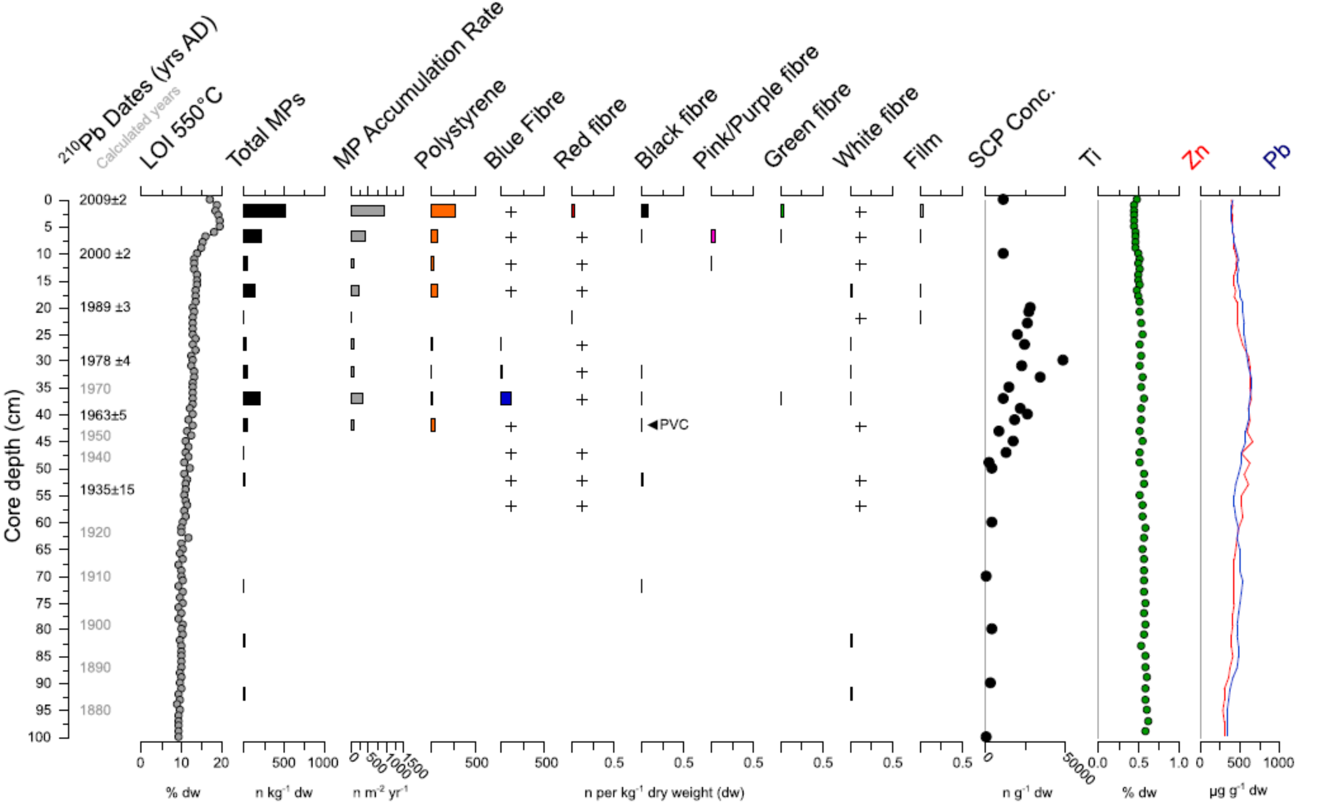


Fig. 1 Stratigraphic plot of ^{210}Pb-dated sediment variables and occurrence of microplastic (MP) types in core HAMP1. Crosses indicate below-blank occurrence. LOI 550 °C (dry mass loss on ignition); SCP Conc (spheroidal carbonaceous particle concentration); Ti, Zn and Pb element abundance in sediment samples measured by XRF (see text)

(Turner *et al.* **2019**, *J. Paleolimnol.*)

What’s the use of sediment cores
for HELCOM & GoF work?

- **Strenghten rapidly the trend assessment, now based mainly on biota**
- **Very little data from last 10 yrs = ”uppermost slice missing” !**
  - PROBLEM: data is tedious to import to ICES database afterwards
  - But maybe some selected sites?
  - ➔ **Might be easier to set up new Gulf of Finland project & database??**
- **Data could be added to the HELCOM indicator reports (before HOLAS III)?**
- **Sediment core data is pressure/trend/status data, which is highly ”wanted”**

SYKE

Epilogue:

”Life is understood backwards,
but must be lived forwards”

(S. Kierkegaard: Either – Or 1843)

SYKE

jaakko.mannio@ymparisto.fi

НАУЧНО-ИССЛЕДОВАТЕЛЬСКИЙ ПРОЕКТНЫЙ ИНСТИТУТ АКВА-ТЕРРИТОРИАЛЬНОГО ПЛАНИРОВАНИЯ «ЕРМАК СЕВЕРО-ЗАПАД»
Scientific and Research Institute of Maritime Spatial Planning Ermak NorthWest

Towards a Russian position on MSP and Blue economy development in a view of Blue Growth initiative for the Baltic and Black Sea regions

На пути к национальной позиции России по развитию МПП и Синей экономики в рамках инициативы Голубого роста для Балтийского и Черноморского регионов

Andrei Lappo, Larisa Danilova

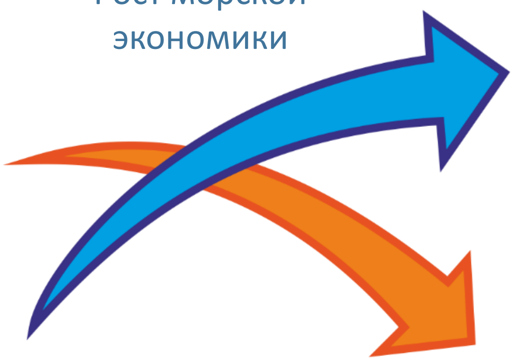
info@ermaknw.ru
www.ermaknw.ru

Helsinki, November 2019, The Gulf of Finland Science Days

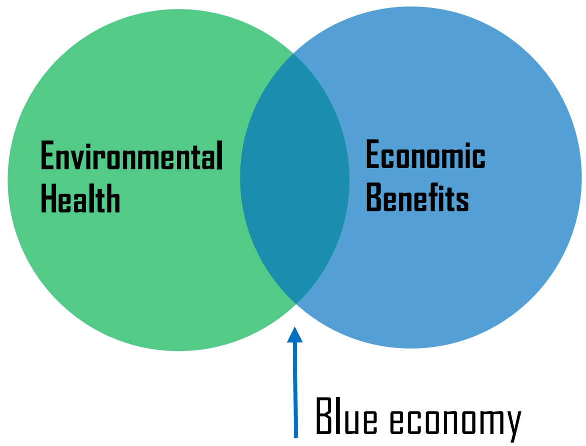
Blue Growth – what is new?

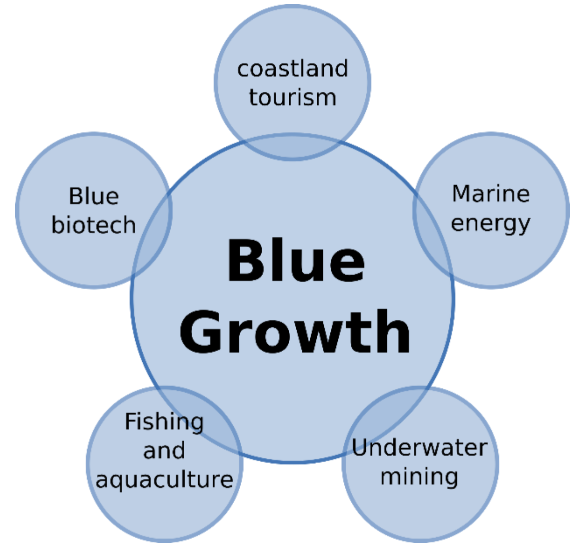
TWO PARALLEL TRENDS IN THE GLOBAL OCEAN

Growth in Ocean economy
Рост морской экономики



Declining health of Ocean environment
Ухудшение состояния окружающей среды океана

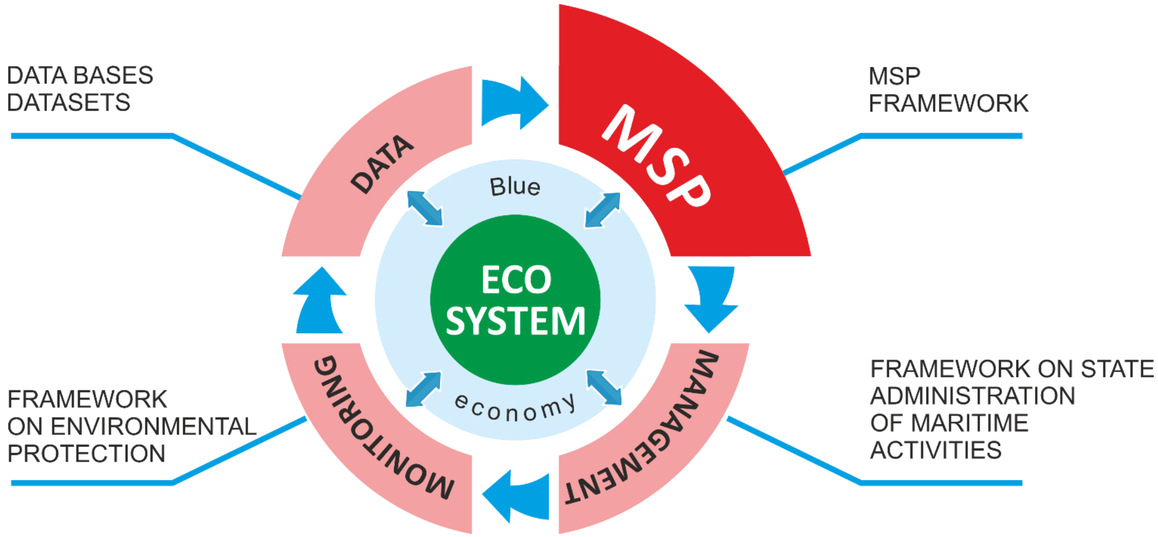




Blue growth is an initiative, or strategy (if it becomes an official political document) that ensures the development of the marine economy in such a way, that economic activity is in balance with the health of the sea.

Синий рост – это инициатива, или стратегия, если она становится официальным политическим документом, которая обеспечивает такое развитие морской экономики, при котором экономическая активность находится в балансе со здоровьем моря.

Integrated Sea Management cycle



Following a meeting on the effective and safe development of the Arctic held on June 5, 2014, Vladimir Putin signed a list of instructions, including an order “To Develop a pilot project for integrated environmental management in the Arctic seas and implement it in the Russian part of the Barents Sea”

По итогам совещания по вопросу эффективного и безопасного освоения Арктики, состоявшегося 5 июня 2014 года Владимир Путин подписал перечень поручений, в том числе: «Разработать пилотный проект комплексного управления природопользованием в арктических морях и реализовать его в российской части Баренцева моря».

Framework for promoting Blue Growth in Russia

Strategic documents

- Spatial Development Strategy of the Russian Federation (2018)
- Strategy for the Development of Maritime Activities of the Russian Federation (2019)
- Strategies for the socio-economic development of coastal regions

Laws and Codes

- Town Planning Code of the Russian Federation (2005 / ...)
- Water Code of the Russian Federation (... / 2015)
- Law on Strategic Planning in the Russian Federation (2015)
- Law on the State Management of Maritime Activities of the Russian Federation (draft, 2015/2017)
- Low on the Maritime Spatial Planning (Concept, 2014)

Стратегические документы

- Стратегия пространственного развития Российской Федерации (2018)
- Стратегия развития морской деятельности Российской Федерации (2019)
- Стратегии социально-экономического развития приморских регионов

Законодательные

- Градостроительный кодекс РФ (2005/…)
- Водный кодекс РФ (…/2015)
- Закон о стратегическом планировании в Российской Федерации (2015)
- Закон о государственной управлении морской деятельностью РФ (проект, 2015/2017)
- Закон о МПП (концепция, 2014)

Blue Growth in Russia. Federal level challenges

Specific Example

Over the past 30 years, more than $200 000 USD has been invested per every 1 meter of the southern coast of the Russian part of the Gulf of Finland – that is $40 billion USD per 180 km of the coastline).

However

- MPA protected areas are not sufficiently developed;
- Regional Environmental Laboratory is closed;
- Reduced reproduction of fish stocks, industrial fishing volumes decreased;
- Indigenous people and coastal municipalities deprived can't influence decisions on the creation of new industrial facilities;
- The criteria for nuclear and radiation safety are insufficient*.

Rosatom, Gazprom and the Ministry of Transport would invest $ 40 billion USD in the next 10-15 years mostly for the port facilities.

* NGO reports and presentations on Strategy Forum in St.Petersburg, 2019

Конкретный пример

За последние 30 лет **в каждый метр** южного берега российской части Финского залива вложено более **$ 200 тысяч** (это $ 40 млрд на 180 км береговой черты).

В то же время

- Не созданы морские охраняемые акватории, финансирование ООПТ недостаточно;
- Закрыта Региональная экологическая лаборатория;
- Снижается воспроизводство рыбных запасов, что ведет к снижению объемов промышленного лова;
- Коренное население и муниципалитеты приморских районов лишены возможности влиять на решения о создании новых промышленных объектов;
- По данным ряда источников недостаточны критерии ядерной и радиационной безопасности региона

В ближайшие 10-15 лет в проекты Росатома, Газпрома и Минтранса намечено инвестировать в береговую полосу еще около $ 40 млрд.

Blue Growth in Russia. Main steps

- Definition of the Federal authority responsible for marine and maritime activities
- Distribution of power for managing of marine and maritime activities between on federal and regional levels
- Development, adoption and implementation of a national framework for managing of marine and maritime activities and MSP

- Определение органа федеральной власти, ответственного за морскую деятельность
- Распределение полномочий по управлению МД между федеральным и региональным уровнями
- Разработка, принятие и внедрение национальной законодательной базы по управлению МД и МПП

Russian Maritime Development Strategy (2019) – towards a regional responsibility

- Development and implementation of ISMP and ISZM programs;
- Marine cultural heritage management;
- Environmental protection of the coastal and marine area;
- Regional cross-border cooperation on the research in the field of marine environment and Blue economy;
- Development of cruise and water tourism;
- Fisheries and aquaculture conservation and development programs.

- Разработка и реализация программ КУПТПА;
- Обеспечение сохранения морского культурно-исторического наследия;
- Охрана окружающей среды морского побережья и прилегающей акватории;
- Развитие международного приграничного сотрудничества по изучению и освоению морской окружающей среды;
- Развитие морского круизного и водного туризма;
- Развитие рыболовства и аквакультуры.

Experience and Knowledge for Blue Growth. International Cooperation

Russia is involved

- HELCOM-VASAB WGs
- BalticLINEs
- BalticRIM

Russia was not involved

- Baltic Scope
- Pan Baltic Scope
- Plan4Blue …

Current projects

- Capacity4MSP
- Black Sea Connect …

Россия участвует

- Рабочие группы ХЕЛКОМ-ВАСАБ
- Проект BalticLINEs
- Проект BalticRIM

Россия не участвует

- Проект Baltic Scope
- Проект Pan Baltic Scope
- Проект Plan4Blue …

В процессе разработки

- Проект Capacity4MSP
- Проект Black Sea Connect

Capacity4MSP

Strengthening the capacity of MSP stakeholders and decision makers
Укрепление потенциала стейкхолдеров МПП и лиц принимающих решения

Project will create a practically oriented and interactive collaboration platform for MSP stakeholders, decision- and policy makers that will inform, support and enhance on-going MSP efforts by capitalizing on the outcomes of various transnational MSP projects and national MSP processes.
Project will widen the knowledge and experience gained from previous MSP projects as well as intensify the dialogue among MSP stakeholders.

Russian participants

- ErmakNW
- RSHU

The project is supported by the Ministry of Natural Resources.

ErmakNW WP

- ✓ To develop Roadmap for MSP in Russia
- ✓ To involve Russian stakeholders in the MSP, including those from federal and regional bodies.

Capacity4MSP создаст платформу для сотрудничества заинтересованных сторон МПП, лиц, принимающих решения и политиков, которые будут информировать, поддерживать и наращивать текущие усилия по МПП, используя опыт и результаты предыдущих проектов МПП и национальных процессов МПП.
Проект углубит и расширит знания и опыт, полученные в результате проектов а также активизирует диалог между заинтересованными сторонами.

Российские участники

- ЕрмакСЗ
- РГГМУ

Проект осуществляется при поддержке МПР

Рабочий пакет ЕрмакСЗ

- ✓ Разработка проекта Дорожной карты МПП для Балтийского моря
- ✓ Вовлечение в процессы МПП российских стейкхолдеров, в том числе из федеральных и региональных органов власти.

Black Sea CONNECT CSA Goals:

- **Development of the National Blue Growth Strategies**
- Creation of a new technological platform for the Black Sea cooperation
- Harmonization of financing of scientific and educational programs
- Update SRIA and action plan for the Black Sea region

- **Разработка национальных стратегий Синего роста**
- Создание новой технологической платформы черноморского сотрудничества (наука, образование, политики, фонды).
- Гармонизация финансирования научных и образовательных программ.
- Обновление Стратегической повестки исследований и инноваций (SRIA) и плана действий для региона Черного моря

Towards a Russian position on MSP and Blue economy development in a view of Blue Growth

На пути к национальной позиции России по развитию МПП и Синей экономики

- ✓ Active participation in the international Platform and CSA projects, such as Caracity4MSP and BLACK SEA CONNECT
- ✓ Development of the Roadmap for MSP in Russia
- ✓ Development of the national Blue Growth Strategy for the Black Sea
- ✓ International platforms in the field of MSP and Blue Growth in the Baltic and Black Seas

- ✓ Активное участие российских институтов в международных проектах платформ и поддержки, таких как Capacity4MSP и BLACK SEA CONNECT
- ✓ Разработка Дорожной карты МПП в Российской Федерации
- ✓ Разработка национальной Стратегии Синего роста для Черного моря
- ✓ Включение России в платформы сотрудничества по МПП и Синему росту на Балтийском и Черном морях

THANK YOU FOR ATTENTION!
СПАСИБО ЗА ВНИМАНИЕ! KIITOS!

Andrei Lappo, Larisa Danilova

info@ermaknw.ru
www.ermaknw.ru

Gulf of Finland Science Days
"Facing our Common Future"

GET READY

"Getting Ready for the Cross-Border Challenges: Capacity Building in Sustainable Shore Use"

Alina Nazarova
Head of development department
Eco-Express-Service LLC

13-14 November 2019

CBC 2014-2020
SOUTH-EAST FINLAND - RUSSIA

Eco-Express-Service LLC

- The company was founded in 1992.

- Today, more than 200 highly qualified specialists are employed in the company, including 12 employees - doctors and candidates of science.

- The company has a modern material and technical base and is located on the territory of two constituent entities of the Russian Federation: two offices in St. Petersburg and the Scientific and Production Ecological Center with the Testing Laboratory in Shlisselburg, Leningrad Region.

- More than 3000 project and environmental works have been implemented in all regions of Russia, incl. at the federal level sites: ports of Ust-Luga, Bronka, Vyborg and Vysotsk; construction of a complex of defenses against floods in St. Petersburg.

- The company Eco-Express-Service develops, manufactures and implements complete treatment facilities for cleaning storm sewage of cities and industrial complexes, including oil depots, transshipment and coal terminals, roads, as well as wastewater car washes, allowing you to organize recycling schemes of their water supply and sewage treatment plants for domestic wastewater.

About project GET READY

GETTING READY FOR THE CROSS-BORDER CHALLENGES - CAPACITY BUILDING IN SUSTAINABLE SHORE USE (KS1529)

ACRONYM
GET READY

LEAD PARTNER
Eco-Express-Service LLC

TOTAL BUDGET
812 713 €

DURATION
01/05/2019 - 30/04/2022

CBC FUNDING
650 171 €

WEB SITE
http://www.ecoex.ru

PARTNERS
Federal State Budgetary Institution State Hydrological Institute (RUS) | Saint Petersburg State University (RUS) | University of Turku (FIN) | South-Eastern University of Applied Sciences (FIN) | Finnish Environmental Institute (FIN) | Kotka Maritime Research Association (FIN)

PROJECT DESCRIPTION

GET READY project's objective is to build capacity in the field of environmental and professional education and training of sustainable use of shores and coastal management.

MAIN ACTIVITIES

Main activities include establishing of the Russian-Finnish center for education, research and innovation in coastal zone management (CERINCO) and development of pilot educational curricula and training programs. Project also aims to form a top specialists' international cohort for further development of relevant topics and to create methodological materials for the professional community, noticing also climate change issues.

CBC 2014-2020
SOUTH-EAST FINLAND - RUSSIA

Funded by the European Union, the Russian Federation and the Republic of Finland.

PRIORITY 2 INNOVATIVE, SKILLED AND WELL-EDUCATED AREA

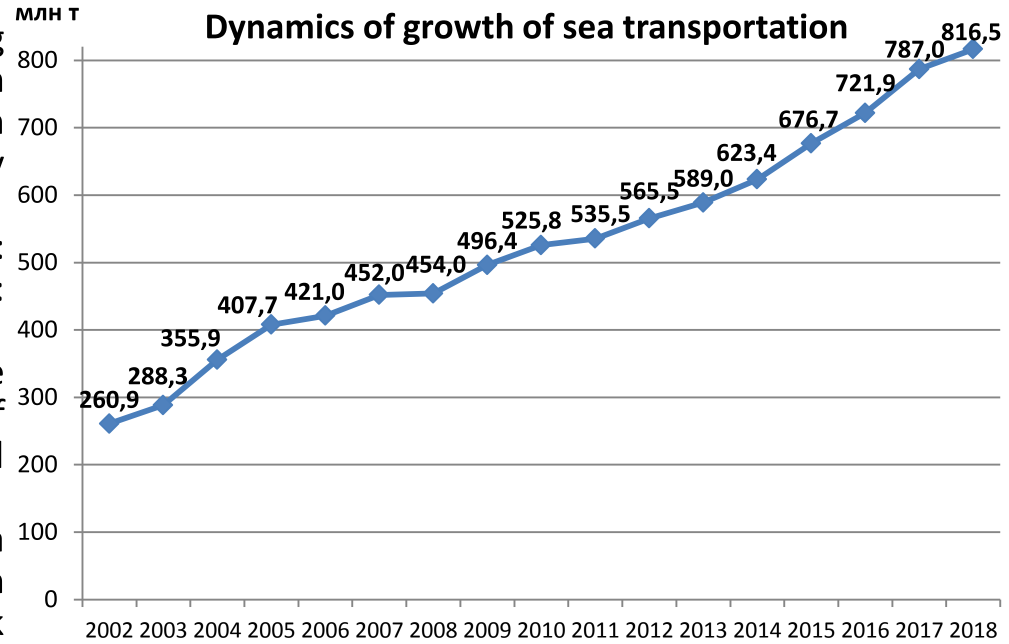
Cargo turnover of Russian seaports

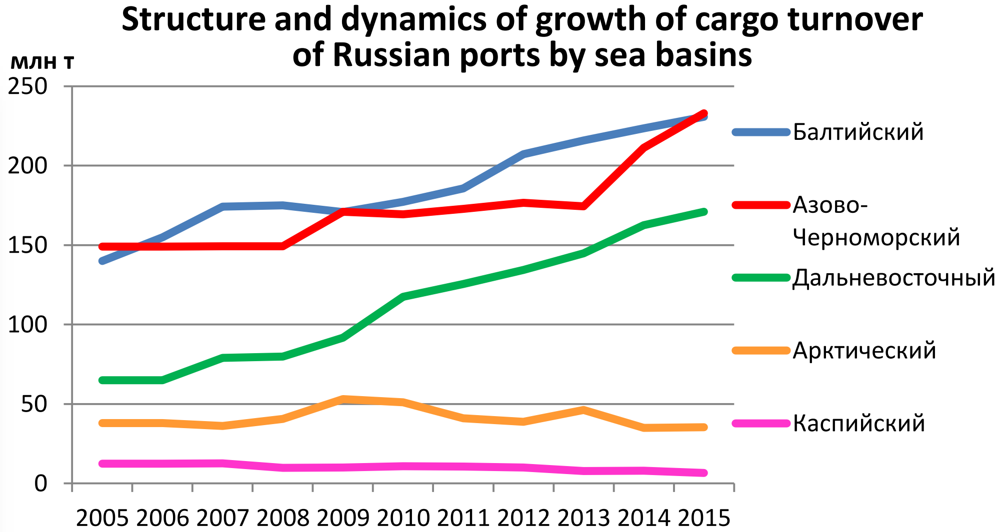
Sea transport plays an important role in ensuring foreign trade and domestic sea shipping in development of Russian economy. But in comparison with the world indicators, cargo transportation by Russian sea transport increased less intensively.

Cargo turnover of Russian ports is growing rapidly: over the past 15 years it has grown more than 3 times: from 260 to 816.5 million tons.

Currently, there are 67 seaports operating in the Russian Federation, with a total cargo turnover of 816,5 million tons, which is about 4% of the world cargo turnover of ports.

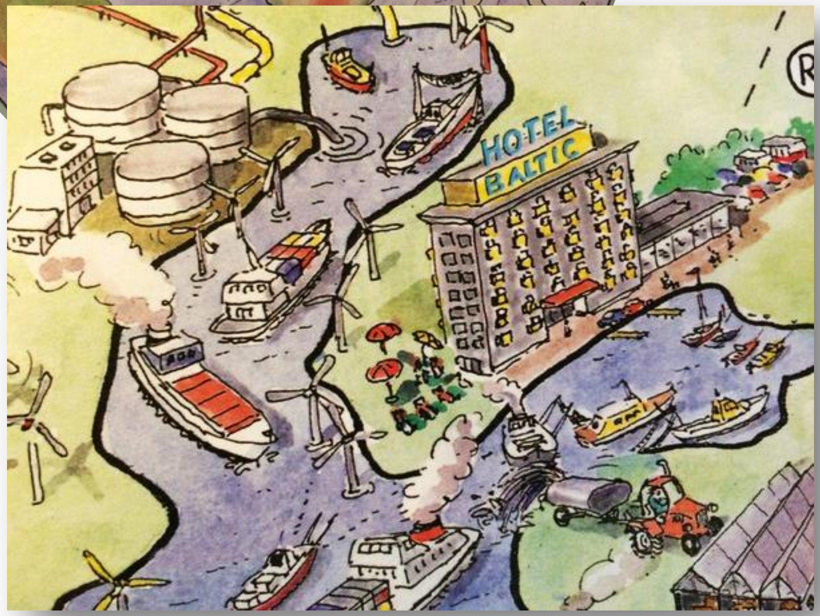
The entire sea area of Russia is divided into 5 sea basins. The maximum share of cargo turnover falls on the Baltic (35% of the total turnover) and Azov-black sea (35%) sea basins.





Relevance of the project

- Increasing of diversity and intensity of anthropogenic load on the water area;
- Increasing conflicts between consumers;
- The Baltic sea washes countries with different legal documents regulating activities in the water area.



There Is No Plan B because There Is No Planet B!

17 UN’s Sustainable Development Goals

GENERAL ASSEMBLY

- Poverty
- Food
- Health
- Education
- Women
- Water
- Energy
- Economy
- Infrastructure
- Inequality
- Habitation
- Consumption
- Climate
- Marine-ecosystems
- Ecosystems
- Institutions
- Sustainability

GET READY overall goals

1) Developing the efficiency of logistics and ports in Russia and Finland;

2) Sustainable environmental shore use in the long term period;

3) Increase of awareness and readyness for logistics and environmental protection in cross-border cooperation.

Main goals of the project

The tasks of this project is capacity building in the field of sustainable shore use by:

(1) raising professional level of coastal zone managers and related specialists, training of the workforce to serve both objects of the technosphere and specially protected natural areas;

(2) developing and implementing professional educational programs and training courses (including those focused on distance learning) for a wide range of specialists, youth and students, stakeholders and decision makers;

(3) developing infrastructure (including distance learning capacities) for continuous education and professional development;

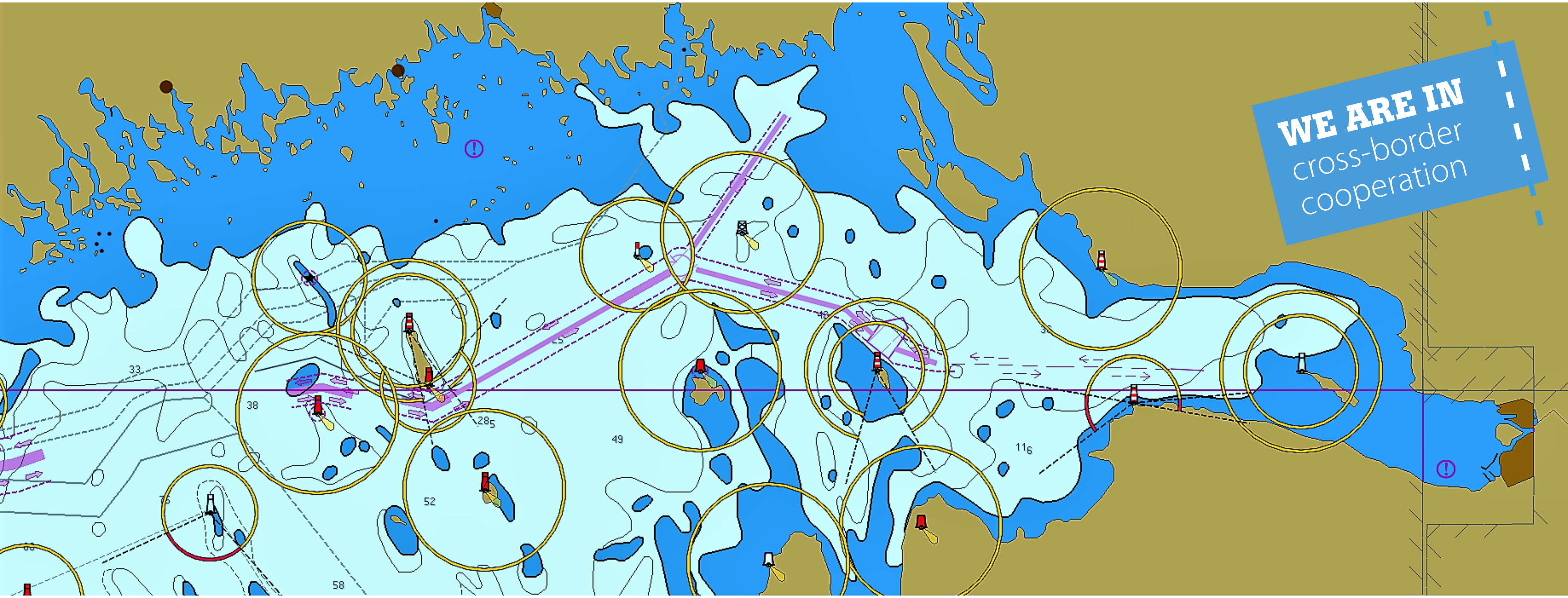
(4) introducing highly professional, scientific approach to shore use and coastal management in the EGoF;

(5) contribution to the safe technosphere in the ports region based on innovative and environmentally friendly solutions.

The project GET READY covers 4 work packages (WPs):

WP1: Science	Improving scientific base for sustainable coastal management to support decision making and implementation innovations / evaluation of environmental status of the project area
WP2: Business and innovations	Implementation of innovations in the field of coastal management and sustainable shore use
WP3: Education, training (skills development) and raising awareness	Capacity building in professional competencies via education and training of young and elderly people, professionals and students;
	Raising an ecological awareness in the field of sustainable coastal management
WP4: Network of professional experise	Establishing of an expert cooperation network for sustainable shore use and coastal management

The final result of the joint work will be a plan for the safe use of the coastal zone of the Gulf of Finland and creation of the Russian-Finnish center for advanced training in the field of sustainable coastal management.



SCIENCE – INNOVATION – BUSINESS – EDUCATION

This is our common treusure.

Suomenlahti (*Soome laht*, *Finska viken*, Финский залив, *Finski zaliv*)

CBC 2014-2020
SOUTH-EAST FINLAND - RUSSIA

Beneficiaries of the GET READY project

1) specialists in the field of coastal zone management;

2) residents and shore users of the Bronka and Hamina-Kotka ports region;

3) employers, which are sending their staff to professional development;

4) specialists in the field of providing educational services.

Thanks for your attention!

Eco-Express-Service LLC
Saint-Petersburg
nazarova@ecoexp.ru
www.ecoexp.ru

www.eco-getready.com

CBC 2014-2020
SOUTH-EAST FINLAND - RUSSIA

INFUTURE

The Gulf of Finland Science Days
"Facing our Common Future",

Helsinki, 13-14 November, 2019

Maritime and Inland Shipping: Gulf Connecting Inland Waterways

Admiral Makarov State University of Maritime and Inland Shipping

CBC Programme: Geographical area where inland waterways of the Finland and Russia meets (from Map of the European Inland Waterway Network)

Main vessels type navigable through and currently commercially viable in Saima and Volgo-Balt

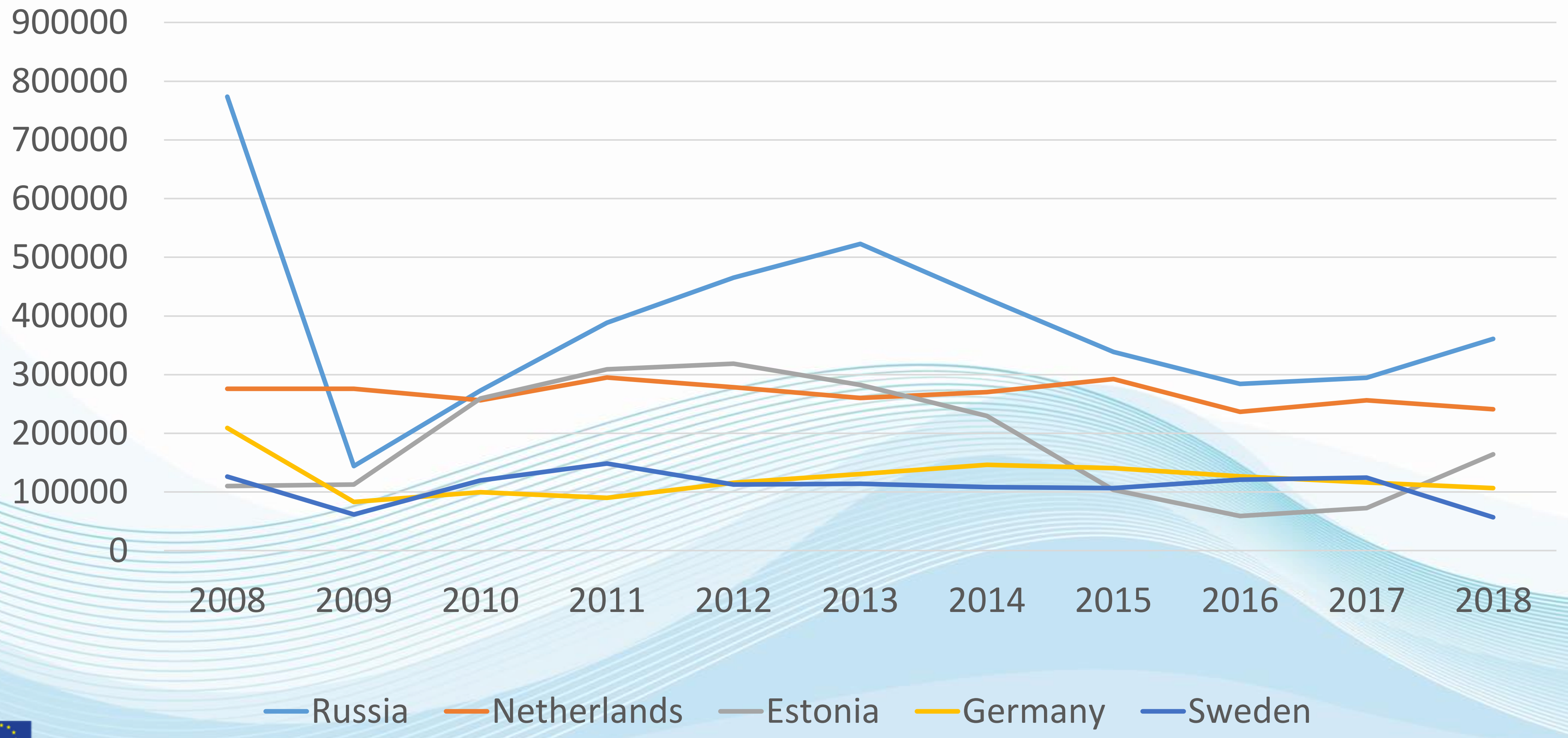
Commodities exported from Russia to Finland

Commodities imported from Finland to Russia

Trade between Finland and regions of Russia in January-November 2018

Region	Trade, in $ mln	Share, %
Moscow	6080	**45.2**
St.-Petersburg	1070	**7.9**
Leningrad region	744	**5.5**
Murmansk region	672	**5**
Karelia	**293**	**2.2**
Novgorod region	**138**	**1**
All regions:	**13400**	**100**

Transport volumes between Finland and other countries Maritime transport of goods 2008-2018

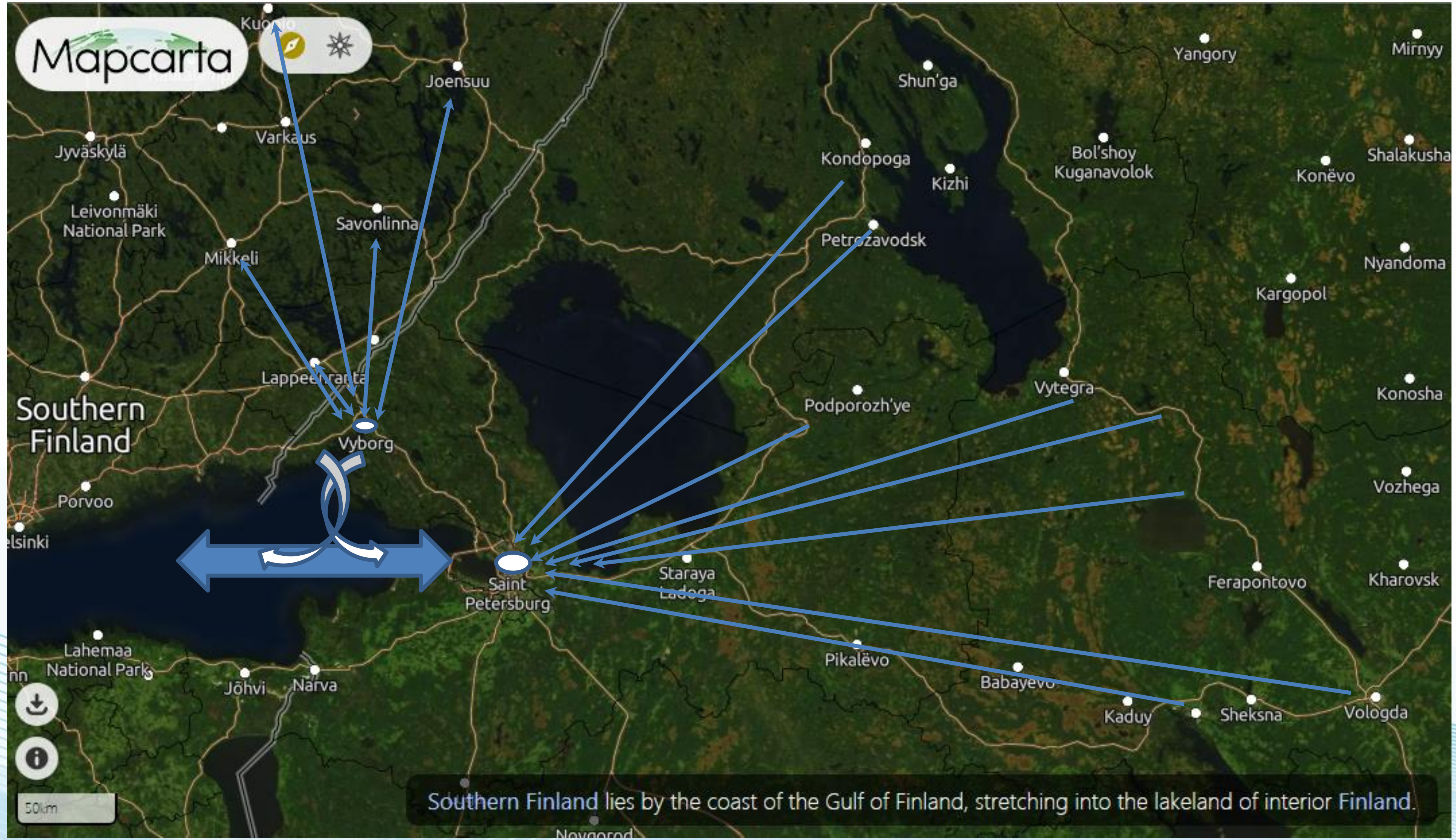


Domestic and international maritime transport through the Saimaa Canal

	Maritime transport of goods through Saimaa							
	Domestic transport			International transport				Total
Year	Export	Import	Total	Export	Import	Total	Transit	
2008	94428	56328	150756	713525	1251457	1964982	11760	2 115 738
2009	47271	24117	71388	473350	538554	1011904	1035	1 083 292
2010	93466	24533	117999	586883	955074	1541957	0	1 659 956
2011	86266	38501	124767	654390	984234	1638624	0	1 763 391
2012	23958	14522	38480	579668	1100135	1679803	0	1 718 283
2013	42990	132	43122	571509	1148993	1720502	0	1 763 624
2014	56602	20579	77181	569820	948051	1517871	0	1 595 052
2015	50968	10108	61076	596440	659631	1256071	0	1 317 147
2016	62524	34014	96538	512766	587872	1100638	0	1 197 176
2017	74886	25515	100401	502992	668639	1171631	0	1 272 032
2018	54571	18774	73345	378696	851942	1230638	0	1 303 983

(Traficom, 2019)

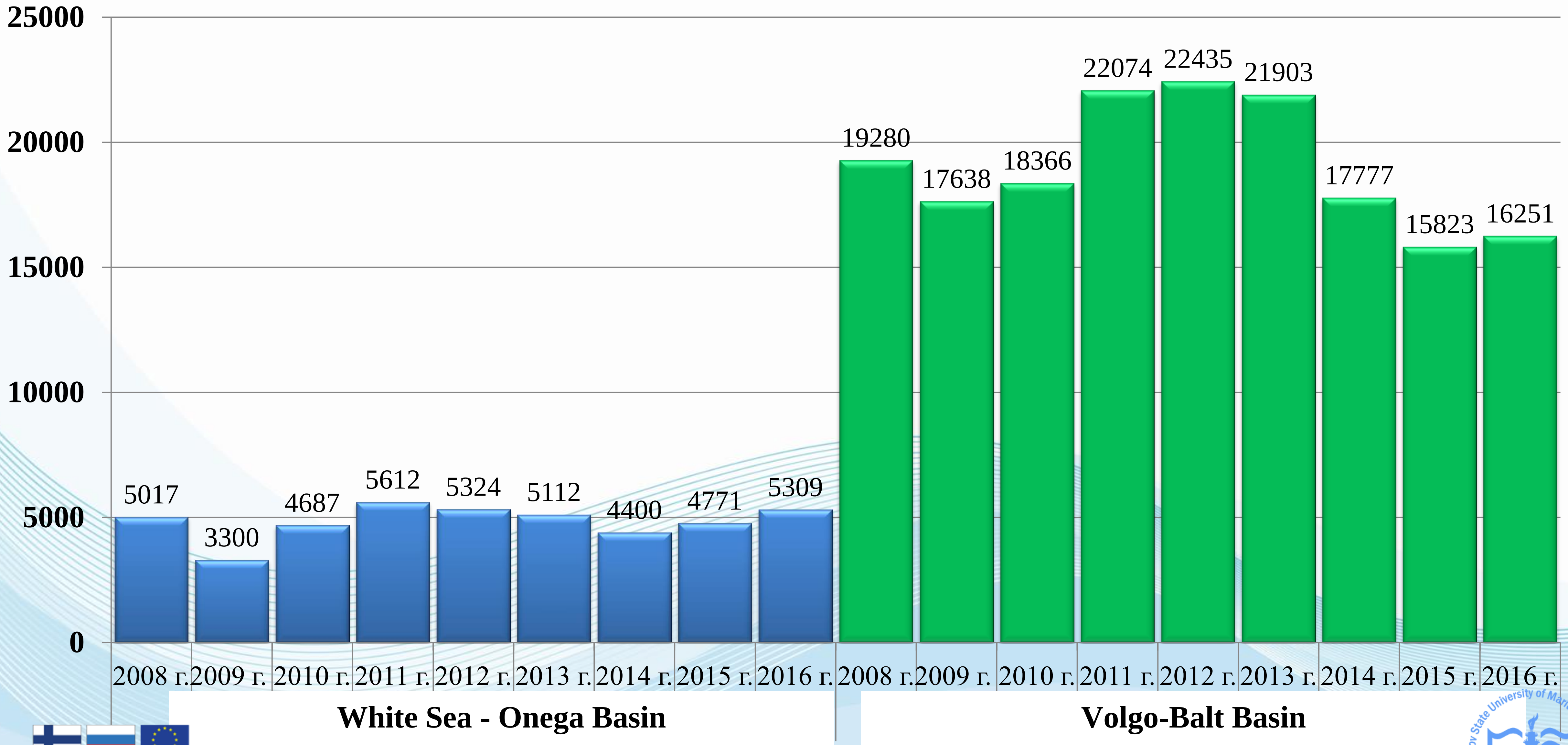
INFUTURE: Gateway and Hub ports for Finland and Russia IWWs



Major transport products in Saimaa canal (incl. transit traffic)

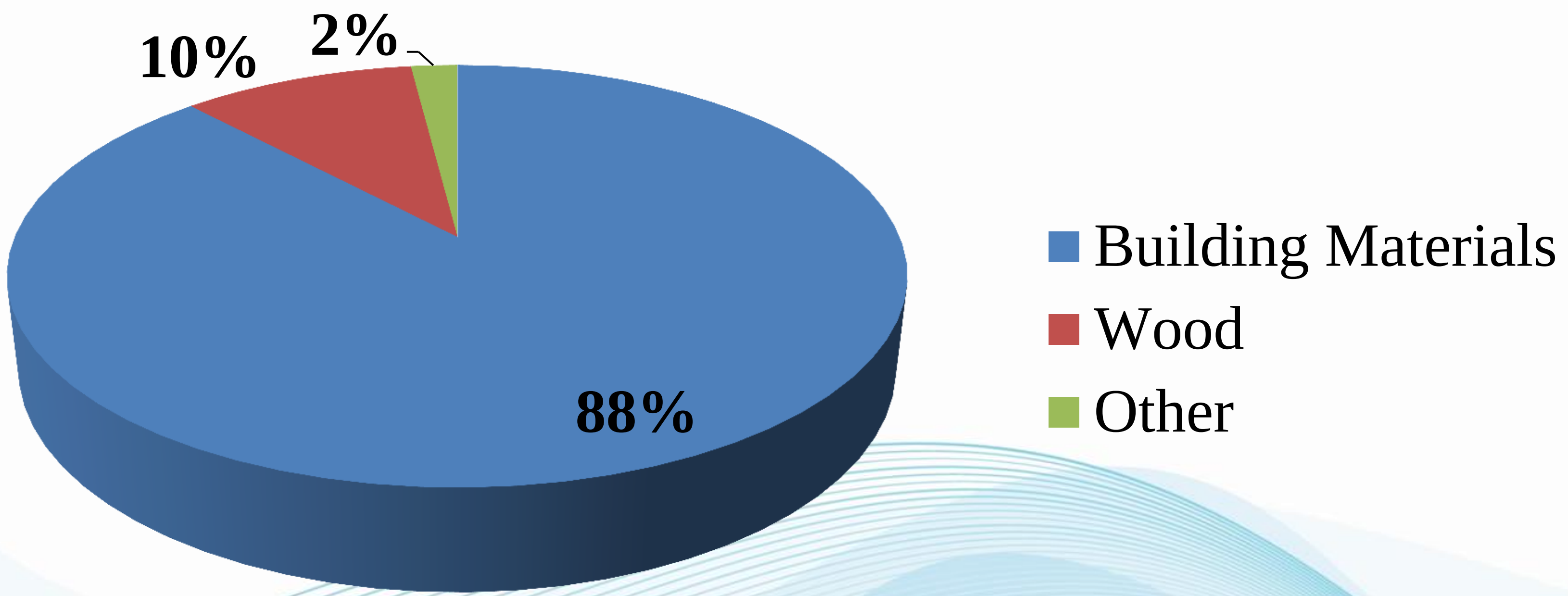
Year	Timber, raw wood, chips	Sawn wood	Paper, cardboard	Woodpulp	Plywood, veneer	Crude minerals	Chemicals, fertilizers	Coal, coke	Metals, metal products	Other merchandize	Total
2008	831137	42082	216419	231600	2285	488921	83549	136806	3193	79746	2115738
2009	272472	33791	166067	74730		406812	39650	58731	1001	30038	1083292
2010	676993	43160	157315	124170		465723	95342	66406		30847	1659956
2011	736421	43624	149137	116981		473712	120878	87394		35244	1763391
2012	806465	48447	143118	105408		347569	133003	101107	221	32945	1718283
2013	856480	65270	132473	90018		368314	134049	81972	3482	31566	1763624
2014	726826	53204	130066	79796		372827	151027	39268	16125	25913	1595052
2015	442672	43859	100902	86466		396950	168623	22039	25179	30457	1317147
2016	363739	43009	125187	68720	154	313636	163517	56373	33883	28958	1197176
2017	400478	49338	124467	62248	105	399540	142207	37802	27956	27891	1272032
2018	583411	34951	87159	49175		370580	104898	42058	10853	20898	1303983

Dynamics of cargo flows by Basin Administrations, 2008-2016, thousand tons



Structure of cargos transported in White Sea-Onega in 2016

Total cargoes in 2016 - 5 300 000 tons



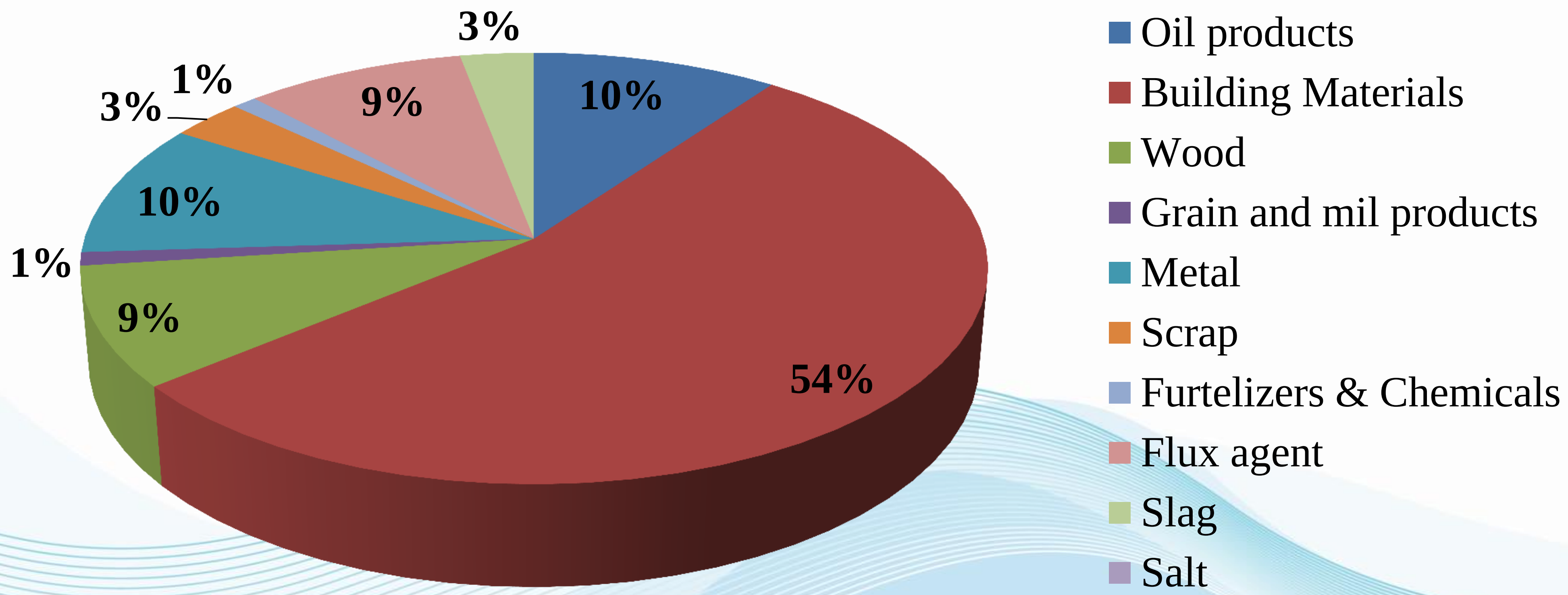
Total cargoes in 2017 - 6 100 000 ton

Total cargoes in 2018 - 6 200 000 ton

CBC 2014-2020
SOUTH-EAST FINLAND - RUSSIA

Structure of cargos transported in Volgo-Balt in 2016

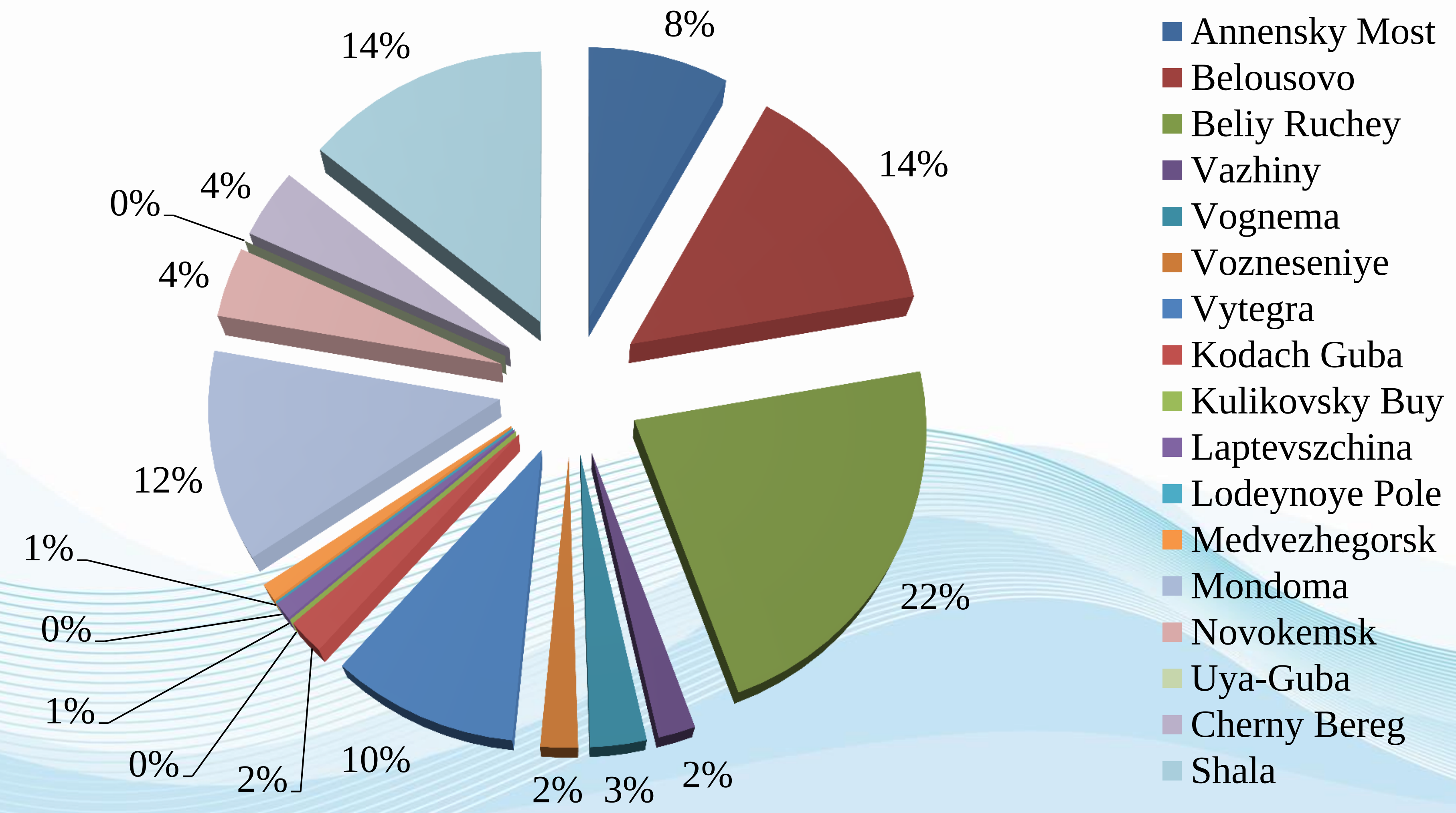
Total in 2016 – 16 200 000 ton



Total in 2017 – 16 600 000 ton

Total in 2018 – 16 200 000 ton

Main Russian inland ports of North-West for transported cargos destined to Finland in 2016

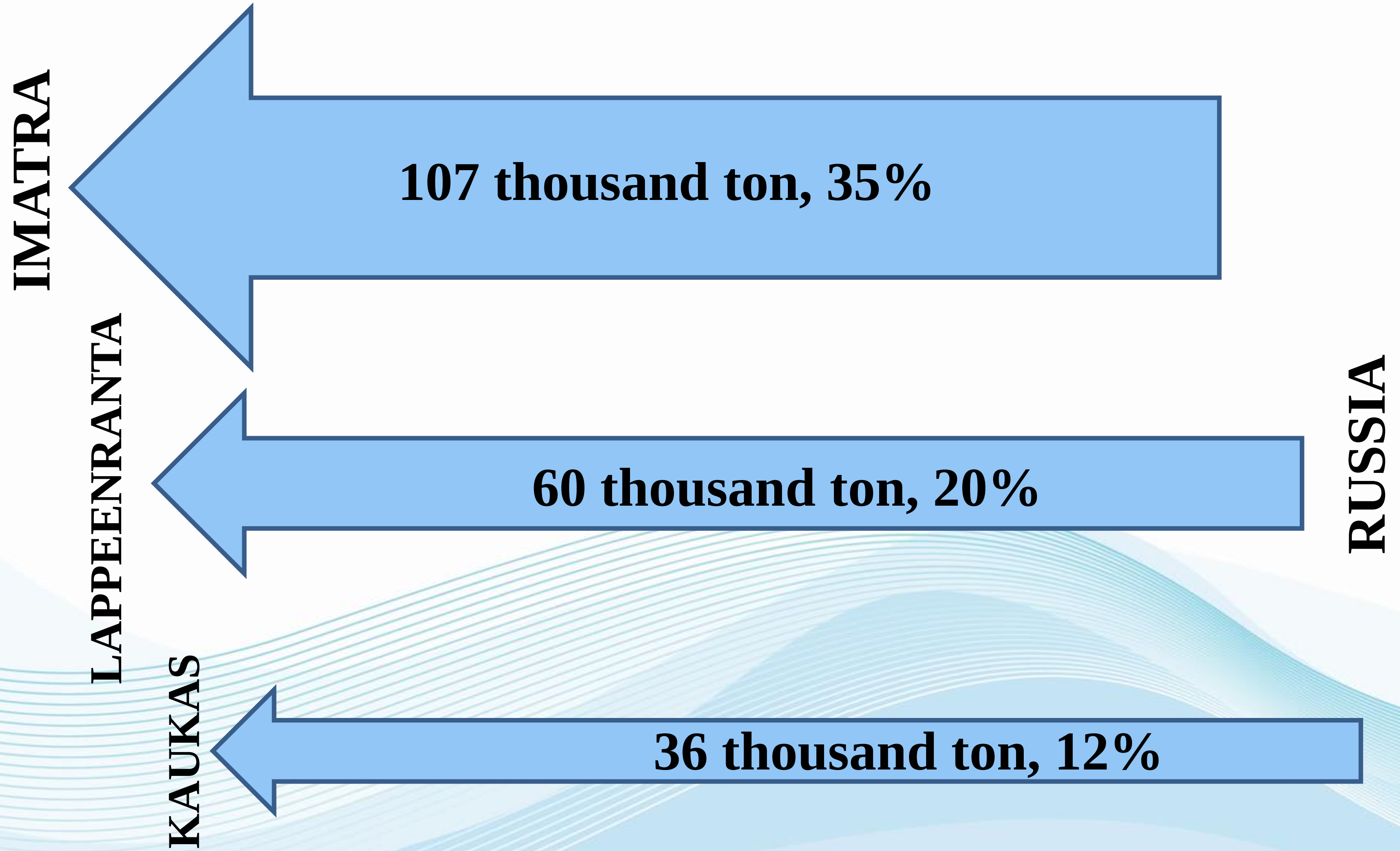


Analysis of voyages and transported cargos from Russia to ports of Finland in 2016

Cargo type	Number of voyages per year	Quantity of cargoes transported, ton
Wood Balances	202	**269 081**
Wood Chips	9	**4 397**
Wood Round	24	**34 514**
Total	235	**307 992 (75%)**

Export transportation of wood by WSO and VB in 2016 totaled in 539 000 ton

Main Finland inland ports for transported cargos originated from Russia in 2016



Analysis of cargo transportation per ports of destination, from Russia to ports of Finland in 2016

Cargo Type - Wood Balances		
Port of destination	Number of voyages	Cargo volumes, ton
Imatra	69	94 219
Joensuu	1	1 338
Kaskinen	21	29 454
Kaukas	23	31 728
Kotka	1	1 311
Kuopio	1	1 125
Lappeenranta	45	54 061
Merikarv	1	2 680
Rauma	1	1 159
Savonlinna	3	4 139
Saimaa Canal	16	19 868
Helsinki	13	16 776
Finland (no port mentioned)	7	11 223

CBC 2014-2020
SOUTH-EAST FINLAND - RUSSIA

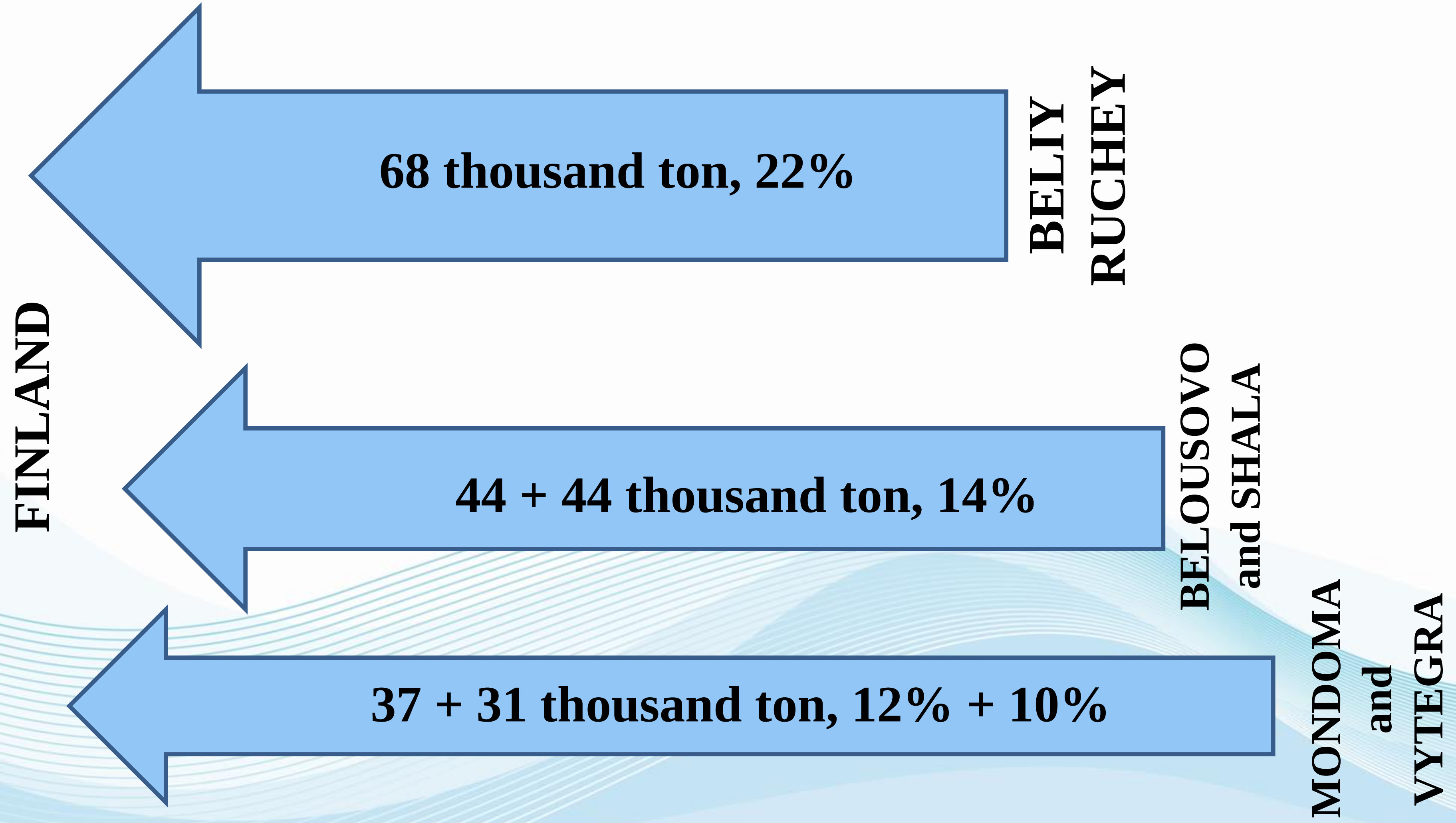
Analysis of cargo transportation per ports of destination, from Russia to ports of Finland in 2016 (continue)

Cargo Type - Wood Chips		
Port of destination	Number of voyages	Cargo volume, ton
Lappeenranta	9	4 397

Analysis of cargo transportation per ports of destination, from Russia to ports of Finland in 2016 (continue)

Cargo Type - Wood Round		
Port of destination	Number of voyages	Cargo volume, ton
Imatra	9	12 661
Kaukas	3	4 273
Lappeenranta	1	1 419
Merikarv	1	2 450
Savonlin	1	1 413
Saimaa canal	6	8 088
Helsinki	1	1 452
Finland (no port mentioned)	2	2 758

Main Russian inland ports for transported cargos destined to Finland in 2016



Main vessels type navigable through and currently commercially viable in Saima and Volgo-Balt

Analysis of cargos transported by vessel's types from Russia to ports of Finland in 2016

Vessel's Type	Cargo Type	Number of Voyages	Cargo Volumes, ton
10523	Wood Balances	12	15 762
	Wood Round	1	1 372
	Total	**13**	**17 134**
1743.1	Wood Round	1	2 450
2-95A	Wood Balances	5	7 517
2-95A/P1	Wood Balances	6	12 398
326.1	Wood Balances	42	51 228
	Wood Chips	2	979
	Wood Round	4	5 228
	Total	**48**	**57 435**

Analysis of cargos transported by vessel's types from Russia to ports of Finland in 2016 (continue)

Vessel's Type	Cargo Type	Number of Voyages	Cargo Volumes, ton
326.1/00	Wood Balances	27	33 857
	Wood Chips	4	1 951
	Wood Round	1	1 432
	Total	**32**	**37 240**
326.1/M-	Wood Balances	5	3 969
	Wood Chips	3	1 467
	Total	**8**	**5 436**
P168	Wood Balances	90	124 491
	Wood Round	15	21 273
	Total	**105**	**145 764**
P-168M-п	Wood Balances	15	19 859
	Wood Round	2	2 759
	Total	**17**	**22 618**

Recommendations on technical requirements for a new vessel concept

Class of the vessel and Flag :

Russian Maritime Register of Shipping or Russian River Register
Флаг судна – Российская Федерация.

Purpose of the vessel:

Carriage of general and dry bulk cargoes, carriage of containers (TEU & FEU), and carriage of dangerous cargoes.

Area of navigation:

Inland waterways of Finland and Russia, sea coastal areas for navigation on line Saimaa Lakes – Finish Gulf of Baltic Sea.

Navigational conditions/operability:

Ice conditions – sailing in crushed ice with 40 centimeters thickness;
Estimated temperatures for keeping normal internal climate conditions: for outer air + 35 C and moisture 65% in summer and - 21 C, moisture 85% in winter time, outer water from + 27 °C down to -2 C, consequently;
Estimated temperatures of outer air on the conditions of operability for the ship equipment:

for the ship equipment mounted in closed compartments - from 0 up to + 45 °C;
for the ship equipment mounted on open decks - from -25 up to + 45°C;
outer water from + 32°C down to 0 °C.

Recommendations on technical requirements for a new vessel concept (continue)

Autonomy:

The autonomy of the vessel in terms of fuel, oil, water and provisions is 15 days.
Autonomy under environmental safety conditions - 15 days.

Speed:

Vessel speed - at least 10 knots at 85% MDM.

Number of seats for the crew:

Provide 9 (nine) crew seats, one spare single cabin and one cabin for the pilot.

Hull

Two options for the hull of the ship's hull:
- with the highest possible coefficient of completeness;
- with the possibility of independent navigation in continuous annual ice with a thickness of 20 cm (with a high ice class).

Recommendations on technical requirements for a new vessel concept (continue)

Ship equipment, ship systems:
The specification and design of ship's equipment and ship's systems must comply with the requirements of the RRR or RS Rules.

Propulsion, steering and power plant:
Two options for the propulsive complex:
- the classic propulsive complex (GD-reducer-shaft-propeller) for the vessel with the maximum possible completeness coefficient;
- propulsion system with full-rotary helical-steering columns for a ship with a high ice class.

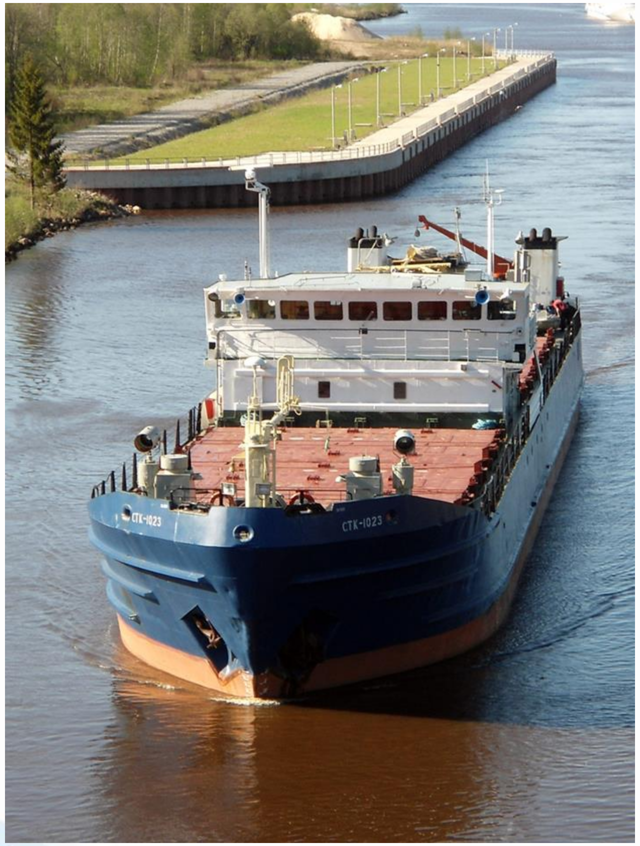
Marine Power Station:
Ship power station power network 400V, 50Hz. The electrical system is three-phase, three-wire, isolated. Provide two main diesel generators, emergency auxiliary diesel - generator. Equipment to provide power supply from the shore, when vessel berths in the port, or in repair.

Radio equipment and navigation equipment:
Must meet the requirements of the RRR or RS Rules for the intended navigation area of the vessel.

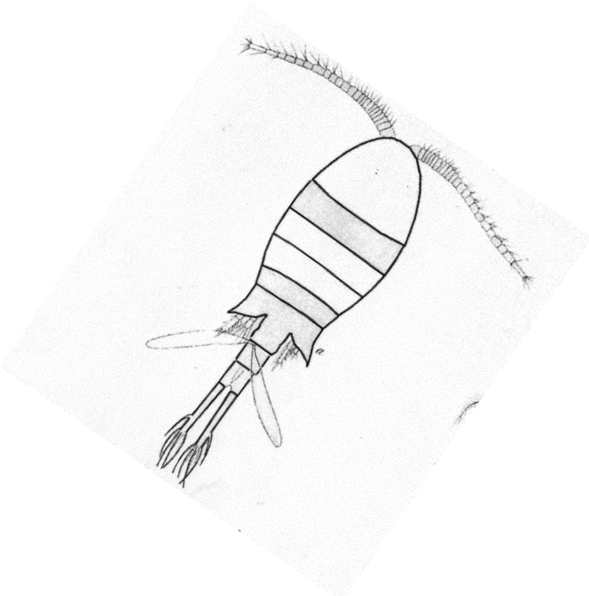
Thank you for your kind attention

Anatoly Burkov, PhD,
Associated Professor
INFUTURE Project Manager
Department of Management of Waterway Transport
AMSUMIS
burkovav@gumrf.ru

Tatiana Pantina, Dr.of Sc.,
Professor, vice-rector for research and innovations of AMSUMIS
pantinata@gumrf.ru



Coexistence of native *Eurytemora affinis* and invasive American *Eurytemora carolleeae* (Crustacea: Copepoda) in the Gulf of Finland



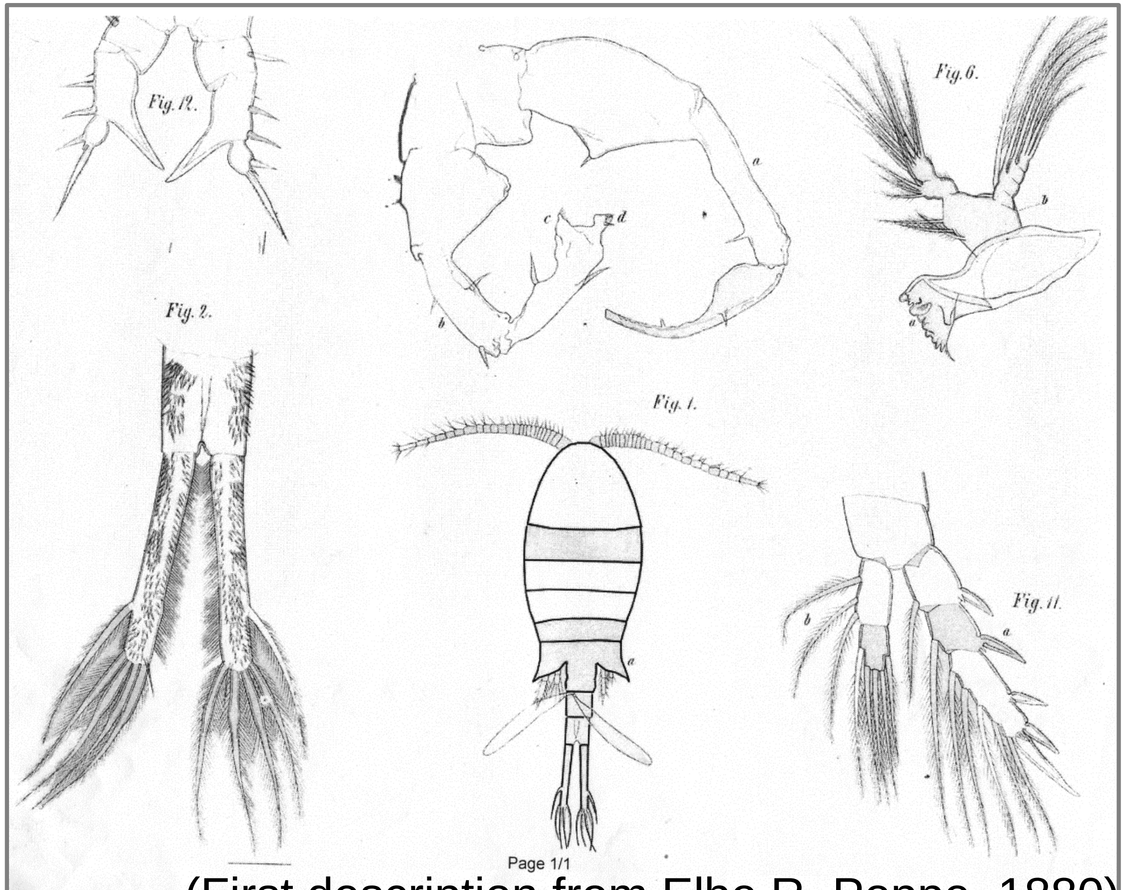
Sukhikh Natalia, Alekseev Victor

Eurytemora affinis – actively studied group of species

1- a food source for higher trophic levels throughout the Holarctic

2- model for alien species study

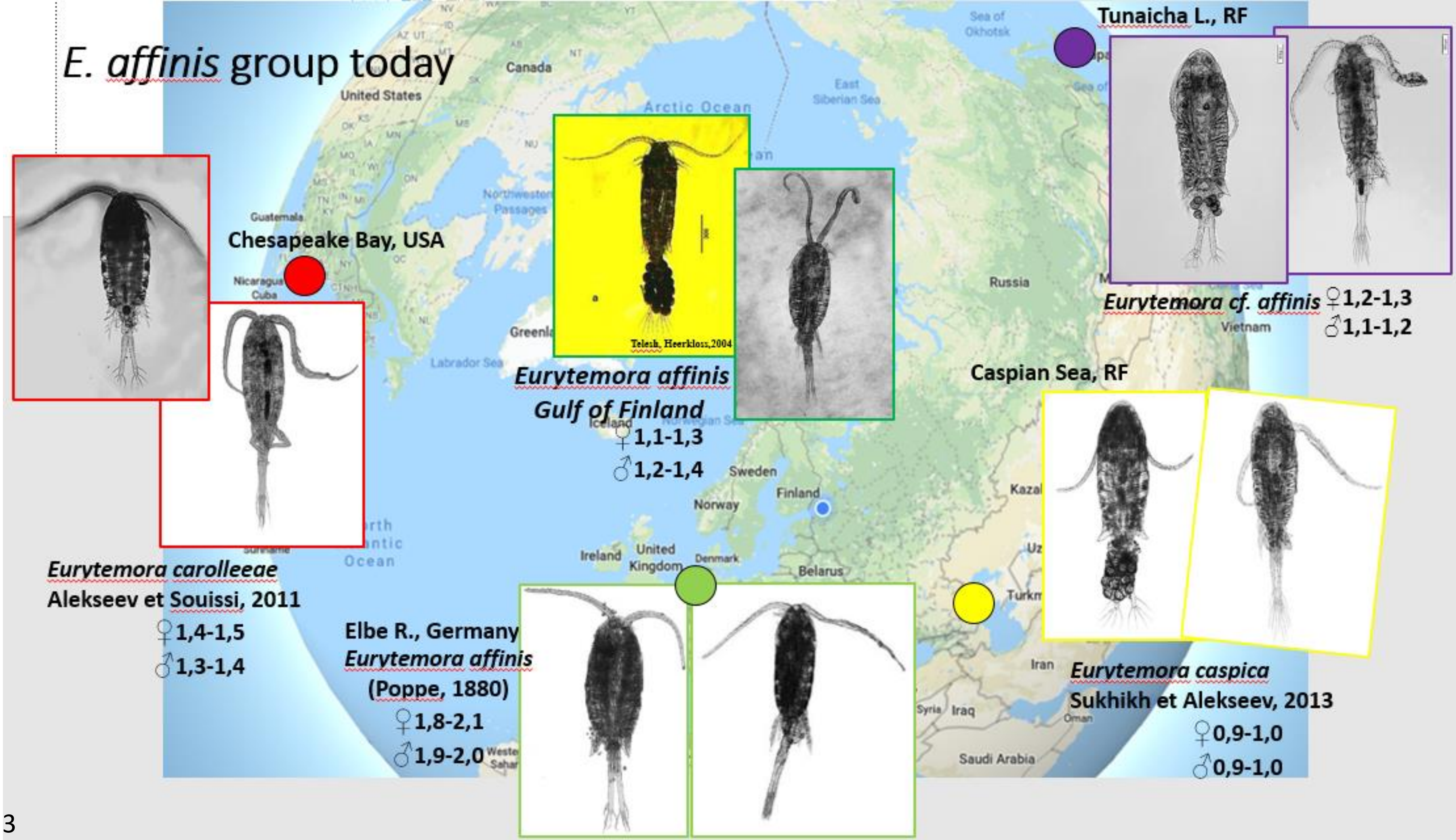
- **Short life cycle**
- **Perfect osmoregulation mechanisms**
- **Diapause in life cycle**



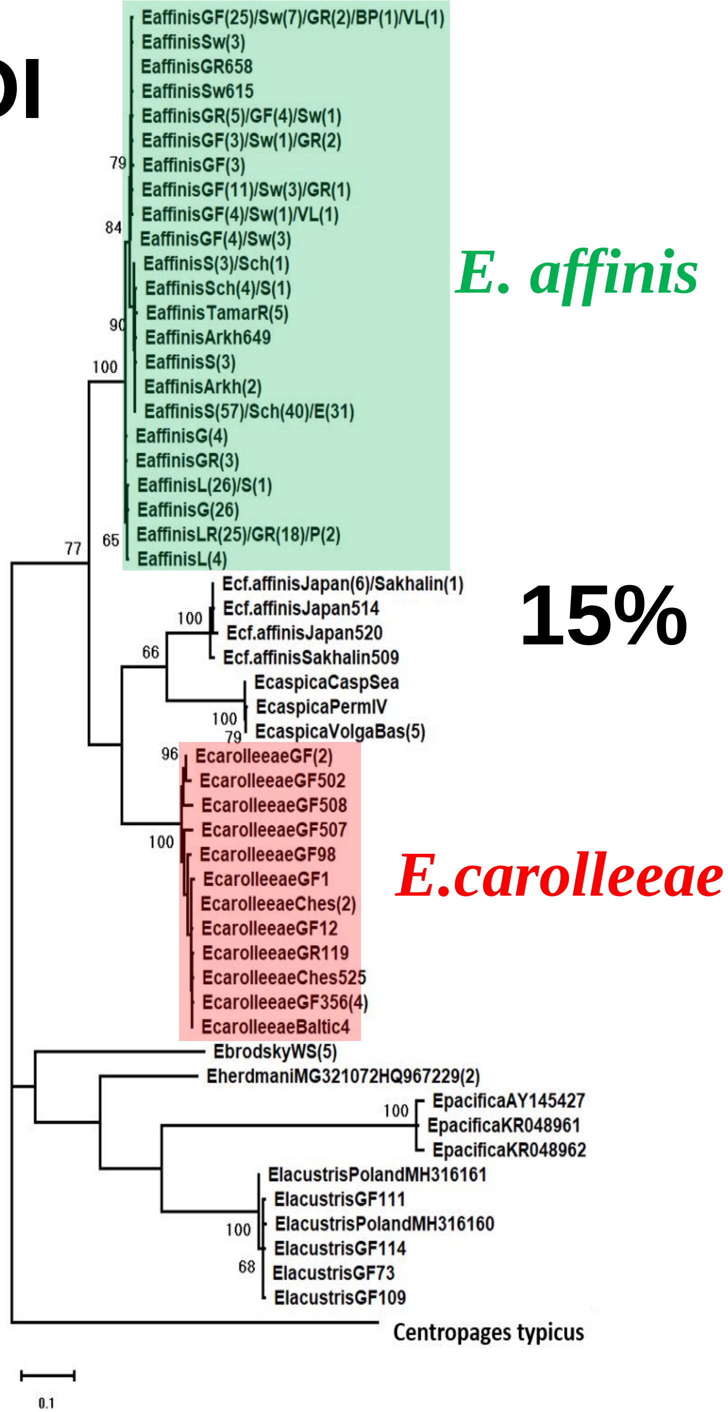
(First description from Elbe R. Poppe, 1880)

Order Copepoda
Suborder Calanoida
Family Temoridae
Genus Eurytemora Giesbrecht, 1881
***Eurytemora affinis* (Poppe, 1880)**

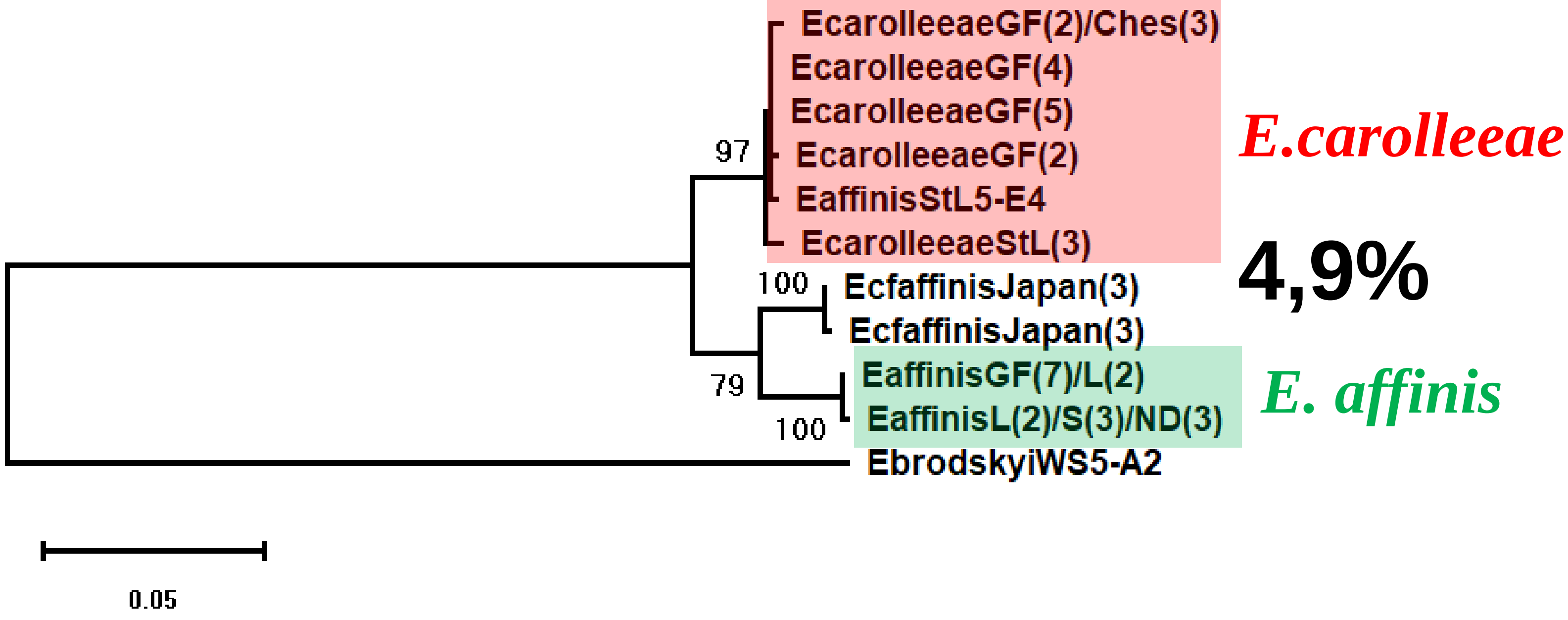
E. affinis group today



COI

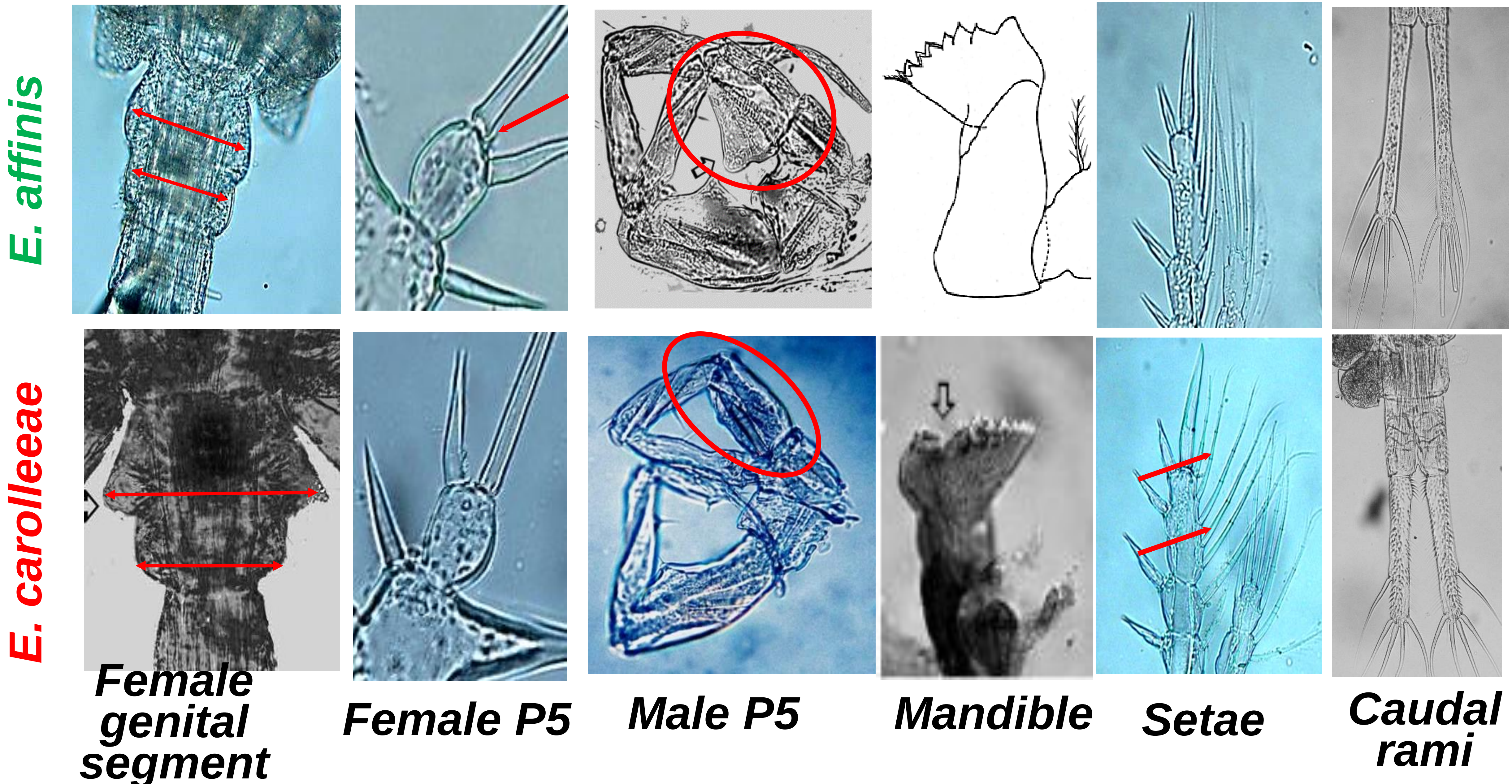


nITS

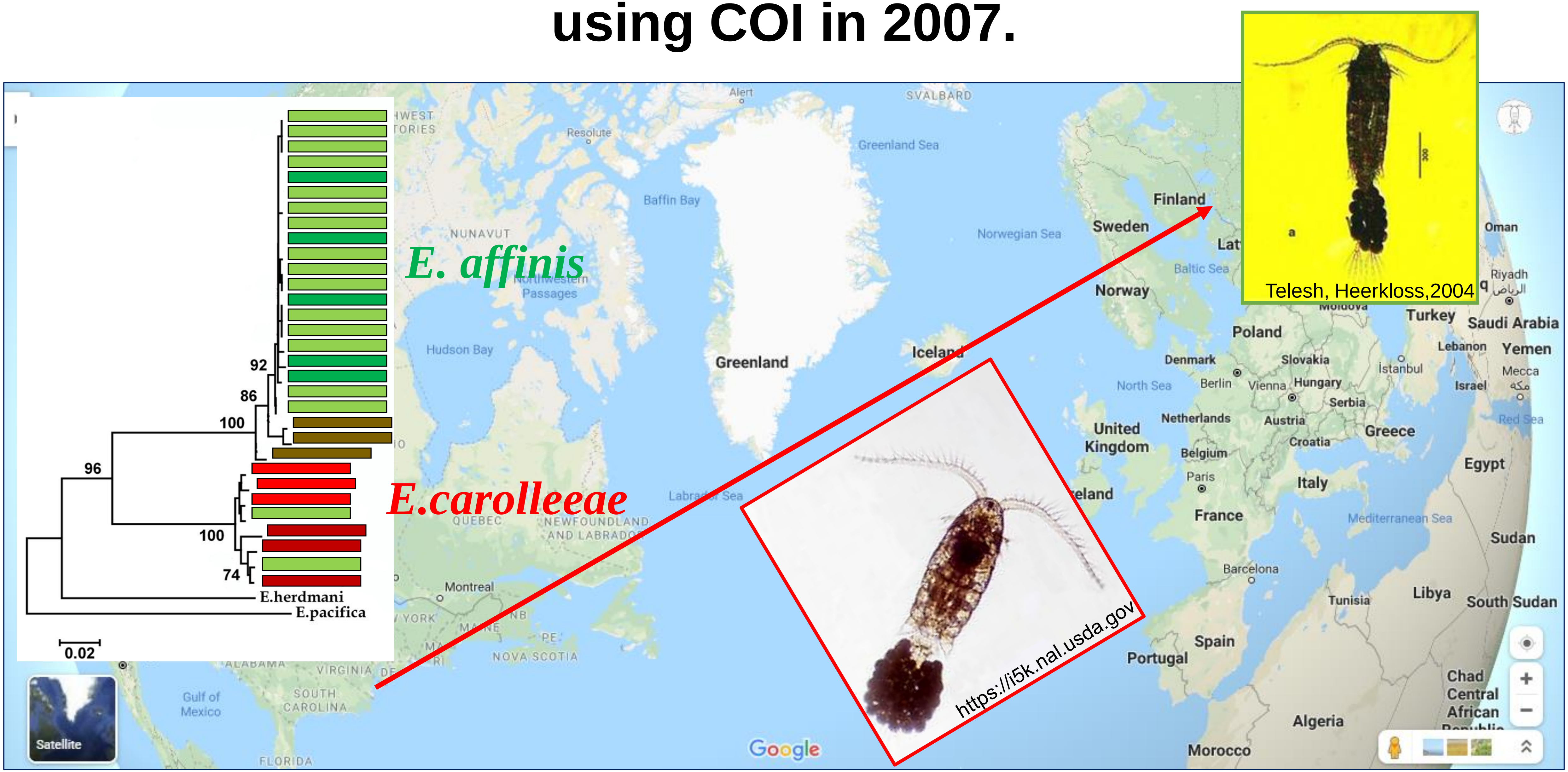


Maximum Likelihood tree based on most frequent haplotypes using mitochondrial cytochrome oxidase I (COI, 652 base pairs) and nuclear nITS genes
(ITS1-5.8SrRNA-ITS2) 820 bp . Totally more than 100 sequences were used.

Morphological differences between *E. affinis* and *E. carolleeae* in the Gulf of Finland



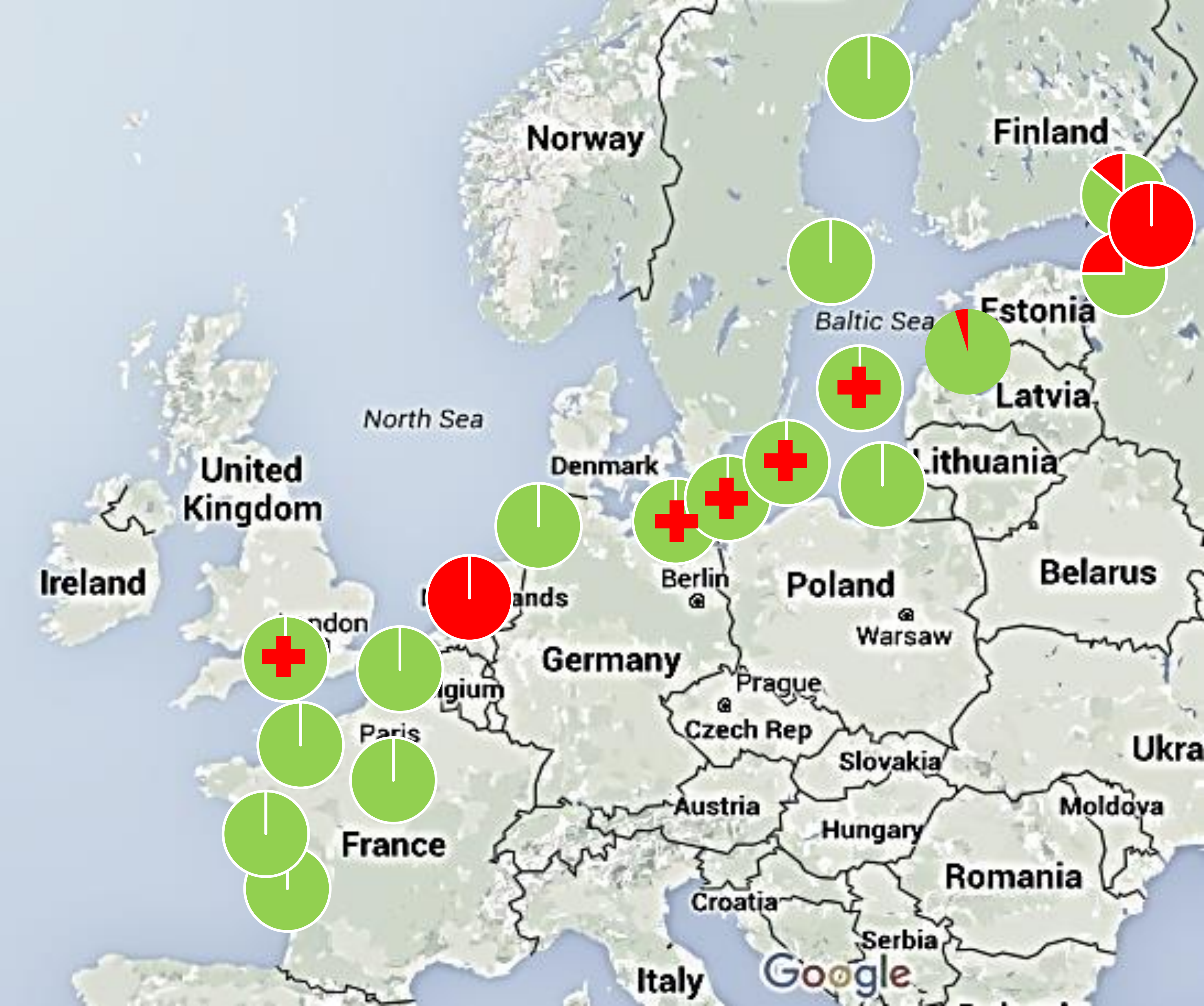
E.carolleeae was found among *E.affinis* in the Gulf of Finland using COI in 2007.



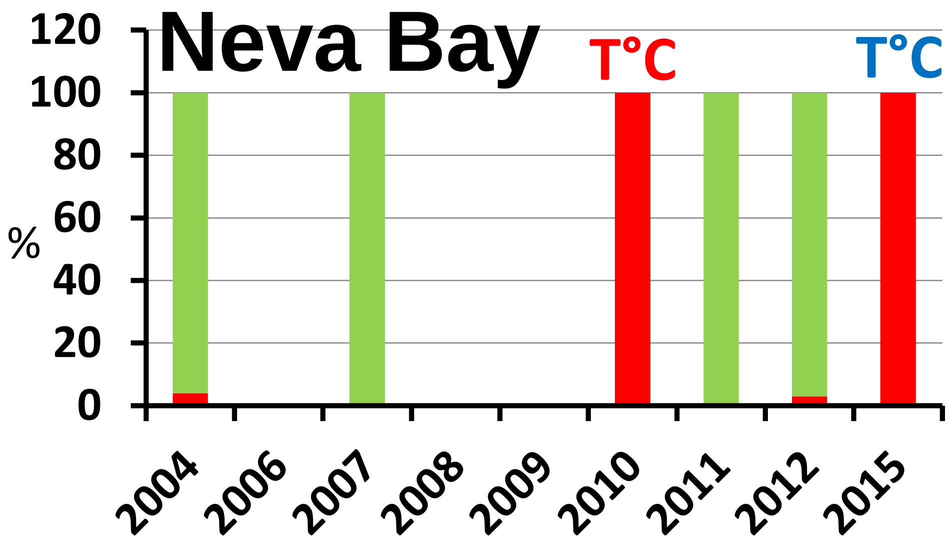
Coexistence of native and invasive *Eurytemora* species in Europe

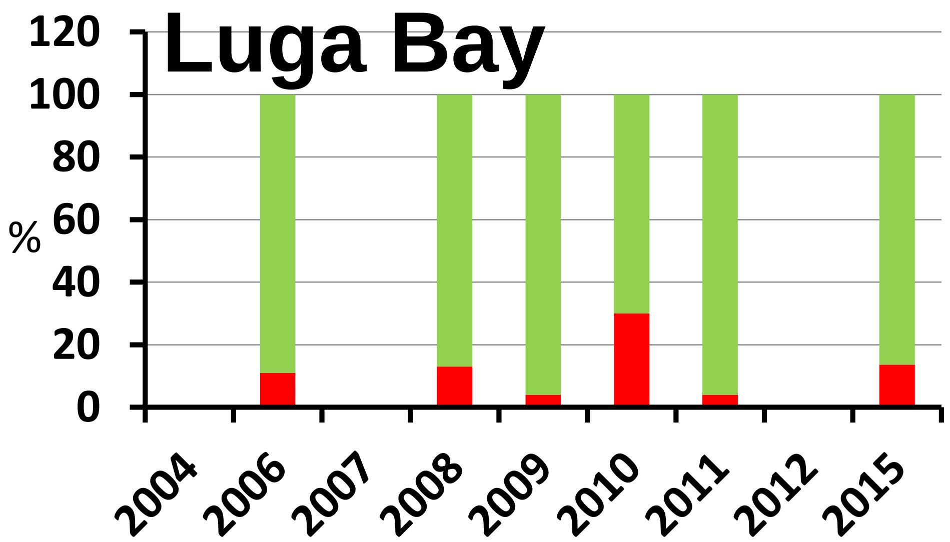
Red sector is the ratio of invasive *E.carolleeae*,

Plus – there is E.carolleeae

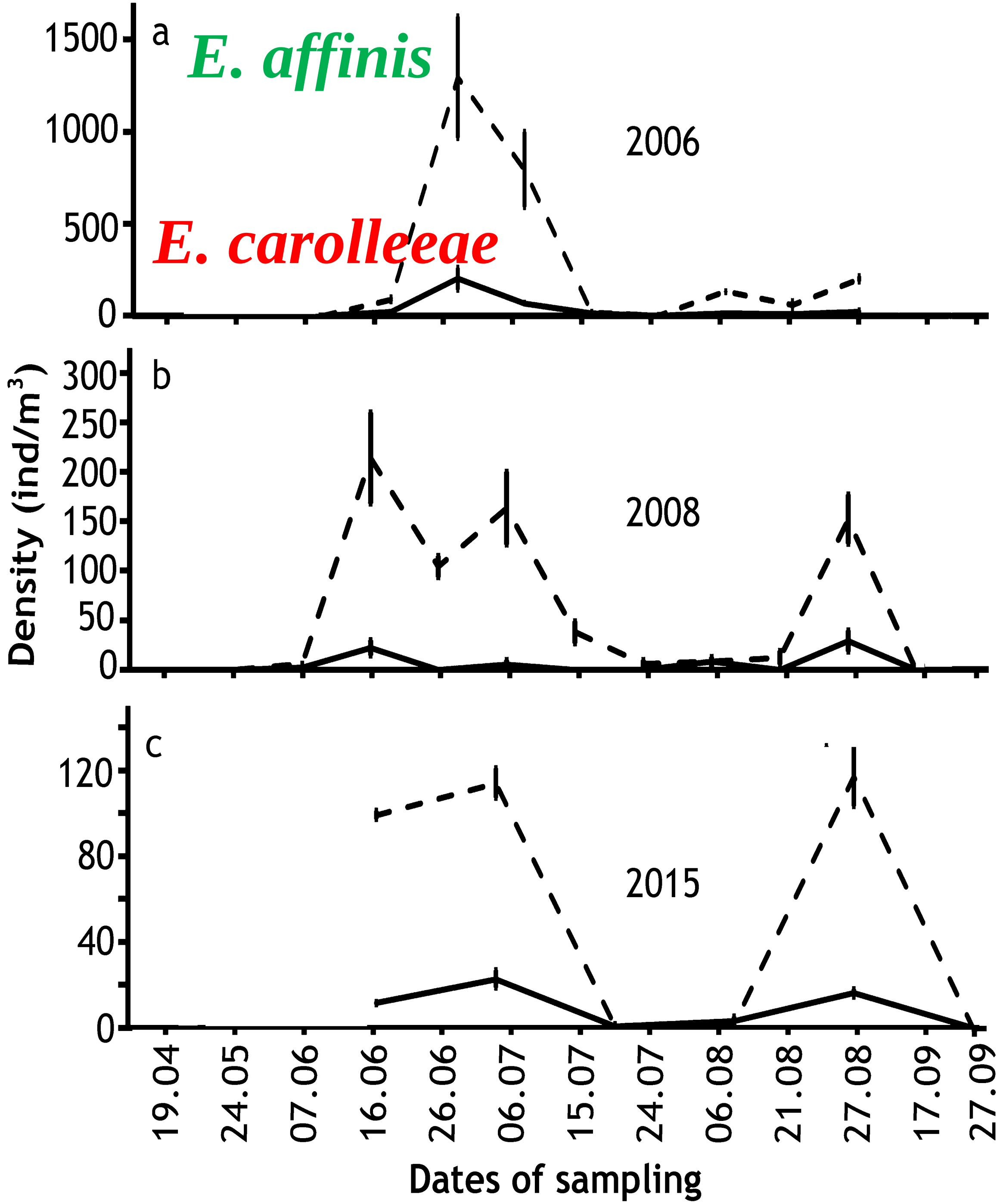


Ratio of *E. affinis* and *E. carolleeae* in the Gulf of Finland

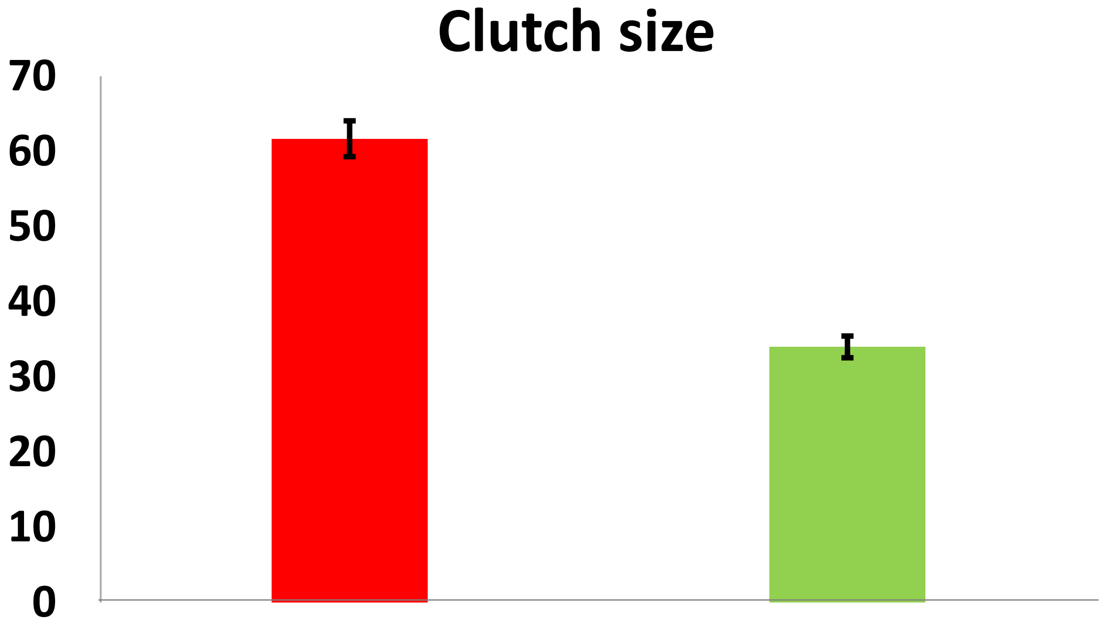


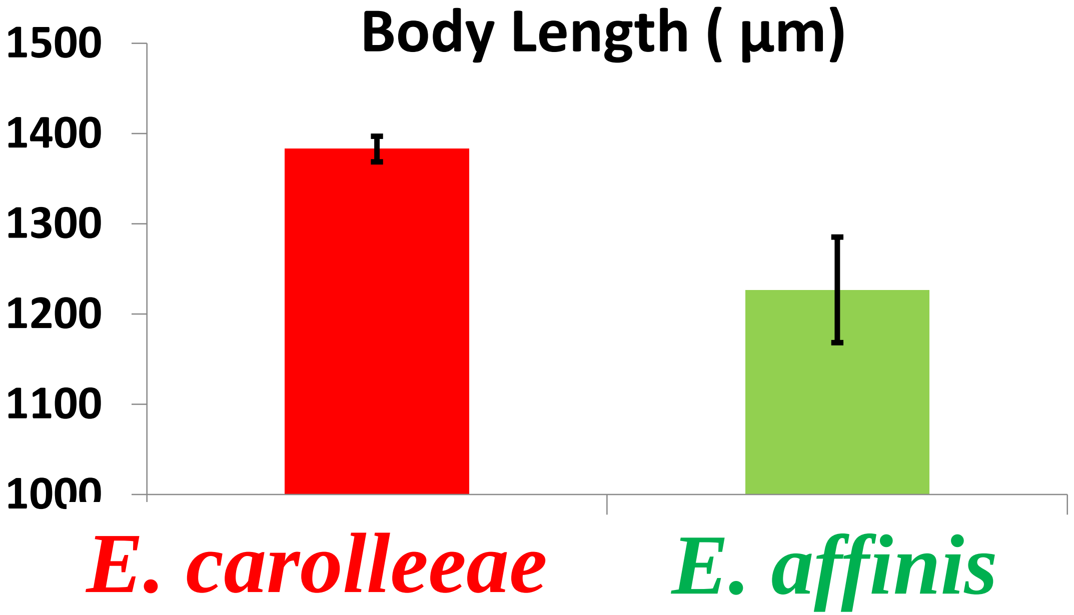


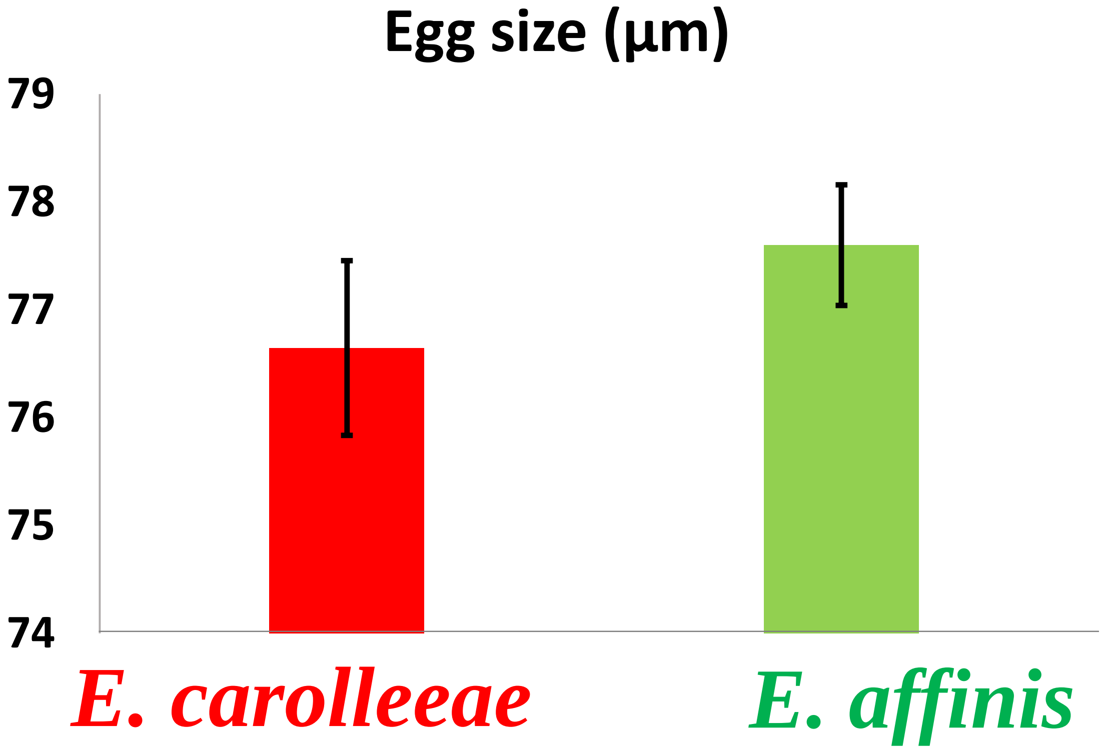
Population density changes in adult *E. affinis* (dotted line) and *E. carolleeae* (solid line) during the 2006 (a), 2008 (b), and 2015 (c) summer seasons in Luga Bay



Some parameters in females of *E. carolleeae* and *E. affinis* from the Gulf of Finland







Summary

1. **Two species native *E. affinis* and invasive American *E.carolleeae* co-exist in the same area in the Baltic Sea and according to literature date in the North Sea.**

2. **The population dynamics of both species are largely parallel. Invasive *E. carolleeae* is usually second to *E. affinis* in terms of density, but sometimes the species dominates and even replace the native one in freshwater part of the Gulf of Finland more closed to SPb.**

3. **The larger body size and different reproductive and physiological traits of *E. carolleeae* confer a potential for it to displace native *E. affinis* species. This is supported by the periodical dominance of the species in Neva Bay.**

4. **Assessing the prospects of further *E.carolleeae* settlement we should consider not only interspecific competition between these closely related forms, but result of the competition also depends on fish predation and food ability.**

Thank you for attention!

For the work the Federal Collection of ZIN RAS, St. Petersburg was used.

This work was supported by the BIODISEINE and ZOOGLOBAL Seine Aval projects in France, the "Biodiversity" grant from the Presidium of the Russian Academy of Sciences; Russian Foundation for Basic research under 14-04-01149 A, 14-04-00932 A.

We are grateful to

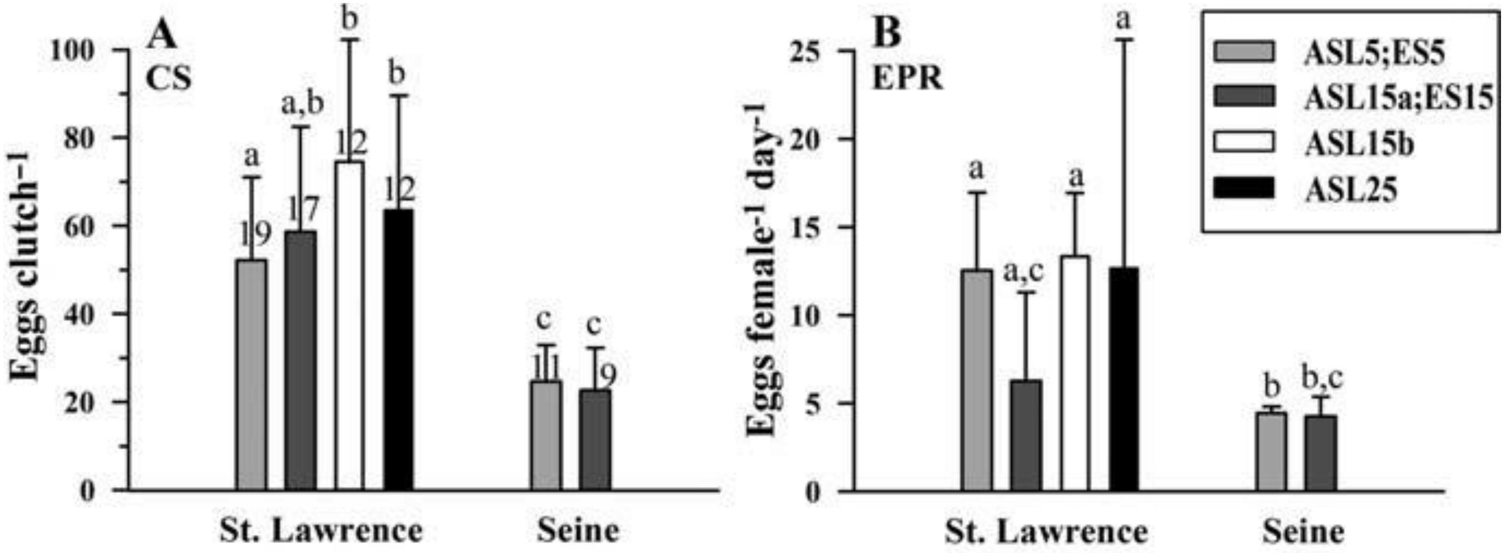
all the collectors who helped with material for the analysis: S.A.Maljavin, N.A.Berezina, E.N.Naumenko, I.V. Telesh.

the whole staff of the Zoological Institute Laboratory of molecular genetic systematics, where the part of the molecular-genetic work was done, in particular the head of the laboratory Dr. Natalia Abramson,

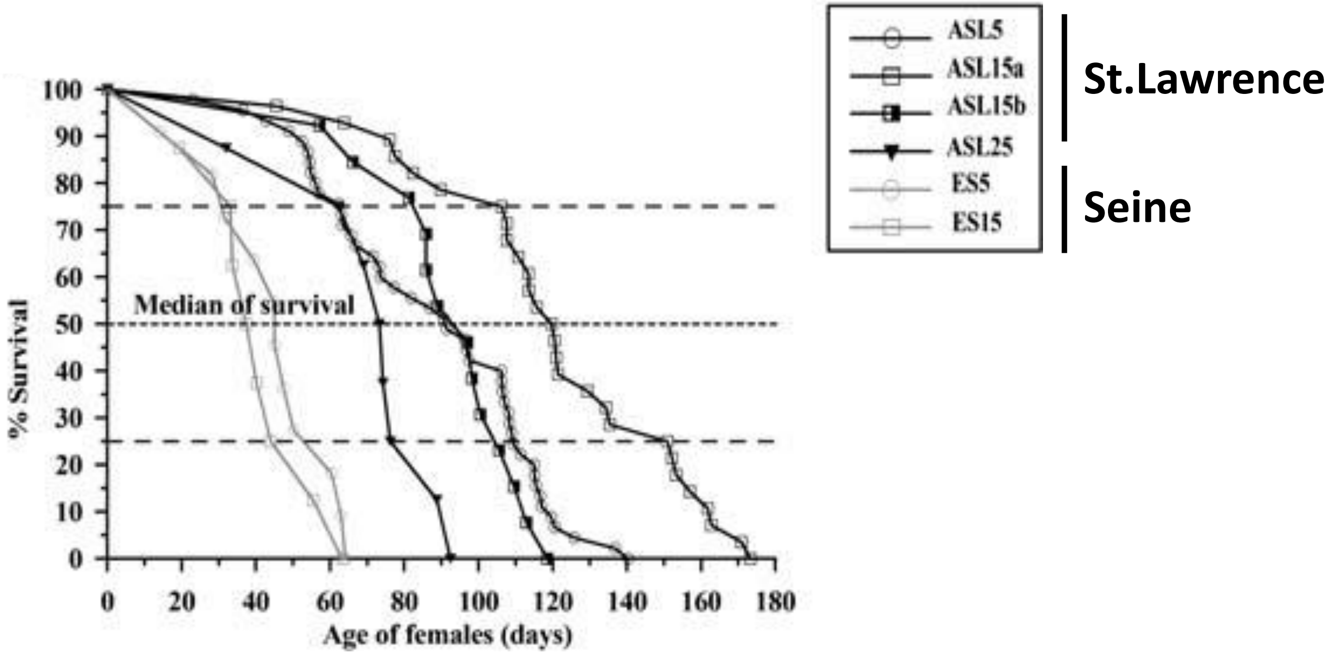
Carol Lee for the presented sequences

Canadian Center for DNA Barcoding for the sequencing.

Eco-physiological differences between American and European *Eurytemora*



Mean values of reproductive parameters of females *E. affinis*
at 10°C: Clutch size (eggs clutch) (A), egg production rate (eggs female day) (B)



Survival rate (%) of males (A) and females (B) of two populations of *E. affinis* from St. Lawrence salt-marshes (ASL) and the Seine estuary (ES) at 10°C.

Beyrend-Dur et al. 2009

It looks like invasive species feels good in the GF,

has high genetic heterogeneity,

always presents in zooplankton community in more or less constant dencity

FA showed even less indices than in its native area (the same level as in E.affinis)

INTRODUCTION TO THE FINNISH MARITIME SPATIAL PLANNING CONTEXT

30.10.2019
Heikki Saarento and Tiina Tihlman

MARITIME SPATIAL PLANNING

EUROPEAN MARITIME AND FISHERIES FUND

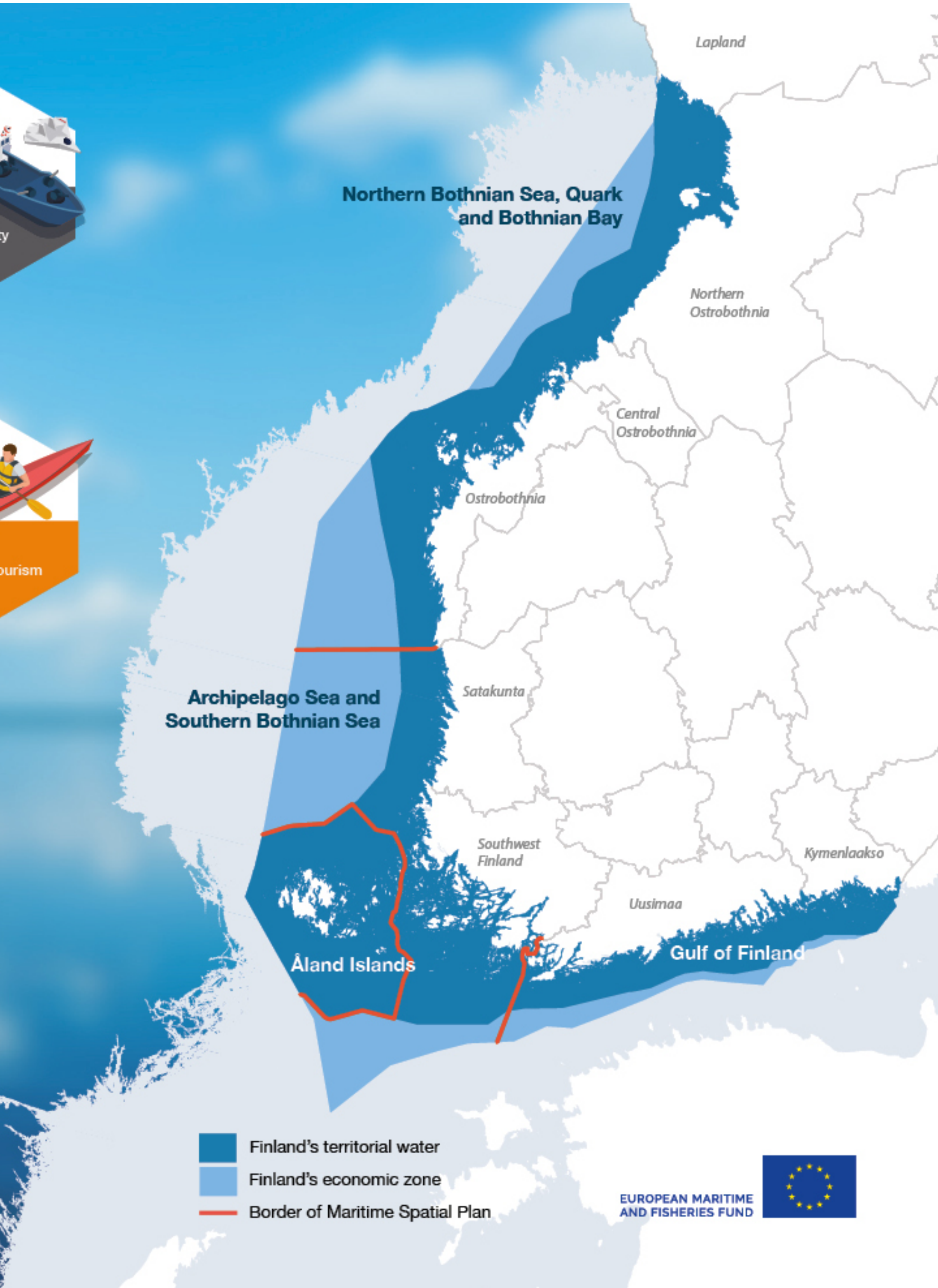
3 maritime spatial plans
+ maritime spatial plan for the Åland Islands

8 coastal regions

2 goals
blue growth & good status of marine waters

2 public consultations, **>250** members in a cooperation network
Finalized by 31 March 2021

MARITIME SPATIAL PLANNING



EUROPEAN MARITIME AND FISHERIES FUND

PLANNING PROCESS

HEARING | HEARING

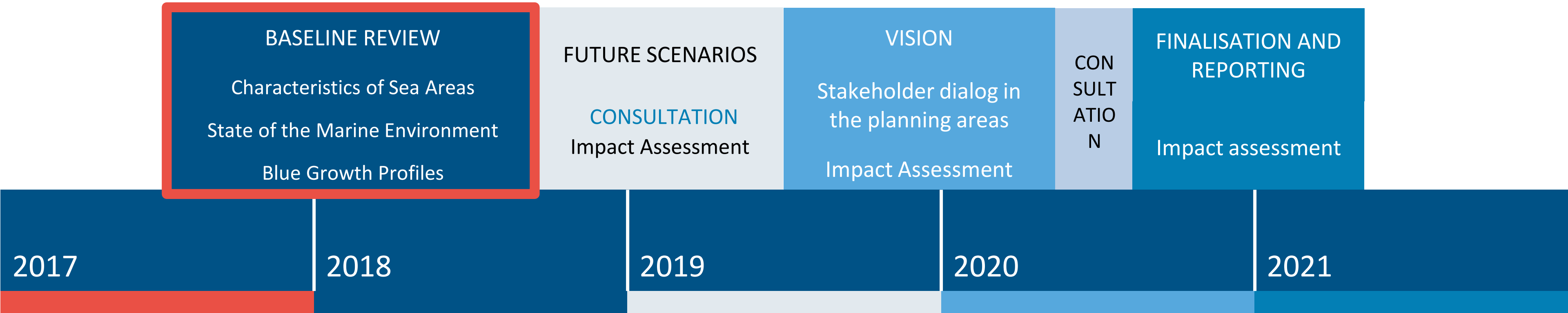
BASELINE	SCENARIOS	VISION	FINALIZATION AND REPORTING
BASELINE REVIEW TO RECOGNIZE THE PRECONDITIONS	FUTURE SCENARIOS POSSIBLE FUTURES	DIALOG OF THE GOALS WANTED FUTURE	APPROVAL DECIDING THE DIRECTION
SPECIAL CHARACTERISTICS ECOLOGY/ STATUS OF FINNISH MARINE ENVIRONMENT BLUE GROWTH / CONDITIONS	STAKEHOLDER COLLABORATION		FINALIZATION
	IMPACT ASSESSMENT		REPORTING > MONITORING

2017	2018	2019	2020	2021

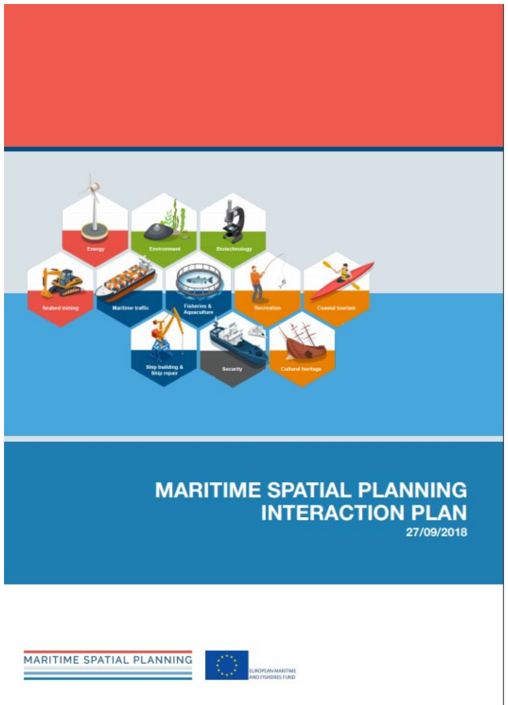
1st Question: HOW SHOULD WE PLAN?

4 stakeholder workshops for chosen group of experts

1. **Cross-cutting themes** (LSI, ESA, Blue Growth, Marine Environment, participation)
2. **Working methods**
3. **Digital planning process and presentation**
4. **MSP process** (time schedule, interaction, decissions, analysess)



WHO AND HOW SHOULD WE INVOLVE?



- COMMUNICATION PLAN (internal)
- INTERACTION PLAN (public)

>350 members in MSP co-operation group

+ Co-operation group formed by state authorities and insitutions

BASELINE REVIEW
Characteristics of Sea Areas
State of the Marine Environment
Blue Growth Profiles

FUTURE SCENARIOS
CONSULTATION
Impact Assessment

VISION
Stakeholder dialog in the planning areas
Impact Assessment

CON SULT ATIO N

FINALISATION AND REPORTING
Impact assessment

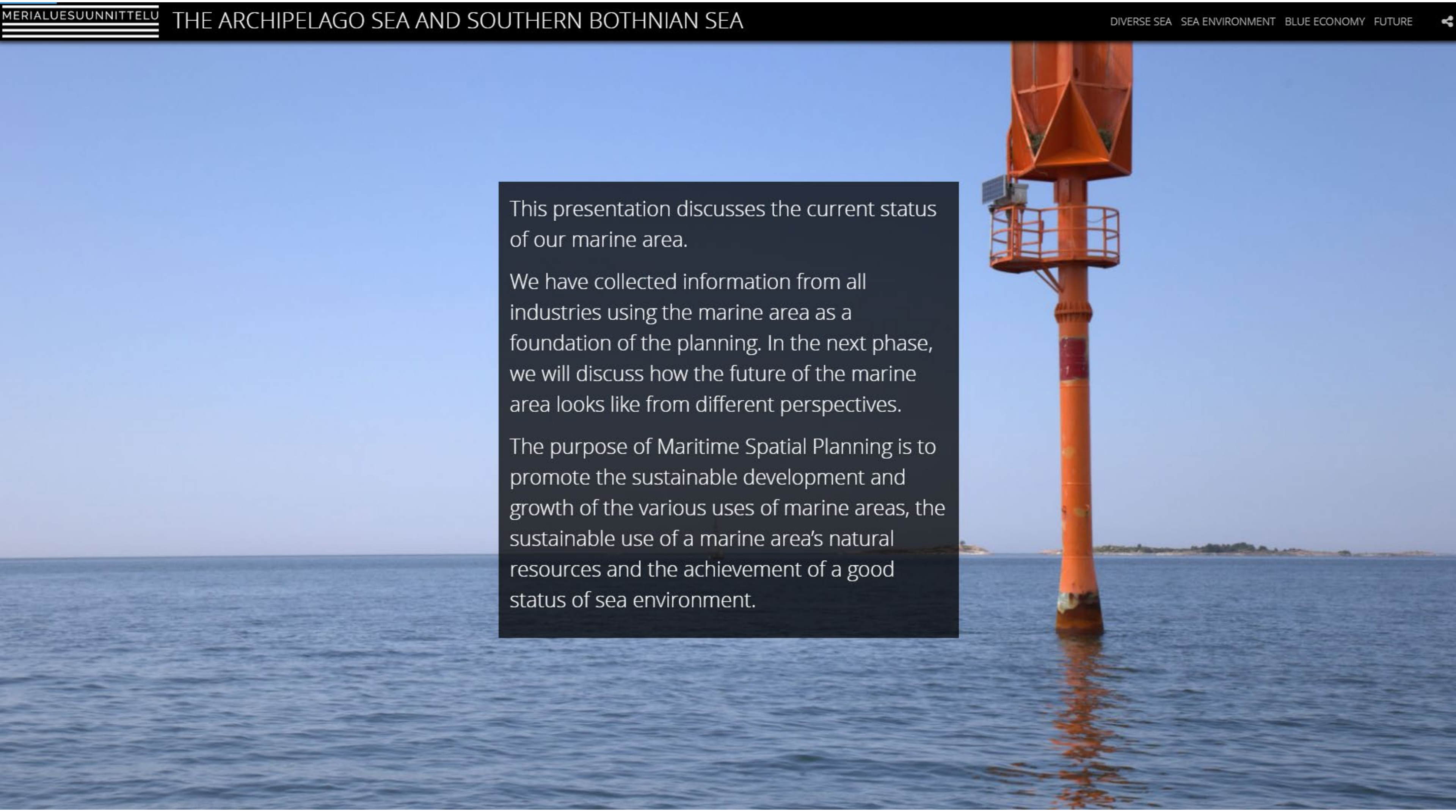
2017 | 2018 | 2019 | 2020 | 2021

BASELINE REVIEW

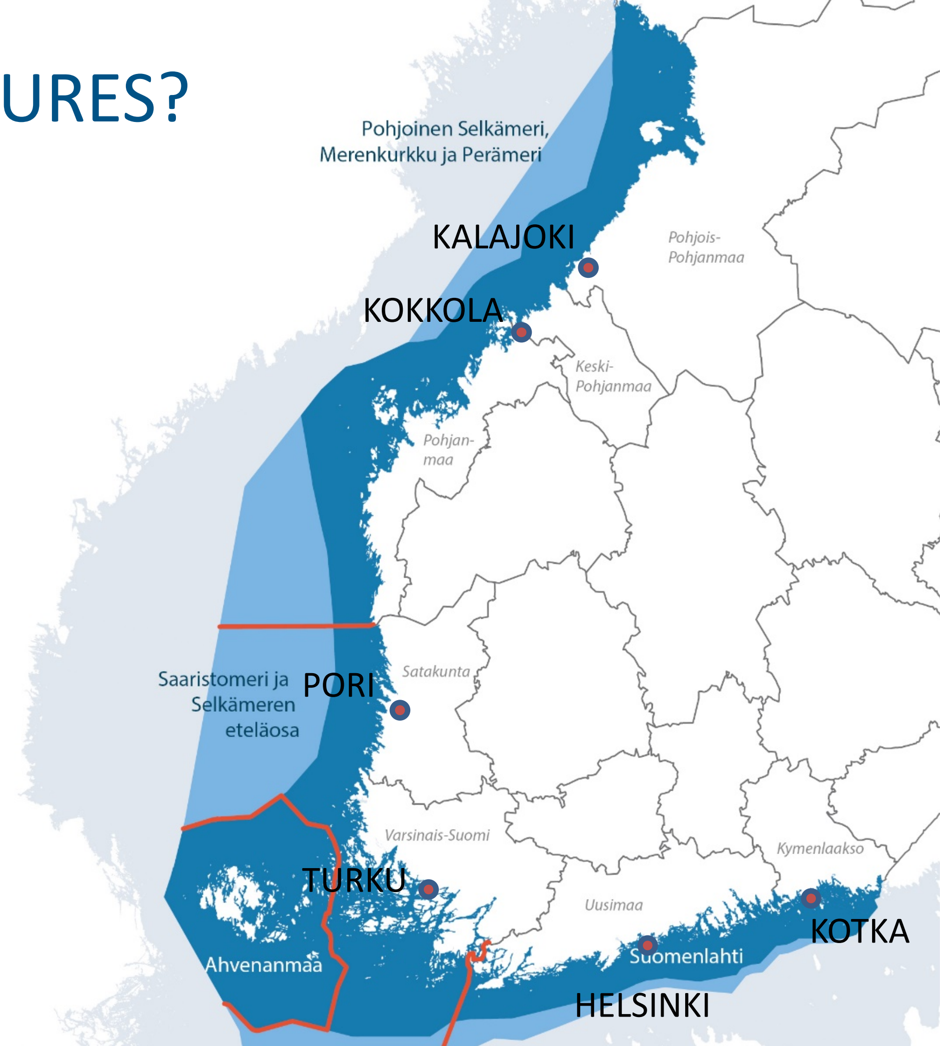
BASELINE REVIEW	FUTURE SCENARIOS	VISION	CONSULTATION	FINALISATION AND REPORTING
Characteristics of Sea Areas State of the Marine Environment Blue Growth Profiles	CONSULTATION Impact Assessment	Stakeholder dialog in the planning areas Impact Assessment		Impact assessment

2017	2018	2019	2020	2021

BASELINE REVIEW AS STORYMAPS



WHAT ARE OUR POSSIBLE FUTURES?



<u>3.4.-20.8.2019</u>

>20 interviews

2 National stakeholder workshops

6 Regional stakeholder workshops

2 Rounds of digital commenting

+ inputs from projects!

BASELINE REVIEW

Characteristics of Sea Areas

State of the Marine Environment

Blue Growth Profiles

FUTURE SCENARIOS

CONSULTATION

Impact Assessment

VISION

Stakeholder dialog in the planning areas

Impact Assessment

CON SULT ATIO N

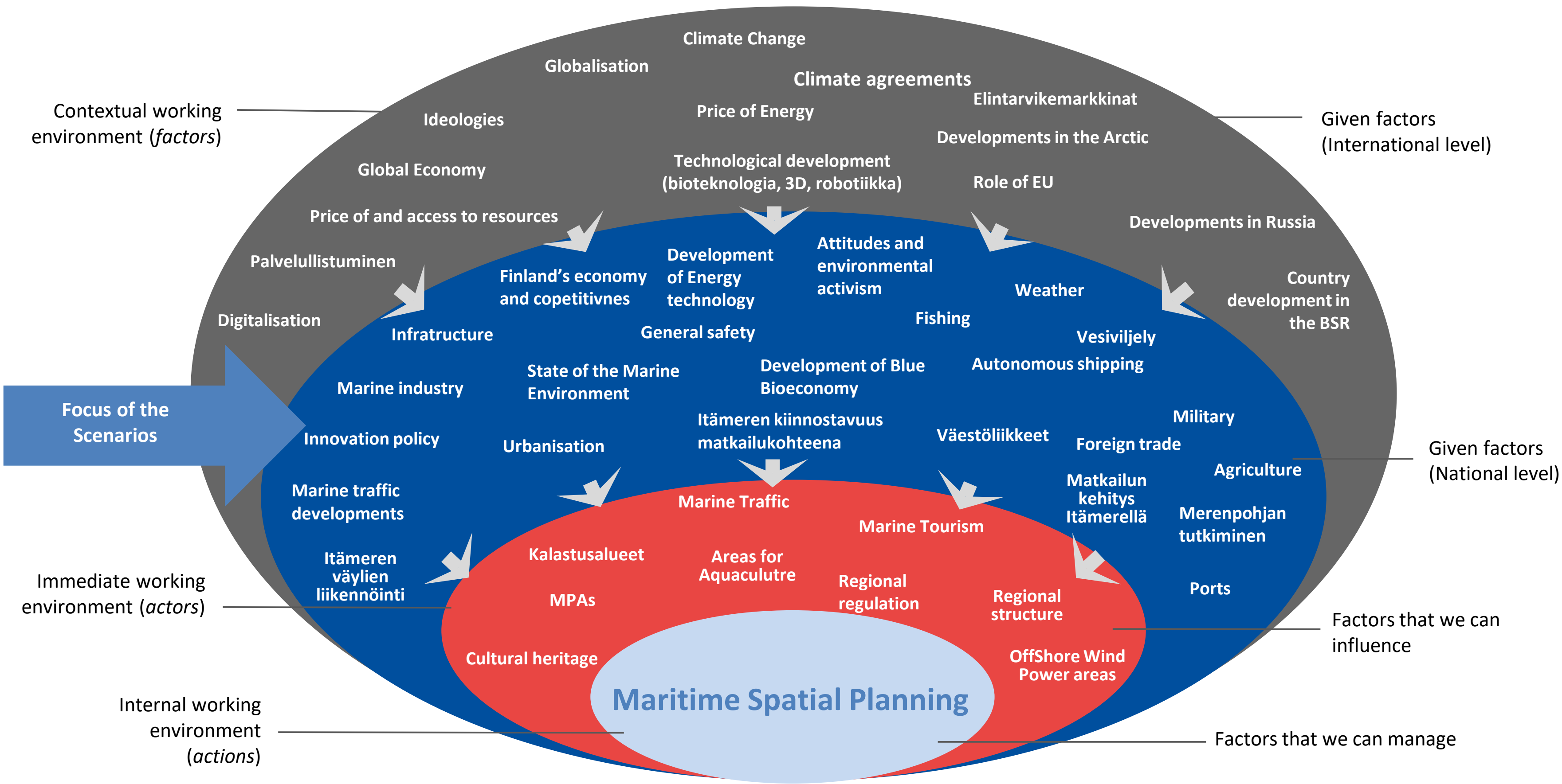
FINALISATION AND REPORTING

Impact assessment

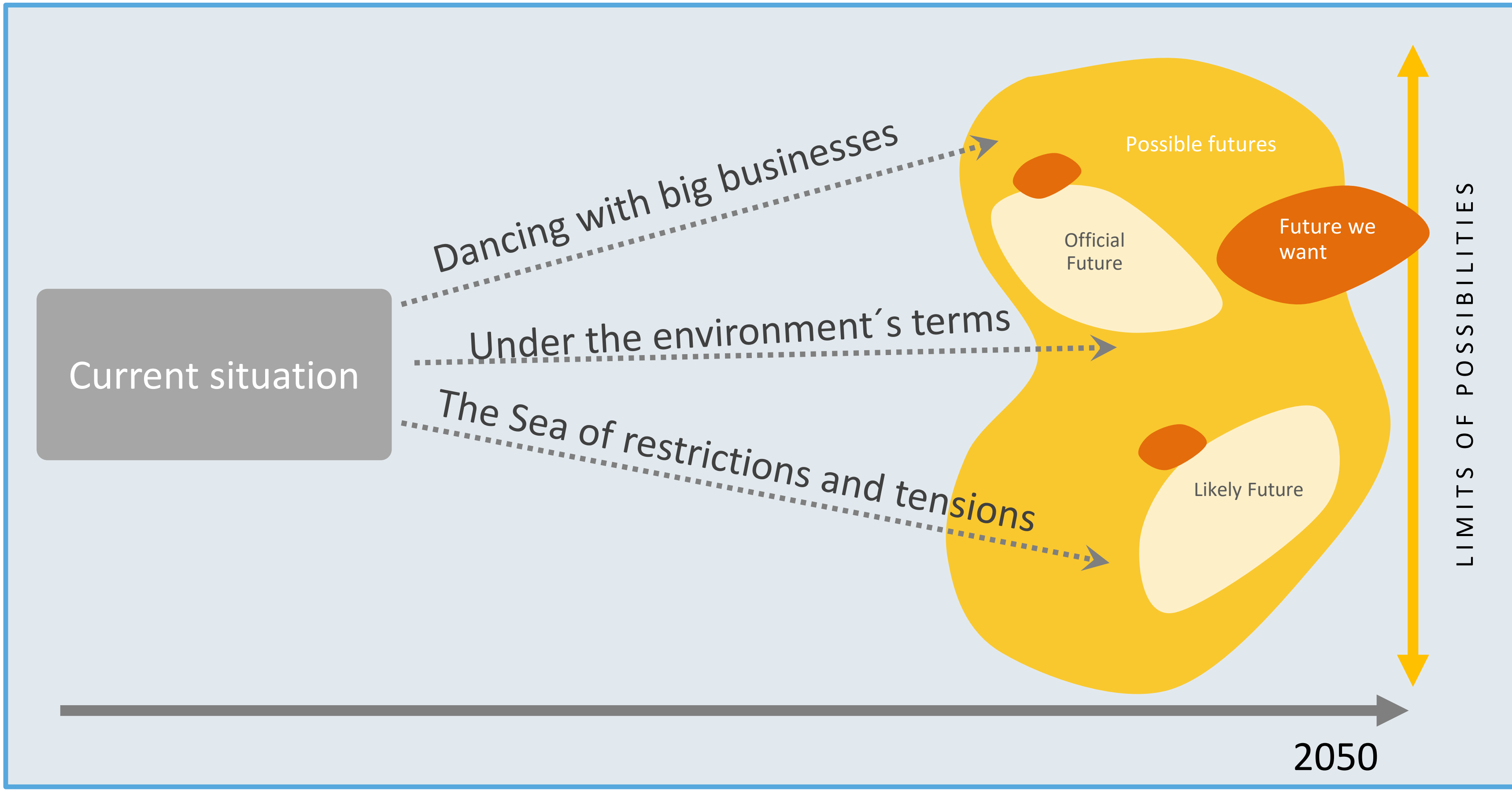
2017 2018 2019 2020 2021

WHAT ARE THE SIGNIFICANT CHANGE FACTORS?

Focus of the Scenario Work



WHAT HAPPENS IN THE POSSIBLE FUTURES?



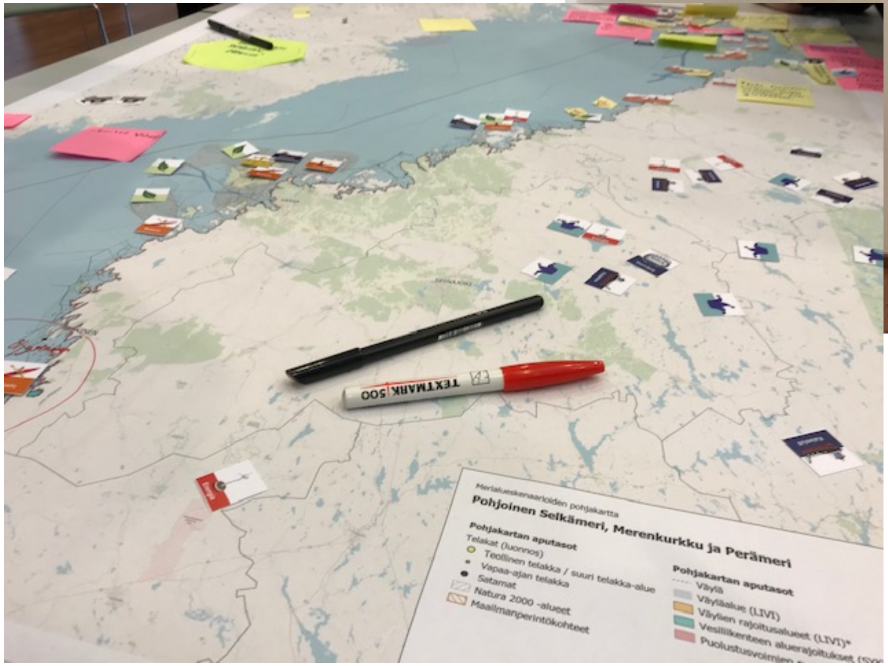
BASELINE REVIEW	FUTURE SCENARIOS	VISION	CONSULTATION	FINALISATION AND REPORTING
Characteristics of Sea Areas State of the Marine Environment Blue Growth Profiles	CONSULTATION Impact Assessment	Stakeholder dialog in the planning areas Impact Assessment		Impact assessment

2017 | 2018 | 2019 | 2020 | 2021

Scenario 1 IMPACTS

Northern Planning Area

	SECTOR / THEME				MSP objectives		
IMPACTS	**ENERGY**	**FISHERY & AQUACULTURE**	**TOURISM, CULTURAL HERITAGE**	**MARINE TRAFFIC & BLUE INDUSTRY**	**State of Marine Environment**	**Blue Growth**	**Human wellbeing and participation**
RISKS	• Ylituotanto voi aiheuttaa ongelmia. • Itämeri energianlähteenä, toimijan ehdoilla, ympäristön kustannuksella. • Energiantuotanto voi uhata jopa puolustusvoimien toimintaa.	• Liika kasvu tuottaa ympäristöpainetta. • Ulkomaalaisomistuk-sessa olevien suuryritysten tuotto valuu ulkomaille ympäristön kustannuksella, paikallistaloudelle ei hyötyjä.	• Pienet toimijat ovat vaikeuksissa. • Kulttuuriperinnön liian voimakas hyväksikäyttö ja tuotteistus. • Kasvava meriliikenne ja tuulivoima-rakentaminen ovat riski kulttuuriperinnölle.	• Koillisväylän sulaminen siirtää meriliikennettä pois Perämeren satamista. • Merihiekkaesiintymien hyödyntämisen negatiiviset vaikutukset meriluonnolle.	• Meriympäristön tila ja veden laatu heikkenee voimakkaasti: hapettomat alueet lisääntyvät, monimuotoisuus vähenee. • Meriympäristön heikko tila heijastuu ekosysteemipalveluihin ja elinkeinoihin, esim. kalakantojen romahtaminen.	• Kestävyyteen perustuva talous ei toteudu. Luonnonvara käytetään kestämättömästi. • Meren heikko tila rajoittaa elinkeino-toimintaa (esim. vesiviljely, kalastus, matkailu). • Yksityiset alueet rajoittavat toimintaa.	• Syriemmällä olevien alueiden elinkeinojen näivettyminen. • Meriympäristön heikko tila heikentää ihmisten hyvinvointia. • Virkistystoiminta heikentyy esimerkiksi sinilevätilanteen myötä. • Sääntely heikkoa, osallisuus vähenee. • Jokamiehen oikeudet vaarassa. • Ilmastopakolaisuuden vaikutukset.
OPPORTUNI TIES	• Yleinen hyvä energiakehitys. • Hajautetun tuotannon mahdollisuudet.	• Globaalit markkinat. • Kestävämpien kalanviljelytekniikoiden kehittyminen.	• Suuret matkailijamäärät mahdollistavat tarvittavan infrastruktuurin. • Matkailun keskittäminen säästää ”reuna-alueita”. • ”Teollisuusmatkailu” (kiinnostus teollisuuslaitoksiin) lisääntyy.	• Teollisuuden uudet investoinnit edistävät alueiden työllisyyttä ja elinvoimaa.	• Ympäristöinnovaati-oiden kehittäminen. • Ympäristöongelmien tiedostaminen kasvaa kuluttajien keskuudessa. • Suuryrityksille voi olla kilpailuetu ympäristöarvojen huomioiminen.	• Työssäkäyntialue laajenee (Vaasa-Uumaja) ja osaaminen lisääntyy. • Kiertotalouden mahdollisuudet. • Synergiaedut eri toimintojen kesken. • Meren huono tila voi pakottaa uusiin innovaatioihin.	• Oulun seudun elinkeinoelämän vahvistuminen. • Kansalaisaktiivisuuden nousu. • Yhteisöllisyys voi nousta suuryritysten vastavoimaksi. • Talouskasvu voi luoda (ainakin hetkellistä) hyvinvointia.



Merialueskenaarioiden pohjakartta
Pohjoinen Selkämeri, Merenkurkku ja Perämeri
Pohjakartan aputasot
Telakat (luonnos)
Teollinen telakka / suuri telakka-alue
Vapaa-ajan telakka
Satamat
Natura 2000 -alueet
Maailmanperintökohteet
Pohjakartan aputasot
Väylä
Väyläalue (LIVI)
Väylien rajoitusalueet (LIVI)*
Vesiliikenteen aluerajoitukset
TEXTMARK 500

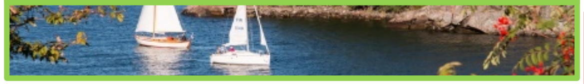
MARITIME FUTURE SCENARIOS 2050

Three possible futures of the Baltic Sea Region

Dancing with big businesses

- EU on liikkunut markkinaliberaaliin suuntaan ja sääntelyä puretaan. **Yritysten ja kaupunkien intressit ohjaavat kehitystä valtiovaltaa enemmän**.
- Merialueita hyödynnetään ruuantuotannon lisäksi erityisesti **korkean lisäarvon tuotteiden raaka-aineiksi** yritysten tarpeisiin.
- Ympäristöpolitiikka on tehotonta eikä fossiilisista polttoaineista päästä eroon toivotulla tavalla. **Merituuli-**

Under the environment´s terms



- Huoli ympäristön tilasta lisääntyy ja **ilmastokysymykset nousevat politiikan keskiöön**. Kuluttajat ovat ympäristötietoisia ja valinnat ohjaavat myös yrityksiä tarjoamaan kestäviä ratkaisuja.
- Uusiutuvia energiamuotoja edistetään vahvasti ja **valtio tukee merituulivoiman verkkoliityntää.** Tuotanto on

The Sea of restrictions and tensions

- Maailman suurvaltojen välinen valtataistelu on yltynyt kauppasodaksi ja **länsimaiden ja Venäjän väliset jännitteet kiristyvät Itämerellä**. Epävakaa turvallisuustilanne vähentää investointeja.
- EU-maiden välinen yhteistyö lisääntyy ja **unioni tiukentaa ohj- ityisesti ympäristö- ja energiapolitiikan**

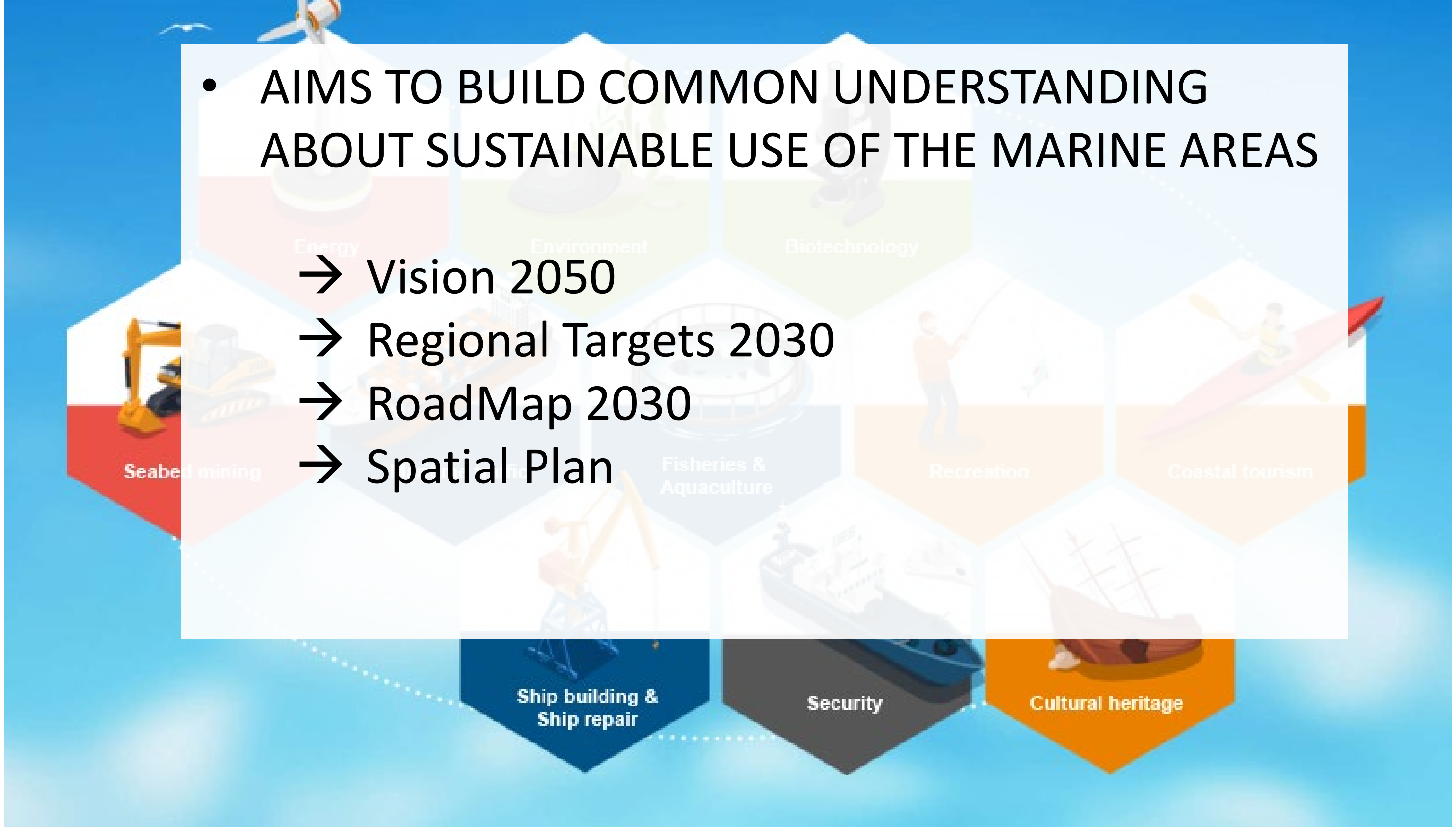
ATION!

avaraisuus Euroopan tasolla korostuu ja EU:lle dostetaan **yhteinen energiaunioni**. Uusiutuvaa

STAKEHOLDER DIALOG Oct 2019 – Jan 2020

- AIMS TO BUILD COMMON UNDERSTANDING ABOUT SUSTAINABLE USE OF THE MARINE AREAS

  → Vision 2050
  → Regional Targets 2030
  → RoadMap 2030
  → Spatial Plan

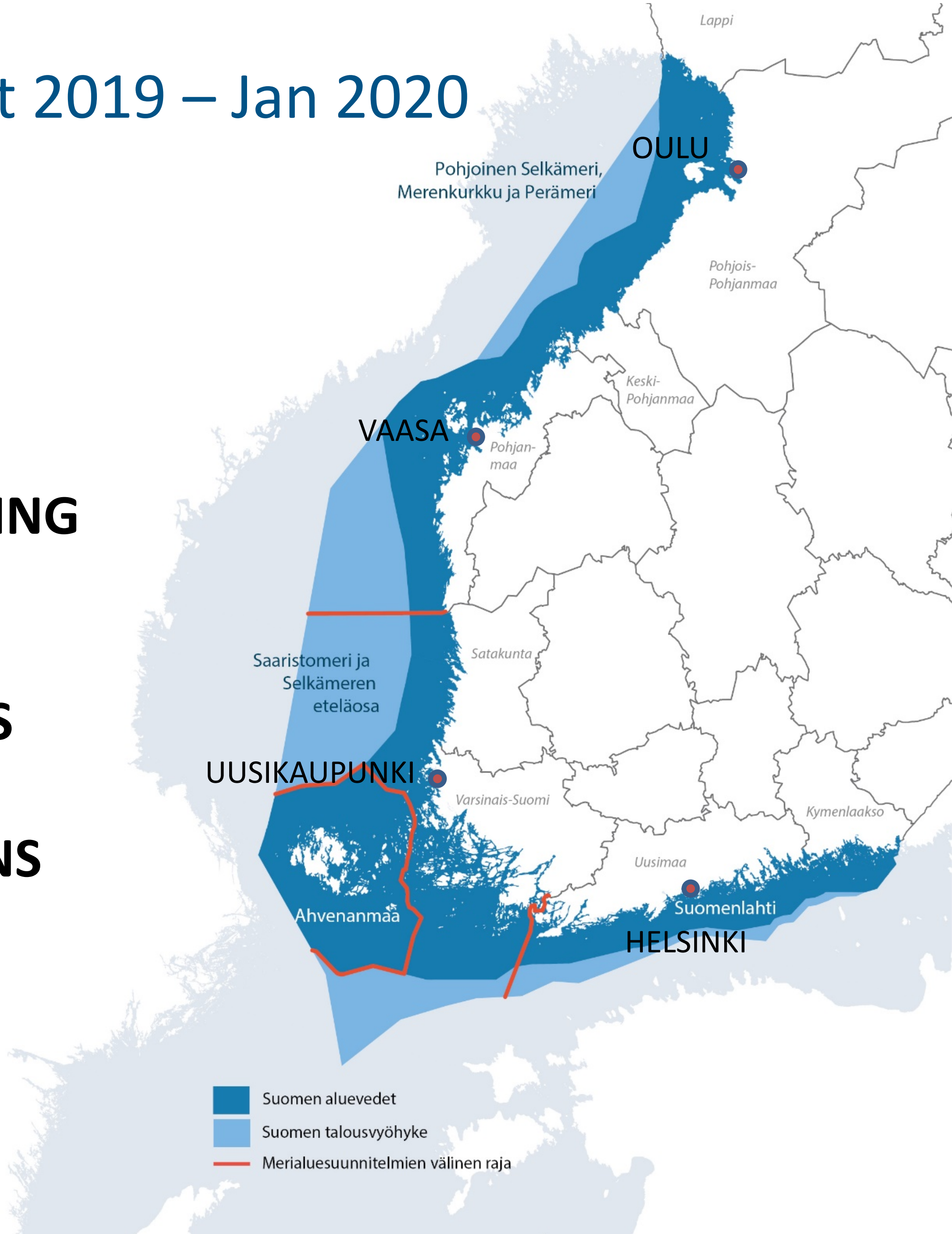


BASELINE REVIEW	FUTURE SCENARIOS	VISION	CONSULTATION	FINALISATION AND REPORTING
Characteristics of Sea Areas State of the Marine Environment Blue Growth Profiles	CONSULTATION Impact Assessment	Stakeholder dialog in the planning areas Impact Assessment		Impact assessment

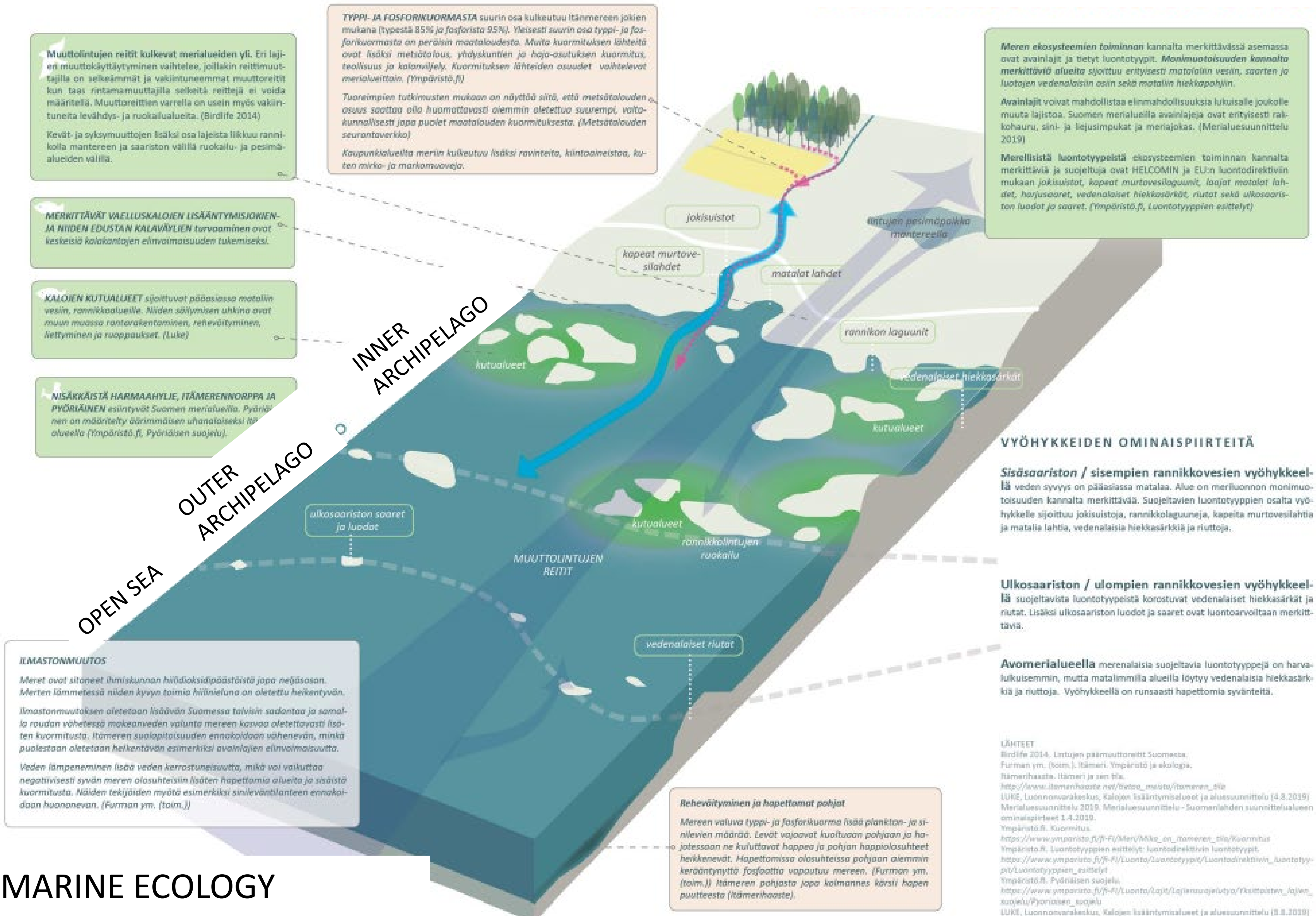
2017 | 2018 | 2019 | 2020 | 2021

STAKEHOLDER DIALOG Oct 2019 – Jan 2020

- **1 NATIONAL VISION WORKSHOP**
- **4 REGIONAL TARGET SETTING WORKSHOPS**
- **+ DIGITAL CONSULTATIONS**
- **+ THEMATIC NEGOTIATIONS**



THEMATIC VISUALISATIONS

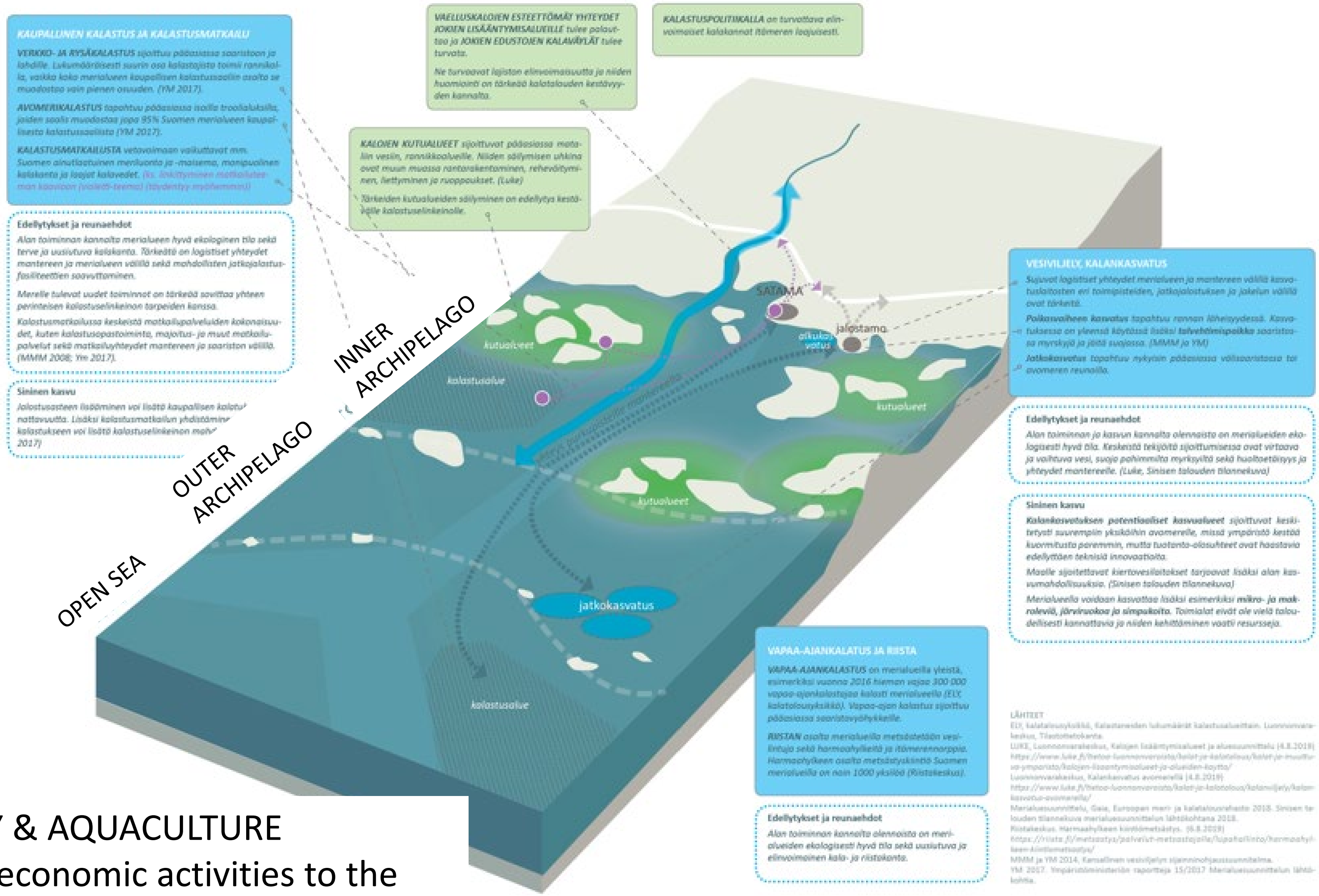


D
R
A
F
T

MARINE ECOLOGY
Linking marine ecology to geographical zones and land-sea interaction.

MARITIME SPATIAL PLANNING

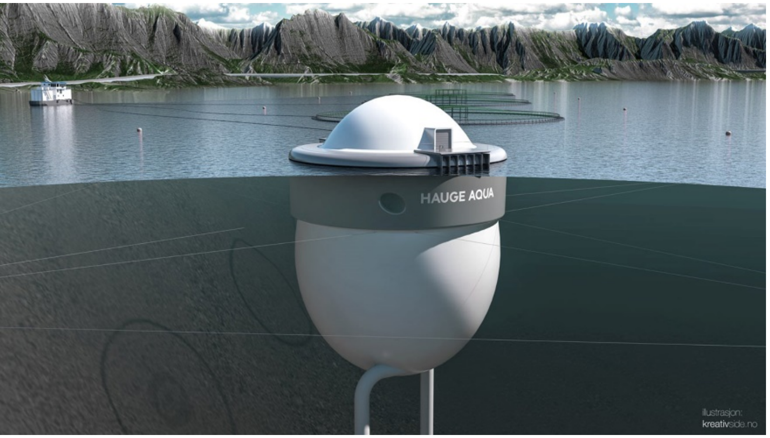
THEMATIC VISUALISATIONS



D R A F T

FISHERY & AQUACULTURE
Linking economic activities to the geographical zones, ecosystem services and land-sea interaction.

MARITIME SPATIAL PLANNING



MAY 2020 FINAL PUBLIC CONSULTATION

- VISION 2050
- REGIONAL TARGETS 2030
- ROADMAP 2030
- SPATIAL PLAN
- IMPACT ASSESSMENT

HEARING OF THE PLAN PROPOSAL
MARCH–APRIL 2020

MARITIME SPATIAL PLANNING

www.merialuesuunnittelu.fi

meriskenaariot.info

merialueenvisiot.info

MARITIME SPATIAL PLANNING

EUROPEAN MARITIME AND FISHERIES FUND