BONUS+ BEAST PROJECT

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Finnish Environment Institute (SYKE)

Biological Effects of Anthropogenic Chemical STress: Tools for the Assessment of Ecosystem Health

Estonia	Estonian University of Life Sciences
Finland	**Finnish Environment Institute (Co-ordinator)**
	Finnish Game and Fisheries Research Institute
Denmark	National Environmental Research Institute, University of Aarhus
Germany	Alfred Wegener Institute for Polar and Marine Research
	Institute for Applied Ecology Ltd.
	Johann Heinrich von Thünen-Institut/Institute of Fishery Ecology
	Leibniz Institute for Baltic Sea Research
Latvia	Institute of Biology, University of Latvia
	Latvian Institute of Aquatic Ecology
Lithuania	Institute of Ecology, Nature Research Centre
Poland	Sea Fisheries Institute in Gdynia
Russia	Zoological Institute of RAS
	Scientific Research Center for Ecological Safety RAS
	Atlantic Research Institute of Fisheries & Oceanography
Sweden	Department of Applied Environmental Research, Stockholm University

r/v Walther Herwig III (Germany)

What does **BEAST** aim at?

EXAMINATION OF THE EFFECTS OF HAZARDOUS SUBSTANCES ON MARINE ORGANISMS AND COMMUNITIES

…by investigating the chemical pressure and biological effects at different levels of biological organisation

PROVIDING NEW MANAGEMENT TOOLS AND INDICATORS

…for the overall assessment of the health status of the Baltic Sea in regard to the integrated monitoring approach
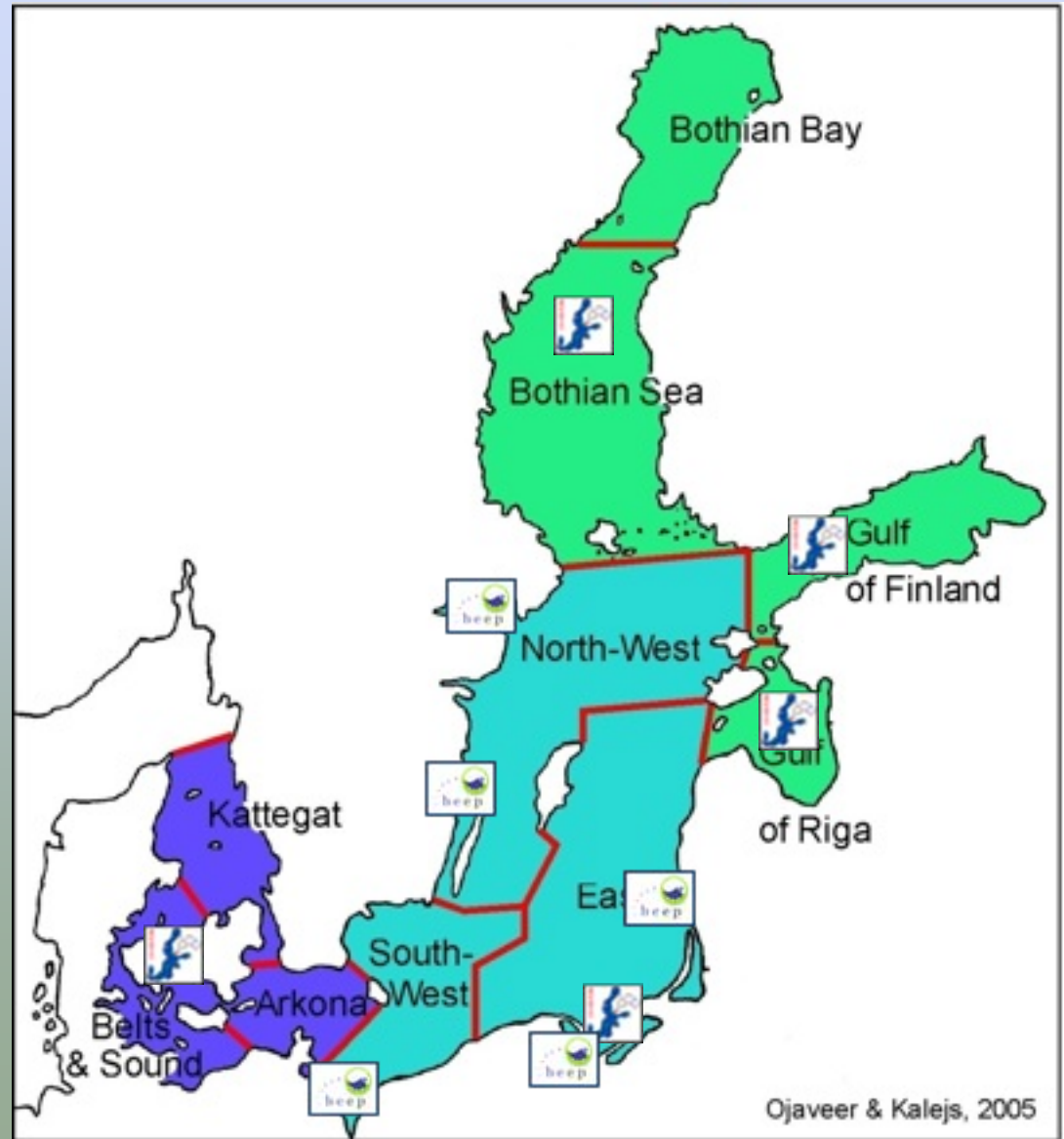
Past and present join together...

Biological **E**ffects
of **E**nvironmental **P**ollution
in Marine Coastal Ecosystems

EU Project 2001-2004

Biological **E**ffects of
Anthropogenic Chemical **ST**ress:
Tools for the Assessment of
Ecosystem Health

BONUS+ Programme Project
2009-2011

Ojaveer & Kalejs, 2005

BEAST approach

- ✓ **RESEARCH, APPLICATION AND EVALUATION** of established and new biomarker techniques

- ✓ **DETERMINATION** of sub-regional reference/target/effect levels

- ✓ **LINKING EARLY EFFECTS AND HIGHER LEVEL EFFECTS** by relating responses directly to changes in growth, reproductive output or energy utilization

- ✓ **SUB-REGIONAL ECOSYSTEM HEALTH ASSESSMENTS**

- ✓ **TESTING AND VALIDATION** of integrated monitoring approaches

- ✓ **CO-OPERATION with HELCOM** in regard to implementation of the BSAP

- ✓ **PROVIDING NEW MANAGEMENT TOOLS AND INDICATORS** for the overall assessment of the health status of the Baltic Sea in regard to the integrated monitoring approach.

= development of cost-efficient monitoring and assessment tools

Biological effects monitoring

- ✓ DETECTS exposure to a wide range of contaminants by using a small and economic battery of methods

- ✓ is PROGNOSTIC for the occurrence of pathology and disease

- ✓ REVEALS potential effects at higher biological levels (populations, communities, ecosystems)

-> EARLY WARNING SYSTEM!

= looking at Ecosystem Health

Holistic assessments of Ecosystem Health covers various chemical and biological characteristics of specific ecosystems

- ✓ assessment of Ecosystem Health encompasses the health of living organisms – "HEALTHY ORGANISMS, HEALTHY ECOSYSTEMS"

- ✓ evaluation of combinations of indicators for applicability in Ecosystem Health assessments in different sub-regions of the Baltic Sea

Work Package 1: "Basic research"

Field studies and experiments in selected sub-regions of the Baltic Sea:

- **Gulf of Bothnia**
- **Gulf of Finland**
- **Gulf of Riga**

- **Gulf of Gdansk**
- **Belt Sea**

Main output: identifying contaminant impacts in different sub-regions
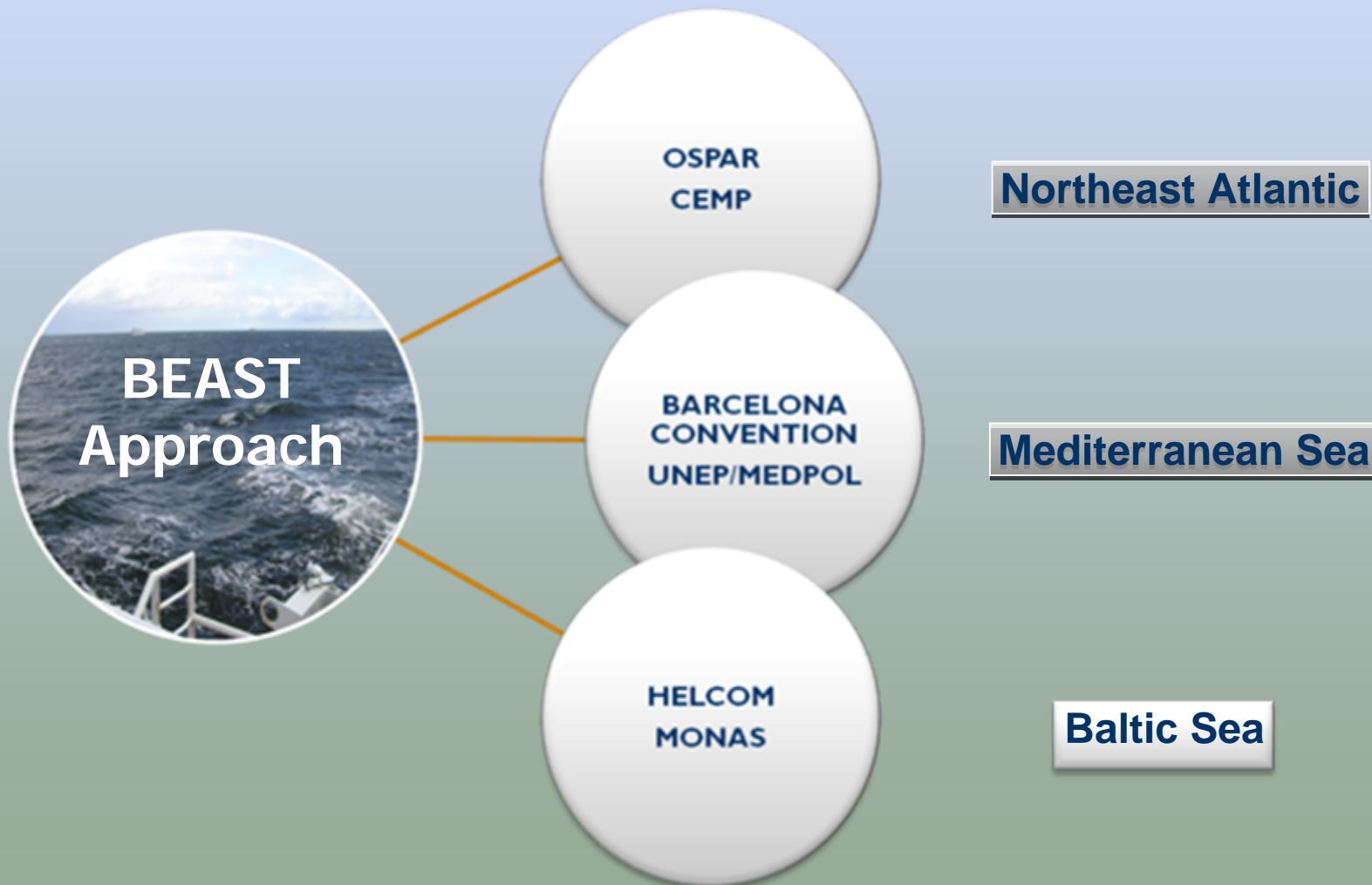
Work Package 2: "Guidelines"

Application and validation of methods in monitoring and assessment in the Baltic Sea

Main output: recommendations and practical guidelines
for integrated chemical-biological monitoring of hazardous substances
in the Baltic Sea

supports harmonisation of environmental monitoring in European sea areas

OSPAR
CEMP

Northeast Atlantic

BARCELONA
CONVENTION
UNEP/MEDPOL

Mediterranean Sea

BEAST
Approach

HELCOM
MONAS

Baltic Sea

Work Package 3: "Assessment"

Developing tools for Ecosystem Health assessment in the Baltic Sea

Main output: indices and statistical approaches for integrated assessments of Ecosystem Health in the Baltic Sea. Links between early signals and late effects.

Sampling type	Sampling device	Parameter	Specific parameter	Species	Function or process
Hydrography	Near-bottom O2	Oxygen concentration	O2 content	-	Eutrophication
Hydrography	CTD	Salinity	Salinity	-	Background data
Hydrography	CTD	Temperature	C-degrees	-	Background data
Hydrography	CTD rosette	Nu...		-	Eutrophication
Phytoplankton comm.	Water sampler	Co...		-	Disturbed structure
Zooplankton comm.	Zooplankton net 100 um	Co...		-	Community description
Macrozooplankton comm.	Zooplankton net 500 um	Community structure	Indicators & indices	-	Community description
Benthic comm.	Bottom grab/corer	Community structure	Indicators & indices	-	Disturbed structure
Benthic comm.					Anomalous growth
Near-bottom & surface water	W...				Increase in natural toxins
Near-bottom & surface water	W...				Increase in natural toxins
Sediment surface layer	Bottom grab/corer	Algal toxins	Nodularin/hepatotoxins	*Nodularia spumigena*	Increase in natural toxins
Sediment surface layer	Bottom grab/corer	Heavy metals	Cu, Zn, Cd, Hg, Pb	-	Anthropog. contamination
Sediment surface layer	Bottom grab/corer	Bioa...		*Corophium, Gmelinoides*	Anthropog. contamination
Benthic organisms	Bottom grab/corer	Hea...		*Macoma balthica*	Anthropog. contamination
Benthic organisms	Bottom grab/corer	PAH		*Macoma balthica*	Anthropog. contamination
Benthic organisms	Bottom grab/corer	Organochlorine compounds	PCBs, DDTs	*Macoma balthica*	Anthropog. contamination
Benthic organisms	Bottom grab/corer		TBT, DBT, MBT	*...balthica*	Anthropog. contamination
Macrozooplankton	Zooplankton n...			*...anus*	Anthropog. contamination
Benthic organisms	Bottom grab/c...			*...balthica*	Anthropog. contamination
Benthic organisms	Bottom grab/corer	Biomarkers	Neurotoxicity: AChE	*Macoma balthica*	Anthropog. contamination
Benthic organisms	Bottom grab/corer	Biomarkers	Genotoxicity: MN	*Macoma balthica*	Anthropog. contamination
Fish					Reduction in stock
Fish					Reduction in stock
Fish					Disturbed structure
Fish	Trawling	Algal toxins/liver & muscle	Nodularin/hepatotoxins	Pelagic: herring	Increase in natural toxins
Fish	Trawling	Algal toxins/liver & muscle	Nodularin/hepatotoxins	Benthic: flounder, eelpout	Increase in natural toxins
Fish	Trawling	Disea...		Pelagic: herring	Anthropog. contamination
Fish	Trawling	Disea...		Benthic: flounder, eelpout	Anthropog. contamination
Fish	Trawling	Bioma...	(...m.)	Pelagic: herring	Anthropog. contamination
Fish	Trawling	Biomarkers	Oxidative stress (3 param.)	Benthic: flounder, eelpout	Anthropog. contamination
Fish	Trawling	Biomarkers	Neurotoxicity: AChE	Pelagic: herring	Anthropog. contamination
Fish					contamination
Fish					contamination
Fish					contamination
Fish	Trawling	Biomarkers	General stress: LMS	Pelagic: herring	Anthropog. contamination
Fish	Trawling	Biomarkers	General stress: LMS	Benthic: flounder, eelpout	Anthropog. contamination
Fish	Trawling	Biomarkers	exposure: PAH metabol.	Pelagic: herring	Anthropog. contamination
Fish	Trawling	Biomarkers	exposure: PAH metabol.	Benthic: flounder, eelpout	Anthropog. contamination
Fish	Trawling	Biomarkers	...ompetence	Pelagic: herring	Anthropog. contamination
Fish	Trawling	Biomarkers	...ompetence	Benthic: flounder, eelpout	Anthropog. contamination

HYDROGRAPHY

POPULATION/COMMUNITY DATA

ALGAL TOXINS

HAZARDOUS SUBSTANCES

BIOASSAYS (SEDIMENT TOXICITY)

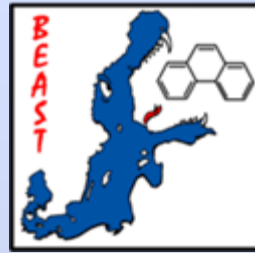**BIOMARKERS**

DISEASES, PARASITES & HISTOPATHOLOGY

ECOSYSTEM HEALTH ASSESSMENT

links with environmental policy-making

BEAST Products

- HELCOM BSAP
- EU MSFD
- National monitoring prog's
- EIAs
- ERAs
- REACH

r/v Aranda (Finland)

Contact

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WP1 Leader: Brita Sundelin (ITM/SU, Sweden)
WP2 Leader: Thomas Lang (vTI/FOE, Germany)
WP3 Leader: Doris Schiedek (NERI, Denmark)

- BEAST Website:
  http://www.environment.fi/syke/beast

See also
- BONUS Newsletter November 2009
- BONUS portal:
  http://www.bonusportal.org

THANK YOU FOR YOUR ATTENTION!