MARISPLAN

Marine Spatial Planning in a Changing Climate

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FICCA Midway Seminar 16.4.2013
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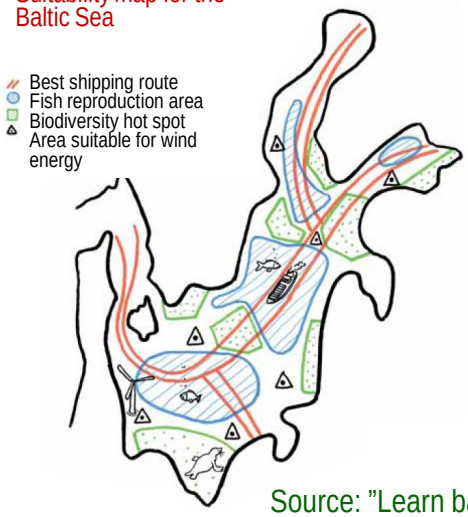
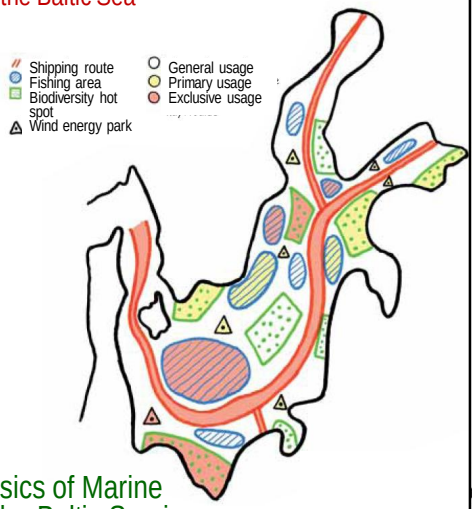
What is MSP?

Suitability map for the Baltic Sea



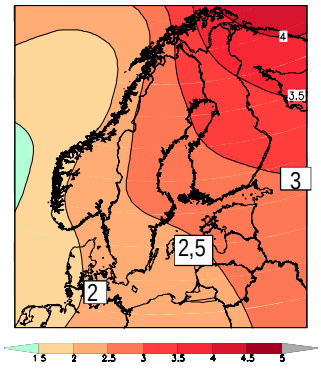
Spatial zonation plan for the Baltic Sea



Source: "Learn basics of Marine Spatial Planning in the Baltic Sea in 10 minutes" (www.wwf.fi)

Climate change vs. Marine Spatial Planning

Air temperature will increase
Precipitation will increase



⇒ SPATIAL shifts in sea & land:
- ⇒ Hydrography (temperature and salinity)
- ⇒ Land use / agriculture
- ⇒ Nutrient loading

⇒ Consequences to the marine ecosystem

⇒ A challenge to
- ⇒ marine protection
- ⇒ sustainable use of ecosystem services
- ⇒ MSP

MARISPLAN - objectives

Investigations on climate induced changes in...

1.	Physical environment	FMI	Jari Haapala
2.	Watershed processes	SYKE Freshwater Centre	Bertel Vehviläinen
3.	Agriculture	MTT Agrifood Research	Heikki Lehtonen
4.	Baltic Sea ecosystem	SYKE Marine Res. Centre	Maiju Lehtiniemi
5.	Coastal fish and fisheries	FGFRI	Lauri Urho
6.	Policy	SYKE Env. Policy Centre	Mikael Hildén
		Helsinki City Env. Centre	J.-P. Pääkkönen

- ✓ Assessment of management approaches and adaptation options
- ✓ Practical guidelines for climate adaptive MSP in local scale

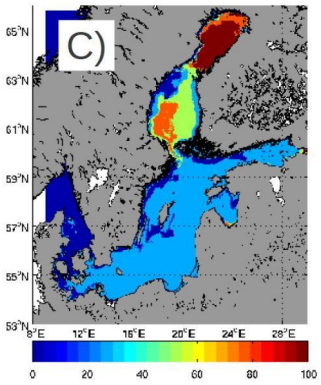
WP1
Marine physics

WP1. Development of Baltic Sea community model

Ocean & sea ice modelling

- 3D model based on NEMO/LIM-3 ocean engine
- Baltic Sea – North Sea
- Sea ice model
- Horizontal resolution: 2 nm; vertical resolution: 84 layers
- Co-developed with SMHI

Probability of sea surface temp.increasing by more than 3 degrees in June-August



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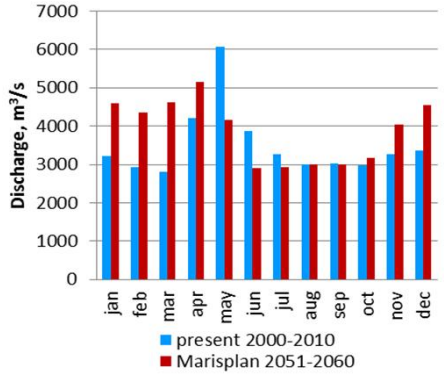
WP2
Hydrology and nutrient dynamics

WP 2. Assessment of Baltic Sea nutrient loads under changing climate

Using the MARISPLAN scenarios for climate (WP1) and agricultural change (WP3), WSFS-VEMALA model predicts for the Finnish watersheds:

Increase in freshwater discharge:
+11% by 2060



Prediction for 2051-60:

⇒ Increase in N loading by 8%

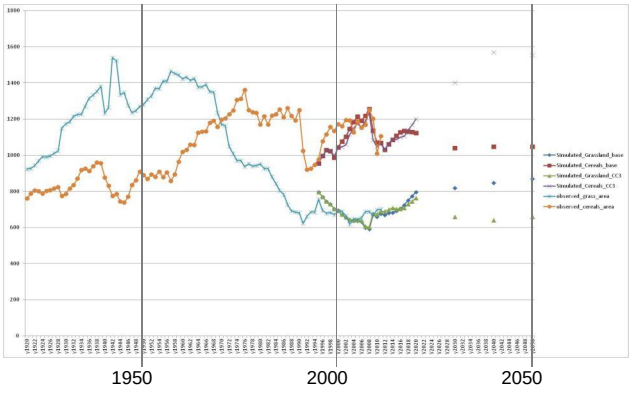
⇒ *Decrease* in P loading by 3%

WP3
Agriculture

WP 3. Regional agricultural development

Land use changes in agriculture – observed grassland and cereals areas: observed in 1920-2010; simulated in 1995-2050

- Take into account: climate, markets, policies;
- Study: Field level, farm level, sector level



Until 2050:

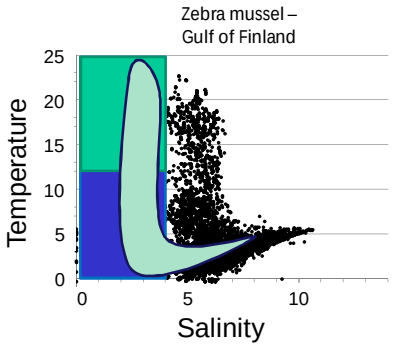
- cereals & grass: 40% increase
- protein crops (oilseeds, peas) and winter cereals: 90% increase

WP4
Marine ecosystem
WP5
Fish and fisheries

WP4. Changes in distribution of Baltic Sea biota

Zebra mussel (*Dreissena polymorpha*):
a non-indigenous invasive freshwater species in the Baltic Sea


Photo: Katriina Könönen, SYKE



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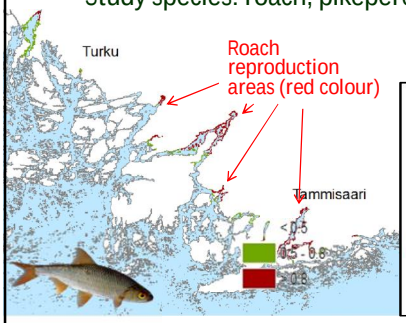
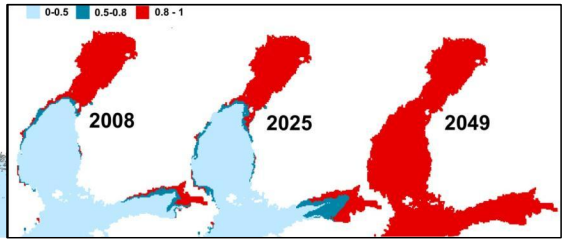
WP5. Changes in coastal fish and fisheries due to changing climate

- Reproduction areas will be predicted by using spatial distribution models
- Data from Wp1 and 2 are used in the future scenario modeling
- Study species: roach, pikeperch and whitefish



Distribution model for roach reproduction (Härmä et al. 2008)



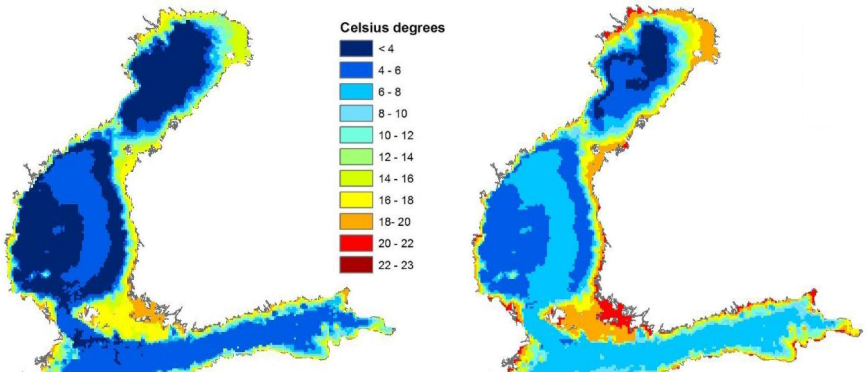
Preliminary scenario model for roach reproduction (only with salinity data)

GAME AND FISHERIES RESEARCH

WP4. What happens to the marine ecosystem if bottom temperature increases?

Bottom temp. 2005-2009

Bottom temp. 2095-2099



3D oceanographic simulations from SMHI (Meier et al. 2012). GCM:s: HadCM3 & ECHAM5 forced with A1B or A2 emission scenarios. Phys. Model: RCO; Biogeoch. Model: SCOBI. Recalculated by R. Ljungberg, SYKE

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WP6
Society

WP6. Adaptation of society to climate change

- Under work: Present planning practises and future planning needs: Interviews of national level actors
- MSP as a tool for adaptation to climate change? Conceptual paper presented in a Climate Change conference in Helsinki
- Case studies
  - Bothnian Sea (National park!)
  - Helsinki sea area (co-operation with the City of Helsinki)
- Other links: VELMU programme, Kymenlaakso regional planning

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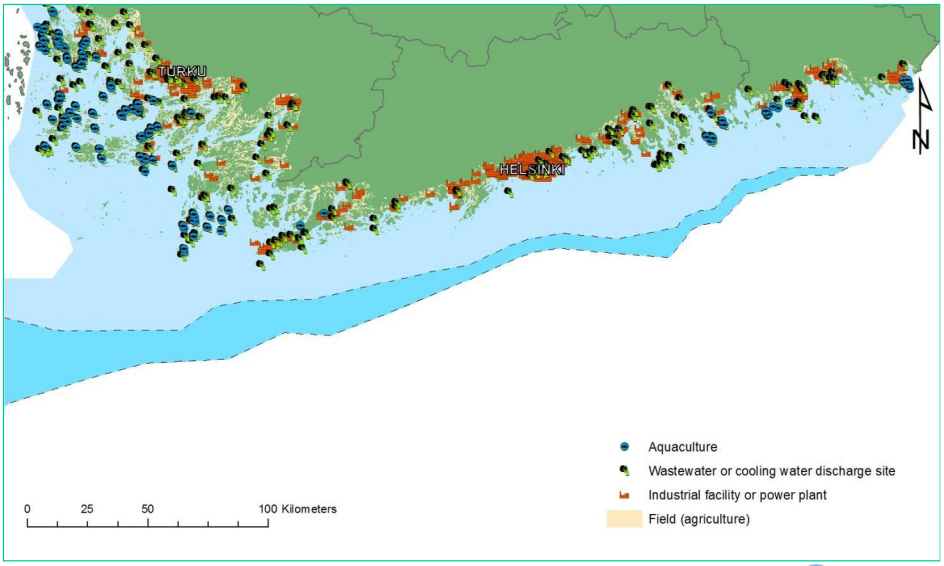
Assessment of Human Pressures



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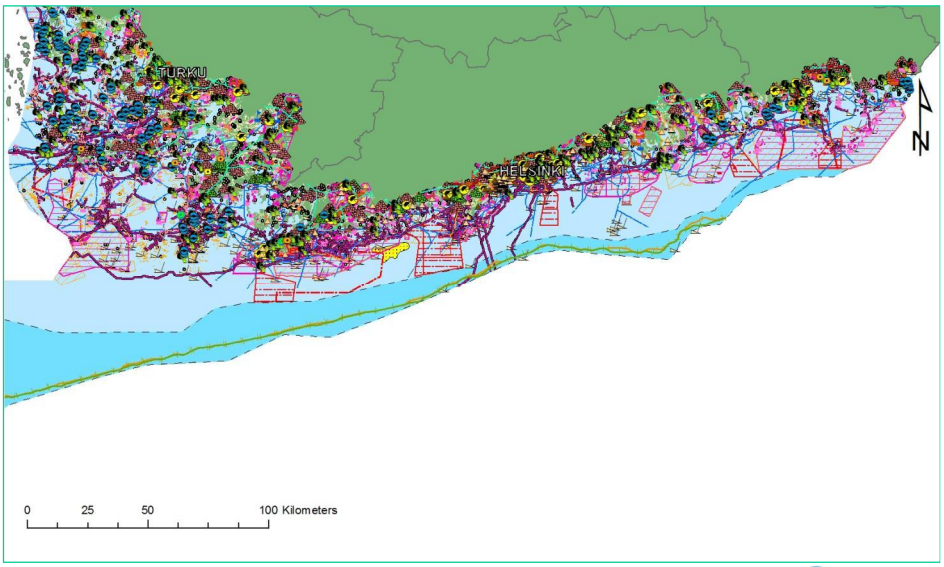
Assessment of Human Pressures



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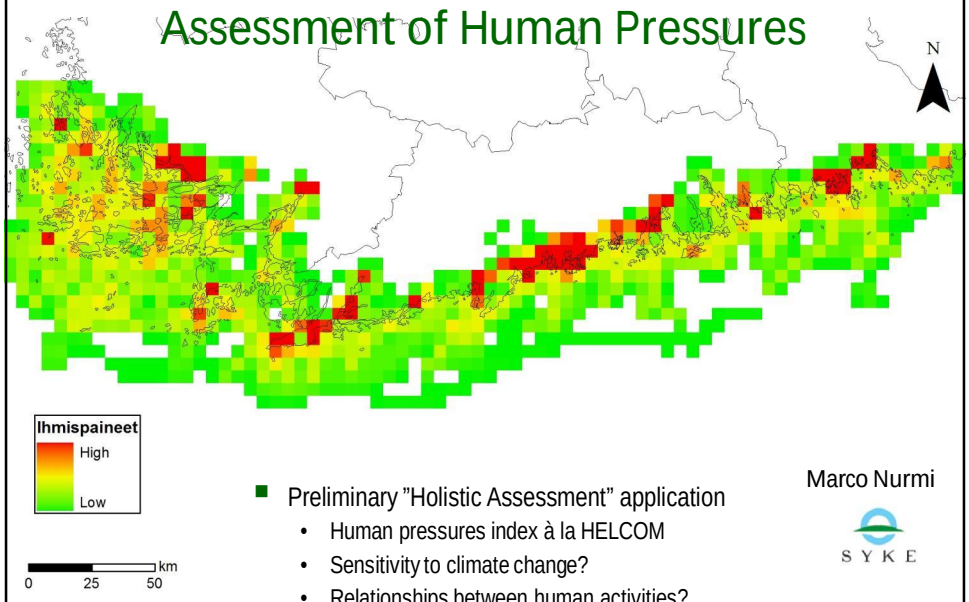
Assessment of Human Pressures



- Preliminary "Holistic Assessment" application
  - Human pressures index à la HELCOM
  - Sensitivity to climate change?
  - Relationships between human activities?

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Summary

This far:

- First scenarios have been made: promising results
- Links between the studied processes will be analysed further
- Consequences for MSP will be assessed