

Field and on line measurements in Finnish aquatic monitoring

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Call for environmental knowledge is increasing

Climate change mitigation • Green economy • Sustainable use of natural resources • Biodiversity • Ecosystem services • Baltic Sea •

Global challenges

Interdisciplinarity,
internationalisation

From water protection to
environmental protection

Decade of
water protection

Increasing
environmental
awareness

1970

National Board
of Waters

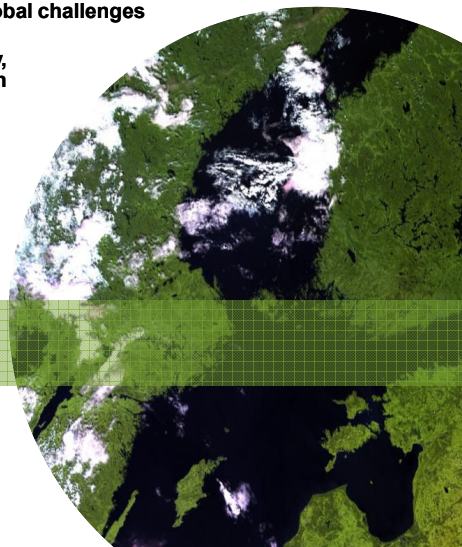
1983

Ministry of
the
Environment
National Board of Waters
and the Environment

1986

1995

SYKE

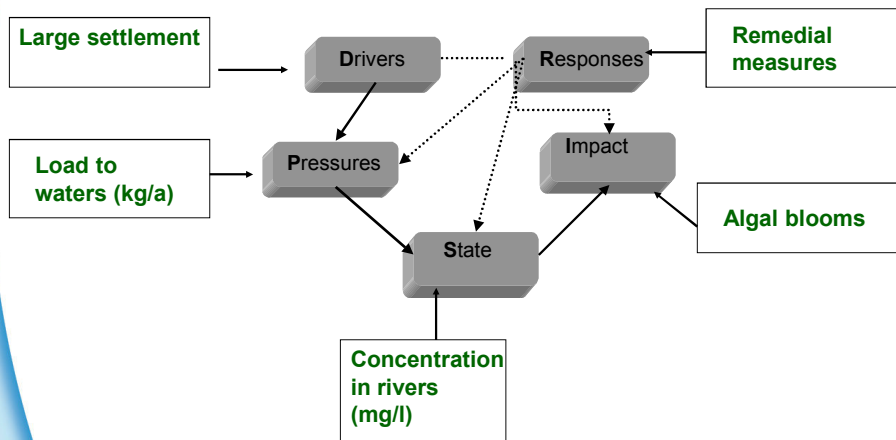


Aquatic monitoring

- **Surveillance** monitoring
 - To provide information of long term changes
 - To supplement and validate the impact assessment
 - Several actors (state research institutes)
- **Operational** monitoring
 - In water bodies under environmental threat
 - At risk of failing to meet the environmental objectives
 - More than 1700 obligated actors → consultants services
- **Investigative** monitoring
 - If the reasons for this failure are unknown
- **Public observations**
 - Active persons



DPSIR Framework for operational monitoring



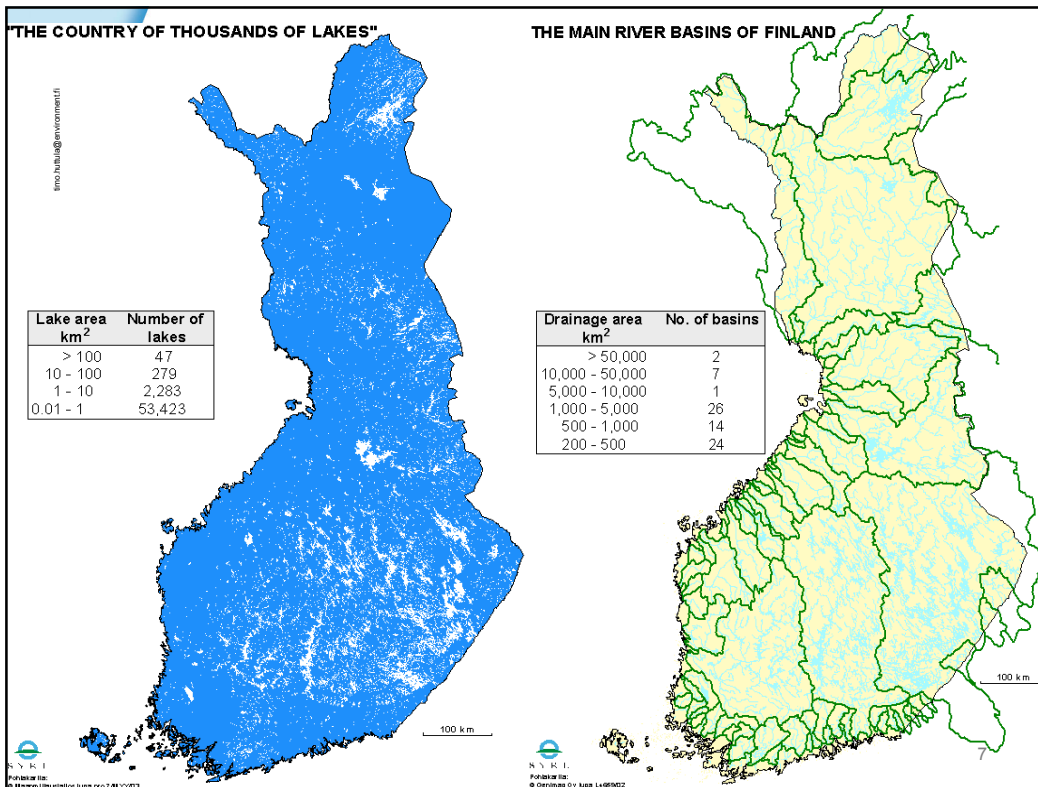
International obligations – driving forces for monitoring

Legislation	What to monitor	Database	Reporter
Nitrate directive (91/676/EY)	Nitrate contents	Hertta-database	SYKE
EEA/SoE (voluntary)	Water quality and ecology in rivers and lakes Loading from point and diffuse sources	Hertta-database	SYKE
Bathing directive (2007/6/EY)	Water quality at bathing sites	Municipalities	THL
OECD/Eurostat/Tilastokeskus	Water quality in rivers, lakes and coastal sites	Hertta database	SYKE
HELCOM/PLC	Loading from agricultural sites	Hertta database	SYKE
Marine strategy directive (2008/56/EY)	Not decided	Hertta database	SYKE
Water framework directive (2000/60/EY)	Monitoring programmes Ecological and chemical status Pressures from different sources	Hertta database	SYKE
Ground water directive (2006/118/EY)	Ground water status Ground water trends		

Hydrological monitoring

- Hydrology is the basis
 - Quantity is more important than quality
 - Climate change is changing precipitation
 → Different hydrological regime, different loading
- Present hydrological network forms solid basis for surface water monitoring









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NATIONAL HYDROLOGICAL MONITORING PROGRAMME

	Number of stations/sites		
	SYKE	Others	Total
Observation network			
Hydrometeorology			
Precipitation	-	350	350
snow water equivalent	170	-	170
evaporation (Class A)	10	10	20
Surface waters			
water level	225	90	315
river discharge	175	110	285
ice thickness	55	-	55
water temperature	45	-	45
Geohydrology			
ground water basins	55	several	55
soil frost thickness	45	-	45
Small basins	35	107	143

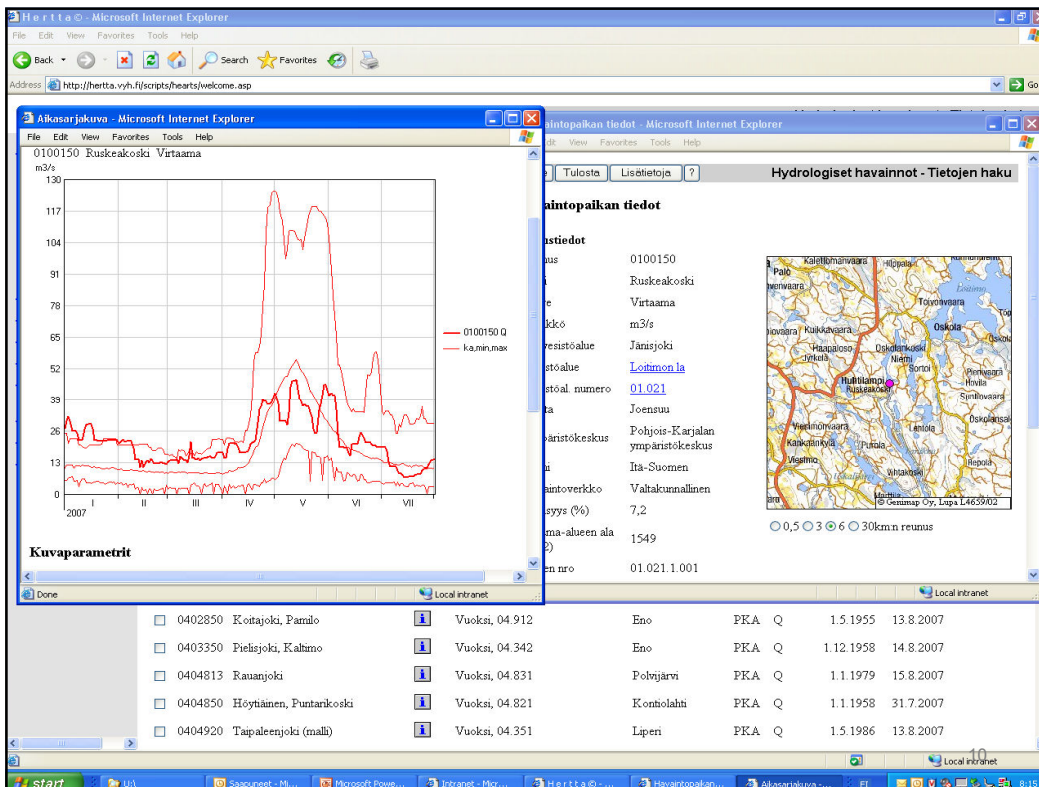





28.8.2013
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Status and resources of hydrological network

- High automation of water level stations
 - More than 300 on-line water level stations
- Effective and large database
 - Extensive flood forecasting system covering whole Finland

- SYKE Hydrological monitoring group; 15 – 20 people
- Regional ELY-centres; 20 people
- Temporary workers



Water quality monitoring at eight river basin districts (RBD's)

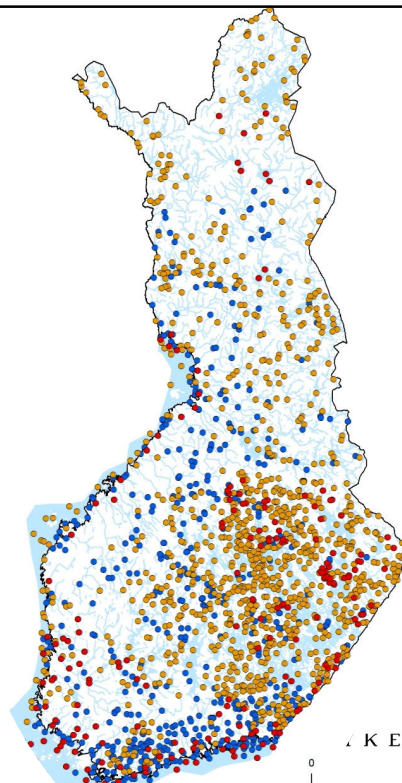
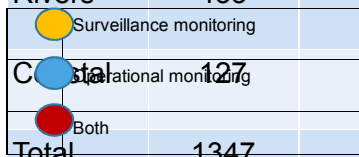
- 1. Vuoksi RBD
- 2. Kymijoki-Gulf of Finland RBD
- 3. Kokemäenjoki-Archipelago Sea- Bothnian Sea RBD
- 4. Oulujoki-Iijoki RBD
- 5. Kemijoki RBD
- Two international river basin districts (*IRBD*) have also been designated covering parts of Finland:
 - 6. Tornionjoki IRBD (shared with Sweden)
 - 7. Teno, Näätämöjoki and Paatsjoki IRBD (shared with Norway)
- 8. A separate RBD has been defined to cover the autonomous Åland Islands, where the WFD is being implemented by the provincial government.



8/28/2013

Number of water bodies and water quality monitoring stations

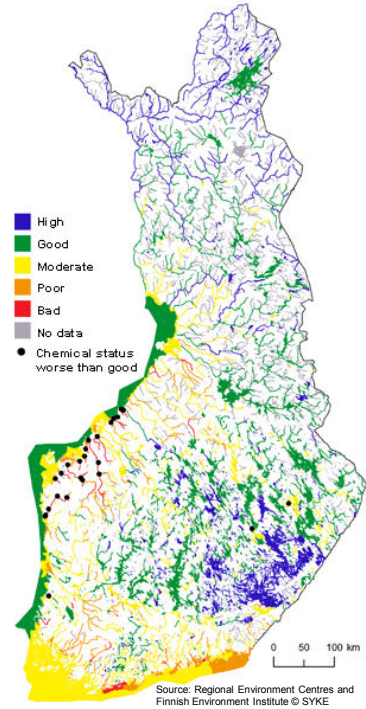
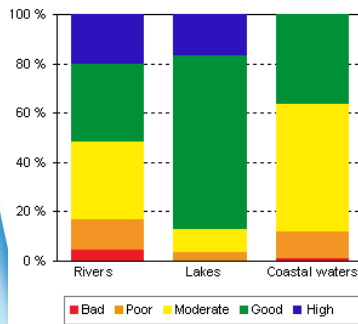
Surface water category	WFD 2010	
	sites	water bodies
Lakes	787	4275
Rivers	433	1602
Coastal	127	276
Total	1347	6153



Why - Ecological status of surface waters

by proportion of total length (rivers) or surface area

Ecological status	Rivers	Lakes	Coastal waters
High or Good	52%	87%	36%
Moderate, Poor or Bad	48%	13%	64%



Source: Regional Environment Centres and Finnish Environment Institute © SYKE

Example of water quality classification

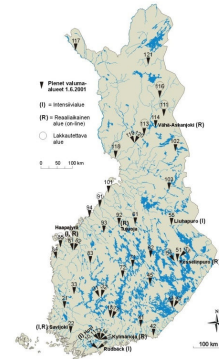
- Based on laketypes
- Varies a lot depending on natural properties

Liite 2.5 Järvien vedenlaatu.

Tyyppi	Muuttaja	Kausi	Yksikkö	Vertailuolot	Laadukangat				
					E/H	H/T	T/V	V/Hu	
Vh Pienet ja keskikokoiset vähähumukset järvet	kok. P (0-2 m)	kaivukausl VI-IX	µg/l	8	10	18	35	70	
	kok. N (0-2 m)		µg/l	320	400	500	750	1000	
Ph Pienet humusjärvet	kok. P (0-2 m)	kaivukausl VI-IX	µg/l	13	18	28	45	90	
	kok. N (0-2 m)		µg/l	430	510	700	1000	1500	
Kh Keskikokoiset humusjärvet	kok. P (0-2 m)	kaivukausl VI-IX	µg/l	13	18	28	45	90	
	kok. N (0-2 m)		µg/l	400	540	660	1000	1500	
SVh Suuret vähähumukset järvet	kok. P (0-2 m)	kaivukausl VI-IX	µg/l	8	10	18	35	70	
	kok. N (0-2 m)		µg/l	350	400	500	700	900	
Sh Suuret humusjärvet	kok. P (0-2 m)	kaivukausl VI-IX	µg/l	12	15	25	40	80	
	kok. N (0-2 m)		µg/l	400	460	600	900	1300	
Rh Ruisas-humukset järvet	kok. P (0-2 m)	kaivukausl VI-IX	µg/l	22	30	45	65	120	
	kok. N (0-2 m)		µg/l	520	590	750	1100	1800	
MVh Matalat vähähumukset järvet	kok. P (0-2 m)	kaivukausl VI-IX	µg/l	11	15	25	45	80	
	kok. N (0-2 m)		µg/l	380	480	600	1000	1500	
Mh Matalat humusjärvet	kok. P (0-2 m)	kaivukausl VI-IX	µg/l	20	25	40	65	100	

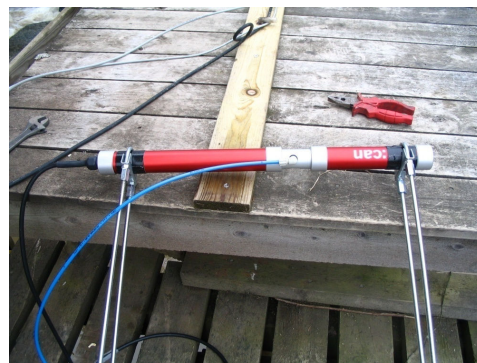
Small basins for high frequency measurements in time

- Homogenous land use
- Network cover the whole country
- Longest time series over 70 years
- Daily measurements
- Mostly hydrology
- Hydro chemical observations added presently



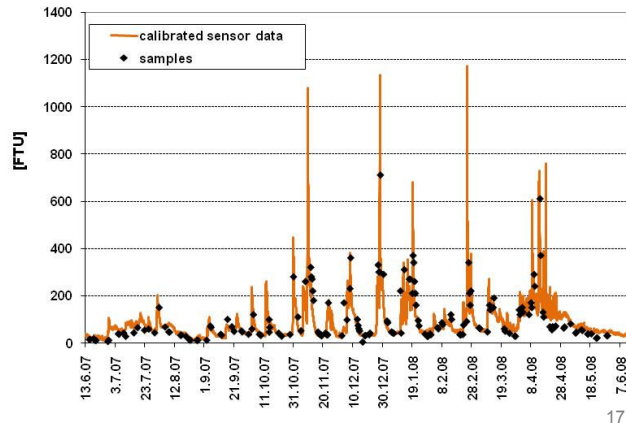
Small basins – Automatical water quality measurements

- Luode Ltd. equipments
 - Small container, electricity + batteries, compressor
 - Nitrate, suspended solids, water level and temperature

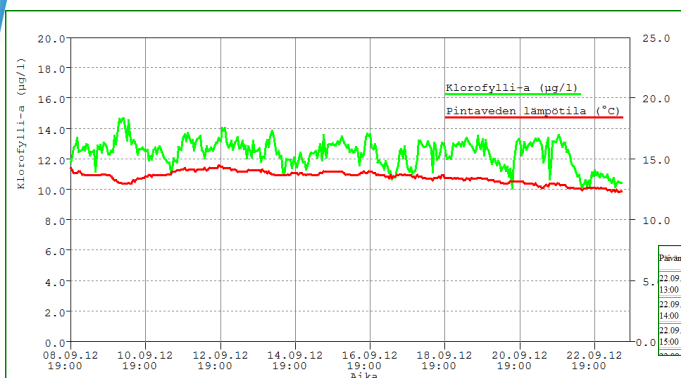


Benefits of automated measurements

- Continuous data
- Easy to follow loading
- Cost effective...



Automatic station in Lake Pyhäjärvi, Säkö



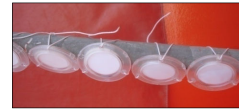
Päivämäärä	Pintaveden lämpötila (°C)	Säkö (FTU)	Nitraatti (mg/l)	Klorofylli-a (µg/l)	Säkö (mg/l)
22.09.2012 13:00	12.6	2.9	0.0	10.6	2.3
22.09.2012 14:00	12.7	2.7	0.0	10.3	2.1
22.09.2012 15:00	12.7	2.6	0.0	10.6	2.3

- Data can be seen in www.ymparisto.fi
- Chl a, temperature, turbidity (FTU), blue green algae (mg/l), nitrate, weather conditions
- Weekly overhaul by lake salvage service



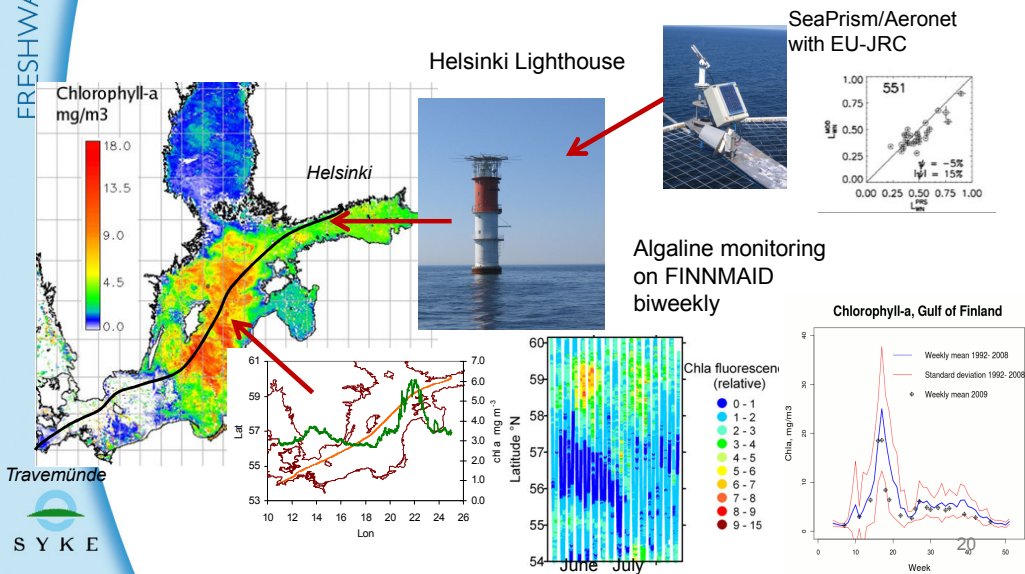
Chemcatcher

- A phase for receiving the chemicals and polycarbonate body
- Integrated samples in time
 - Substances are accumulated in the receiving phase they are analyzed in a laboratory
 - Phenols, TBT-compounds, metals
 - Pesticides
 - Pharmaceuticals
- Economical, simple deployment, laboratory work is the main cost



28.6.2013

Combined remote sensing and automated sampling



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Timo Hatanen, SYKE, WYMA
28.3.2013

MTT KASVU₈
**Automatisoidun mittausverkon
kehittäminen ympäristön
seurantaan**
 Hanna Multu (toim.)

www.ymparisto.fi/syke/jyvaskyla

Uudet ympäristömittausmenetelmät
 – haasteita, mahdollisuuksia ja liiketoimintaa
 Silla Kesäta (toim.)
 Lähde: ympäristöministeriö, ympäristöministeriön ympäristömittauskeskus, MTT

YMPÄRISTÖHALLINNON OHJEITA 2 | 2012
**Jatkuvatoiminen
sameusmittaus**
 Hyvät mittauskäytännöt ja aineistokäsitteily
 Hanna Arala (toim.)
 LUONNON-
MUKAT

Käynnissä olevia hankkeita
 COMPAT
 PASMA
 GISBLOOM
 MMEA
 REFRESH

LAHDEN AMMATTIKORKEAKOULU
 Lahti University of Applied Sciences

Suomen ympäristökeskus

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08/02/2013

Example of modern monitoring program

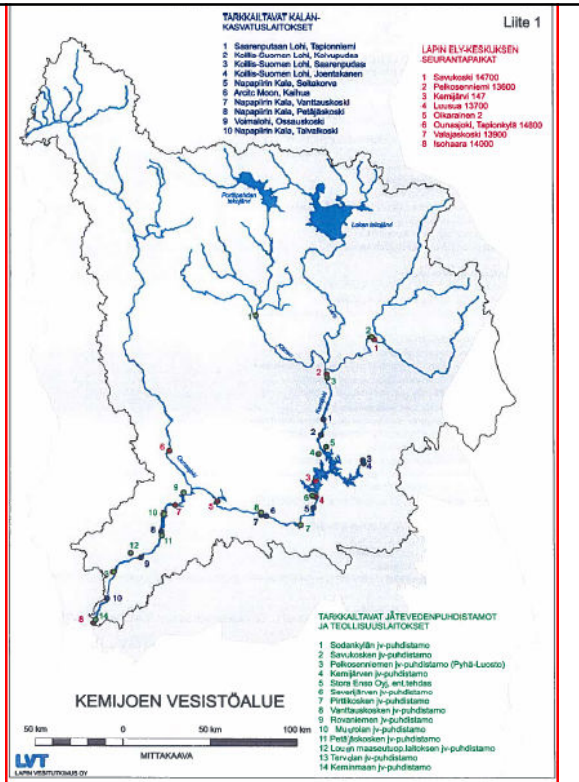
River Kemijoki main channel monitoring program 2013-2018

- One of the largest river basin (51 127 km²)
- Main pressures
 - Hydropower production (15 powerplants)
 - Pulp mill (closed 2008)
 - Aquaculture (fish farming)
 - Waste water plants
 - Diffusive loading from agriculture and forestry
 - Peat production

S Y K E

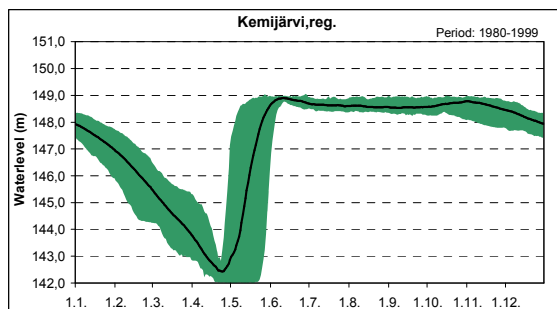
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- Red color = surveillance monitoring sites
- Blue color = fish farming sites
- Green color = waste water treatment sites and industry



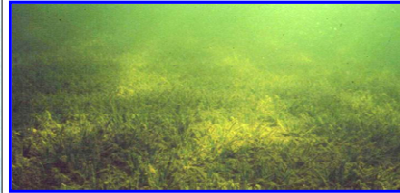
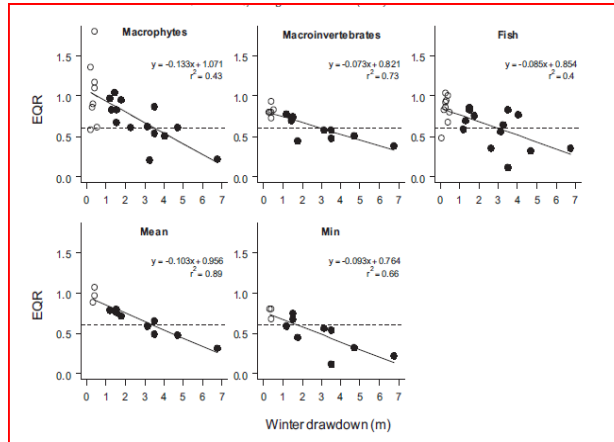
Hydropower production – regulated Lake Kemijärvi

- Regulation amplitude of 7 meters
- How to select monitored parameters?



Pressure sensitive

- Water quality and phytoplankton are NOT sensitive for water level fluctuation
- Aquatic macrophytes and macroinvertebrates selected
- Ecological Quality Ratio (EQR)

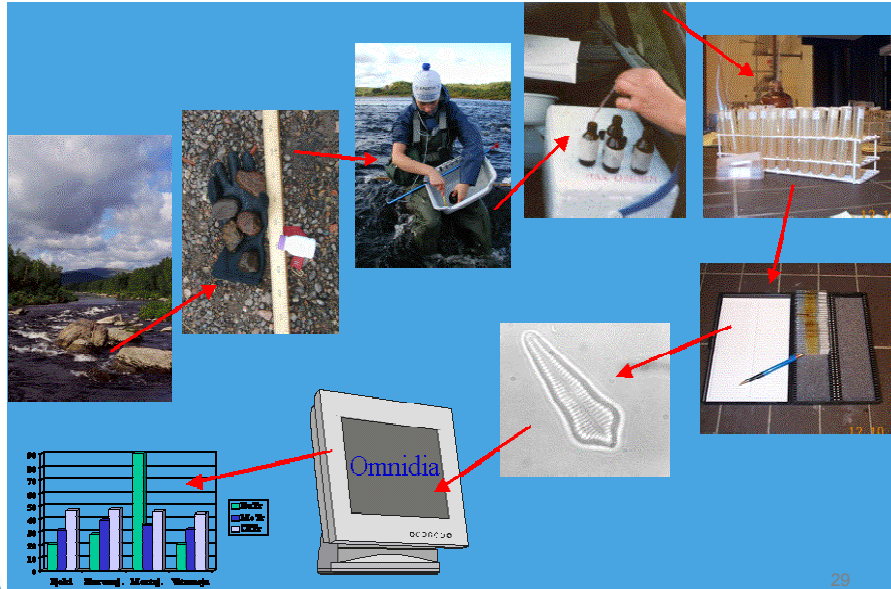


Aquaculture (fish farming)

- Causing eutrophication
 - Algae blooming
 - Sliming of stones
- Select
 - Phytobenthos monitoring

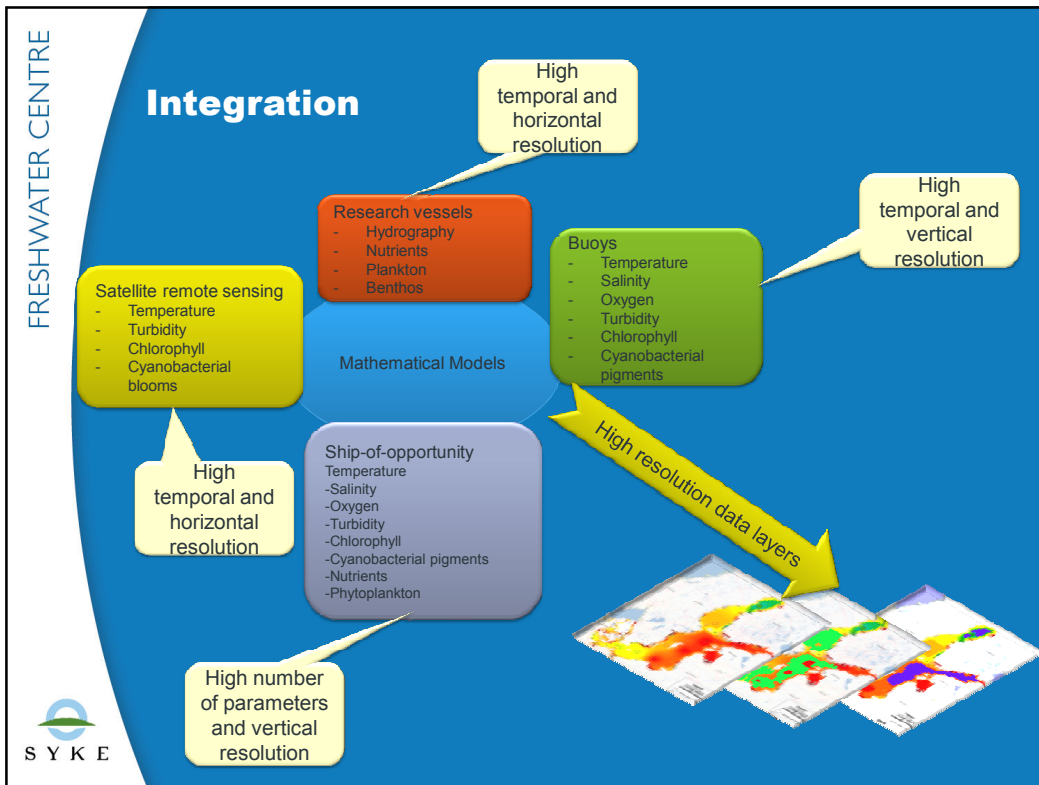


Phytobenthos method



Key issues of successful operational monitoring

- Updated legislation with good and clear guidance document
- Flexible monitoring plans with possibilities for updates
- Relatively extensive surveillance monitoring network
- Open centralized databases for public
- Common quality assurance/quality control procedure for methods
- Full trust between operators and environmental officials



- FRESHWATER CENTRE
- ## Final remarks for successful continuous aquatic measurements
- High quality robust instruments
 - Selection of measurement site and time
 - Calibration
 - Maintenance
 - Reliable and economic data transfer
 - Data bases
 - Data quality assurance/quality controls
 - Data availability
- S Y K E

Thank you !



Resources dwindling

- 2008
 - Number of personnel (in SYKE and in regional centres) should diminish with 15 person-years until 2011
 - New monitoring programme for 2009-2012 launched
 - Biological monitoring increased
 - Physico-chemical monitoring decreased
- 2011
 - Monitoring Strategy of the State of the Environment 2020
 - a comprehensive remodeling of the monitoring of the SoE
 - the replacement of labor-intensive monitoring with methods of broad regional scope, covering extensive time periods, making full use of new technologies; such methods will enable production of the legally required information with fewer resources.



Current year 2012

- Time out; current monitoring programme extended till 2013
- Monitoring of priority substances and other harmful substances was increased with extra funding
- Project 'Reconstruction of environmental monitoring' (2012-2016) started in SYKE
 - Data assimilation (remote sensing, manual sampling, automatic sampling)
 - Citizen observation approach
 - Enhance the use of modern technologies
- Freshmon (EU-project) - Providing frequent high quality water services for inland waters based on Earth Observation Data (started on 2010-12-01 lasting 36 months)

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Next year

In January-March we'll have new basis for planning monitoring network

- Revised water body **delineation**
 - All rivers with basin area > 100 km²
 - Recommended all rivers with basin area > 10 km²
 - All lakes with area > 1 km²
- Revised typology
- Revised classification
- More reference sites and surveillance monitoring are needed for some river and lake types
- We must decrease sampling frequency of some types and/or variables
- Operative remote sensing products for lakes
 - Chl a, turbidity, developing system for humic waters
 - Resolution now 300x300 m, in autumn 2014 10X10 m

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F1 Varmaan kysyvät millä värkillä....
Författare, 24/09/2012