Data Management – (Baltic) Large Marine Ecosystem View

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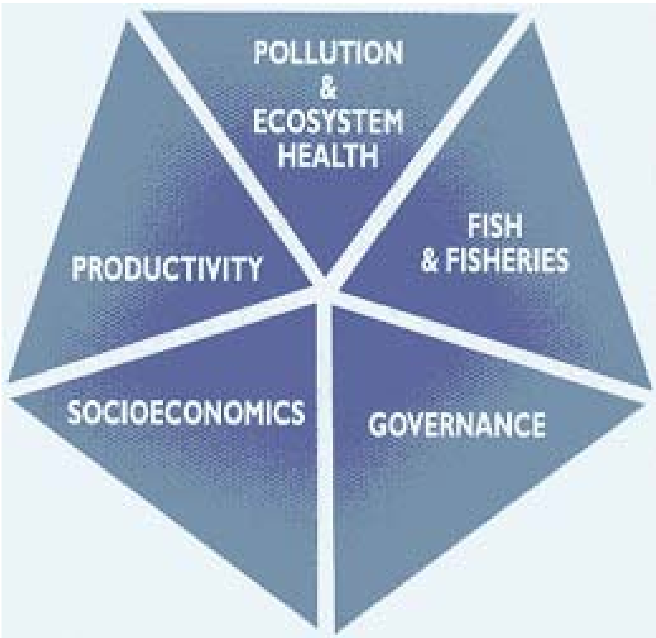
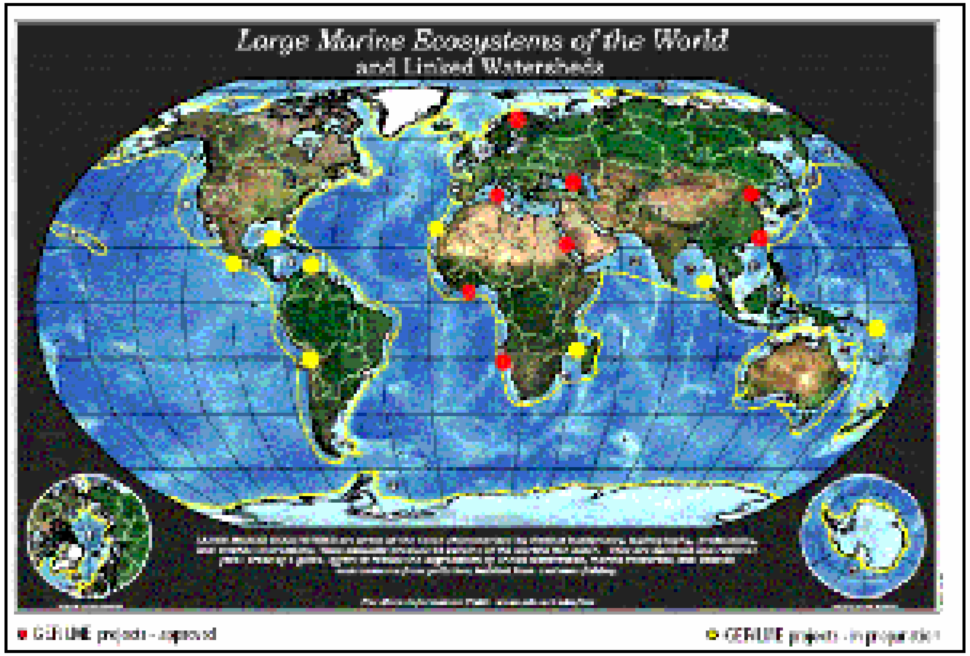
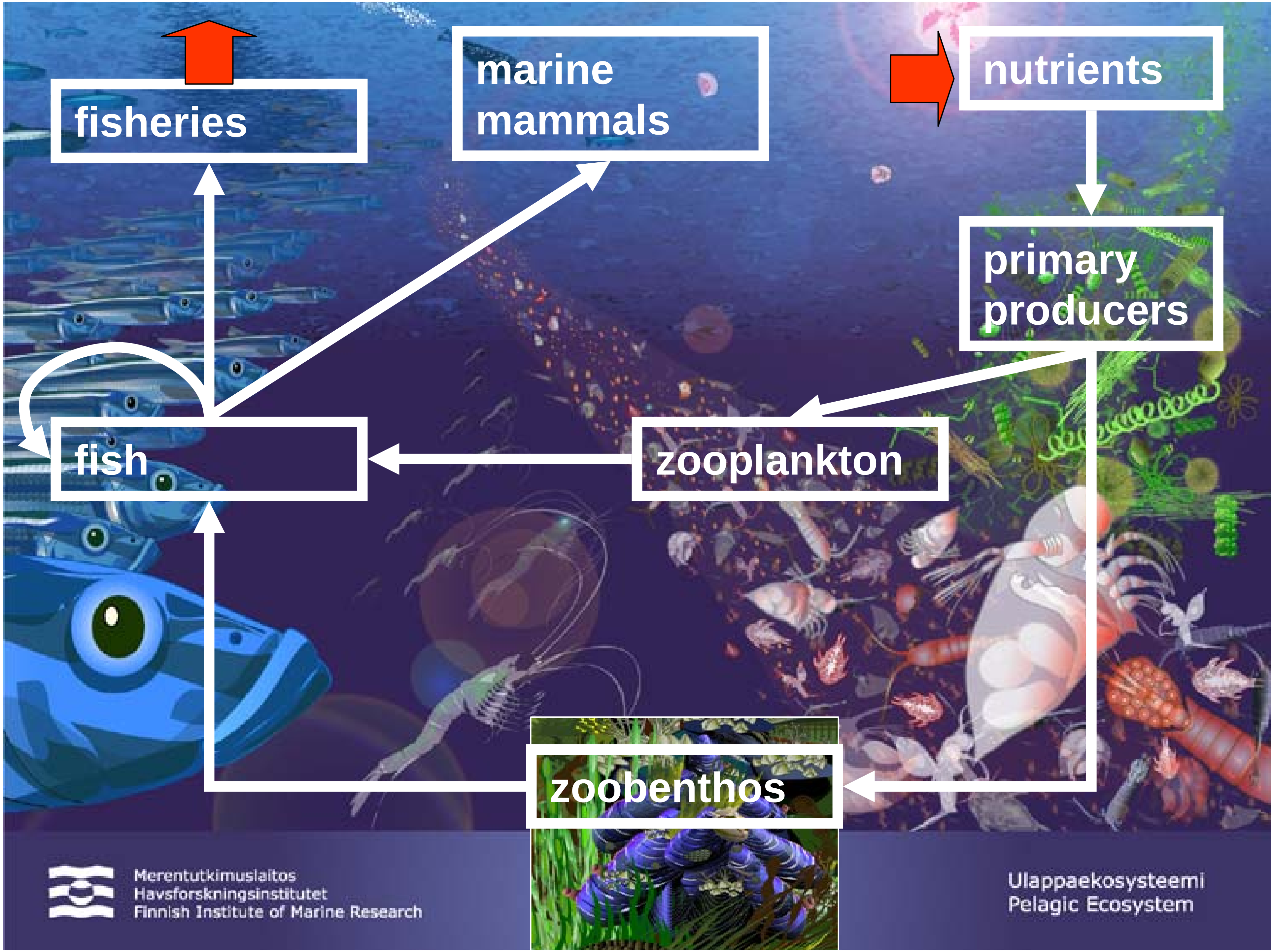
Baltic Sea Regional Project

- Goal: implement ecosystem approach to management of in the Baltic
- GEF funding 2003 – 2006, continuation applied for
- LME modules: integrated view of marine ecosystems






fisheries
marine mammals
nutrients
primary producers
fish
zooplankton
zoobenthos
Merentutkimuslaitos
Havsforskningsinstitutet
Finnish Institute of Marine Research
Ulappaekosysteemi
Pelagic Ecosystem

WKIAB

ICES/BSRP/HELCOM Workshop on Developing a Framework for Integrated Assessment for the Baltic Sea

1-4 March 2006
Tvärminne, Finland

ICES CIEM
International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

BSRP

HELCOM

Indicator based ecosystem description

- Indicator: time series that describes a characteristic ecosystem state variable or ecosystem process
- Time series covering 1973 – 2004
- Climate and physics: temperature, ice cover, salinity (bottom, intermediate, surface), inflow index, oxygen
- Nutrients: DIN, DIP (winter values, bottom, below halocline, surface), nutrient loads
- Phytoplankton: chlorophyll *a*, biomass of species groups, Secchi depth (spring, summer)
- Zooplankton species biomass
- Fish stock indexes (sprat, herring, cod, flounder, salmon)
- Fishing mortality

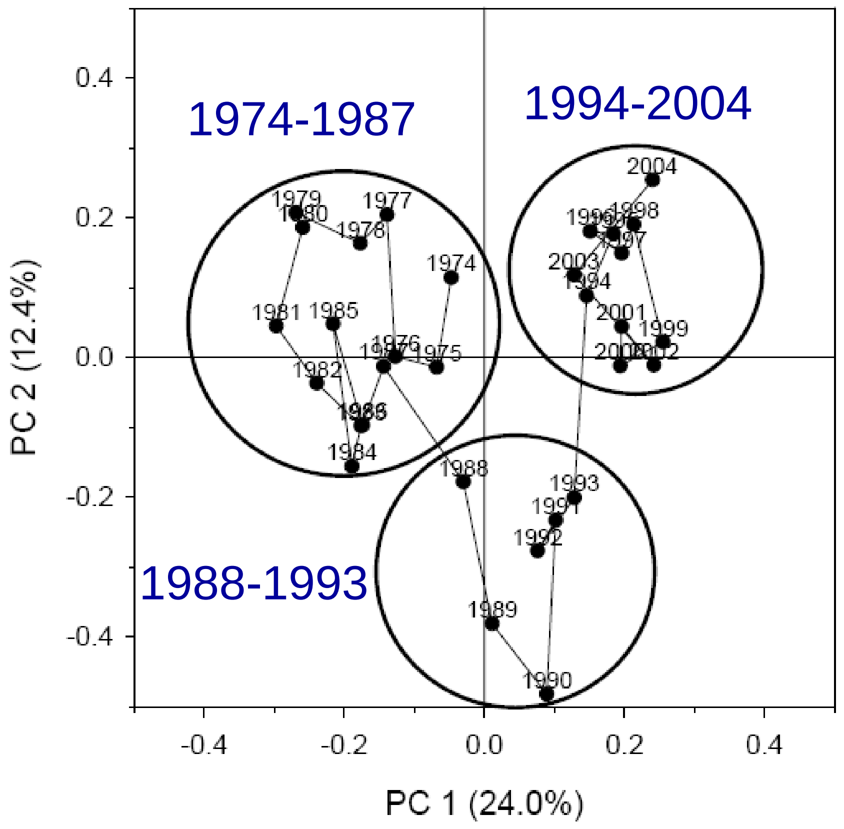
Trial assessment database

- **75 biotic and abiotic variables for the <u>Central Baltic</u>**
  - **18 fish**
  - **9 zooplankton**
  - **17 phytoplankton**
  - **12 nutrients**
  - **19 hydroclimatic**

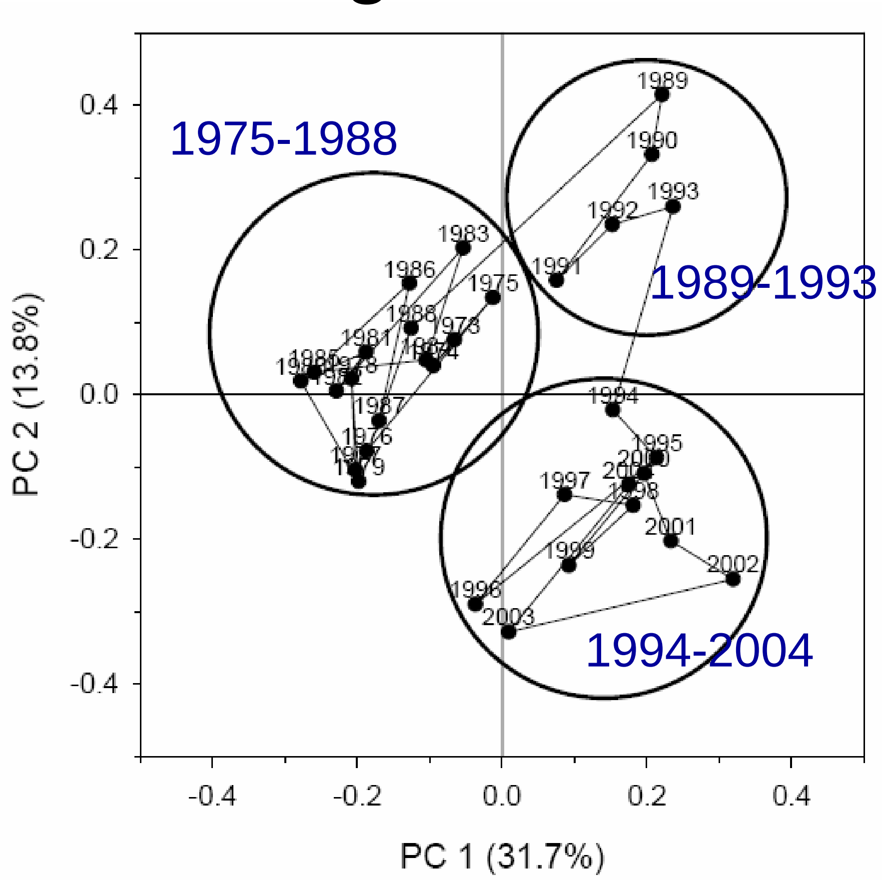
- **31 biotic and abiotic variables for the <u>Gulf of Riga</u>**
  - **4 fish**
  - **13 zooplankton**
  - **4 phytoplankton**
  - **4 nutrients**
  - **6 hydroclimatic**

Ecosystem stable states

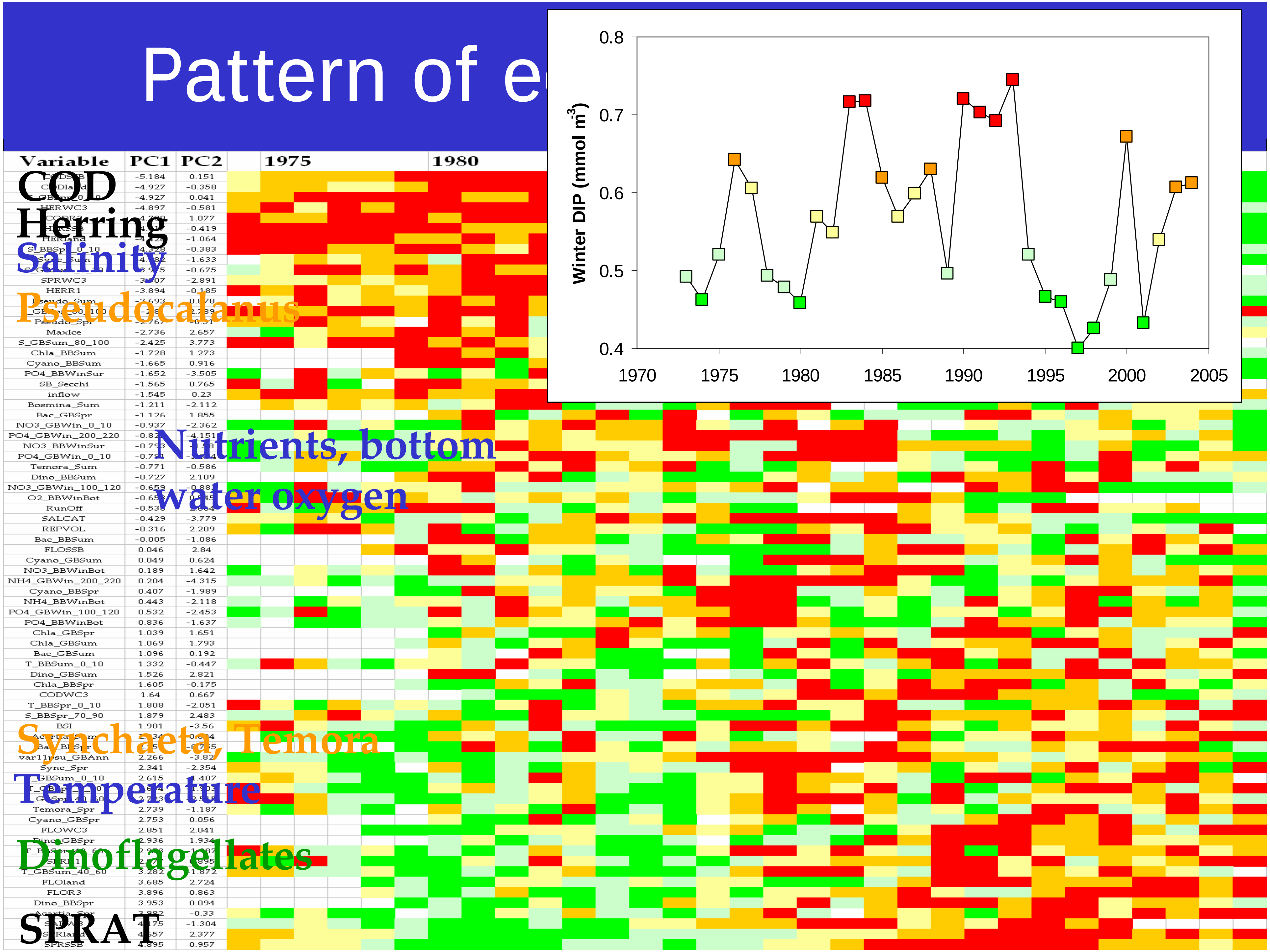
Baltic Proper



Gulf of Riga



Pattern of e



Variable PC1 PC2 1975 1980
COD
Herring
Salinity
Pseudocalanus
Nutrients, bottom water oxygen
Synchaeta, Temora
Temperature
Dinoflagellates
SPRAT
HERWC3 -4.897 -0.581
SPRWC3 -2.891
HERR1 -3.894 -0.185
MaxIce -2.736 2.657
S_GBSum_80_100 -2.425 3.773
Chla_BBSum -1.728 1.273
Cyano_BBSum -1.665 0.916
PO4_BBWinSur -1.652 -3.505
SB_Secchi -1.565 0.765
inflow -1.545 0.23
Bosmina_Sum -1.211 -2.112
Bac_GBSpr -1.126 1.855
NO3_GBWin_0_10 -0.937 -2.362
PO4_GBWin_200_220
NO3_BBWinSur
PO4_GBWin_0_10
Temora_Sum -0.771 -0.586
Dino_BBSum -0.727 2.109
NO3_GBWin_100_120
O2_BBWinBot
RunOff
SALCAT -0.429 -3.779
REPVOL -0.316 2.209
Bac_BBSum -0.005 -1.086
FLOSSB 0.046 2.84
Cyano_GBSum 0.049 0.624
NO3_BBWinBot 0.189 1.642
NH4_GBWin_200_220 0.204 -4.315
Cyano_BBSpr 0.407 -1.989
NH4_BBWinBot 0.443 -2.118
PO4_GBWin_100_120 0.532 -2.453
PO4_BBWinBot 0.836 -1.637
Chla_GBSpr 1.039 1.651
Chla_GBSum 1.069 1.793
Bac_GBSum 1.096 0.192
T_BBSum_0_10 1.332 -0.447
Dino_GBSum 1.526 2.821
Chla_BBSpr 1.605 -0.175
CODWC3 1.64 0.667
T_BBSpr_0_10 1.808 -2.051
S_BBSpr_70_90 1.879 2.483
BSI 1.981 -3.56
var11psu_GBAnn 2.266 -3.82
Sync_Spr 2.341 -2.354
Temora_Spr 2.739 -1.187
Cyano_GBSpr 2.753 0.056
FLOWC3 2.851 2.041
FLOland 3.685 2.724
FLOR3 3.896 0.863
Dino_BBSpr 3.953 0.094
SPRSSB 4.895 0.957
Winter DIP (mmol m-3)
0.8
0.7
0.6
0.5
0.4
1970
1975
1980
1985
1990
1995
2000
2005

Dominant processes

- Baltic Proper
  - Temperature and salinity changes
  - Changes in fish stocks
  - Inflow dynamics are second strongest signal
  - Nutrient dynamics follow inflows, mask eutrophication signal
  - Weak relationship nutrients and phytoplankton (?)
- Gulf of Riga
  - Temperature and salinity changes
  - Changes in herring stock
  - Impact of eutrophication, but decoupled from nutrient loads (long residence time of DIP)
  - Summer chlorophyll a responds to DIP
  - Top down effects herring - zooplankton

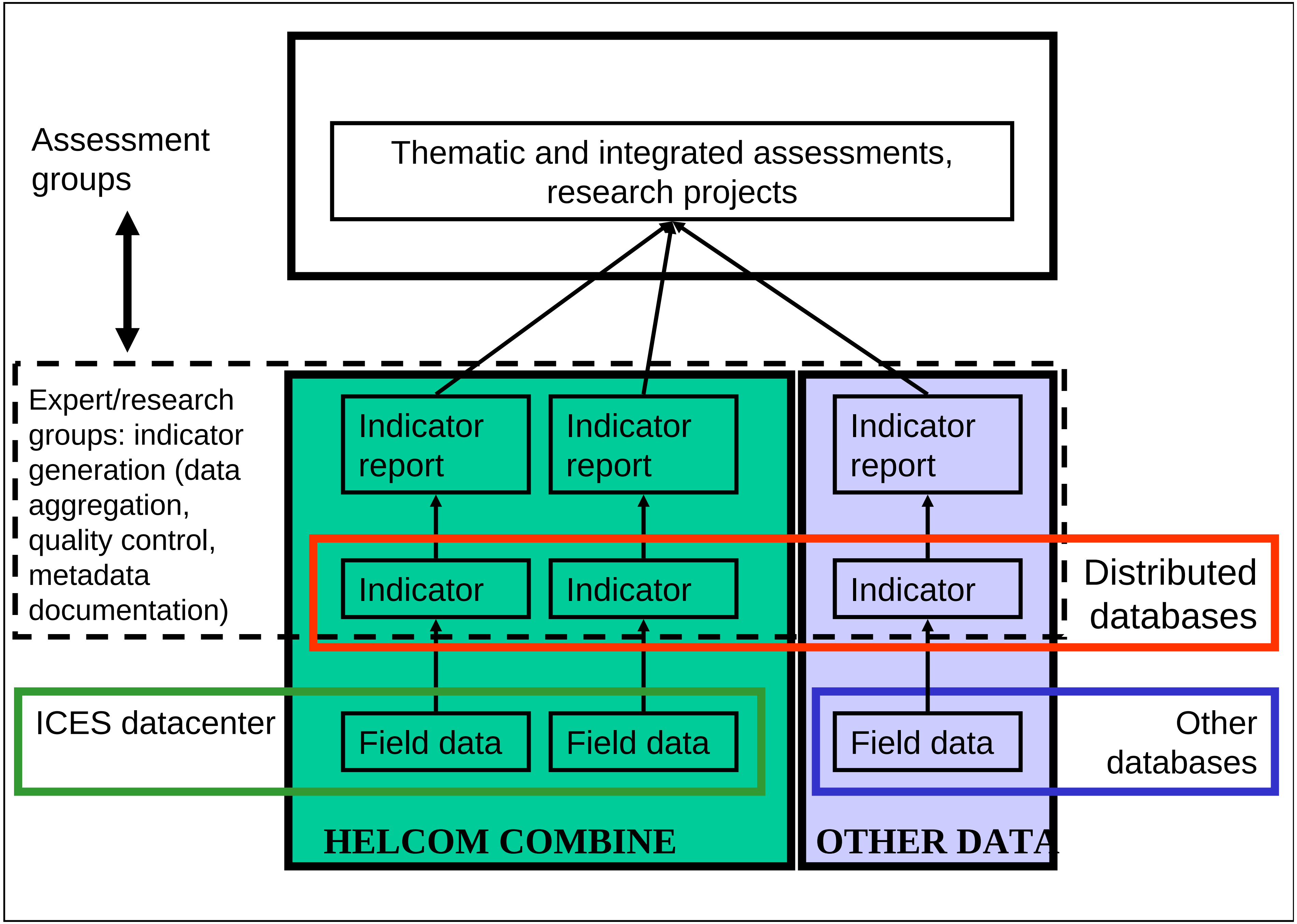
Integrated assessment summary

- **Changes on all trophic levels !**
- **relationships between temperature/salinity (oxygen) and fish and zooplankton variables**
- **no consistent relationships between nutrient and phytoplankton variables**
- **systems to a large degree hydrography-driven which defines the carrying capacity**
- **fishing and internal processes modify the ecosystem structure**

Lessons learned for data management

- Aggregation of raw data into meaningful indicators is time consuming
- Pre-processed indicators are not readily available
- Biological data (e.g. phytoplankton biomass, zoobenthos data) is difficult to access
- Long-term time series (> 30 years) are rare
- Change in data source and/or data processing protocol leads to inconsistent indicators

➡ integrated assessment work flow should be based on pre-processed indicators aggregated from raw data by expert groups

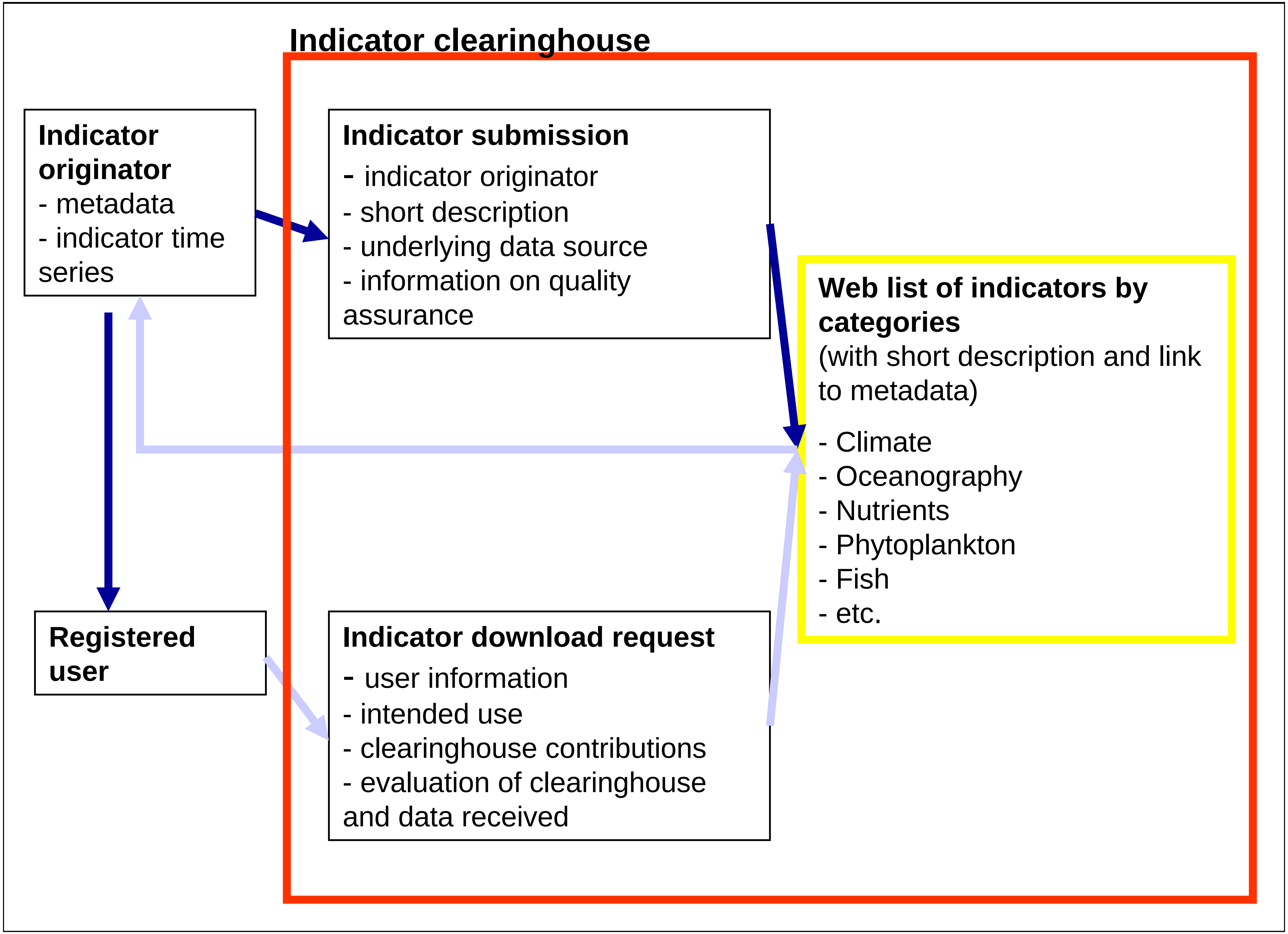


Assessment groups
Thematic and integrated assessments, research projects
Expert/research groups: indicator generation (data aggregation, quality control, metadata documentation)
Indicator report
Indicator report
Indicator report
Indicator
Indicator
Indicator
Distributed databases
ICES datacenter
Field data
Field data
Field data
Other databases
HELCOM COMBINE
OTHER DATA

Indicator database

- Provide user friendly, timely (web-) access to information
- Implement a high degree of quality control
- Increase the efficiency of assessment and environmental research
- Attract data contributors besides obligatory data submitters (research data)
- Respect intellectual property rights
- Assure database sustainability

Implement web-based clearing house


Indicator clearinghouse
Indicator originator
- metadata
- indicator time series
Indicator submission
- indicator originator
- short description
- underlying data source
- information on quality assurance
Web list of indicators by categories
(with short description and link to metadata)
- Climate
- Oceanography
- Nutrients
- Phytoplankton
- Fish
- etc.
Registered user
Indicator download request
- user information
- intended use
- clearinghouse contributions
- evaluation of clearinghouse and data received

Conclusions

- Archiving and management of raw data is important
- Efficient assessment relies on quality controlled indicators
- Access to aggregated indicators would improve work efficiency

➡ Management of raw data AND aggregated indicators is needed!