



SAF - application case study Vistula Lagoon

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**A SYSTEM APPROACH FRAMEWORK FOR
COASTAL RESEARCH & MANAGEMENT**



Case study site



Source:
https://pl.wikipedia.org/wiki/Zalew_Wi%C5%9Blany



Photo by Konrad Kosacz/elblag.net



Source: <http://www.zalew.org.pl/lagomar/index.htm>

Vistula Lagoon (Polish: *Zalew Wiślany*; Russian: Калининградский залив or *Kaliningradskiy Zaliv*) is a brackish water lagoon on the Baltic Sea roughly 91 km long, 6.8 to 13 km wide and 2.7 m deep, max 5m, separated from Baltic Sea by the Vistula Spit.



Case study site



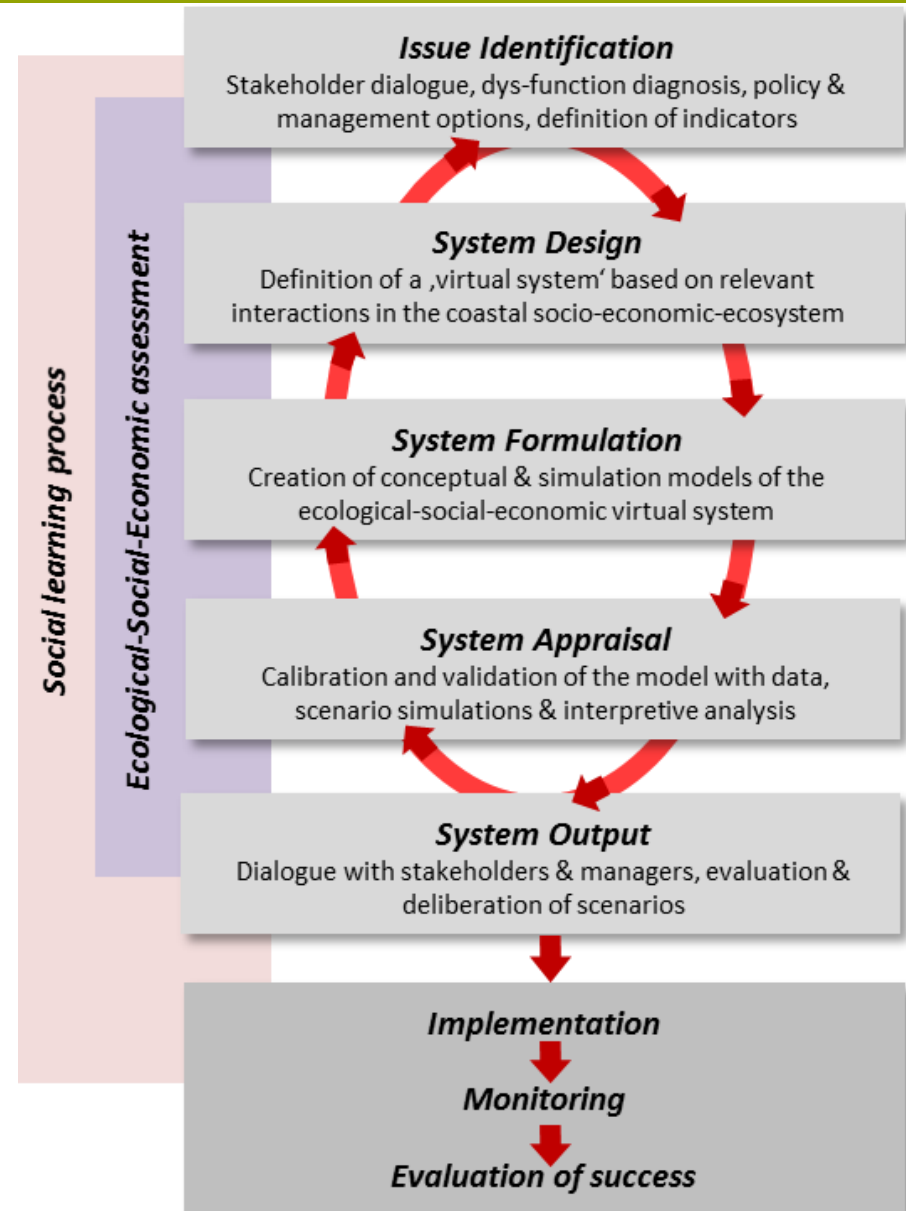
Source: petla-zulawska.pl

- Administrative division of the Polish part of the Lagoon between Pomeranian and Warmia-Masuria provinces – unfavourable in terms of communication and management
- Polish part – NATURA 2000 region



➤ Issue identification:

1. Key human activities
2. Stakeholder mapping
3. First stakeholder meeting to agree on Issue
4. Institutional mapping
5. Description of cause – effect chain (DPSIR and CATWOE)
6. Identification of social and economic components relevant for the Issue
7. List of main Ecosystem Goods and Services and Economic drivers relevant for the Issue



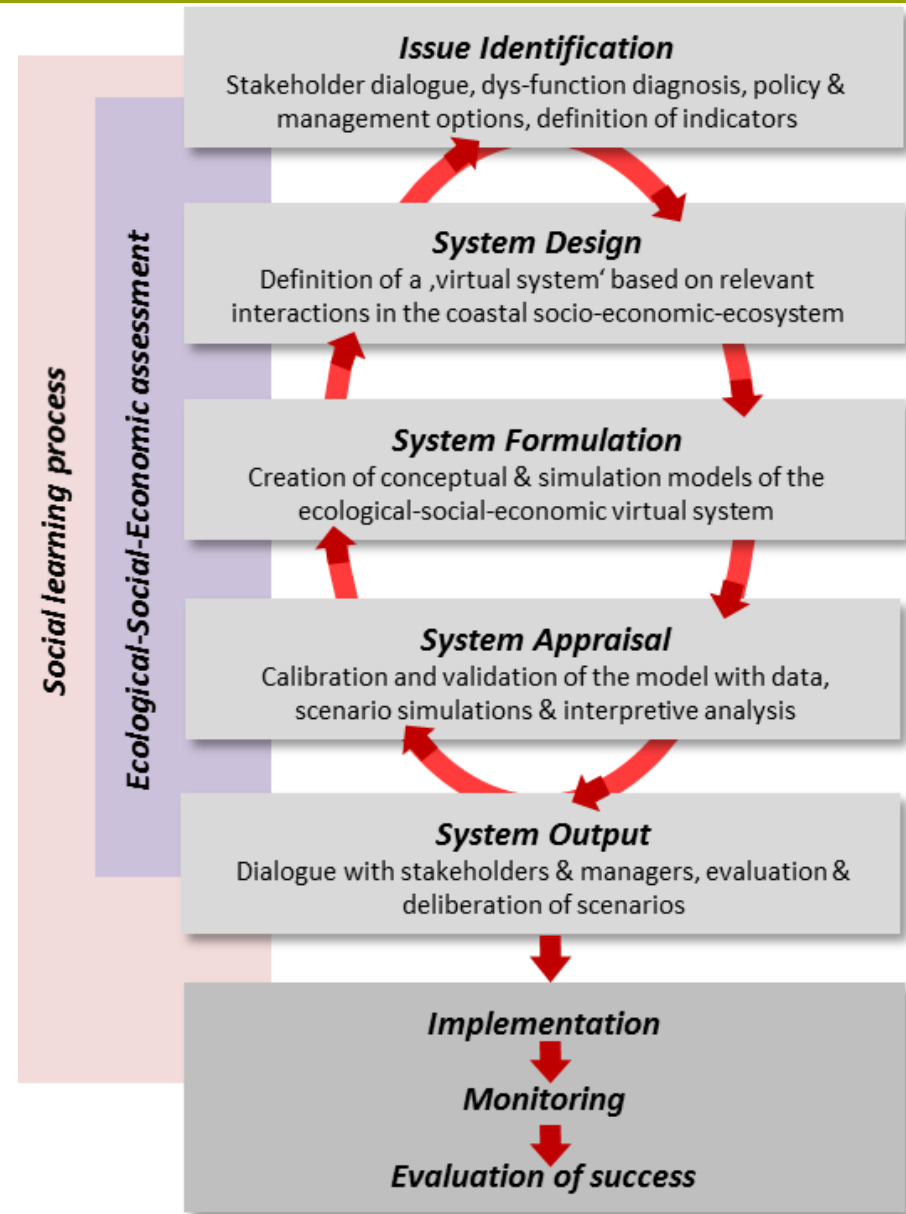


➤ System Design

1. System definition
2. Conceptual model
3. Data and methods
4. Problem scaling

➤ System Formulation:

1. Data preparations (inputs)
2. Building and testing sub models
3. Documenting the model development





Key human activities

Human Activities	Associated stakeholder groups
<p>Fisheries concentrated in VL harbors: (Nowa Pasłęka, Piaski, Frombork, Kąty Rybackie, Suchacz, Krynica Morska, Tolkmicko, Kamienica Elbląska).</p>	<p>Fishermen associations, harbor operator and users, Regional Inspectorate of Sea Fisheries in Gdynia, with branches in Frombork and Sztutowo.</p>
<p>Tourism – hotels, restaurants, harbors, transboundary tourism erratic due to political relations with Russia and isolation of the Lagoon from the rest of EU.</p>	<p>Hotel and restaurant operators, harbor operators, local authorities interested in tourism development.</p>





Key human activities

Human Activities	Associated stakeholder groups
Commercial navigation: harbor in Elbląg (potential not fully used due to erratic trade with Kaliningrad Region).	Elbląg harbor operators, Elbląg authorities, shipping & logistics companies.
(Intensive) beach use on the Spit.	Tourism sector on the Spit (hotel, restaurant and camping operators).
Economic activities: prevalence of small shops and businesses with low creditworthiness- points to economic backwardness of the Lagoon area.	Shop owners.
Agriculture at south side of the Lagoon	Farmers, authorities





Key human activities

Human Activities

Environmental protection: all Polish part is NATURA 2000 region (PLB280010, PLH280007).



Associated stakeholder groups

Ecologists, ecological organizations, institutions responsible for implementation of NATURA 2000 (Maritime Office in Gdynia, Regional Directorates of Environmental Protection in Gdańsk and Olsztyn).





Stakeholder mapping

Based on existing experience from other projects

- FP 7 cooperating projects:  
with common activities focused on stakeholders participation – joint workshops – contributing to socio-economic impact analysis (**LAGOONS**) and development of Management Plan (**ARCH**).
- LT-PL-RU Cross-border Cooperation Programme 2007-2013 **VILA** project: „The common benefits of the Vistula Lagoon potential development” 
- South Baltic Programme **ARTWEI** project 
- Żuławy Loop 



Focus Groups to identify most acute problems of the area from a perspective of local communities – LAGOONS + ARCH projects.

Frombork:

Fishermen, hotel and gastronomy operators, teachers

Piaski:

Fishermen and hotel operators

Kadyny:

Citizens and local authority

Krynica Morska:

Fishermen

Result: combined map indicating „best” and „worst” areas.



Focus Groups movie



Citizens Jury as a next step allowing to refine insights and to formulate recommendations and scenario of future lagoon development.

Jurors from: *Krynica Morska, Piaski, Braniewo, Frombork, Kadyny*

Experts:

- *Quality of the Vistula Lagoon environment,*
- *Problems of the Vistula Lagoon fisheries,*
- *Problems of agriculture in the Vistula Lagoon region,*
- *Regulations and management in the Vistula Lagoon region,*
- *Transport and infrastructure in the Vistula Lagoon (maritime aspects),*
- *Environmental protection of the Vistula Lagoon,*
- *Tourism and recreation in the Vistula Lagoon region.*



Citizens Jury movie



Stakeholder mapping

- Public consultations in the framework of Żuławy Loop Project



Program devoted to tourism development in the Gulfs of Gdańsk and Puck and the Vistula Lagoon, by modernization and development of marinas and harbors.

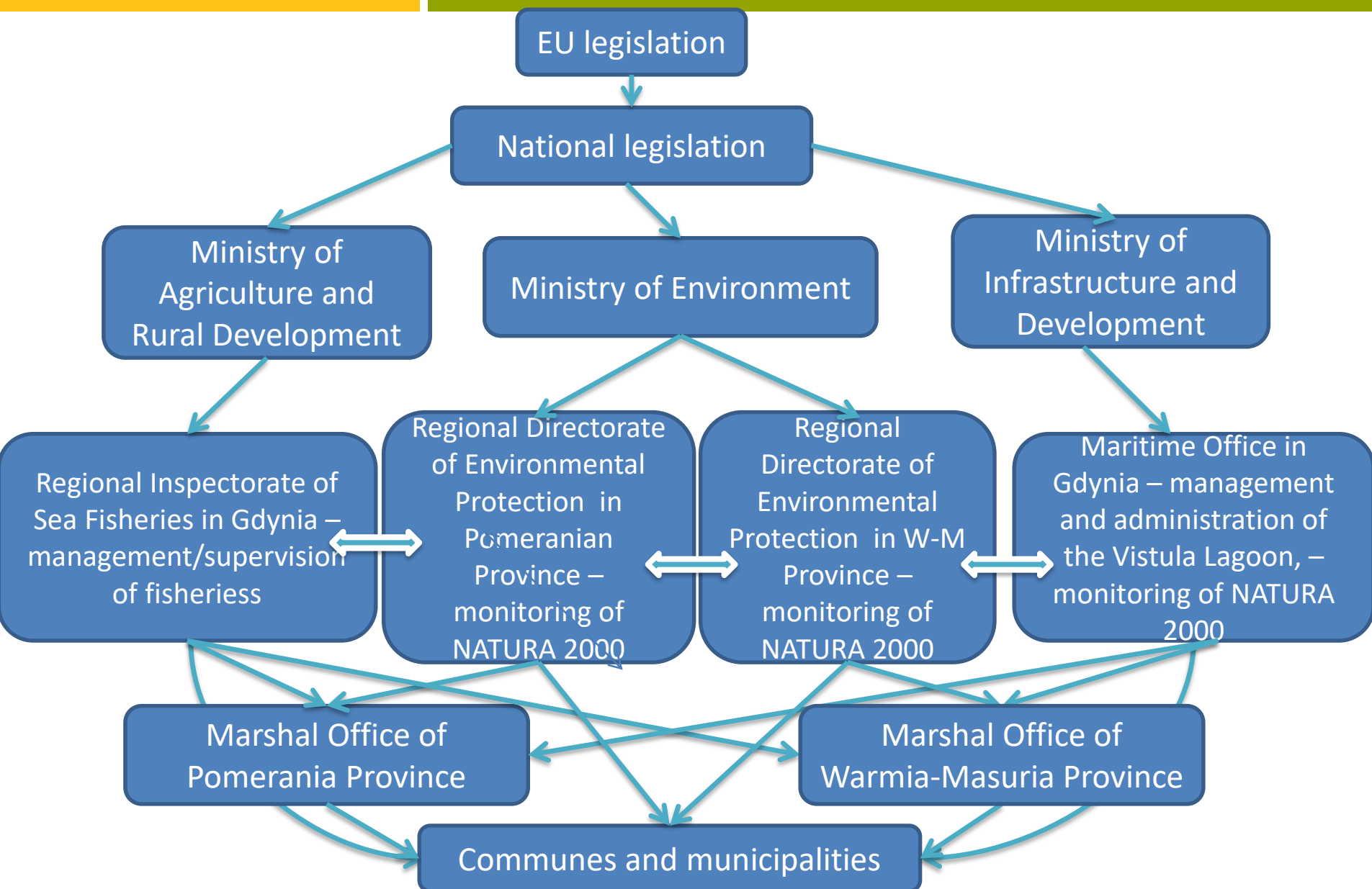
Pętla Żuławska (Żuławy Loop) waterway system

Schemat dróg wodnych Pętli Żuławskiej i sąsiednich szlaków wodnych





Institutional mapping





1st Stakeholder Meeting Tolkmicko 26th Oct. 2015

Presentation of BaltCoast project





1st Stakeholder Meeting



Presentation 'Natural and economic aspects of the functioning of Szczecin Lagoon in local scale',

K. Rabski (EUCC Poland),

Presentation 'Improvement of navigation in Vistula Lagoon - Żuławy Loop and Gulf of Gdańsk Programme',

M. Górski, Żuławy Loop Manager, R. Wasil, Dept. of Infrastructure of Pomorskie Province Marshall Office,





1st Stakeholder Meeting

Moderated discussion on dredging of waterways in Vistula Lagoon and sustainable development of the Lagoon area, incl. questionnaire





1st Stakeholder Meeting

Participants:

- Office of Mayor of Tolkmicko (2 persons),
- Office of Mayor of Frombork (2 persons),
- Local Council at Krynica Morska (1 person),
- Maritime Office in Gdynia, (3 persons),
- Local Fishery Group, fishermen (3 persons),
- EUCC Poland (1 person),
- Żuławy Loop operator,
- Remontowa Holding Co. (1 person),
- Rotax Co. (1 person)
- Scientists from IBW PAN.



1st Stakeholder Meeting

Results of Questionnaire – present situation

A.1. For ... (region/municipality) Environmental Quality compared to Economics is

Much less important	Less important	Slightly less important	Equally important	Slightly more important	More important	Much more important
<input type="checkbox"/>	<input type="checkbox"/>	2	7	<input type="checkbox"/>	2	<input type="checkbox"/>

A.2. For ... (region/municipality) Environmental Quality compared to Social Well-being is

Much less important	Less important	Slightly less important	Equally important	Slightly more important	More important	Much more important
<input type="checkbox"/>	<input type="checkbox"/>	3	5	2	1	<input type="checkbox"/>

A.3. For ... (region/municipality) Environmental Quality compared to Governance is

Much less important	Less important	Slightly less important	Equally important	Slightly more important	More important	Much more important
<input type="checkbox"/>	<input type="checkbox"/>	2	7	2	<input type="checkbox"/>	<input type="checkbox"/>

A.4. For ... (region/municipality) Economics compared to Social Well-being is

Much less important	Less important	Slightly less important	Equally important	Slightly more important	More important	Much more important
<input type="checkbox"/>	<input type="checkbox"/>	2	2	3	3	1

A.5. For ... (region/municipality) Economics compared to Governance is

Much less important	Less important	Slightly less important	Equally important	Slightly more important	More important	Much more important
<input type="checkbox"/>	<input type="checkbox"/>	1	7	1	1	1

A.6. For ... (region/municipality) Social Well-being compared to Governance is

Much less important	Less important	Slightly less important	Equally important	Slightly more important	More important	Much more important
<input type="checkbox"/>	1	3	2	3	1	<input type="checkbox"/>



1st Stakeholder Meeting

Results of Questionnaire – wish for future

B.1. For ... (region/municipality) Environmental Quality compared to Economics should be

Much less important	Less important	Slightly less important	Equally important	Slightly more important	More important	Much more important
<input type="checkbox"/>	<input type="checkbox"/>	4	5	2	<input type="checkbox"/>	<input type="checkbox"/>

B.2. For ... Environmental Quality compared to Social Well-being should be

Much less important	Less important	Slightly less important	Equally important	Slightly more important	More important	Much more important
<input type="checkbox"/>	<input type="checkbox"/>	4	2	2	1	<input type="checkbox"/>

B.3. For ... Environmental Quality compared to Governance should be

Much less important	Less important	Slightly less important	Equally important	Slightly more important	More important	Much more important
<input type="checkbox"/>	2	2	5	1	<input type="checkbox"/>	<input type="checkbox"/>

B.4. For ... Economics compared to Social Well-being should be

Much less important	Less important	Slightly less important	Equally important	Slightly more important	More important	Much more important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7	3	1	<input type="checkbox"/>

B.5. For ... Economics compared to Governance should be

Much less important	Less important	Slightly less important	Equally important	Slightly more important	More important	Much more important
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6	3	1	1

B.6. For ... Social Well-being compared to Governance should be

Much less important	Less important	Slightly less important	Equally important	Slightly more important	More important	Much more important
<input type="checkbox"/>	<input type="checkbox"/>	1	4	4	1	1

1st Stakeholder Meeting - Conclusions

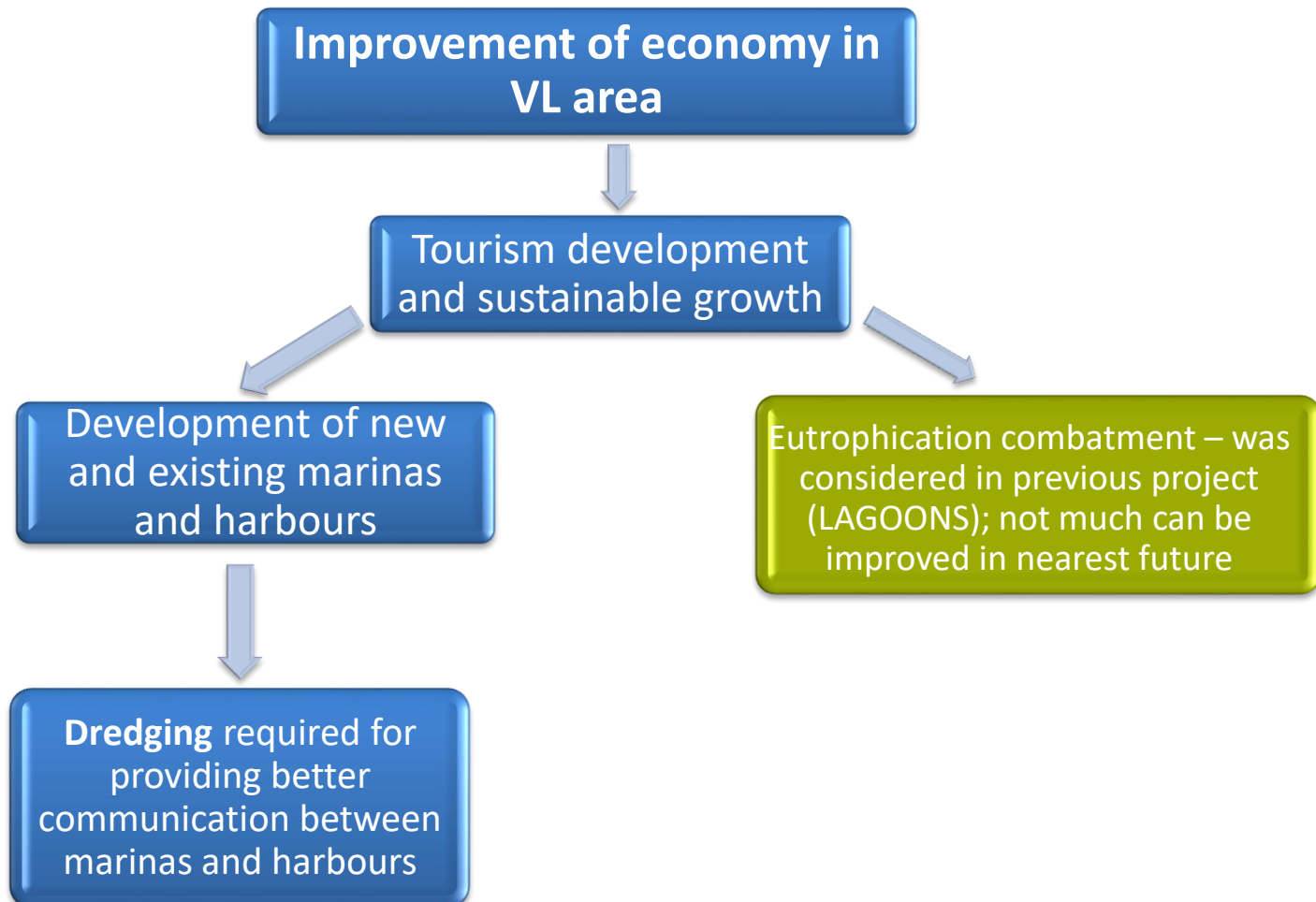
- Need for ferry connections between Spit and hinterland: Tolkmicko - Krynica Morska and Frombork – Piaski.
- Need for integration of road and ferry traffic around Lagoon.
- Some of the waterways will need expansion in terms of depth and width (in case ferry connections are planned).
- Few scenarios of dredging activities will be elaborated based on the discussion and with Maritime Office assistance.





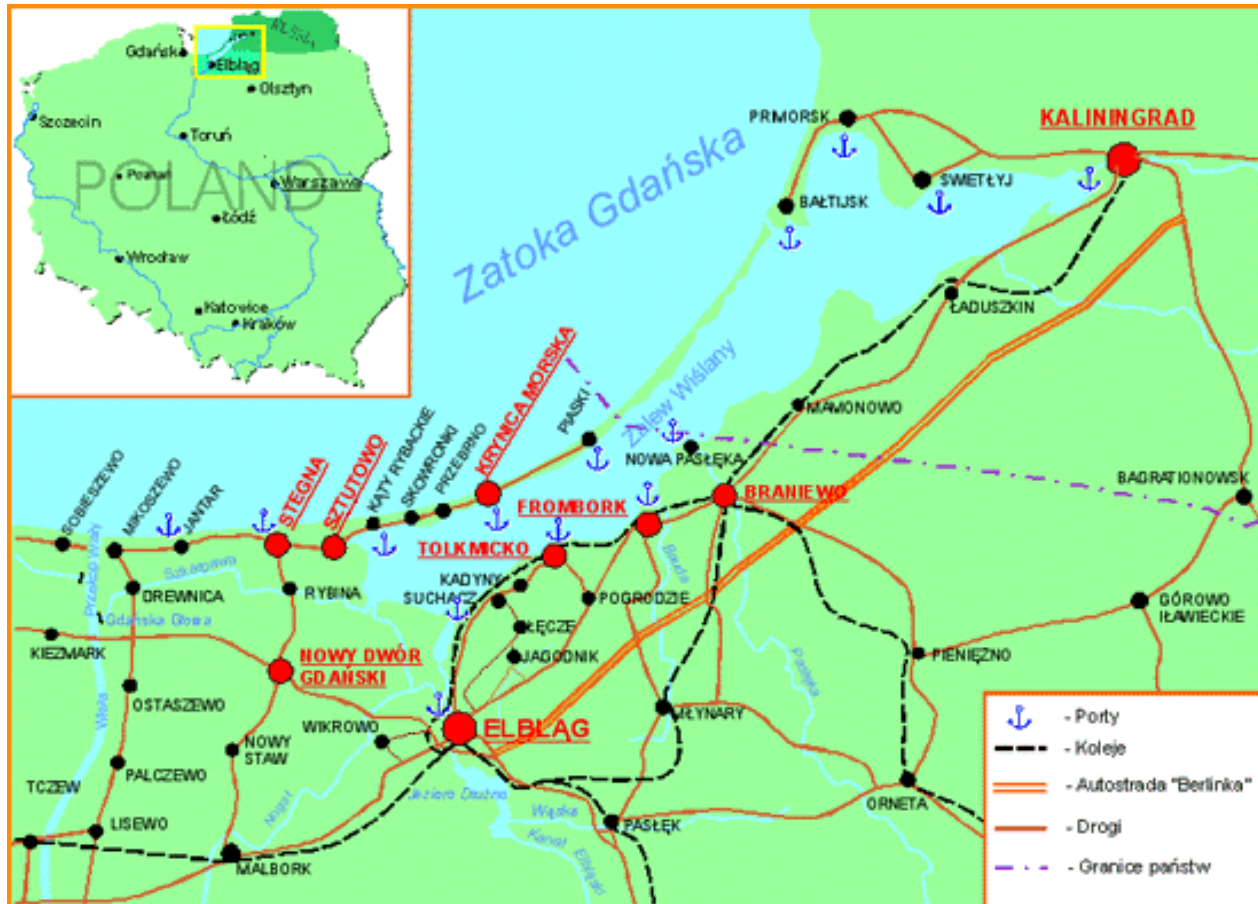
Issue for the Vistula Lagoon

Economy of the Vistula Lagoon area





System Design



- System definition
- **Conceptual model**
- Data and methods
- Problem scaling

Source: <http://www.zalew.org.pl/lagomar/index.htm>



Economy of the Vistula Lagoon

Tourism

Development of marinas & harbours

Navigation

Fishing

Water quality

Dredging

Sediment deposition and management

Use in agriculture

Coastal zone

Siltation of navig. channels

Shore protection

Beach nourishment

Scenarios of dredging activities

Flow field

Model of HD and sed. transp.

Sediment transport and distribution

Assessment of dredging frequency

Cost effectiveness assesment

Benefits from sediment management assesment

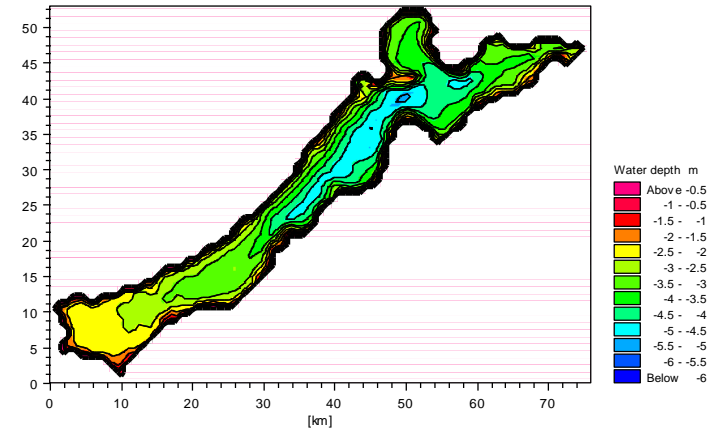
Support to decisionmakers



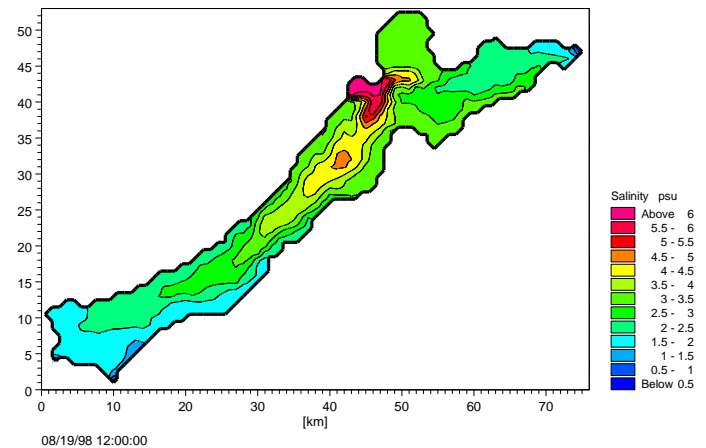
System Formulation

General description of applied model

- **Delft3D** is an integrated modeling suite, which simulates two-dimensional (in either the horizontal or a vertical plane) and three-dimensional flow, sediment transport, morphology change, wave parameters, water quality and ecology, and is capable of handling the interactions between these processes.
- The **FLOW module** is the heart of Delft3D and is a multi-dimensional (2D or 3D) hydrodynamic (and transport) simulation programme which calculates non-steady flow and transport phenomena resulting from tidal and meteorological forcing on a curvilinear, boundary fitted grid or spherical coordinates.



Bathymetry



Salinity



System Formulation - Scenarios

- The scenarios are based on information from the Maritime Office and governmental plans to construct a cross-cut through the Vistula Spit.
- The main goal is:
 - to estimate siltation rates of the channels,
 - dredging frequencies for each case,
 - perform cost-benefit analysis which will indicate most beneficial scenario.



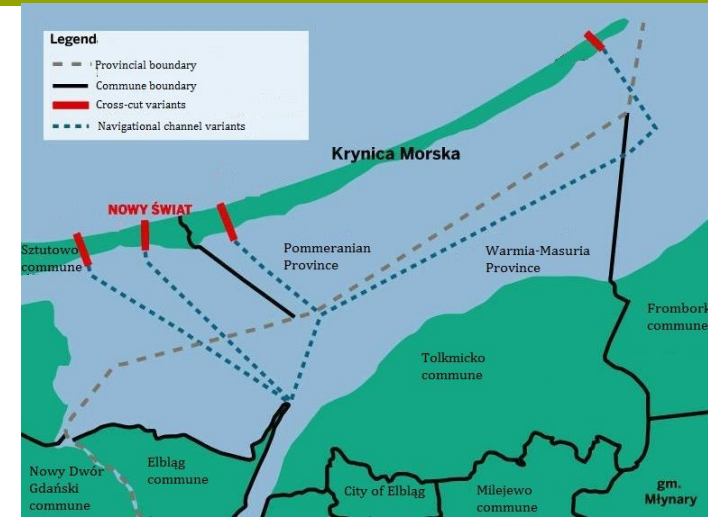


System Formulation - Scenarios

1. Modeling of hydrodynamics and siltation rate assuming **existing navigational channels** – reference conditions
2. Modeling of hydrodynamics and siltation rate assuming **existing navigational channels and including construction of new navigational channel** for the Vistula Spit cross-cut based on two assumptions:
 - a) new navigational channel: 60 m wide and 5 m deep,
 - b) new navigational channel: 100 m wide and 5 m deep.

<https://www.youtube.com/watch?v=Vhkk3iH3cec>

3. Modeling of hydrodynamics and siltation rate for **the existing navigational channels maintained at depth of 3.5 m** (which will require dredging of some parts of the channels) including construction of new navigational channel for the Vistula Lagoon cross-cut of the 60 m width (as in 2a).



Source: <http://www.dziennikbaltycki.pl/artukul/547015,krynica-morska-mieszkancy-nie-chca-przekopu-mierzei-wislanej,id,t.html>



Source: <http://wiadomosci.gazeta.pl/wiadomosci/1,114871,19413609,pis-wraca-do-pomyslu-przekopu-mierzei-wislanej-jeden-z-priorytetow.html>



System Formulation – sediment sampling



- Necessary for correct calibration of the modeling suite.
- Necessary for determination of sediment management methods (e.g. use for building artificial islands, depositing on land, beach nourishment, agriculture, others).

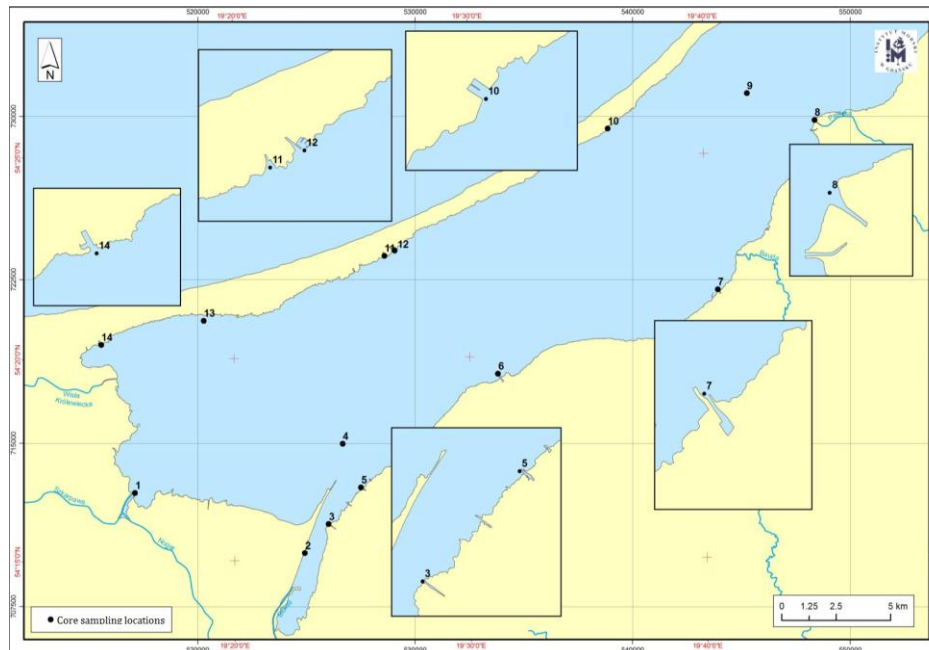
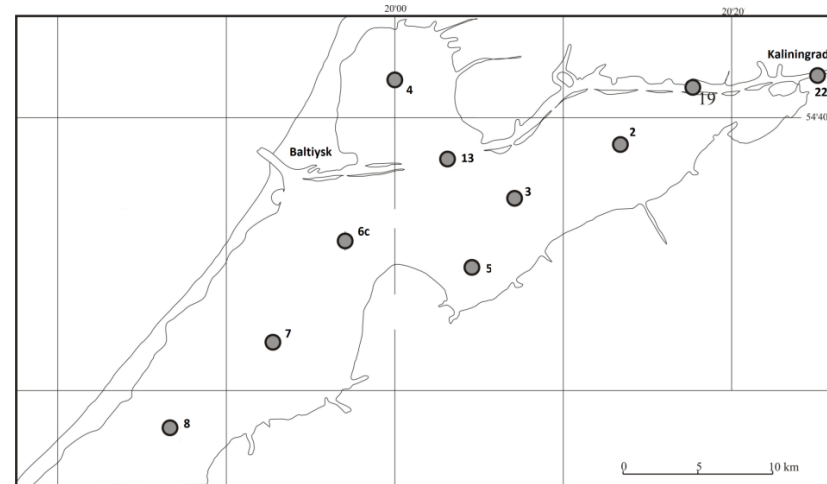




System Formulation – sediment sampling

- Sediment was sampled at 14 locations on Polish side in the vicinity of existing harbors, marinas and navigational channels and 10 locations on Russian side.

Russian part

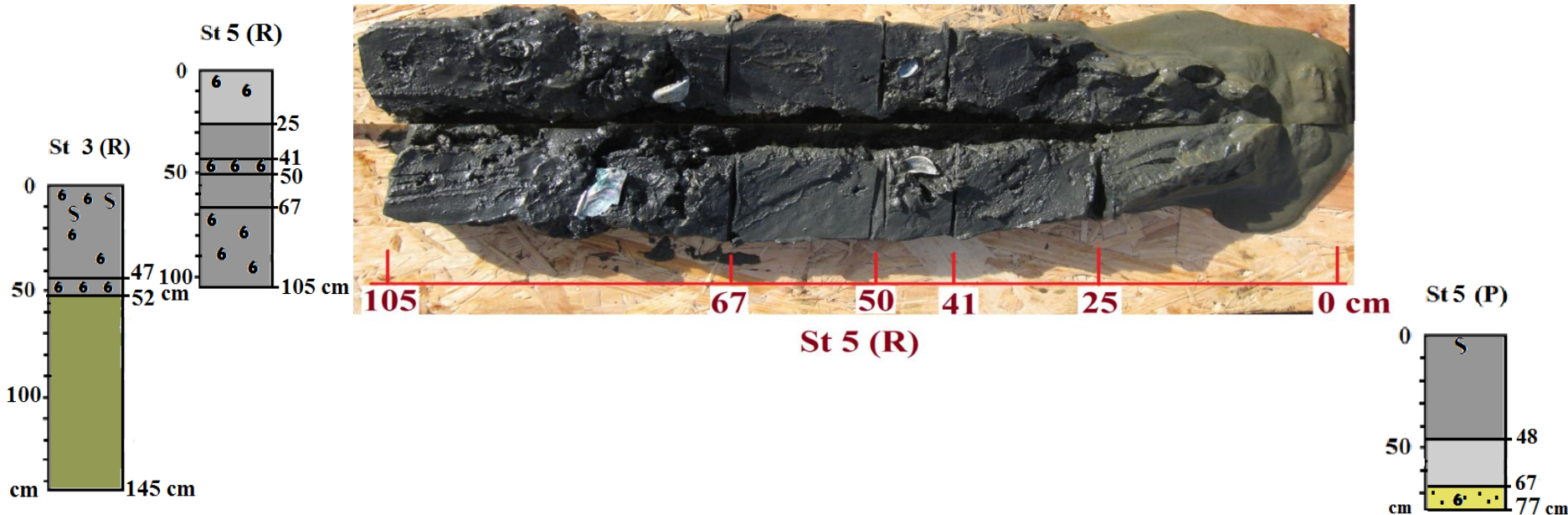


Polish part



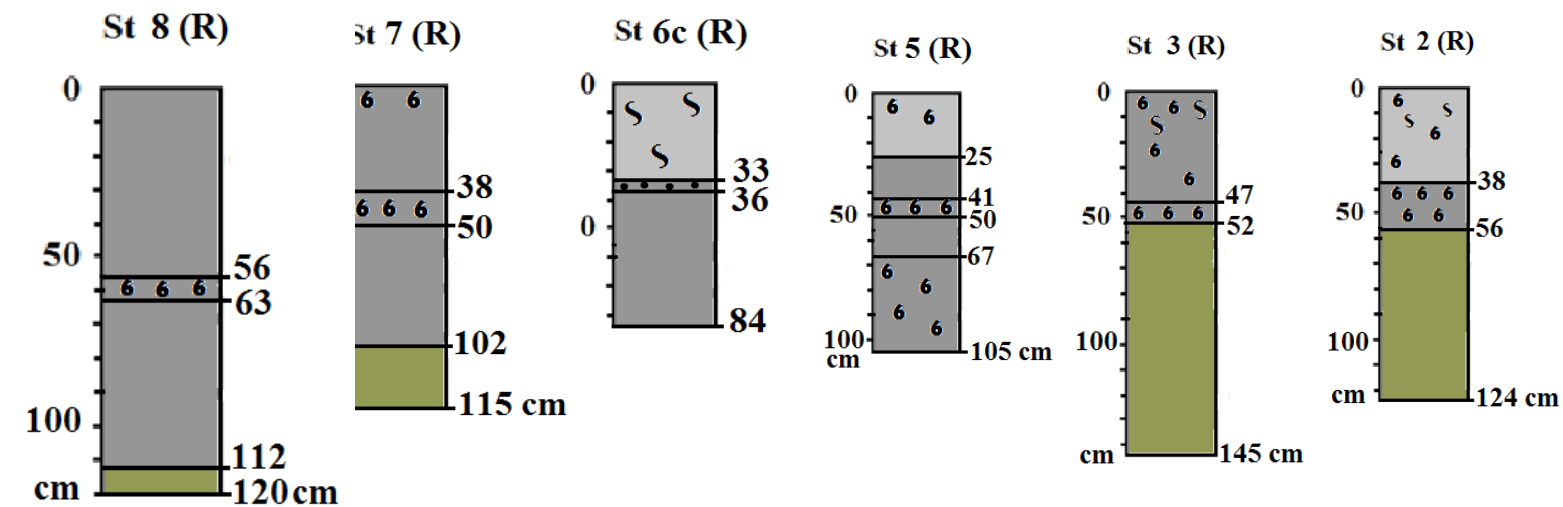
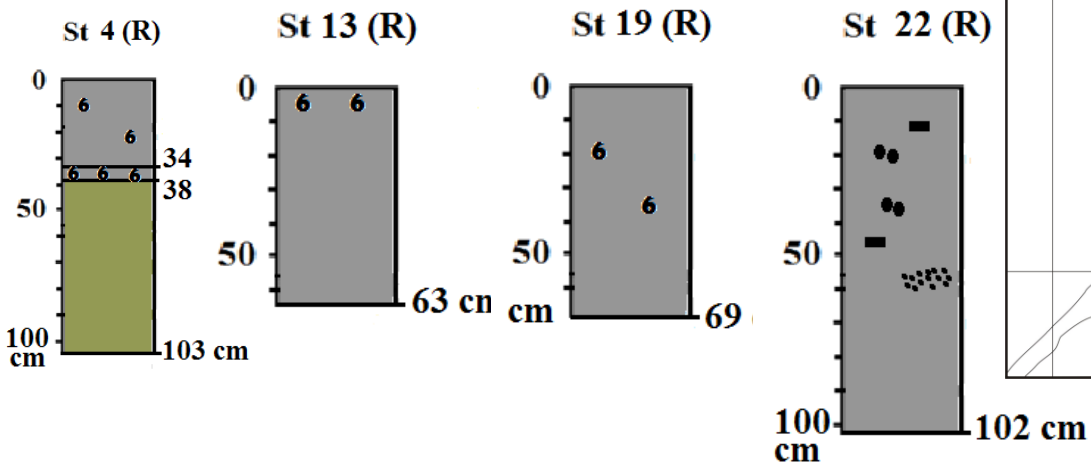
System Formulation – sediment sampling

- Macroscopic analysis of sediment cores indicates that bottom is mostly made of various types of mud (usually soft plastic, sometimes semi-liquid in the upper part) and contain considerable amounts of organic matter. Sand deposits are present only occasionally.
- The samples were tested against the presence of heavy metals and persistent organic pollutants, such as PCB-s and PAH-s. All results are within acceptable limits.





Sediment sampling – Russian part





Sediment sampling – Polish part

St 14 (P)

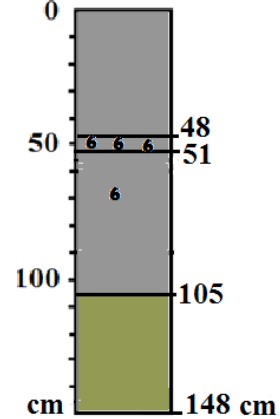
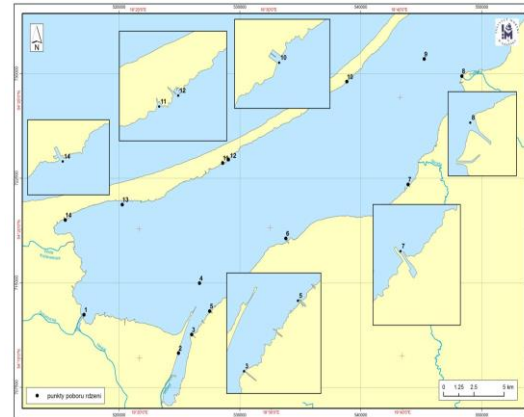
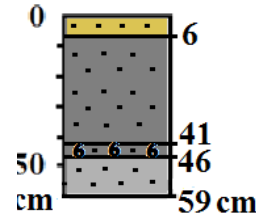
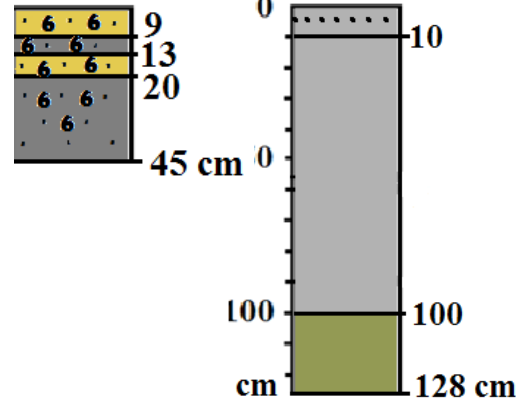
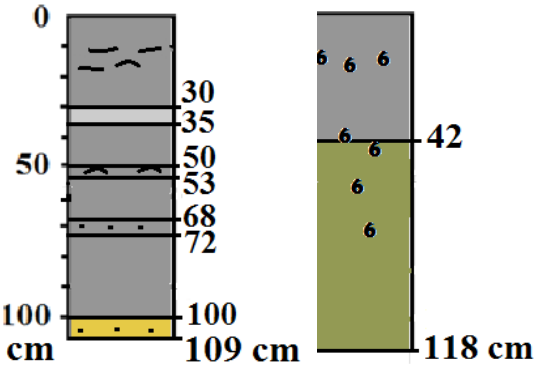
St 13 (P)

St 12 (P)

St 11 (P)

St 10 (P)

St 9 (P)



St 1 (P)

St 2 (P)

St 3 (P)

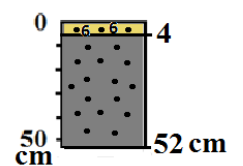
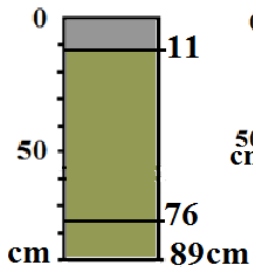
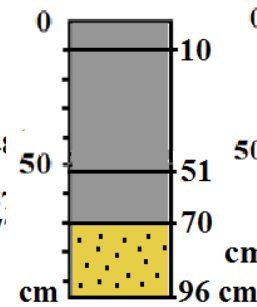
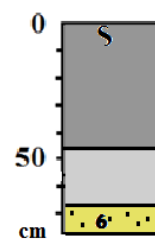
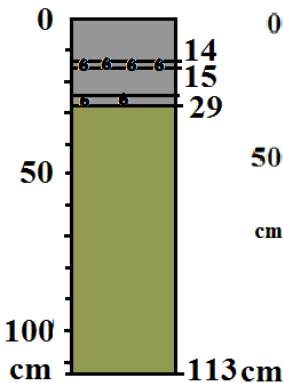
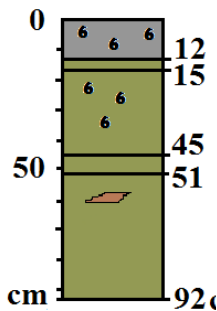
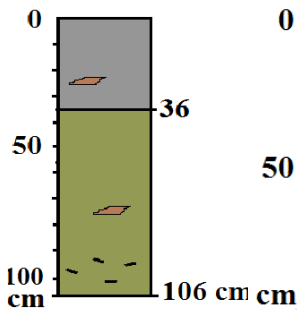
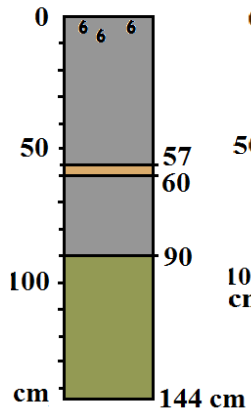
St 4 (P)

St 5 (P)

St 6 (P)

St 7 (P)

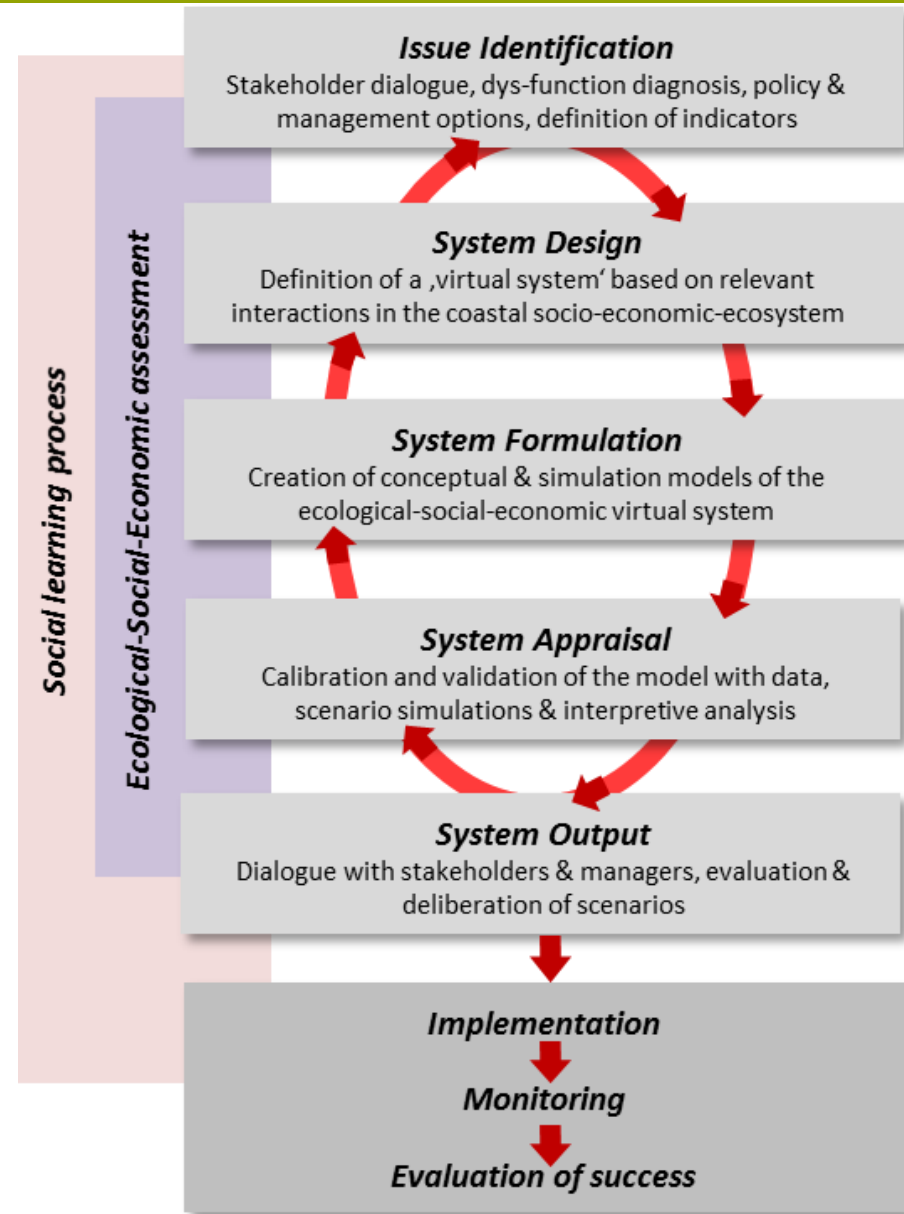
St 8 (P)





Summary

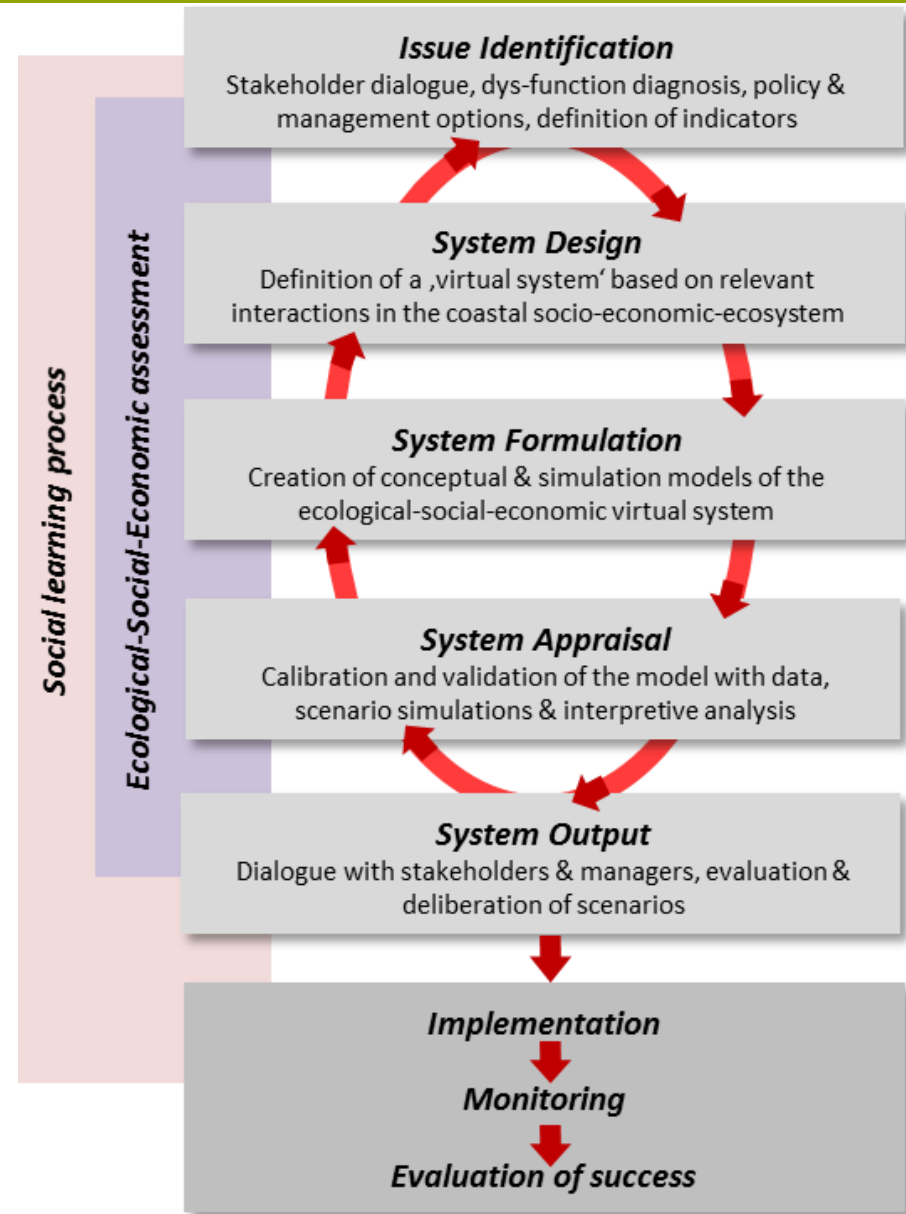
- **The Issue identified – Economy of VL**
- **System Design step completed**
- **Experiences/recommendations so far:**
 - ❑ Well investigate all initiatives going around linked to the Issue.
 - ❑ Participate in public consultations organized at the time on related issues.
 - ❑ Invite all managers involved in the region.
 - ❑ Invite different groups of stakeholders – representatives of major business, groups, regular people.
 - ❑ Stakeholder meetings as mean of providing dialog of stakeholders, preliminary conflict solving, cooperation building, data / valuable information provision.





Summary

- **Formulation Step under development**
 - ❑ Model selected and set up.
 - ❑ Sediment samples collected and analyzed.
 - ❑ Scenarios defined, however we can not be sure that they will be valid by the end of the project (politically conditioned).
 - ❑ Numerical model has to be calibrated



Thank you!

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COASTAL RESEARCH & MANAGEMENT**