SSA 7.2
Gulf of Gdańsk

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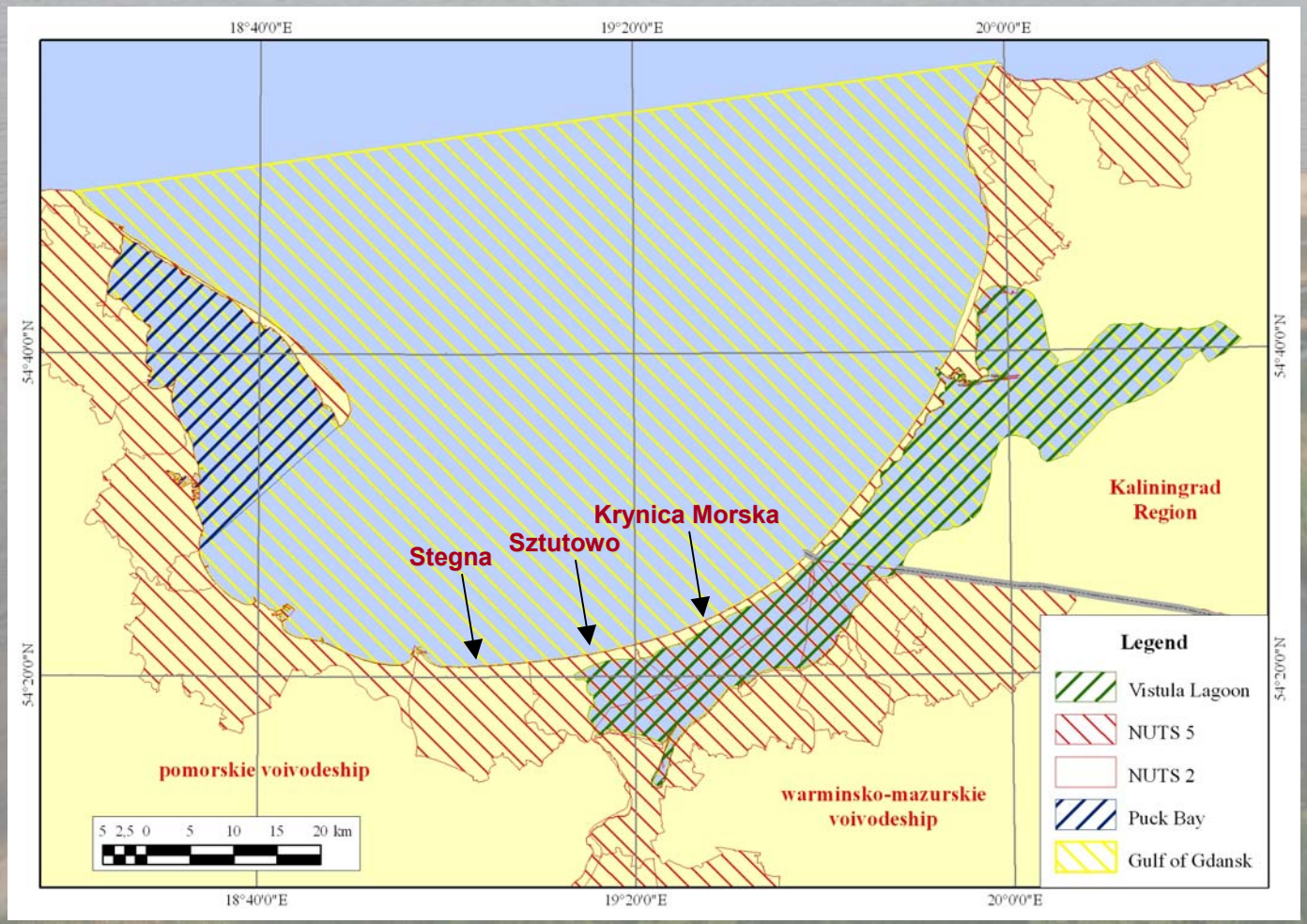
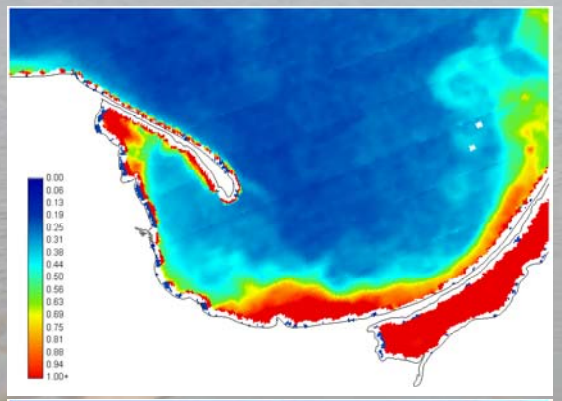
Thessaloniki, 20th-21st of October 2009

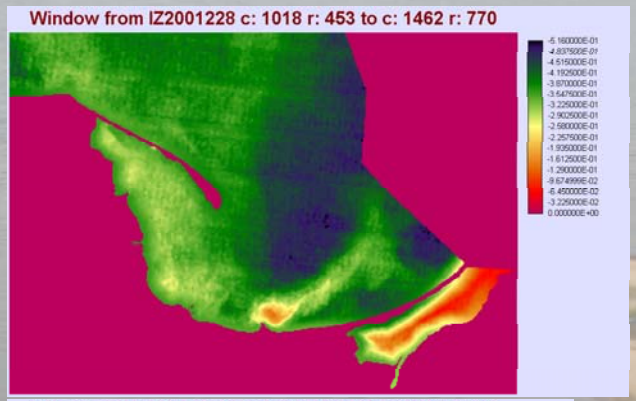
Coastal Zone description

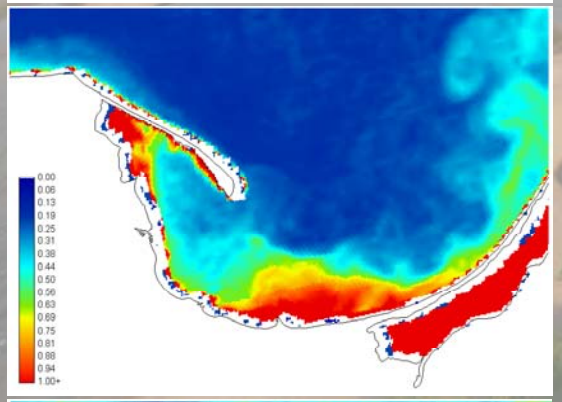


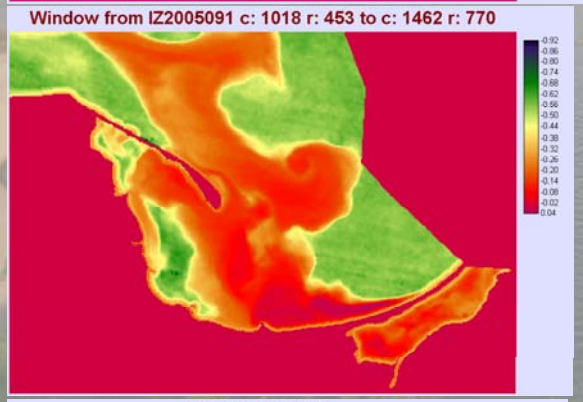
- Due to complexity of the system Design Step revisited
- Instead of Gdansk Bay modelling / simulation selection of beaches located easterly from Vistula River mouth as most promising for demonstration of impact of Vistula River on water transparency
- Final selection - beaches in:
  - Stegna,
  - Sztutowo and
  - Krynica Morska

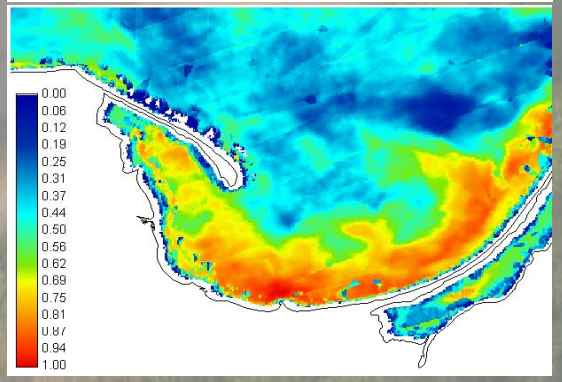
Coastal Zone description

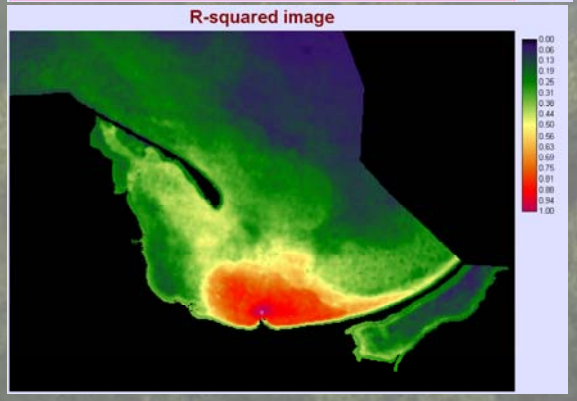












- Basis for selection of beaches easterly of Vistula river mouth have been satellite images showing significant impact of Vistula River fresh water plume on water transparency

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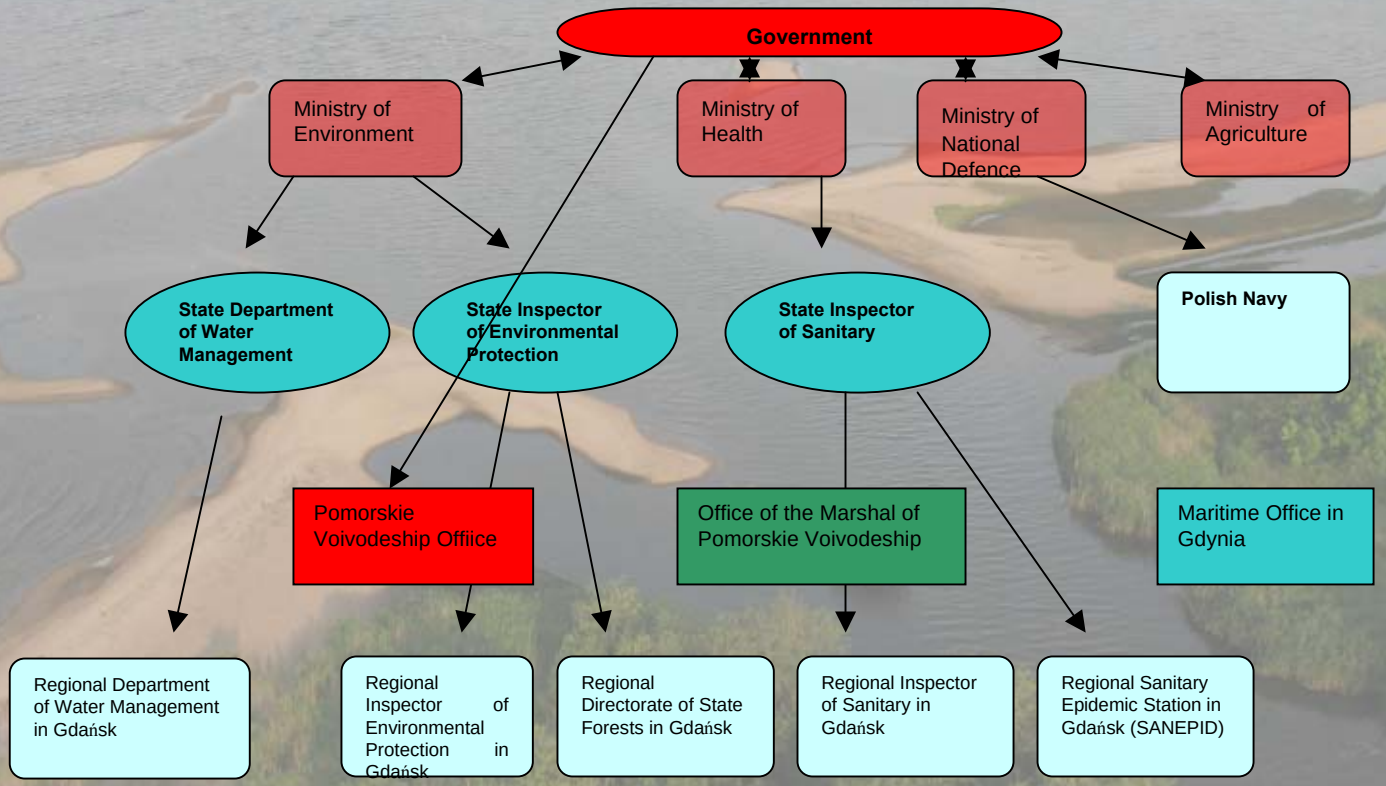
Coastal Zone description
Stakeholder mapping



Stakeholder involvement

- 1st SPICOSA Stakeholders Meeting, Stegna, 12-13 Nov 2007
- 2nd SPICOSA Stakeholders Meeting, Gdynia, 7- 8 Oct 2008
  & SAF Professional Training Workshop

Working group:

- ***Office of the Marshal of Pomorskie Voivodeship***
- ***Gmina Office in Stegna***
- **Vice President of Puck City**
- **Puck City Culture, Sport and Recreation Centre**
- ***Pomeranian Voivodeship Office***
- ***Maritime Office in Gdynia***
- ***Landscape Park 'Mierzeja Wiślana'***
- **Hel Marine Station of Institute of Oceanography University of Gdansk**
- ***Regional Directorate of State Forest in Gdansk***
- **Regional Directorate of State Forest in Gdansk, Wejherowo Branch**
- ***Pomeranian Development Agency SA***
- ***Regional Sanitary Epidemic Station in Gdańsk (SANEPID) & Branch Offices***
- ***Maritime Institute in Gdansk***
- ***Institute of Oceanography University of Gdansk***

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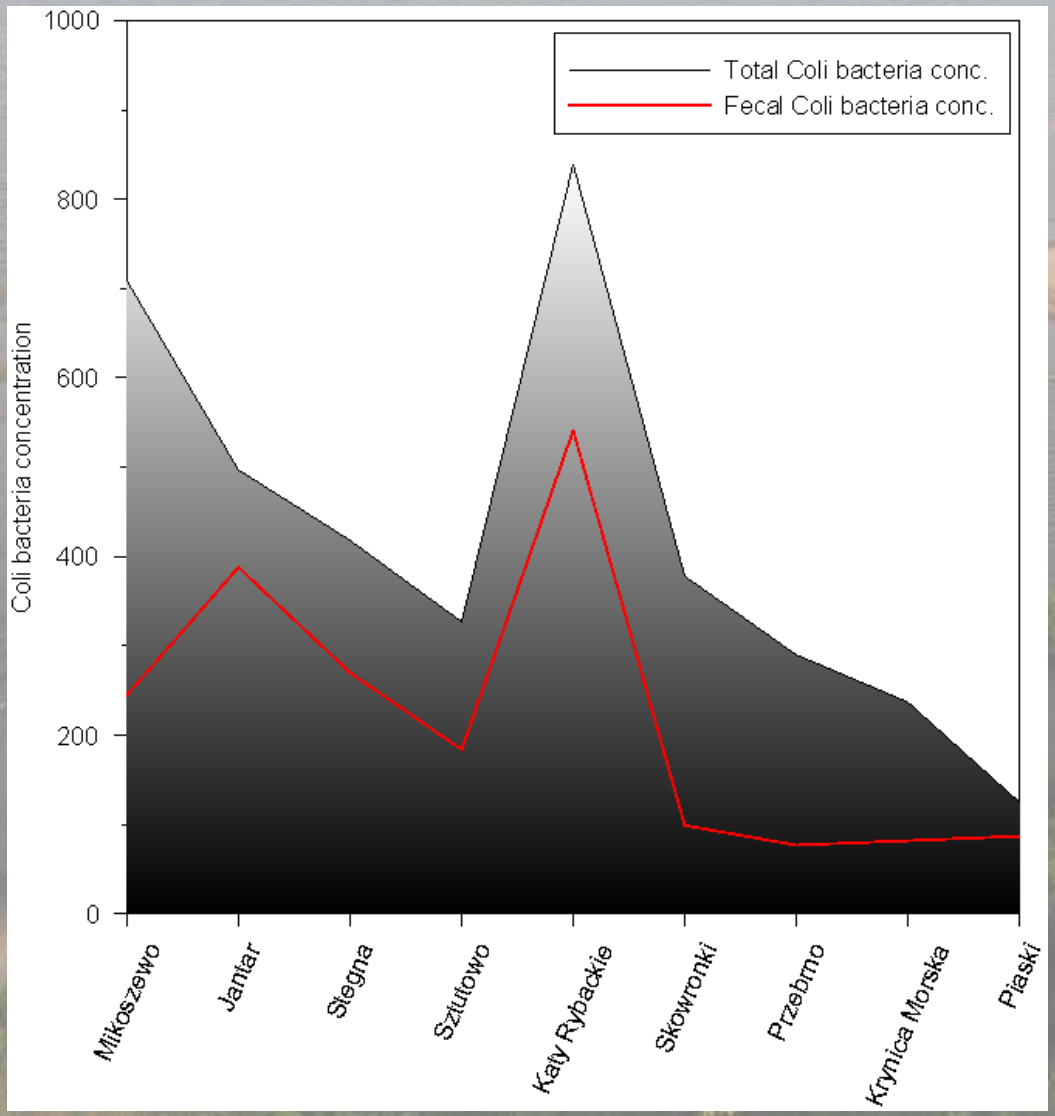
Policy Issues

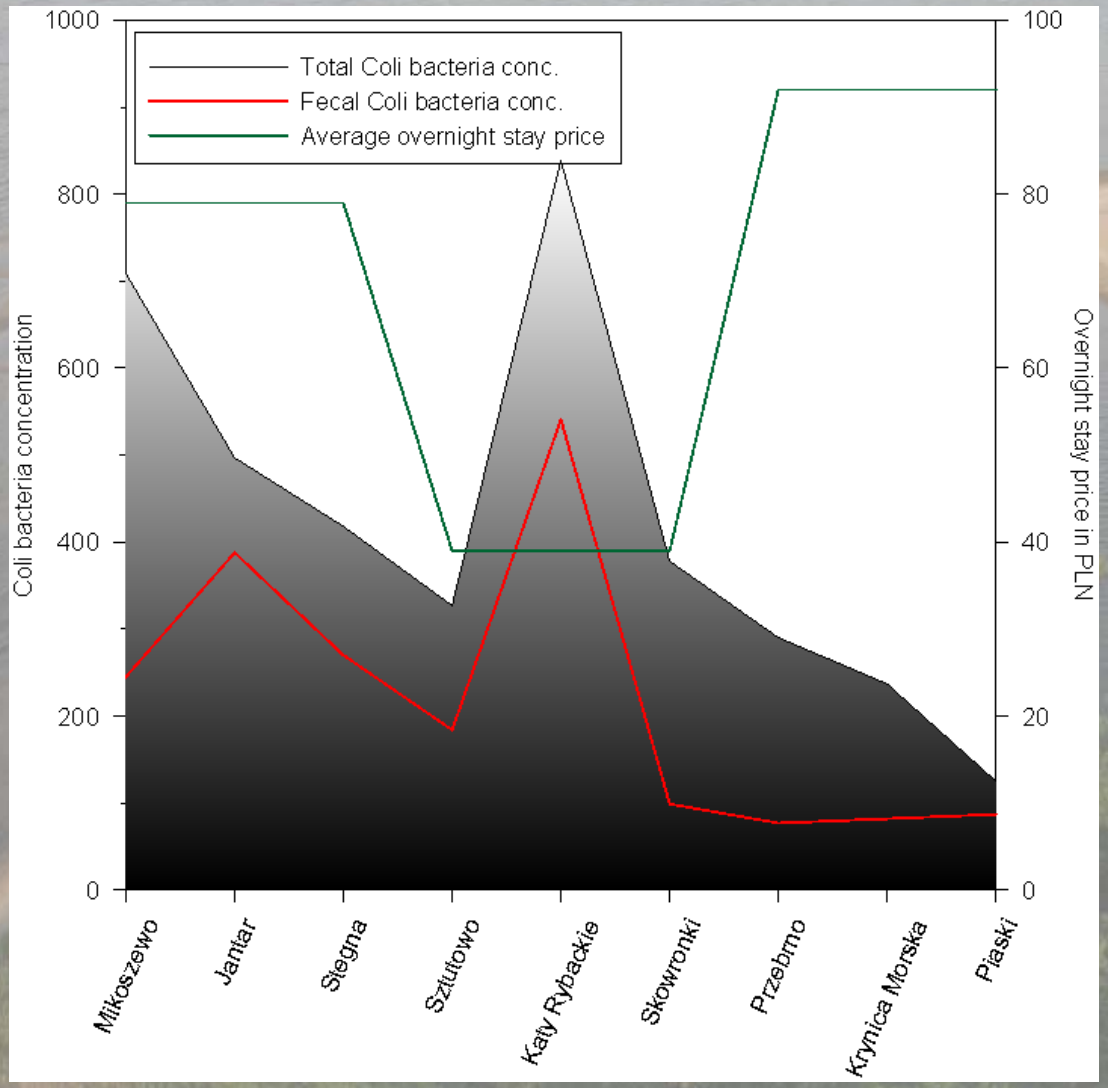
- **Impact – decline in bathing water transparency/quality causing decline in tourist population and in consequence reducing local population income**
- **What are economic consequences of decline in bathing water transparency?**
- **How much economic losses we could expect if degradation of bathing water transparency continues?**
- **Are these impacts compatible with public perception of sustainable use of Gdansk Bay and its resources?**
- **What are costs and benefits of improving the bathing water transparency/quality?**

Environmental Impact



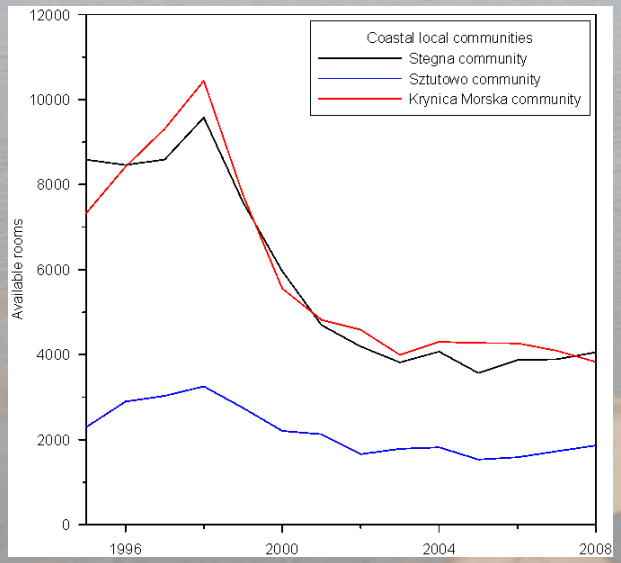
- Water transparency data from satellite imagery already shown
- Here water quality data for all monitored beaches from Vistula River mouth to border with Russia

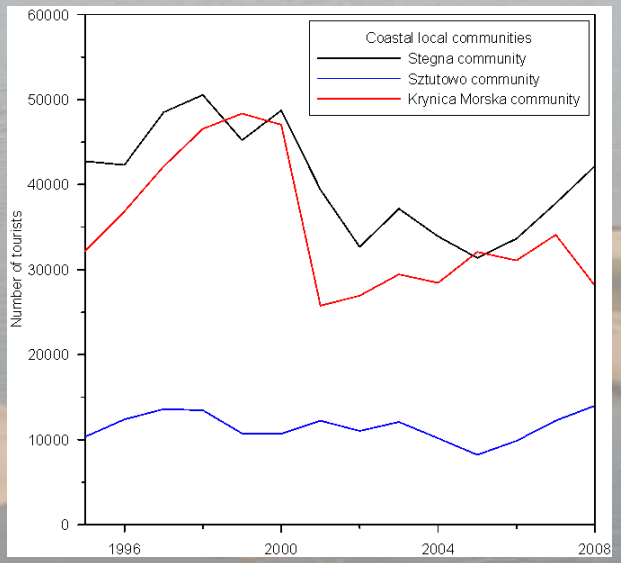
Socio-economic response

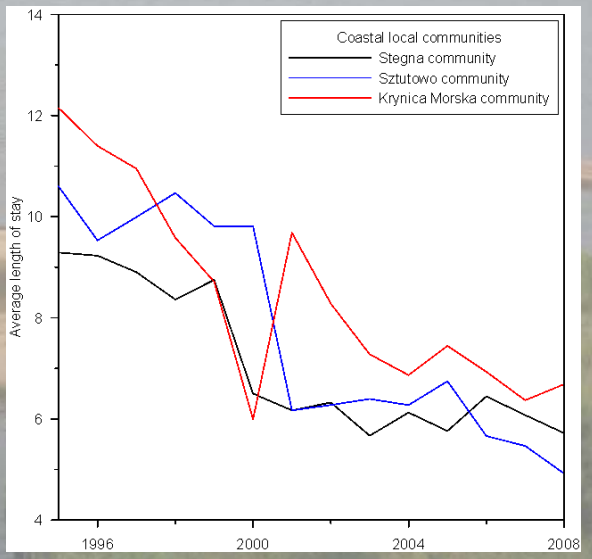


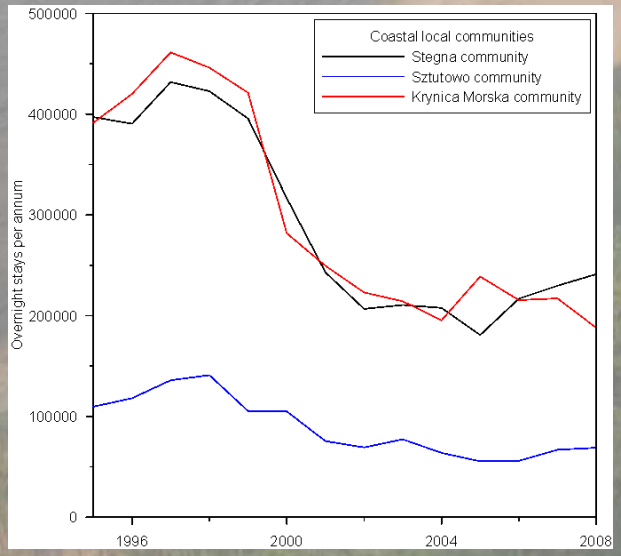
- Water quality data averaged for year 2007, prices at 2009 level
- Definitely strong relationship between water quality and prices of overnight stay
- The same applies to water transparency as shown on remote sensing data
- Similar are trends in tourist population
- Sztutowo local community starts to out lie from point of view of investment in tourist infrastructure

Socio-economic response









- **Tourist population data**
- **Tourists can go now anywhere in the world, location promising or ensuring better weather and water quality**
- **Decrease in tourist population might be partially attributed to agriculture subsidies – increase in fertilizers use**

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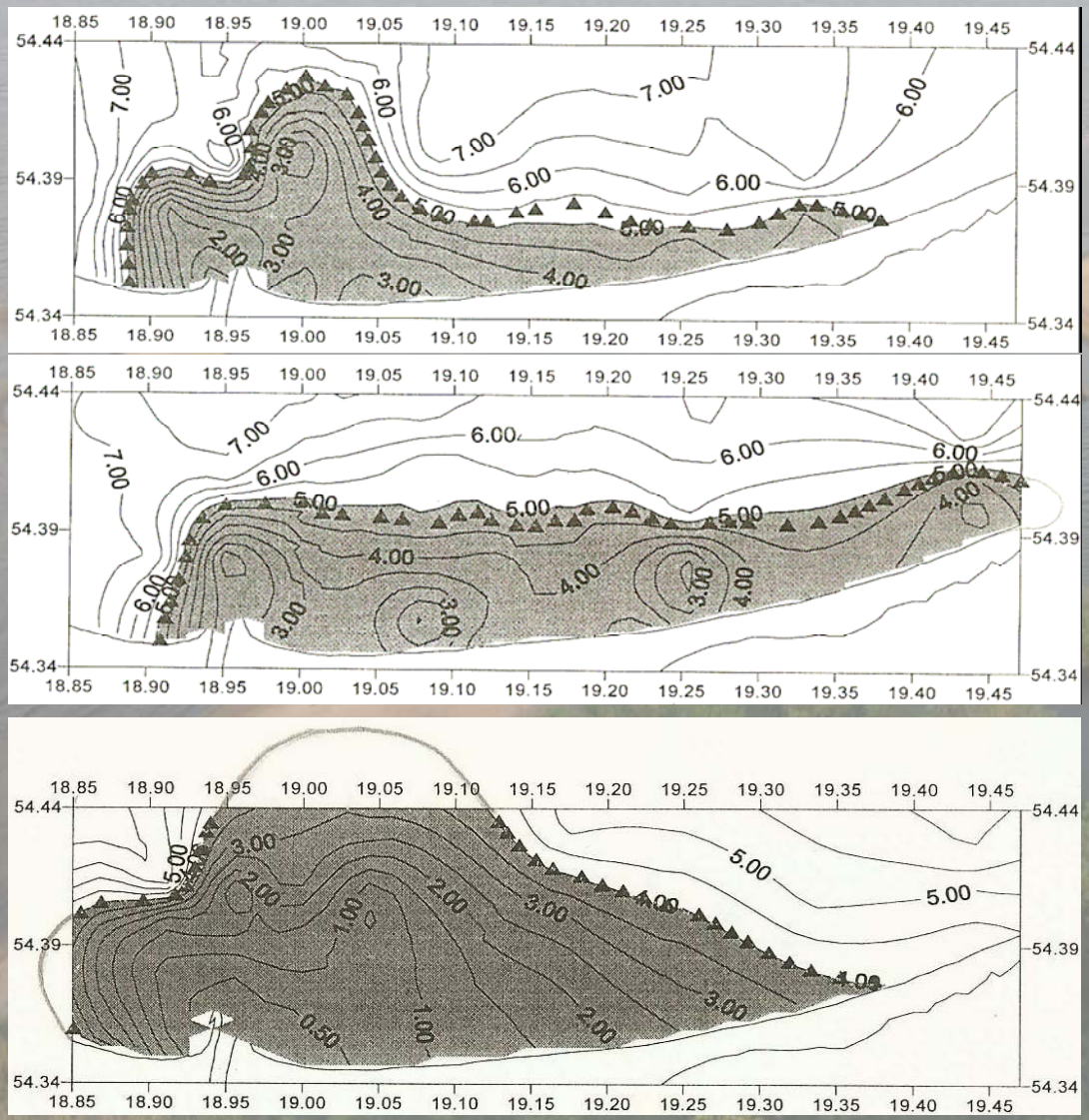
Scenarios/Measures – Response to degrading water transparency

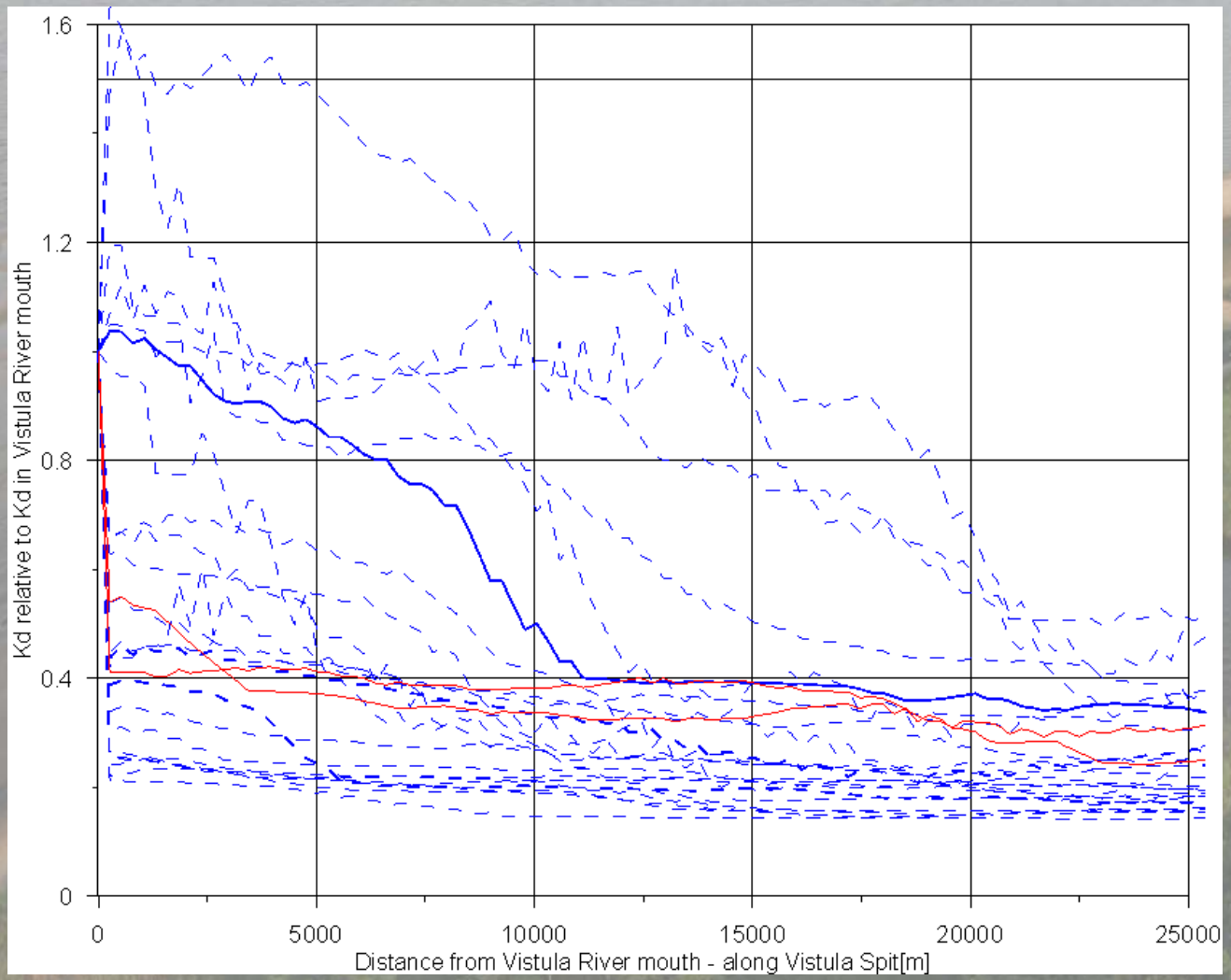
- **Do nothing – still cost associated with potential loss of tourism industry income**
- **Waste Water Treatment Plant improvement options – almost exhausted in Stegna and Krynica Morska local communities (cost of tertiary treatment installation versus potential improvement is not acceptable). Sztutowo should be equipped with WWTP.**
- **Macroalgae cultivation in Vistula River mouth to filter nutrients – „innovative" option requires research**
- **Riverine buffers installation along low Vistula River**
- **Fines for excessive nutrient load to Baltic (Baltic Sea Action Plan limitations and targets)**

Formulation of Simulation Analysis (Environmental Component)



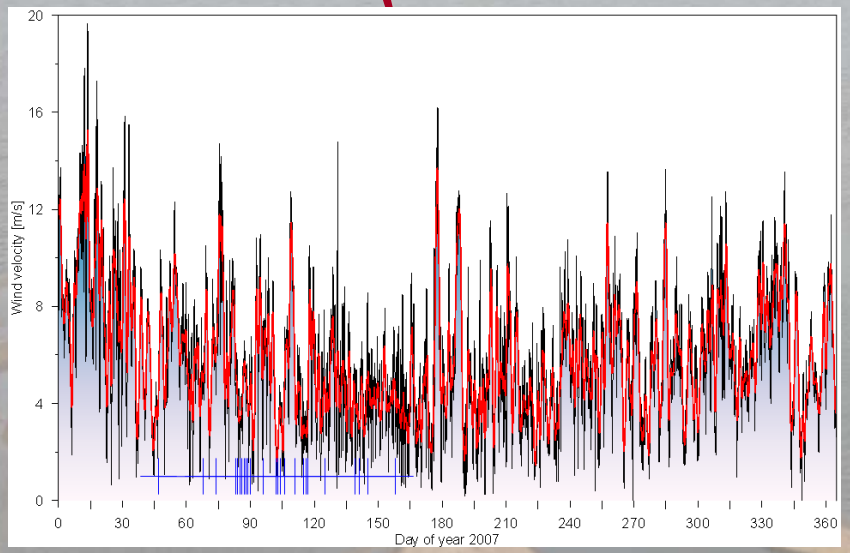
- Fresh water plume, being major cause of water quality decline along the coast can be defined by its' volume and extent
- Extent is dependent on volume, being result of fresh water discharge and diffusive loses of fresh water to Gdańsk Bay, as well as an advection in East direction (mainly driven by wind events)
- Extent of the plume defines area being impacted by declined water transparency and/or quality

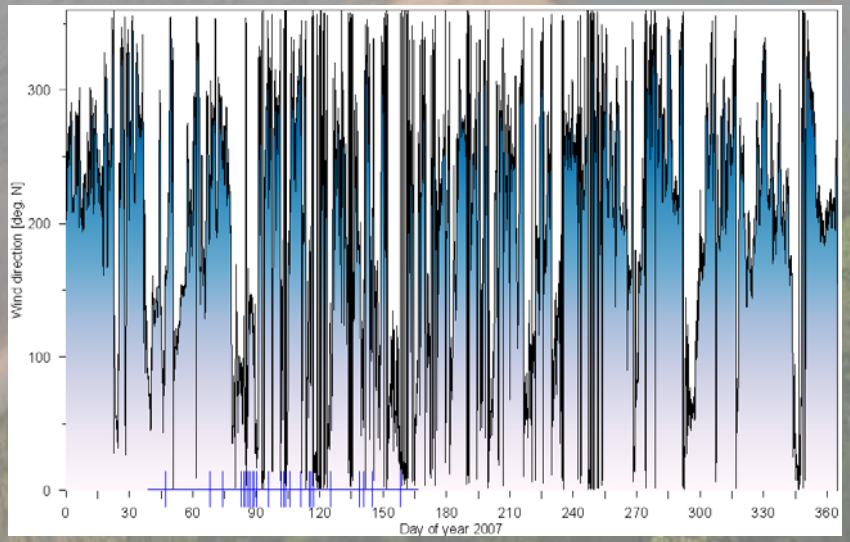
Formulation of Simulation Analysis (Environmental Component)



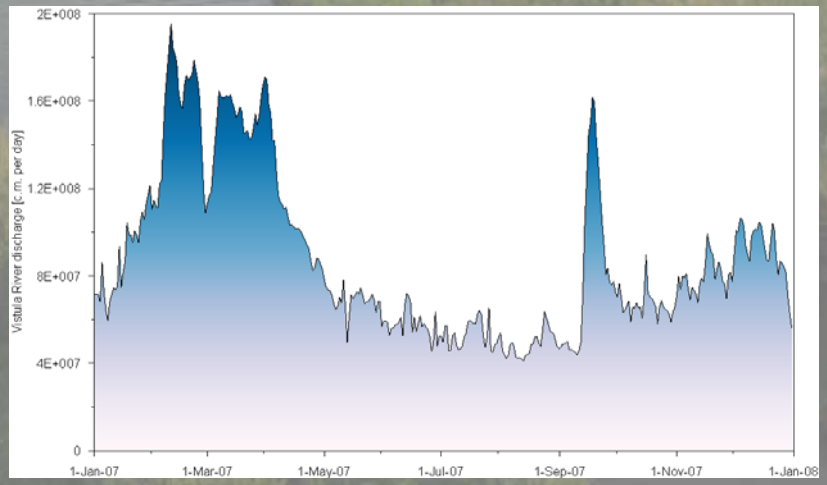
- Relation to Vistula Spit beaches
- The impact of Vistula river plume decreasing with distance from Vistula River mouth
- Based on light attenuation derived from MODIS/SeaWifs satellite
- Particular situations to be tight with wind events to feed advection/diffusion mechanisms in plume model

Formulation of Simulation Analysis (Environmental Component)





- Relation to wind and river discharge
  - Particular events observed on remote sensing data to be related to wind events
  - Additionally Vistula river discharge to be linked also



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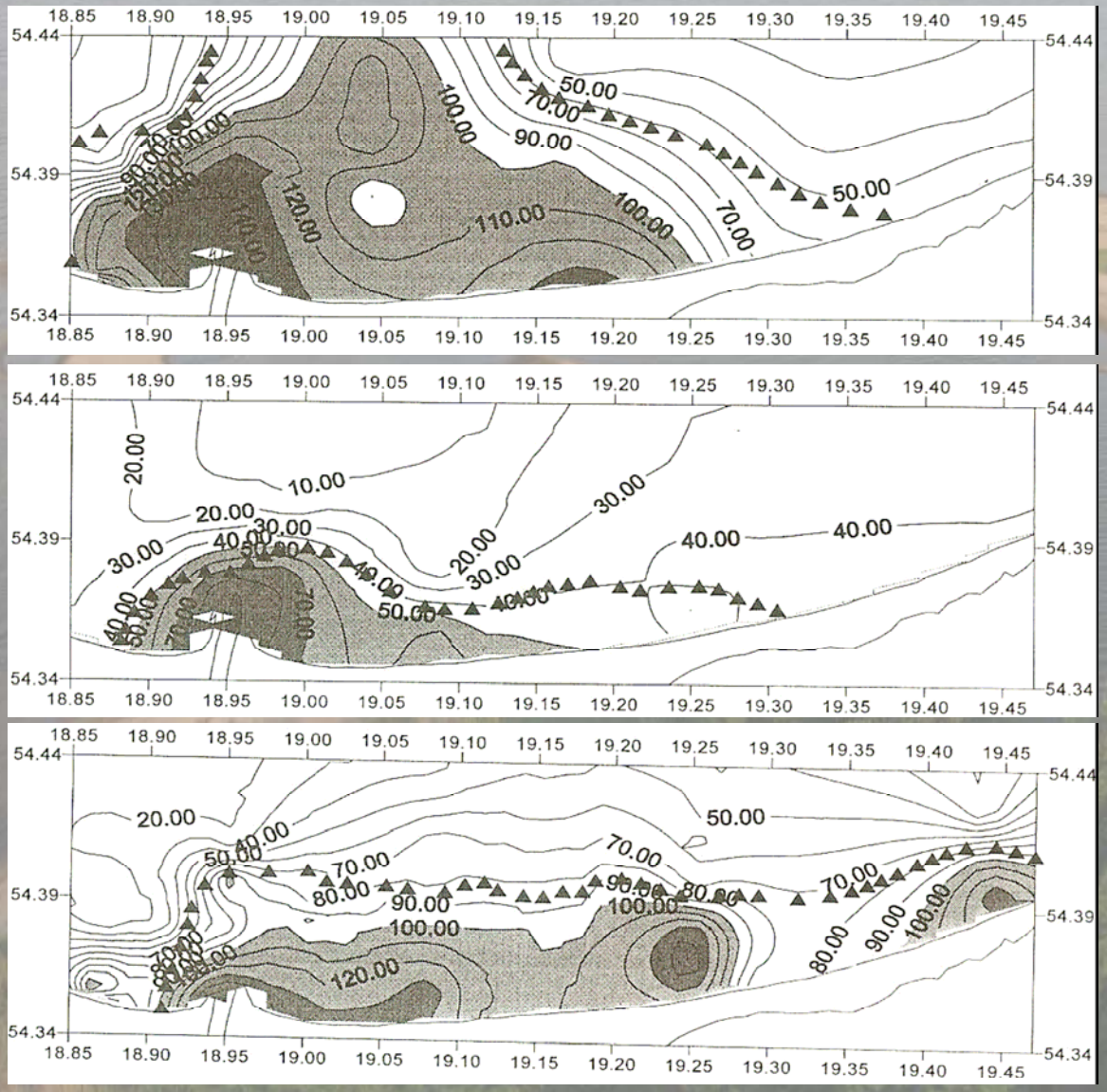
Formulation of Simulation Analysis (Environmental Component)



- **Nitrogen Budget:**
  - Nitrogen follows well fresh water plume
  - Vistula River is contributing with 90 000 tons of N per annum out of 120 000 tons of N from whole Poland to the Baltic Sea
  - According to BSAP it means 30 000 tons of N are excess subject to fines (ca. 30 kEUR/tonne)
  - Part of water transparency problems is related to high nutrient concentration
  - For modelling of riverine buffers effectiveness difference between Wloclawek Dam and Vistula river mouth will allow for budgeting N

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Formulation of Simulation Analysis (Environmental Component)

- **Blocks/processes to be included:**
  - River with certain discharge and nutrient (N) load
  - Freshwater plume
  - Meteorological forcing
  - Advection modules representing beaches along the coast
  - Riverine buffers
  - Macroalgae cultivation
  - WWTP option for Sztutowo local community

Formulation of Simulation Analysis (Socio-economic Components)

- **Beach preference model**

Model for the Gulf of Gdansk will focus on:

- **Beach preferences quesionnaire (social perception)**
- **Economic analysis of tourists response & impact on the local tourism**
- **General Beach Tourist Activities**
- **Willingness to participate in Sustainable Development of Coastal Zone**

Formulation of Simulation Analysis Questionnaire and results

What do you like to do the most on the beach?

- Walking/ spending time outside **15,38 %**
- Bathing/ swimming **30,77 %**
- Sunbathing **19,23 %**
- Fishing **3,85 %**
- Water sports **11,54 %**
- Social meetings **11,54 %**
- Other **7,69 %**

What do you dislike the most on the beach?

- Poor bathing water quality **15,38 %**
- Low sea water temperature **19,23 %**
- Lack of the beach infrastructure **30,77 %**
- Litter **34,72 %**
- Other **13,96 %**

I am not bathing or swimming in the sea water when:

- Water temperature is:
- under 15 degree **38,46 %**
- under 18 degree **19,23 %**
- under 20 degree **42,31 %**

- **Water transparency is:**
- high (visible water) 0
- low (you cannot see your feet: 0,5 – 1m) **57,69 %**
- very low (algae bloom) **42,31 %**

- **Wind conditions are:**
- strong **42,31 %**
- Medium **42,31 %**
- Light **15,38 %**

- **Cloudiness cover is:**
- "zero" (clear sky) **7,69 %**
- partial (50%) **53,85 %**
- full (100%) **38,46 %**

I am leaving the beach when:

- Water temperature is:
- under 15 degree **57,69 %**
- under 18 degree **15,38 %**
- under 20 degree **26,92 %**

Questionnaire and results

- **Water transparency is:**
- high (visible water) **0**
- low (you cannot see your feet: 0,5 – 1m) **42,31**
- very low (algae bloom) **57,69 %**

- **Wind conditions are:**
- Strong **53,85 %**
- Medium **34,62 %**
- Light **11,54 %**

- **Cloudiness cover is:**
- "zero" (clear sky) **0**
- partial (50%) **34,62 %**
- full (100%) **65,38 %**

Please, imagine, that you are arriving at the beach and there is an algae bloom, not pleasant smell of algae and low transparency of the sea water. What would you do:

- Stay at the beach and take more sunbathing **15,38**
- Use the local infrastructure and facilities **30,77**
- Leave the beach and go for sightseeing or shopping **23,08 %**
- Leave the beach and look for the cleaner one **7,69**
- Other **23,08 %**

Please, imagine that you are arrived to the coast for one week and what would you do in case, the poor water quality will last/ continue for the second day?

- I will stay anyway **19,23 %**
- I will prefer sightseeing, shopping, entertainment outside the beach **38,46 %**
- I will refuse the leisure **3,85 %**
- I will change the place **26,92 %**
- Other **11,54 %**

What would you do, if at your favourite holiday destination on the cost the bathing water quality is beyond/behind expectations?

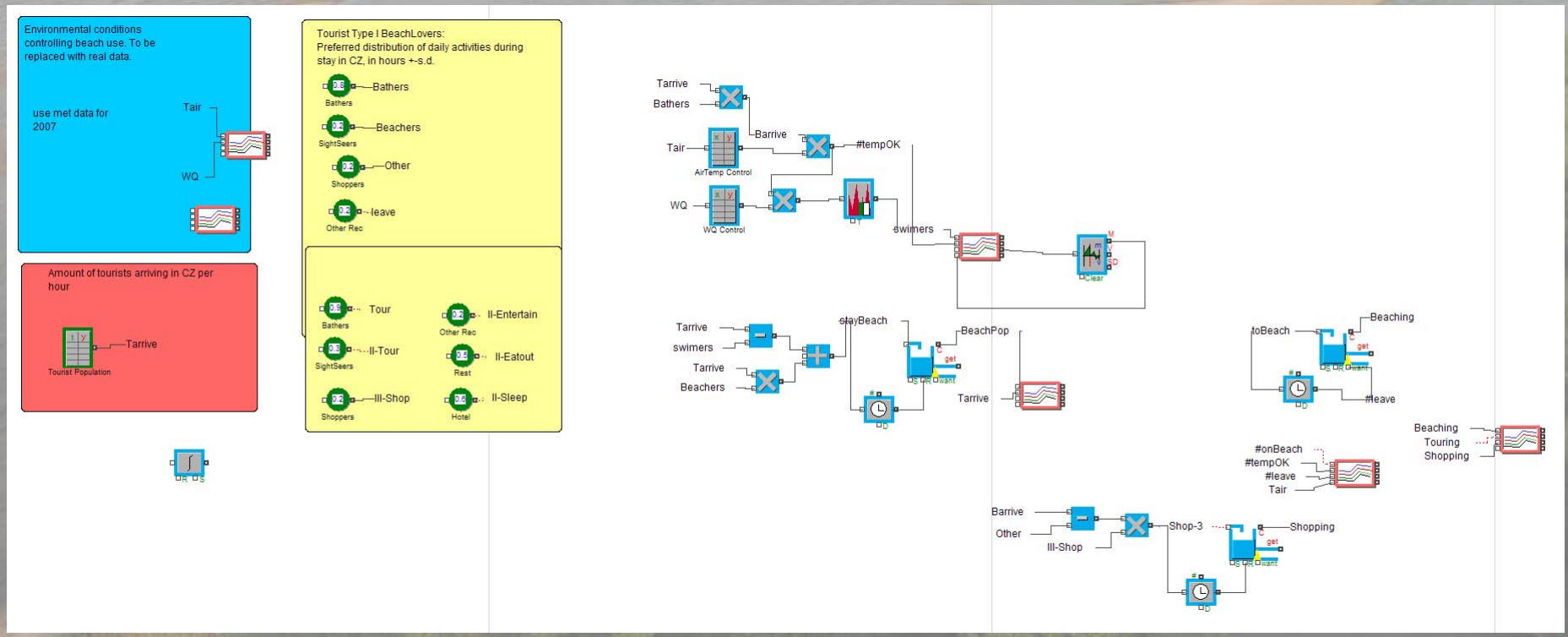
- I will come back next year **11,54 %**
- I will look for the better place on the Polish coast **30,77 %**
- I will plan the holidays abroad **42,31 %**
- I will change the type of leisure next year **15,38 %**
- Other **0**

Do you support the initiatives undertaken in order to improve the sea bathing water quality along the coast?

- Yes **88,46 %**
- No **11,54 %**

Formulation of Simulation Analysis

- **Extend model**

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Thank you for your attention
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