SPICOSA Study Site Application: Izmit Bay

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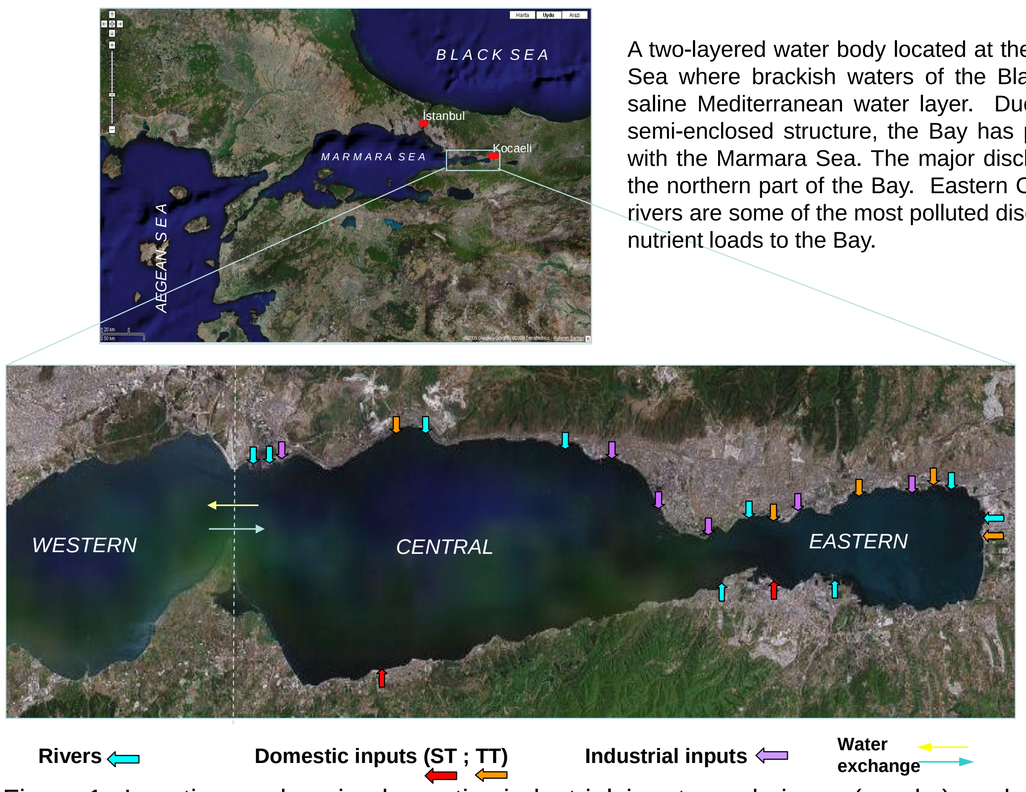
SIXTH FRAMEWORK PROGRAMME

1- IZMIT BAY COASTAL ZONE



A two-layered water body located at the N-E of the Marmara Sea where brackish waters of the Black Sea overlays the saline Mediterranean water layer. Due to its stratified and semi-enclosed structure, the Bay has poor water exchange with the Marmara Sea. The major discharges are located in the northern part of the Bay. Eastern Channel and Dilderesi rivers are some of the most polluted discharges carrying high nutrient loads to the Bay.

Figure.1. Location and main domestic, industrial inputs and rivers (creeks) and water exchange of the İzmit Bay system (original image was taken from the Google Earth)

2- POLICY ISSUE/ HUMAN ACTIVITIES

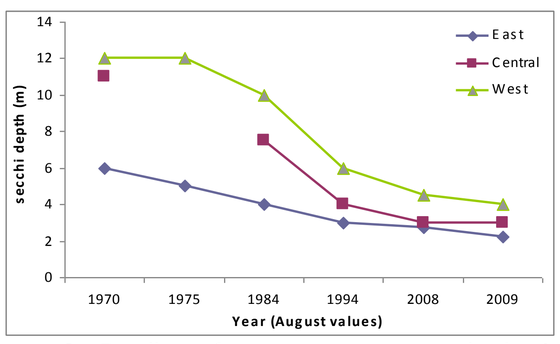
The main drivers and related pressures on the system are :

1-Urbanization → oxygen deficiency in bottom waters; eutrophication, turbidity

2-Industrialization → toxicity; harmful substance accumulation in biota and sediments

3-Marine transportation → harmful substance accumulation in biota and sediments

Pollution prevention attempts resulted only to decrease the industrial organic carbon levels in the 1990's and BOD loads arising from industries were decreased to 9,9 (90% reduction) tons /day in 2002. Since most of the treatment plants only remove organic matter, nutrient loads are still a problem for the Bay coastal waters.



The policy issue:

"Improvement of Water Quality in Izmit Bay"

SDD changes since 1970 have shown that considerable decrease in the water quality in all the basins of the Bay is evident (Figure 2).

Figure 2. Decline of water transparency in the Izmit Bay since 1970.

3- CONCEPTUAL MODEL

The Conceptual diagram of Izmit Bay(Fig.3) was developed on the basis of knowledge of the virtual system and improved according to the needs arise in the formulation and appraisal steps. It shows the relationships between the main components of the system and their functions. The ecological model consists of 3 layers namely upper, intermediate layer and bottom layers.

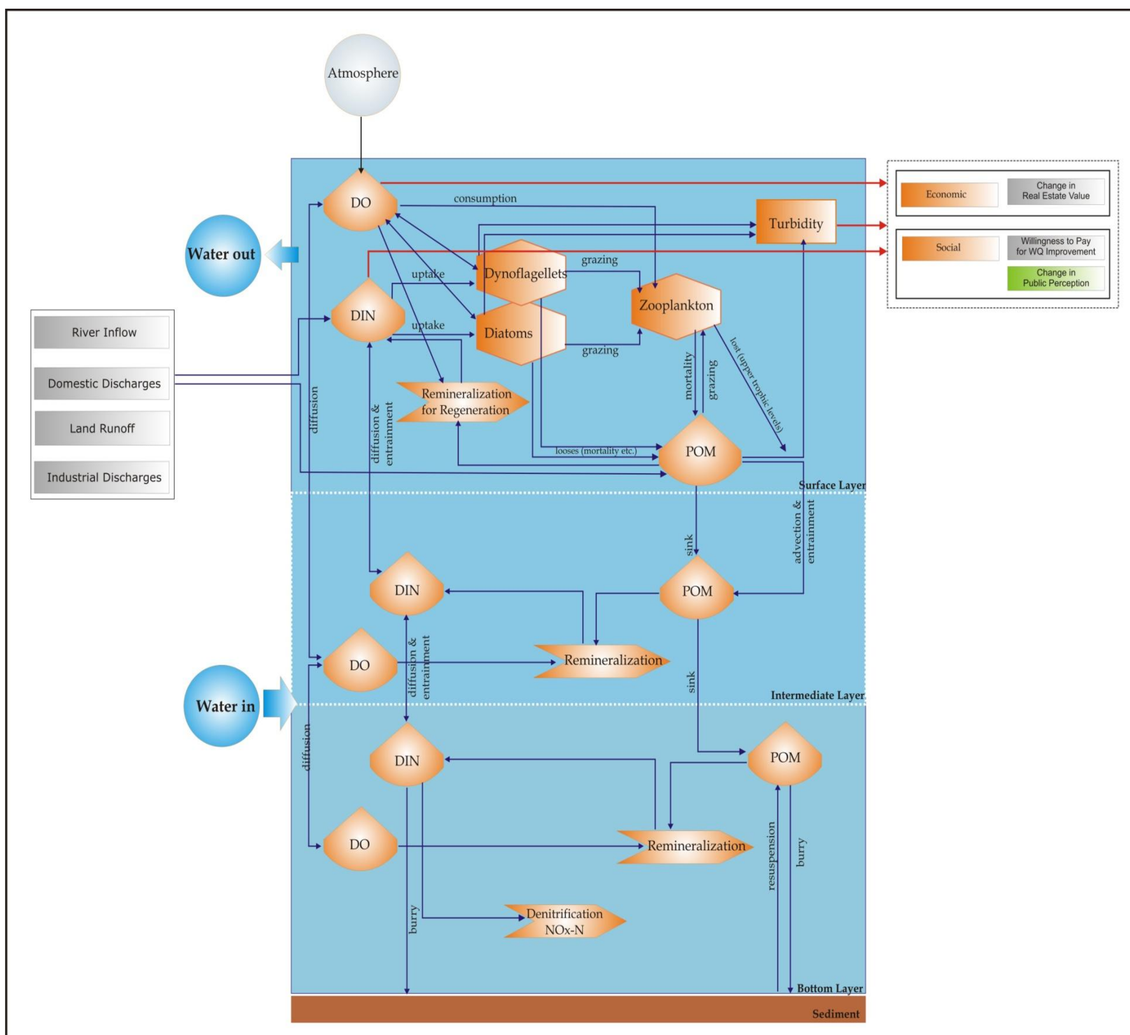


Figure 3. The Conceptual Model

4- SCENARIOS

Scenario 1:
WWTP upgrade
for Golcuk and Karamursel cities

Scenario 2:
Application of integrated control technologies for runoff using plants.

Estimated load reduction for relevant parameters

Parameters	Current situation			Scenarios		
	Total domestic WW kg/day	Golcuk-Karamursel WWTP kg/day	Surface run off kg/day	Total domestic WW kg/day	Scenario 1 kg/day	Scenario 2 kg/day
Total nitrogen	3336	1040	247	2421	125	99
Total Suspended Solids	7949	1635	214	7949	1635	86

5- EXTEND MODEL

In the ecosystem (natural) component of the model nutrient (nitrogen) and TSS (total suspended solids) inputs from land based sources (domestic, industrial and runoff) are considered as main inputs for the biochemical processes and the DO and SDD as main outputs.

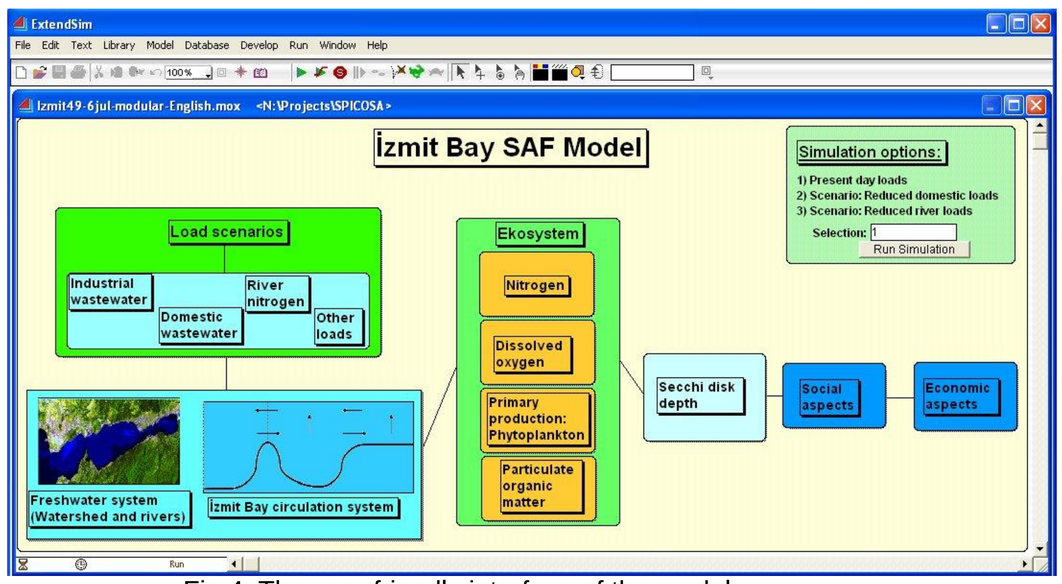


Fig.4. The user friendly interface of the model.

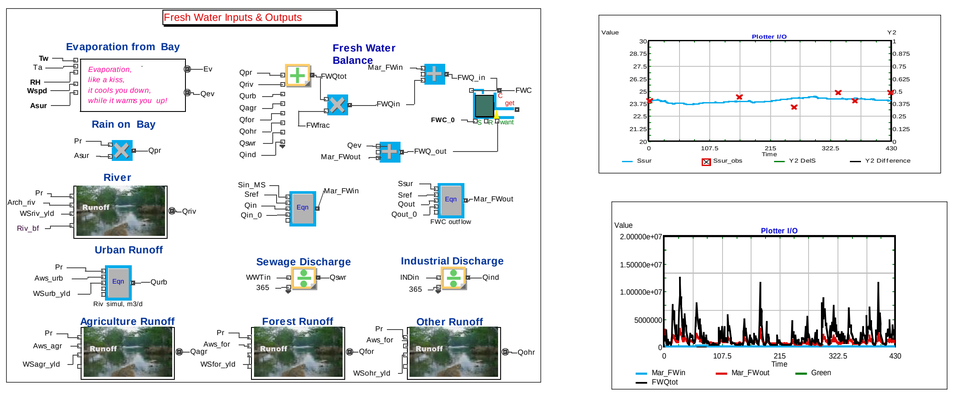


Figure 5.The fresh water component and the graphical outputs (water transport and upper layer salinity)

6- ECONOMIC AND SOCIAL COMPONENT

Cost Benefit Analysis of Upgrading the WWTPs

1) Financial CBA – whether it is financially feasible for municipalities to upgrade their WTTP to advanced treatment?
2) Economic CBA – whether the benefits of upgrading is more than costs from a macro economic point of view

People perception of the water quality was measured by **Willingness to pay** (WTP) survey. WTP is measured by **Contingent Valuation Method**

Economic CBA
The Hedonic Pricing Method
Data collection + Regression analysis

Toatal Economic Benefit
* Benefit from rising real estate values: 22 M€
(SDD target-SDD present)X1.197X apart. (population)
*Benefit from increase in people satisfaction: 13 M€

Total Economic Cost
Daily amount of water treated (146.000 m3) x 0.139 (Euro/m3) x number of days to reach the target SDD

Financial CBA (for scenario1)

Assumptions for cost of treating 1 m^3 of wastewater

Investment Cost : 28 Euro / capita
Unit Investment Cost : 0.019 Euro / m3
Operation Cost : 0.024 Euro / capita / day
Unit Operation Cost : 0.12 euro / m3
Total Unit Cost : 0.139 Euro / m3

Willingness to Pay
55 % is redy to pay
15,8 Euro /cap / annum = 0.256 Euro / m3.

Finacial B/C = 1.84

7- CONCLUSION

The SPICOSA approach is bringing very positive results for the development of stakeholder based coastal management in Izmit Bay; especially for the understanding of the coastal system and the development of a common and simple language for such a complex system. Science and policy integration result on a more effective and sustainable coastal management and the SPICOSA approach demonstrate and illustrate this process to our policy makers and planners.

TÜBİTAK MAM