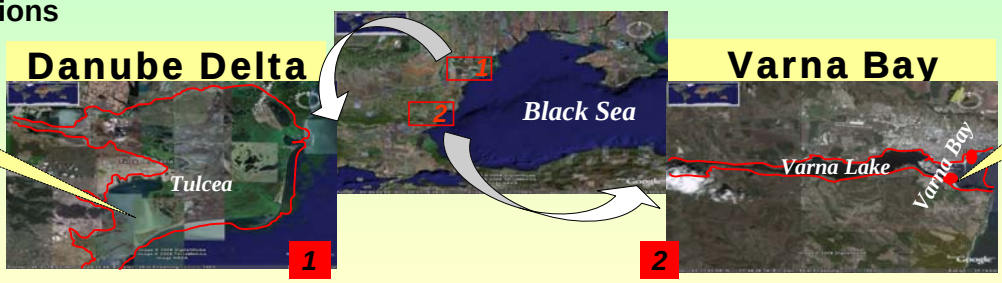
# SSA 18-Danube Delta Romanian–Bulgarian CZ Formulation Step

SPICOSA

## Systems Formulations

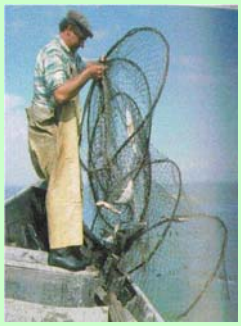
Fishery decline caused by habitat changes




Quality of bathing waters in Varna Bay

## Formulation Step ("… by step")

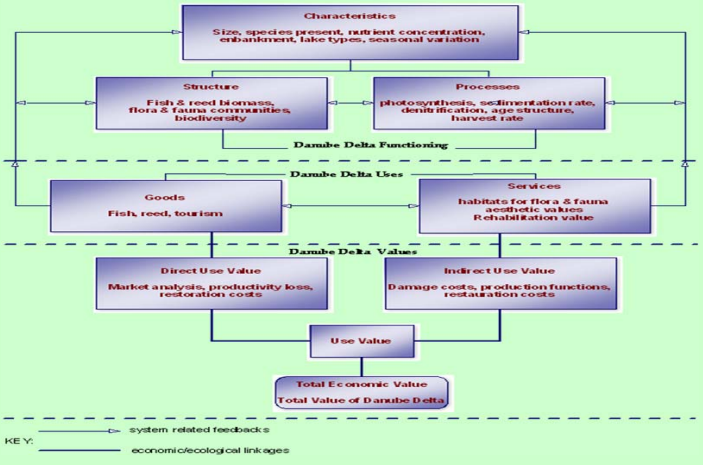
Selection of most relevant inputs, processes, internal interactions, functional components, scenarios



| Components | Processes | Variables | Symbol | Dimension | Units |
|---|---|---|---|---|---|
| Phytoplankton | light transmission | PAR, TSM | PAR, TSM | [I][L]^2*T | uE/m2/s |
| | Nutrient uptake | N, P | [C]/L^3 | | um/d |
| | Grazing rate | Zooplankton | Gzoo | [M]/[T] | mg(ind)/day |
| | Mortality | Virus, bacteria, natural | M | [ind]/[T] | ind/day |
| | Dominant species | phytoplankton | | | |
| Zooplankton | structure | Zooplankton | | | ind/l |
| | biomass | Zooplankton | Bzoo | [M]/L | mg/l |
| | Predation | Higher trophic levels | Gzoo2 | [M]/[T] | mg(ind)/day |
| Fish | Grazing rate | phytoplankton size and density | Gzoo | [M]/[T] | mg(ind)/day |
| | Mortality | Bacteria, natural | M | [ind]/[T] | ind/day |
| | predation | higher trophic levels | Gfish | [M]/[T] | mg(ind)/day |
| | mortality | fishing, virus, bacteria, natura | M | [ind]/[T] | ind/day |
| | age structure | fish | | | |
| | larvae growth rate | | Lgrow | | mm/month |
| Nutrients | Concentration | P, N | P, N | [M]/L | mg/l |
| Benthic invertebrates | Predation by fish | | | | |
| | Structure | | | | |

Use Matrix for CZ System Response to Human Influences

| Influence Category | HA examples | Market Value | Natural System | Social Acceptance |
|---|---|---|---|---|
| Displacing resources | embankment | indirect val=f(economic from fish resources) | Damage=f(degree of sustainable management, restoration actions) | Balance= f(sustainable market benefits), Balance= f(sustainable nonmarket benefits, aesthetics) |
| Adding substances to system | nutrient loads | direct benefit=f(effort saved) | Damage=f(loss of biodiversity, fish community shifts, ecosystem carrying capacity) | Balance= f(human and ecosistem health); Balance= f(sustainable market benefits) |
| Conserving or reducing impact | effective management actions | loss of benefit=f(resource removal from market) | Benefit=f(ecosystem quality, increase of market valued products) | Balance= f(ecosystem sustainability) |




scenarios that will be explored are:

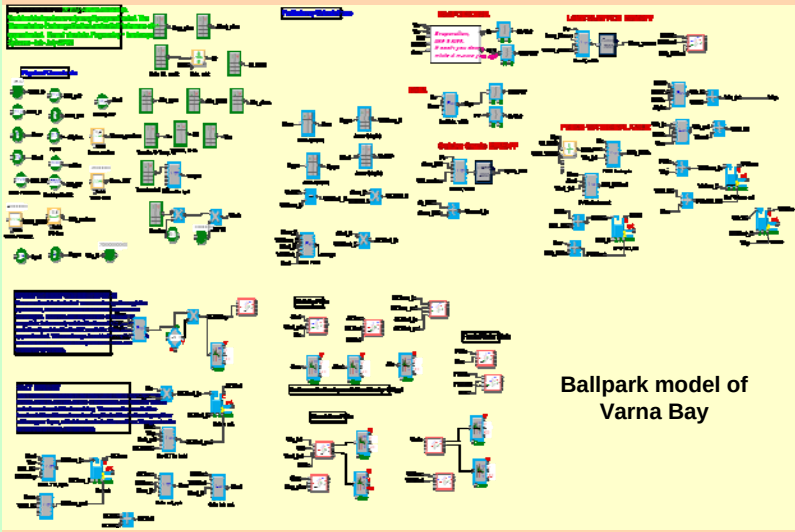
1) Let things take their course- no change;
2) The nutrient input is decreased and the Delta ecosystem is recovered- an increase of commercially important fish species;
3) Measures for restoration of habitats devastated by embankments are taken- fish spawning areas are recovered;

Challenges: (i) what would be the cost benefit from fishing activities recovery; (ii) economic loss for agriculture (2), or reed harvesting (3), or of inactions (1)?; (ii) data quantity


scenarios that will be explored are:

1) Business as usual – baseline scenario – no change in the WWTP, current state of industry and economic incentives;
2) Deep green (optimistic scenario) – the Program for improvement of the WWTPs is fully implemented and the industrial input is decreased and the compliance with the WFD is fully reached;
3) Realistic scenario – The WWTPs program is partially implemented (50% reduction of the loads) and 50% reduction of the industrial loads (input from the lakes) respectively

Functional components



Ballpark model of Varna Bay

Challenges: (i) economic & social components; (ii) data quantity; (iii) What trade-offs and options would minimize conflicts of interests and the respective policy decisions?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SIXTH FRAMEWORK PROGRAMME

Science and Policy Integration for COastal Systems Assessment

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