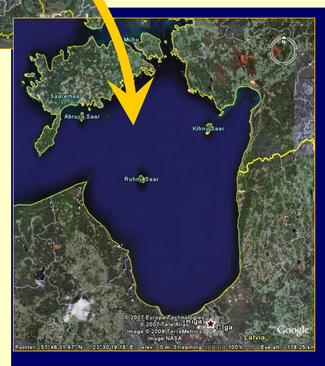

SPICOSA

Science and Policy Integration for COastal System Assessment

SIXTH FRAMEWORK PROGRAMME

SPICOSA

TARTU ÜLIKOOL
UNIVERSITY OF TARTU

SSA No 1

Improvement of management measures for the pikeperch stock in Pärnu Bay (Gulf of Riga)

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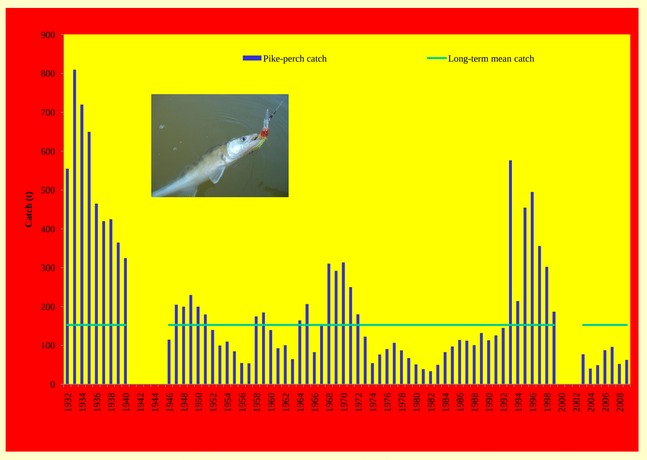
PROBLEM SCALING

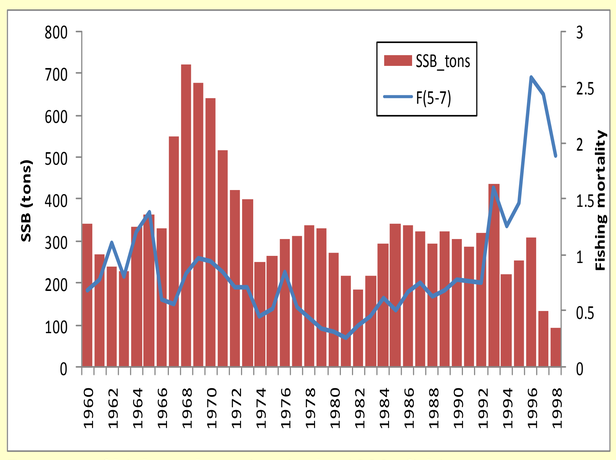
➢Pikeperch of Pärnu Bay is a valuable natural resource. It offers subsistence, engagement and income for coastal population and is a valuable export article. Pikeperch is a very important biomeliorator converting the biomass of inferior fish species into expensive pikeperch biomass. It endures moderate eutrophication.

➢During "open market" system it experienced extremly high fishing preasure, however natural conditions should favour forming abundant year-classes and increased stock biomass.

POLICY ISSUE "Interaction between fisheries managment & fish production"

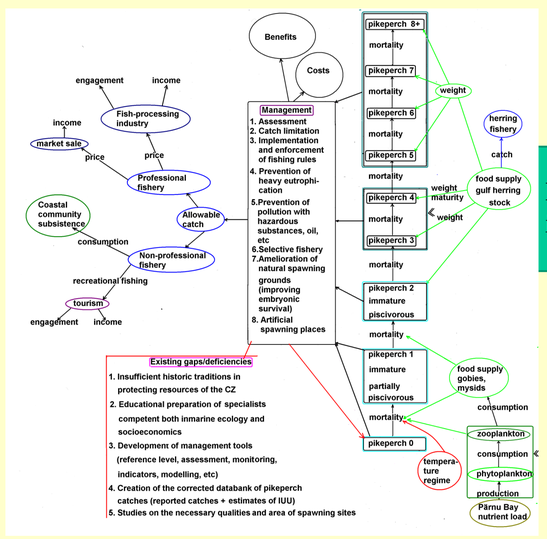


The catches have widely varied since 1932 showing lowest values during last decade

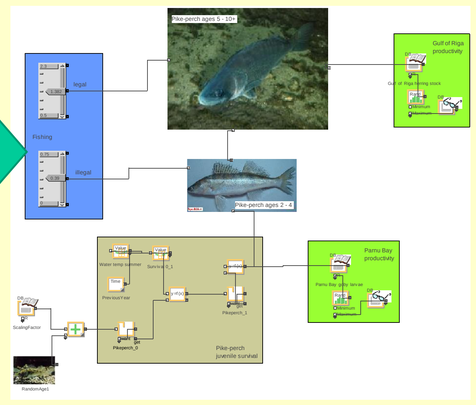


Because of high market price, in the 1990s fishing pressure on the stock, including immature fish, substantially increased and the stock fell into depression

PÄRNU BAY PIKE-PERCH – CONCEPTUAL MODEL



ExtendSIM implementation



MODEL FORMULATION&POLICY-STAKEHOLDER INVOLVMENT

- Main model blocks:
  - Pike-perch juvenile survival
  - Immature piscivorous pike-perch (ages 2 – 4)
  - Mature pike-perch (ages 5 – 10+)
  - Parnu Bay productivity
  - Summer and winter temperature
  - Fishery
  - Climate change
- Step-wise refinement of model blocks
- User interaction via parameter database and slider utilities
- Model output storage in Extend databases
- Verification with pike-perch VPA output from 1970 - 1999

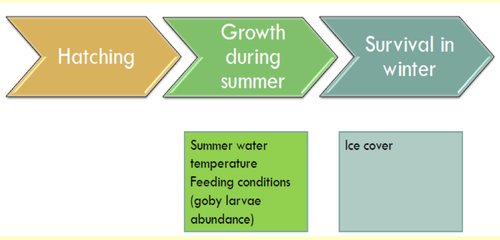
The stakeholder group formed met approximately twice per year and consisted of representatives from nine organizations ;
➢ Fisheries department of the Ministry of the Environment of Estonia,
➢Ministry of Agriculture of Estonia,
➢Environment Board and Environment Inspection of Pärnu county,
➢Estonian Marine Institute of the University of Tartu,
➢Organization of professional fishermen of the Pärnu county,
➢Union of the Gulf of Riga fishermen,
➢Fishery companies "Pärnu Bay" and "Japs".
Initial consultations concluded, that exploitation of the pikeperch stock should be managed at exploitation rates that achieve the maximum catch. Therefore, scenario development and scenario output was designed to identify sustainable yields at different levels of fishing pressure.

We have selected a local fish stock, Pärnu Bay pike-perch, to demonstrate the interaction between eutrophication, fish production, management actions, climate change;

Pärnu Bay pike-perch

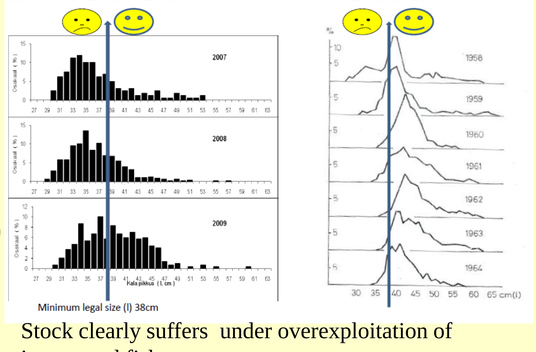
- local pike-perch stock, non-migratory
- economically most valuable species
- high fishing pressure, vulnurable due to late maturity
- experience with local quota and recruitment enhancment
- probably benefits from eutrophication via increase of Gulf of Riga productivity and stocks of forage fish (herring)
- increased water temperatures in Baltic sea enhance survival of YoY

Year – class formulation & stock exploitation



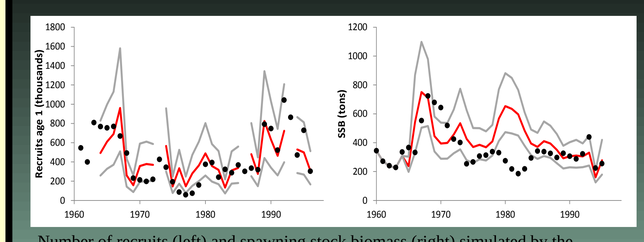
$$\log \frac{N_i^1}{SSB_{i-1}} = a + b \cdot SSB_{i-1} + c \cdot \log(Goby_{i-1}) + s(Temp_{i-1}) + s(Ice_{i-1})$$

Pike-perch length distribution (l, cm) in commercial catches 2007-2009 1958-1964



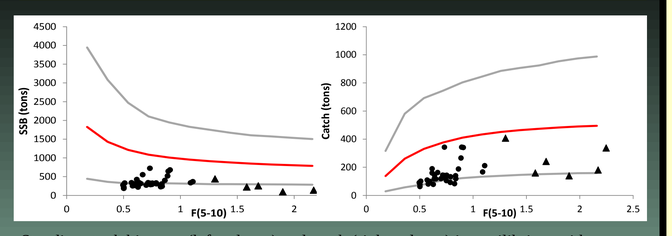
Stock clearly suffers under overexploitation of immatured fish

MODEL PERFORMANCE



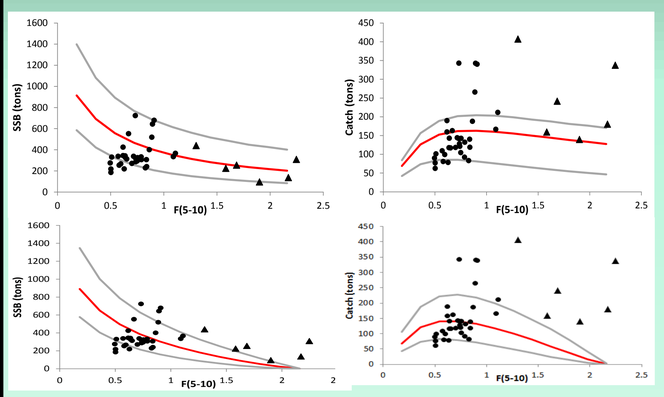
Number of recruits (left) and spawning stock biomass (right) simulated by the pikeperch virtual population model (lines: model results (red) with 5 % and 95 % percentiles (grey), dots: VPA estimates (Eero 2004)

Impact of expected climate change



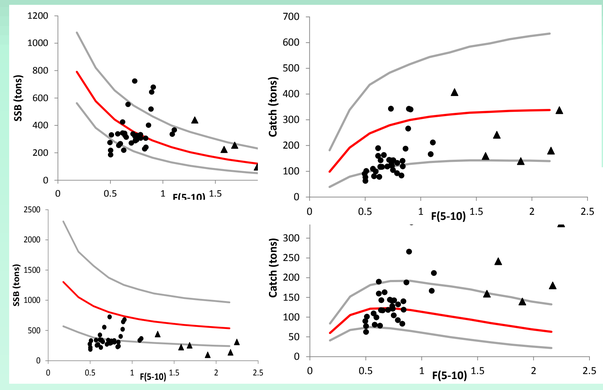
Standing stock biomass (left column) and catch (right column) in equilibrium with different levels of fishing mortality at "future" climate conditions. Lines correspond to average (red) simulated SSB and catch, together with 5 % and 95 % percentiles (grey). Markers denote observed SSB and catches (Eero 2004) with no (circles) and significant (triangles) catch of immature fish.

Effect of harvesting immature fish



Standing stock biomass (left column) and catch (right column) in equilibrium with different levels of fishing mortality, assuming no (top row) or significant catch (bottom row) of immature, undersized fish. Lines correspond to average (red) simulated SSB and catch, together with 5 % and 95 % percentiles (grey). Markers denote observed SSB and catches (Eero 2004) with no (circles) and significant (triangles) catch of immature fish.

Pikeperch stock dependence on Pärnu Bay productivity



Standing stock biomass (left column) and catch (right column) in equilibrium with different levels of fishing mortality, assuming low (top row) or high (bottom row) productivity expressed as Goby larvae abundance in Pärnu Bay. Lines correspond to average (red) simulated SSB and catch, together with 5 % and 95 % percentiles (grey). Markers denote observed SSB and catches (Eero 2004) with no (circles) and significant (triangles) catch of immature fish.