SSA 1 GULF OF RIGA STATUS OCTOBER 2009

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Gulf of Riga SSA modeling concept

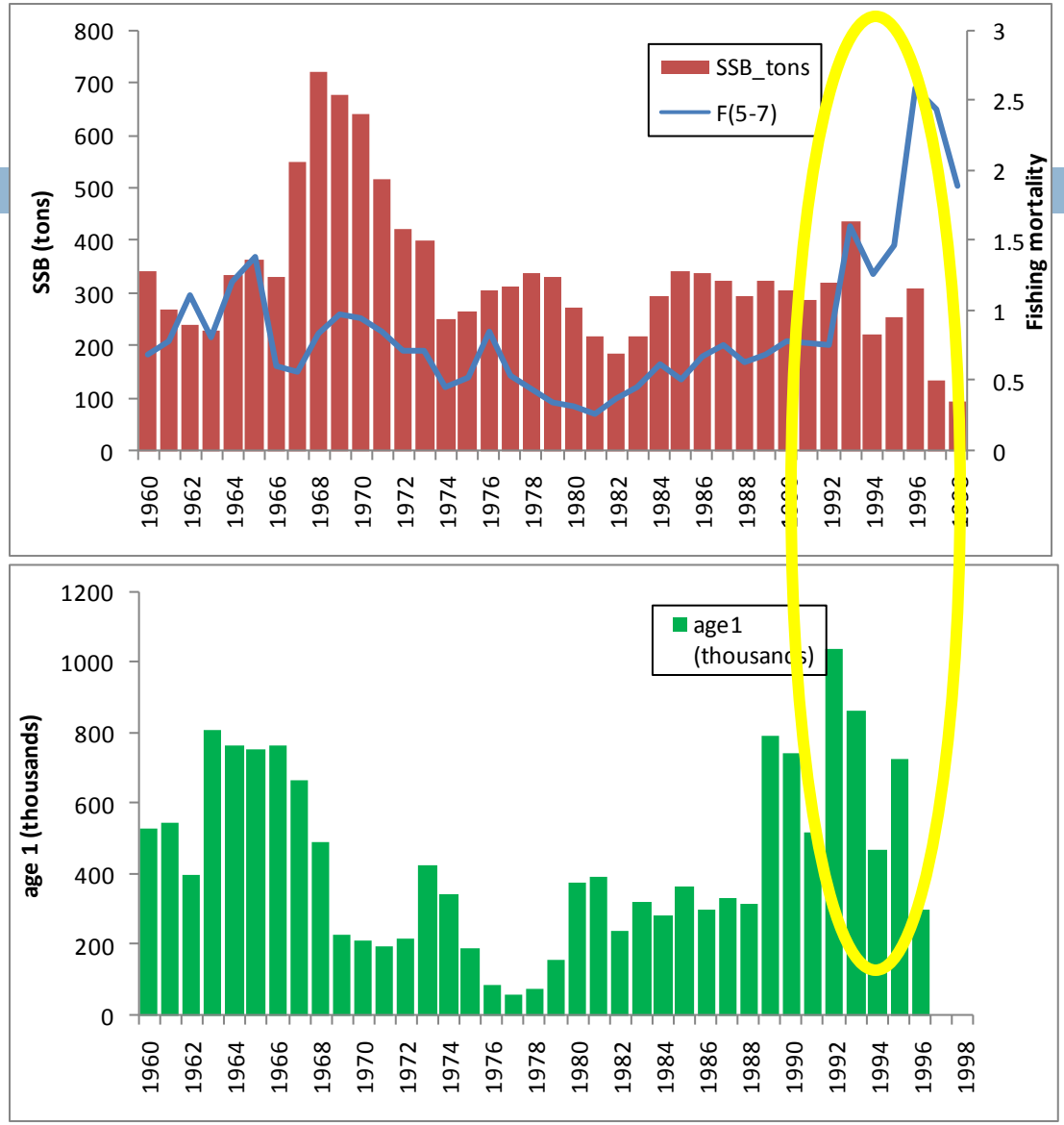
- Main human impacts:
  - Eutrophication
  - Fisheries
- Focus area: Pärnu Bay, pikeperch fishery
- Open coastline with high water exchange and biological interaction between open areas – coast
- 85 % of nutrient load in the Southern Gulf
- Interactions open Gulf productivity – pikeperch stock

Pärnu Bay pikeperch

SSB

recruits

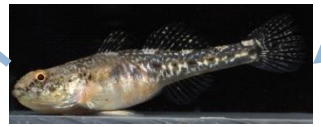
Eero, 2004



Pärnu Bay pikeperch

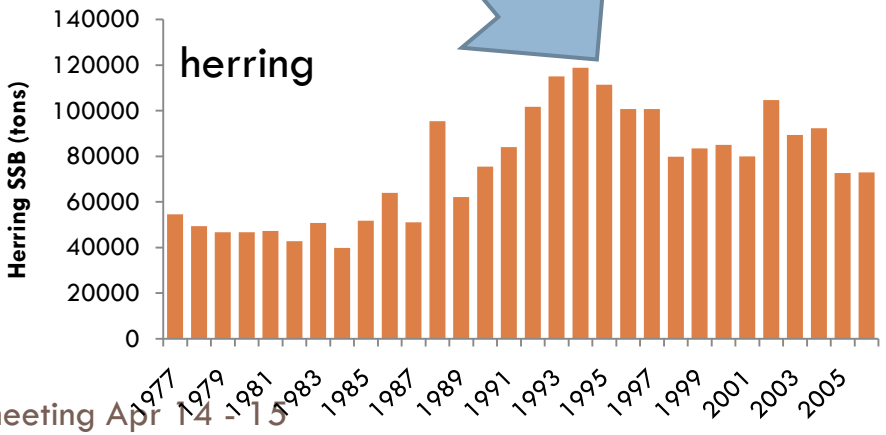
pikeperch

sticklebacks

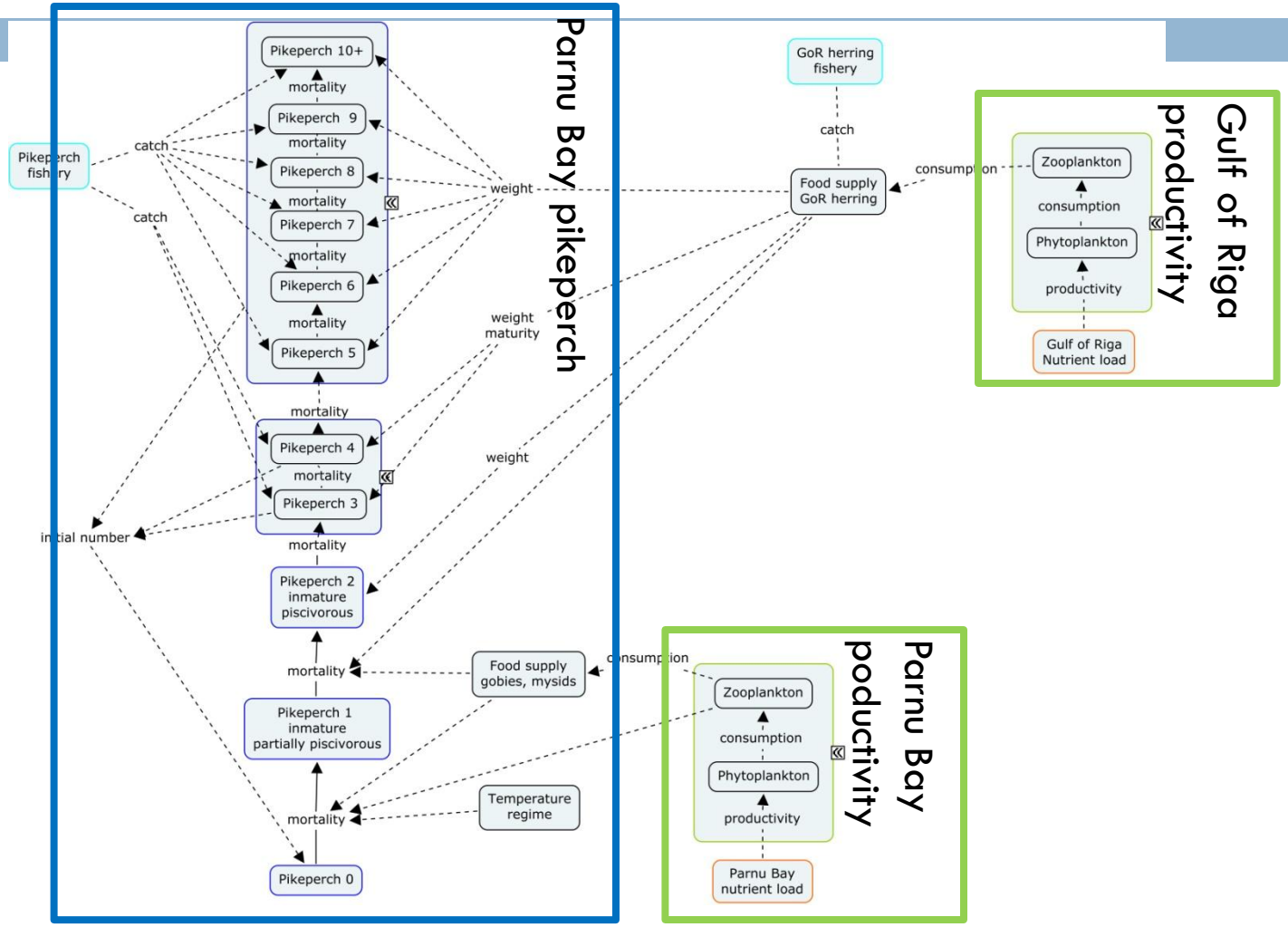


gobies

mesozooplankton



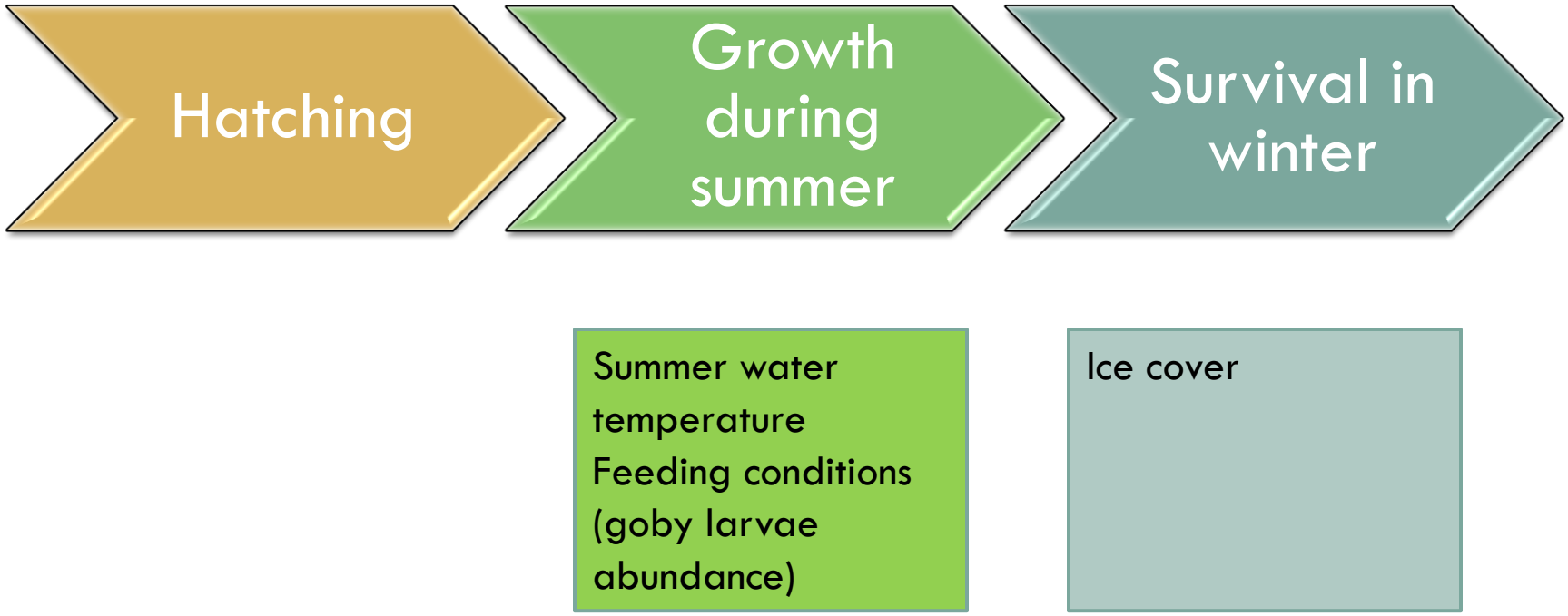
Refined conceptual model



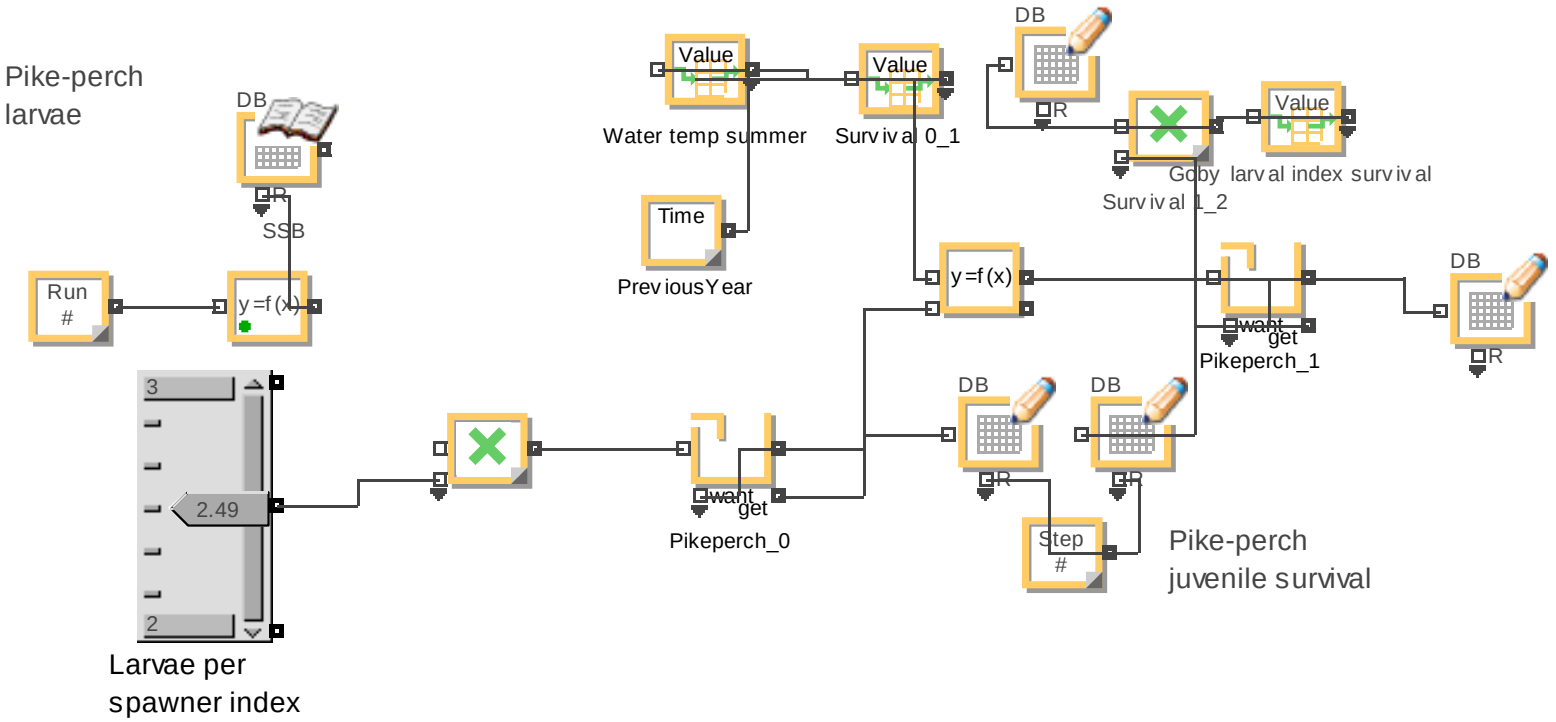
Activities

- Cleanup and calibrate critical steps in Gulf of Riga pikeperch model
  - Pikeperch recruitment
  - Linking fishing mortality to effort
- Simple climate change and fishing scenarios

Threshholds for pikeperch recruitment are difficult to calibrate



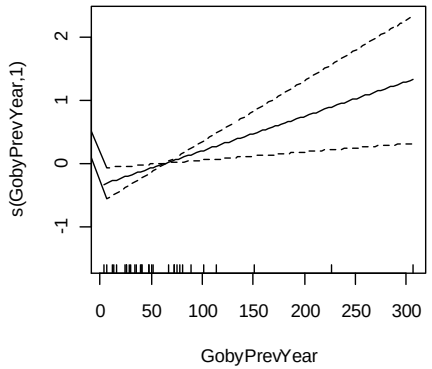
Pikeperch recruitment: initial version

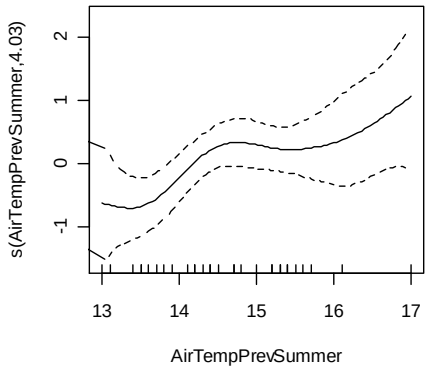


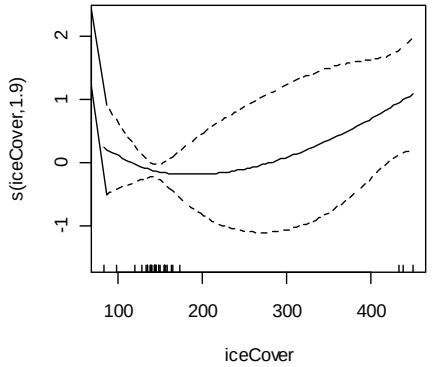
Relationships were implemented in a Ricker-type stock-recruitment relationships and fitted to data

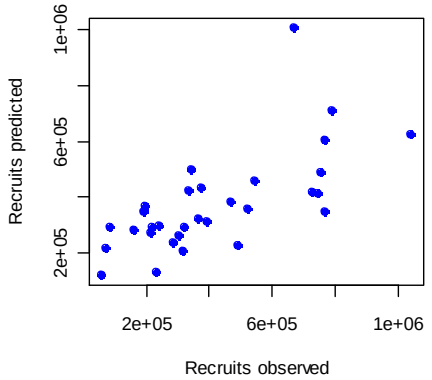
$$\log \frac{Recruits}{SSB_{Year-1}} = a + b \cdot SSB_{Year-1} + s\left(Goby_{Year-1}\right) + s\left(AirTempSummer_{Year-1}\right) + s\left(IceCover_{Year-1}\right)$$

R-sq.(adj) = 0.468

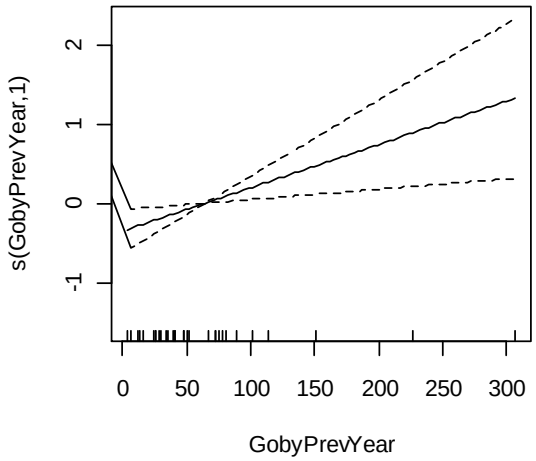


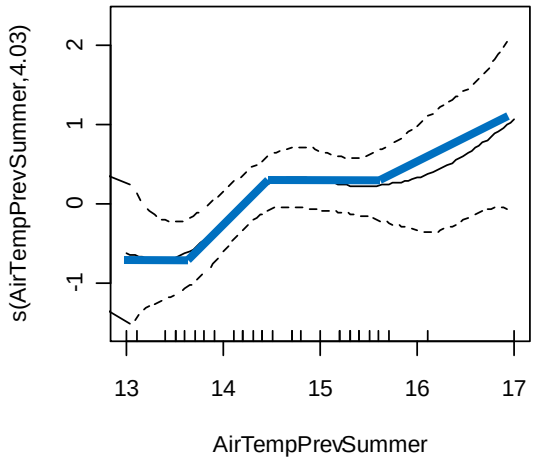


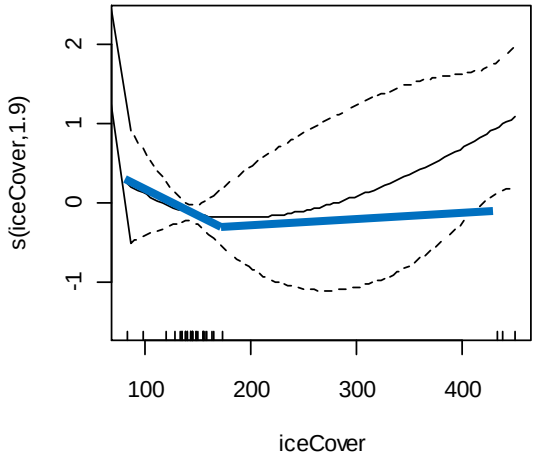


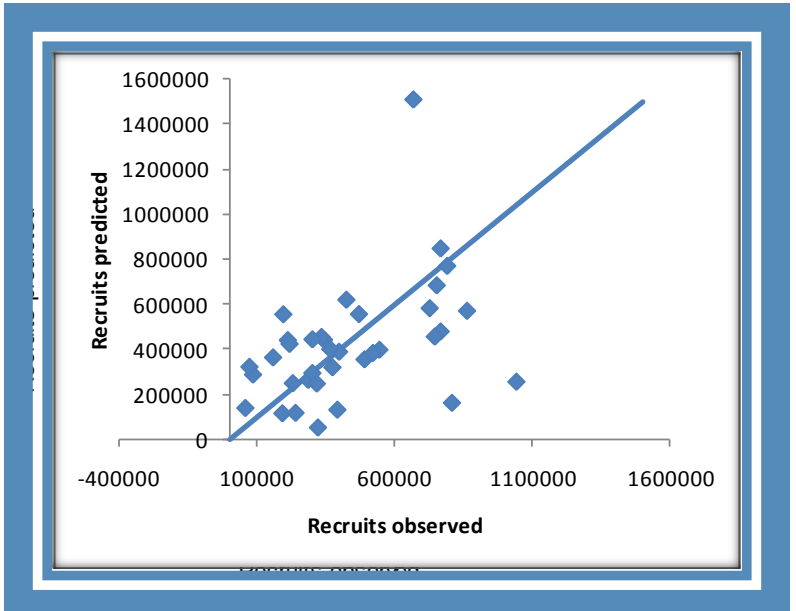


Smooth functions were implemented in Extend by piecewise linear functions

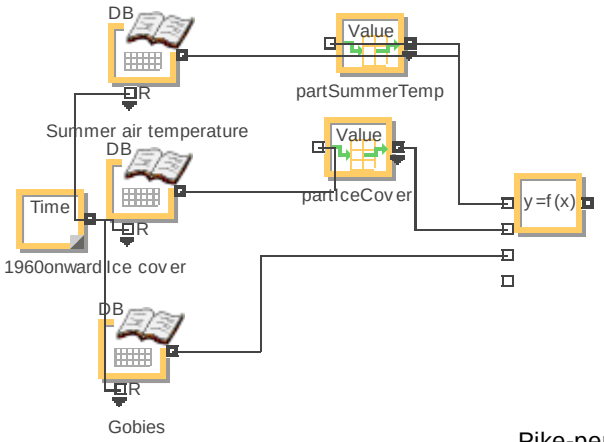








Pikeperch recruitment: cleaned-up version



Pike-perch recruitment

A Gordon-Schafer-Modell was used to related catches to effort

- Because there is hardly any effort data available, we used a little maths to derive effort from fishing mortality:

$$C_i = q_i \cdot E \cdot B_i$$

Gordon-Schafer view on catches

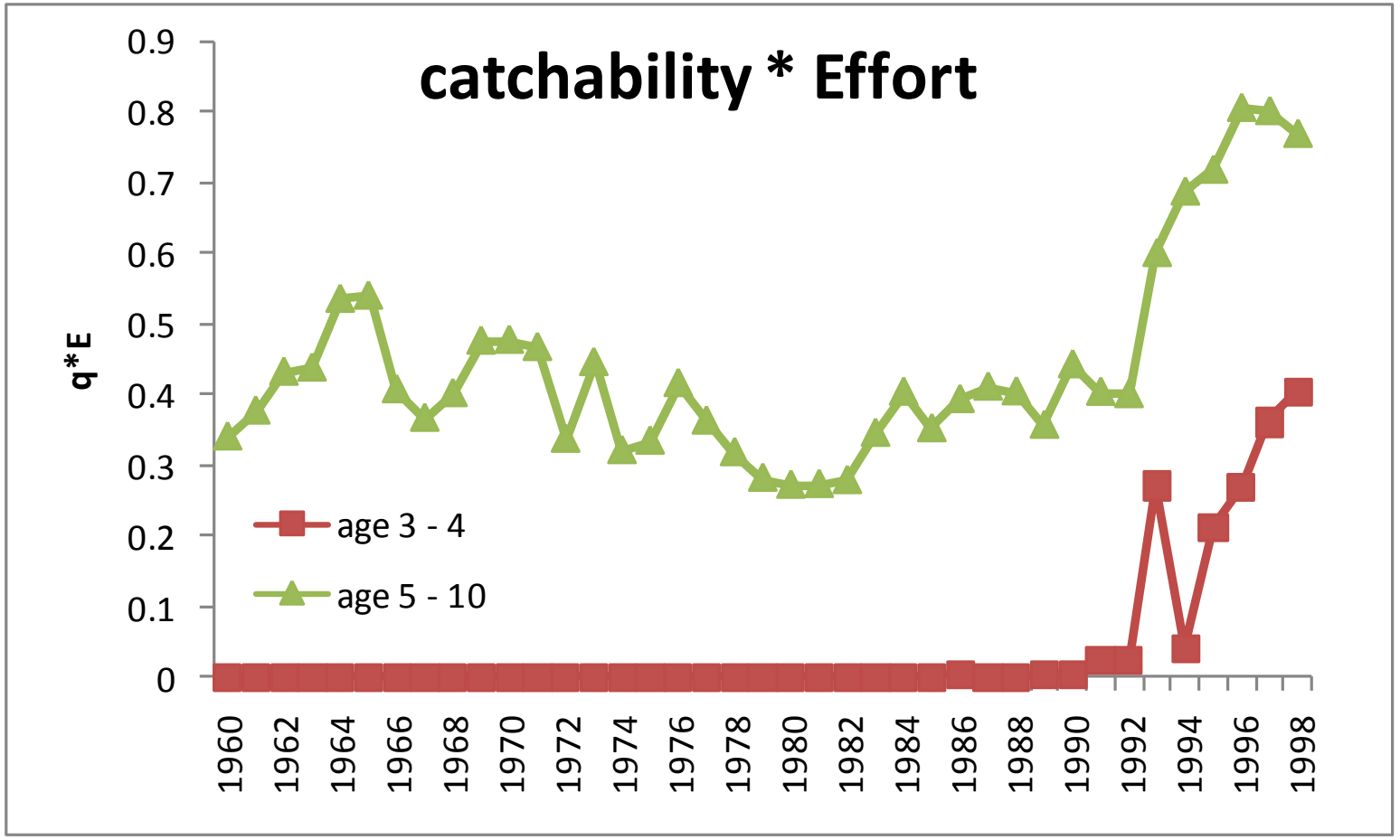
$$C_i = B_i \cdot \left(1 - e^{-F_i}\right) \cdot \frac{F_i}{F_i + M_i}$$

VPA view on catches

$$q_i \cdot E = B_i \cdot \left(1 - e^{-F_i}\right) \cdot \frac{F_i}{F_i + M_i}$$

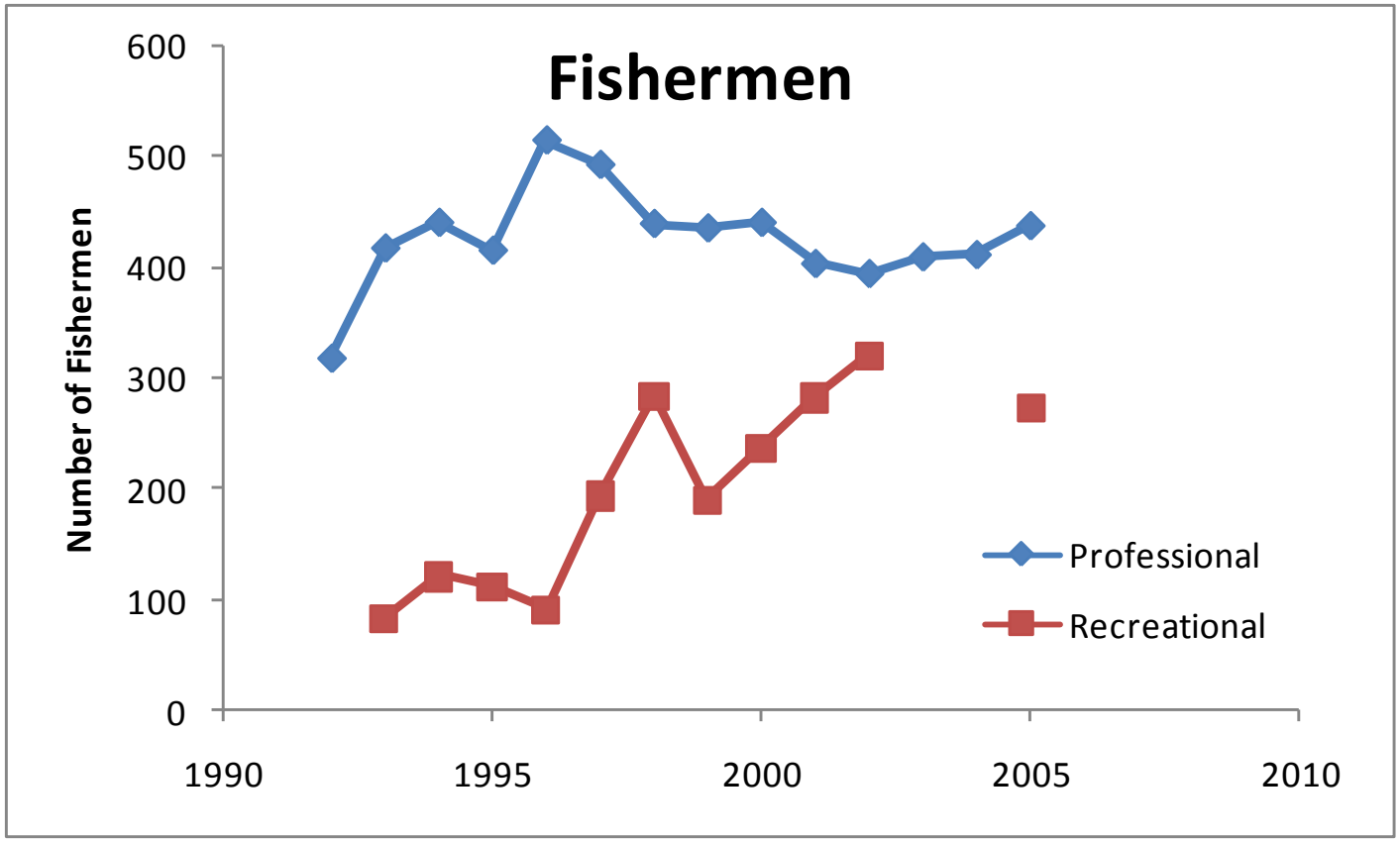
Both combined

Now we get an approximate idea of the effort in the pikeperch fishery



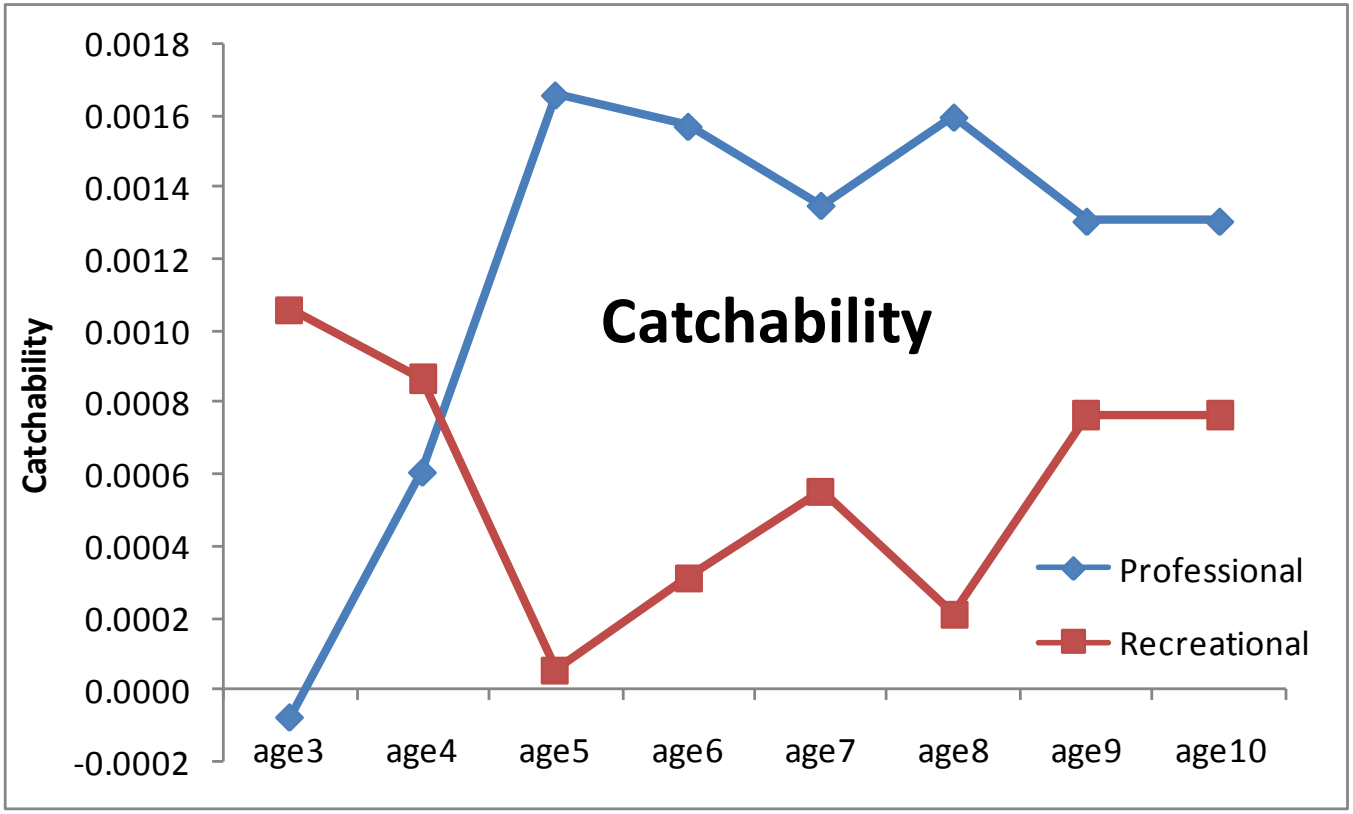
And together with some recent effort data, we calibrated catchability coefficients

Effort

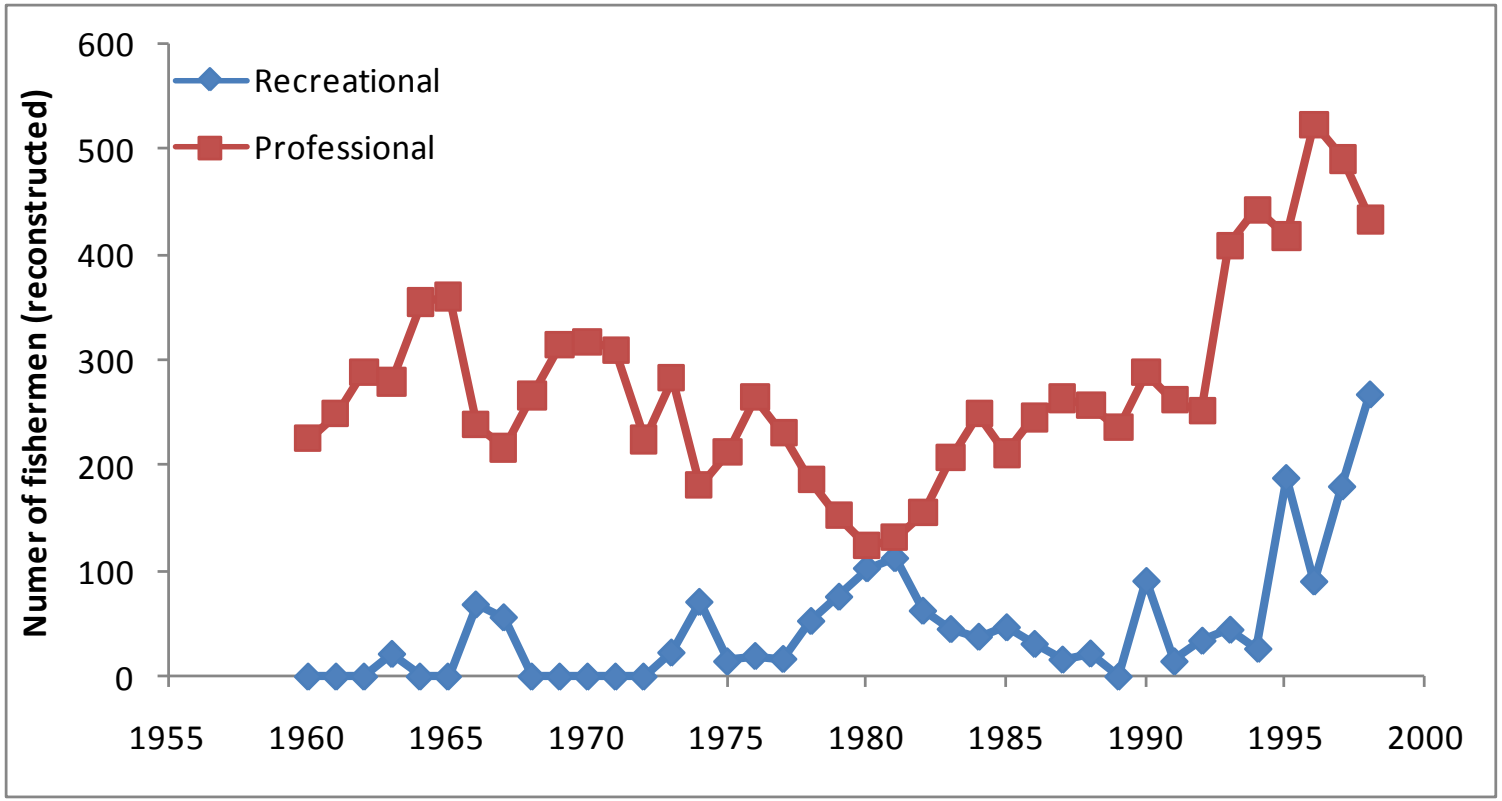


And together with some recent effort data, we calibrated catchability coefficients

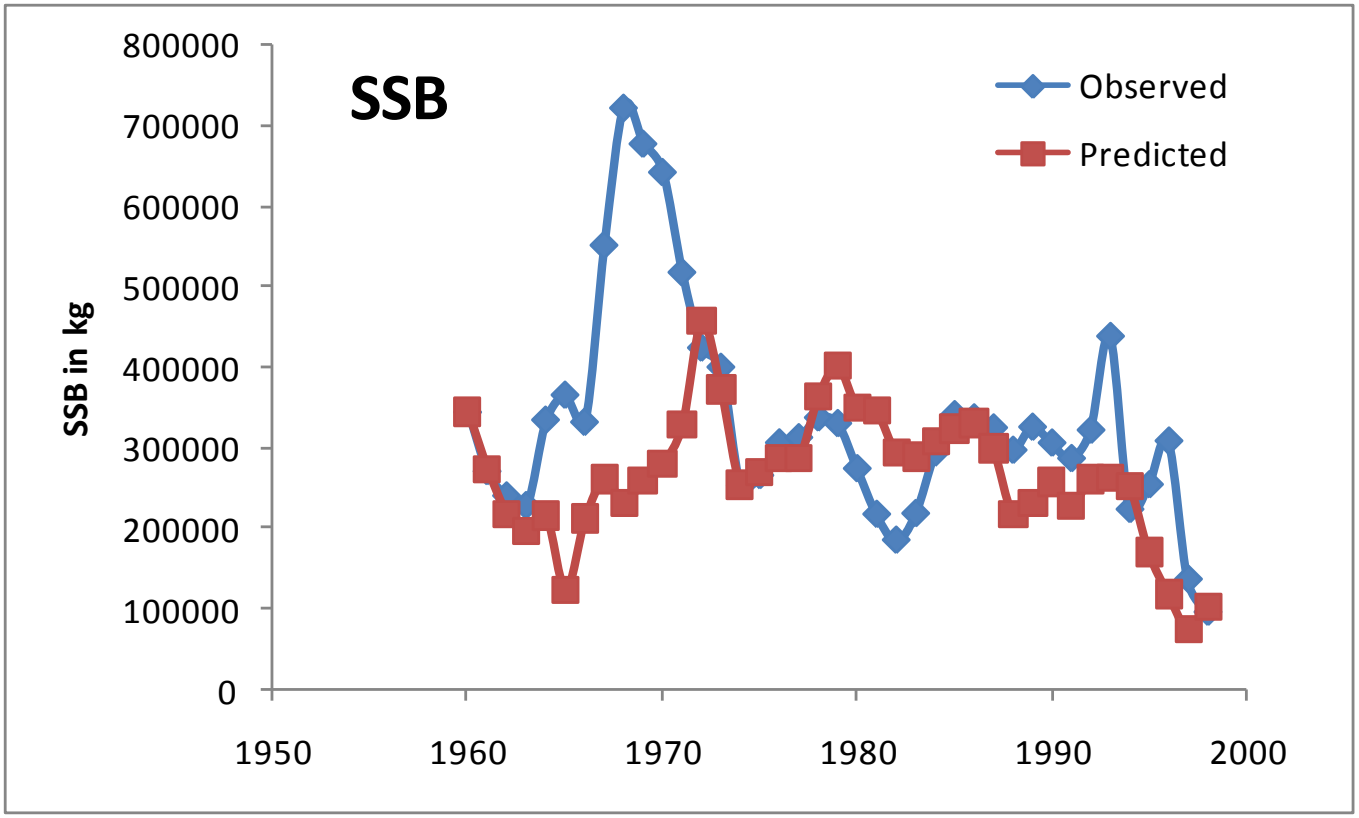
Catchability



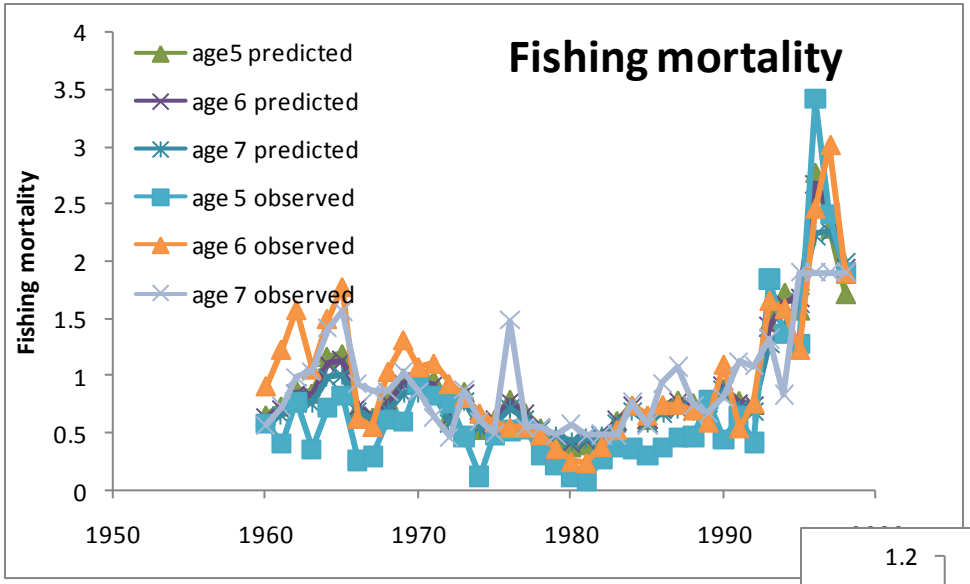
Then we estimated the number of fishermen for the entire VPA timeseries



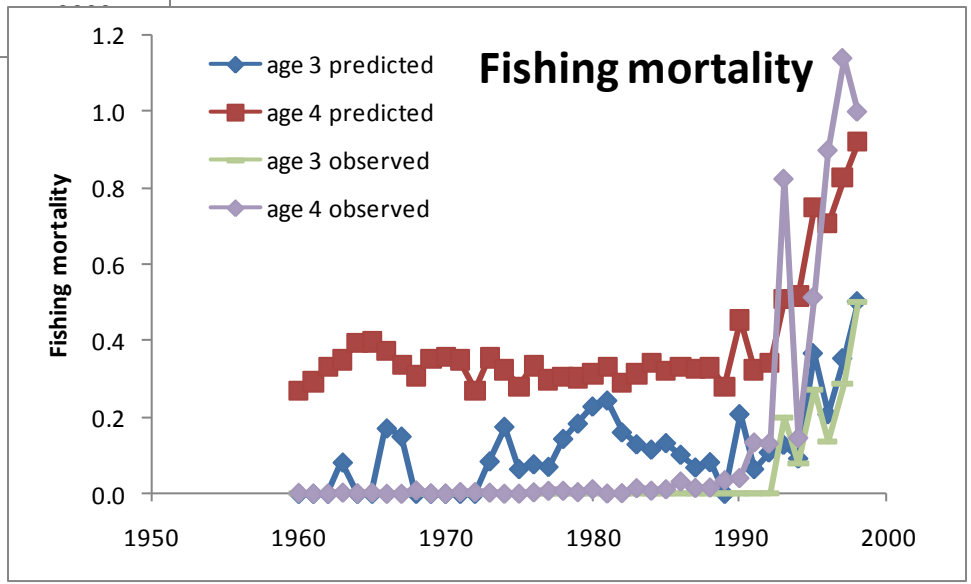
And did a model hindcast:



Our model now fits older pikeperch fishing mortality quite nicely, but overestimates for ages 3 and 4

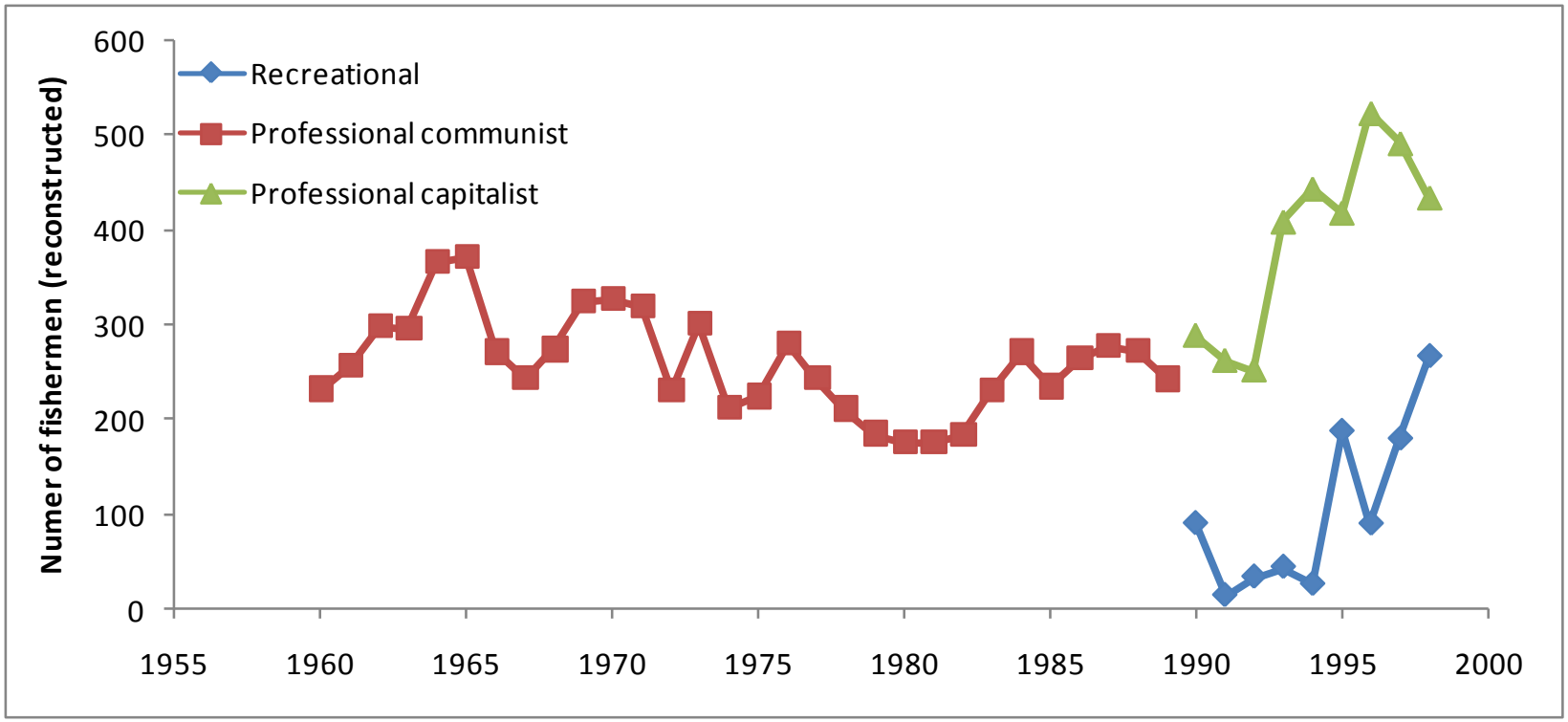


Ages 5 - 7

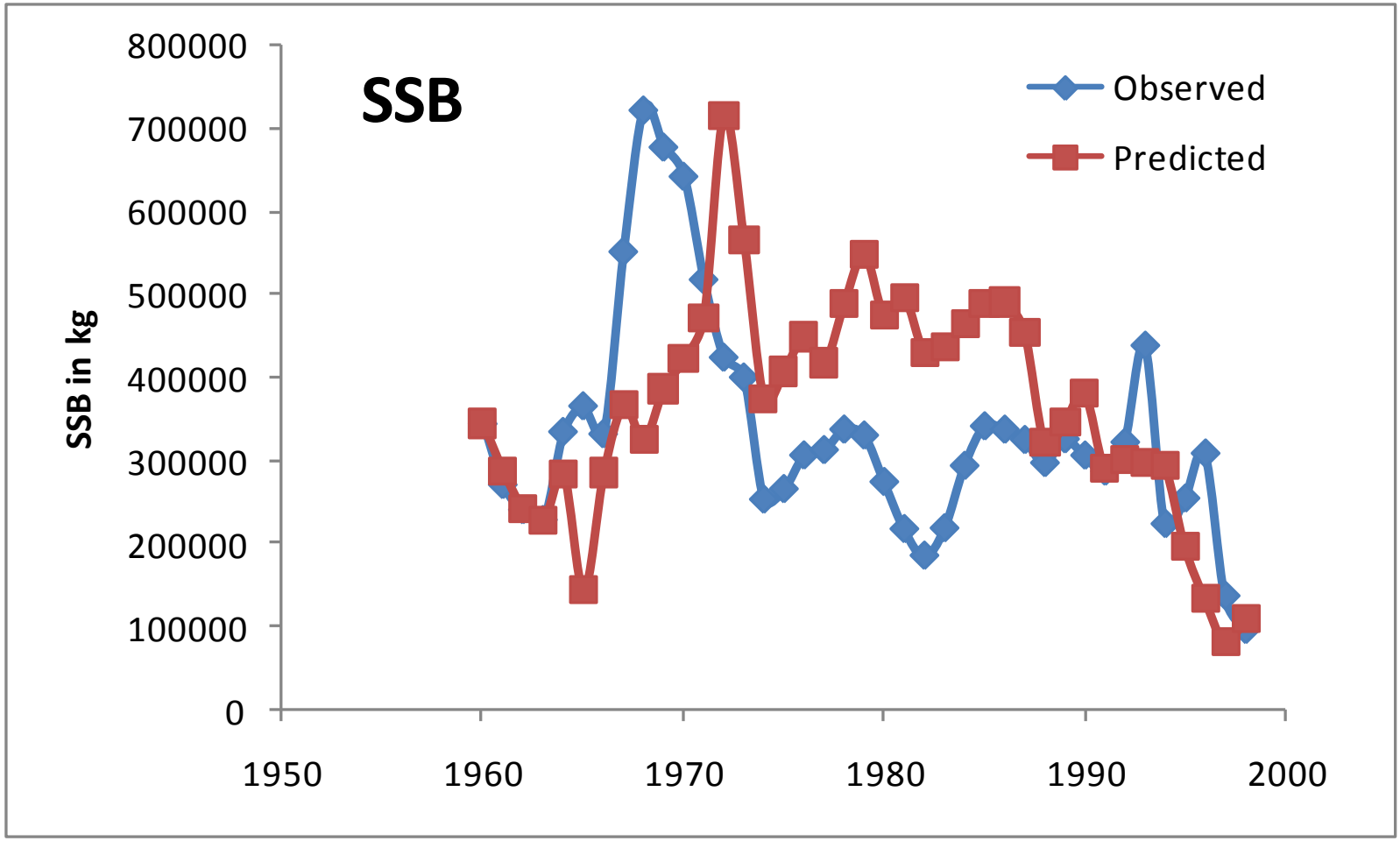


Ages 3 - 4

Taking into account that fishing pattern changed in 1990:



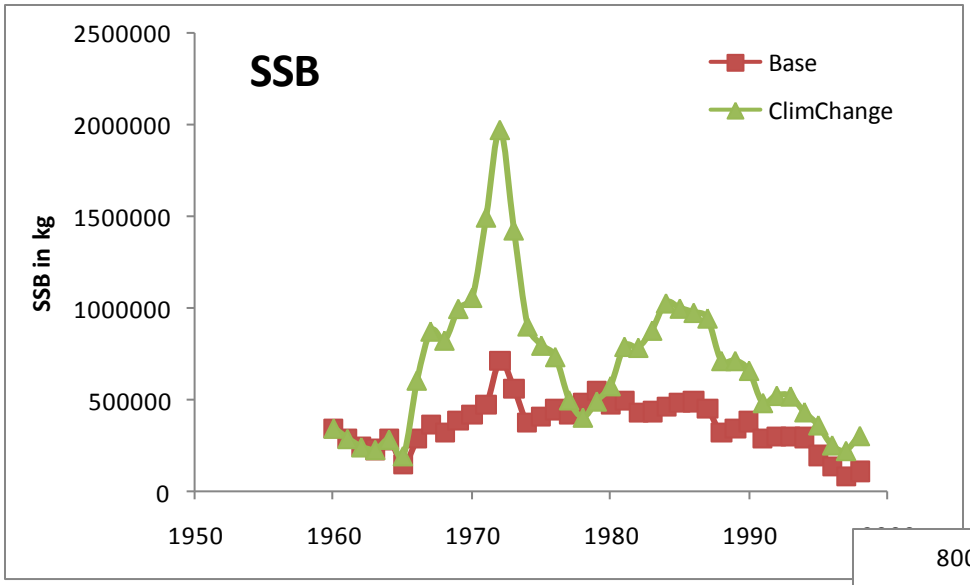
Taking into account that fishing pattern changed in 1990 the model fits observations better

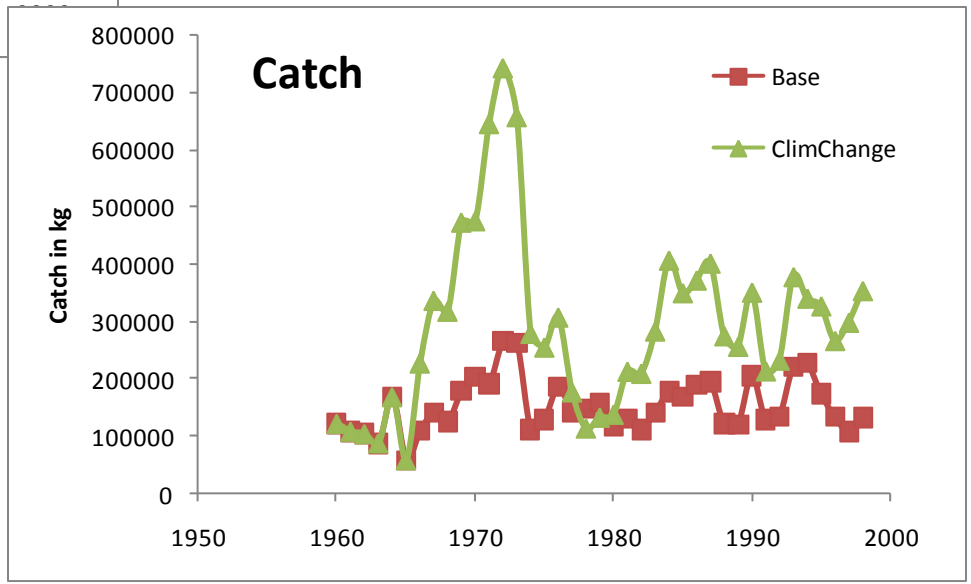


Scenarios

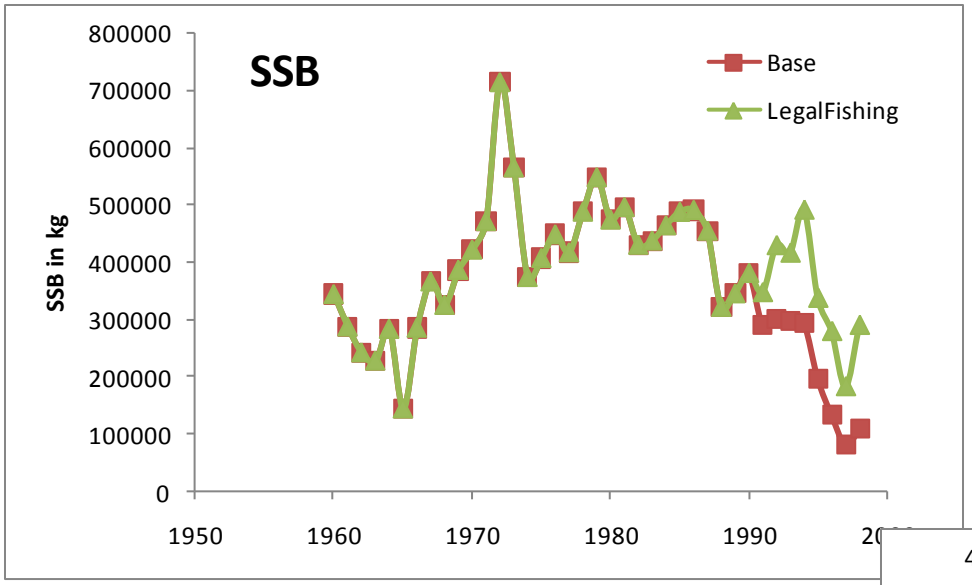
- Climate change: Summer temperature increased by 2 C
- No illegal fishing of age 3 and 4 pikeperch

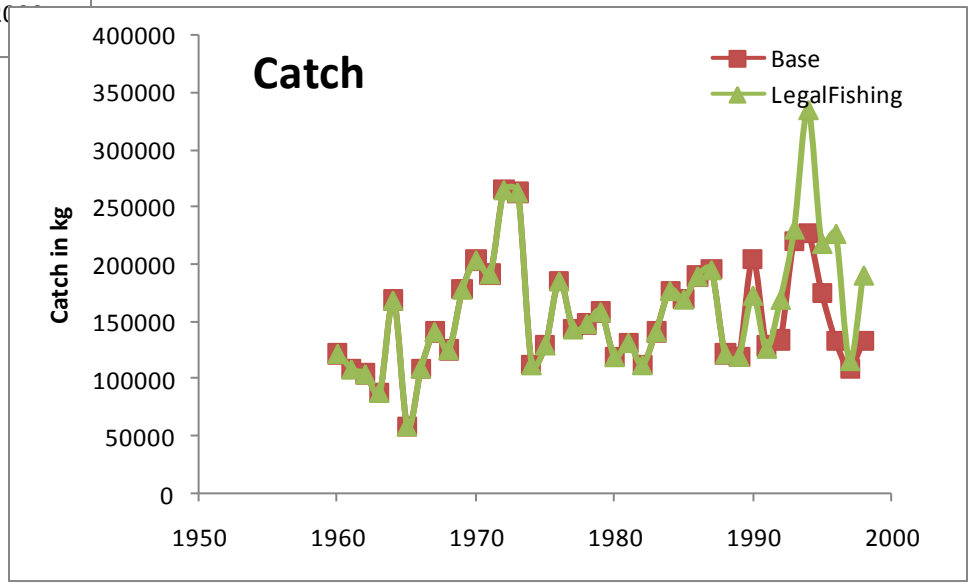
Pikeperch will benefit from warmer future climate





Main cause of the decline in stock was the increased fishing effort after 1990





Loose ends...

- Couple model to Gulf of Riga and Parnu Bay productivity
- Write appraisal step report