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Topic of interest:

BG-2-2015: Forecasting and anticipating effects of climate change on fisheries and aquaculture

Headline:

The effect of climate change on the most important and less resilient exploited fish stocks in large north temperate lakes.

Potential contribution:

Our existing studies have focused on L. Peipsi (a large shallow lake on the border of Estonia and Russia), where multiple stressors (e.g. climate change, overexploitation and eutrophication) interact. L. Peipsi makes an interesting basin for analysis in comparison to other European lakes due to its abundant fish resources that are however severely overexploited by commercial fisheries. However, the climate change interactions with other stressors (e.g. overexploitation) have been paid disproportionately little attention.

Next to fish ecologists and mathematical modellers, sociologists are involved in our team. We explore the different institutional measures for integrating water management and climate change adaptation and mitigation. The mitigation of multiple stressors on most important and less resilient fish stocks is further complicated due to the transboundary nature of the lake: Lake Peipsi is the meeting point of European principles of assessment and management of water ecosystems on the one hand, and on the other hand, the Russian state principles that do not coincide with the Water Framework Directive or Common Fisheries Policy ideas.

Peipsi could be one of the flag-ship basins to be under analysis, as we have long-term data on exploited fish populations and other biota as well as key stressors (e.g. data on water temperature and level from the 1924, records of commercial fisheries since 1930s and limited data on trawl sampling since 1986 and limnological data from last decades etc. Based on this data specific interaction of multistressors - over-fishing and climate change, eutrophication and climate, especially heat waves, and natural fluctuations in water level etc. – need to be explored.

Research goals:

- To clarify the reasons behind the fluctuations in key fish populations at different temporal scales in inland waters;

- To clarify interactions of climate change and other stressors (e.g. eutrophication, overfishing) and their impact on exploited fish stocks;
- To forecast effects of global warming and climate change on fisheries and assess risks on fisheries management;
- To identify, how changes in fish community affect the whole lake ecosystem through the food-web;
- To ascertain whether fish in aquaculture systems are affected by similar problems facing the climate change;

Relevant publications:

Kangur, K.; Kangur, P.; Ginter, K.; Orru, K.; Haldna, M.; Möls, T.; Kangur, A. (2013). Long-term effects of extreme weather events and eutrophication on the fish community of shallow Lake Peipsi (Estonia/Russia). *Journal of Limnology*, 72, 376 - 387.

Jeppesen, E.; Mehner, T.; Winfield, I.J.; Kangur, K.; Sarvala, J., Gerdeaux, D.; Rask, M.; Malmquist, H.J.; Holmgren, K.; Volta, P.; Romo, S.; Eckmann, R.; Sandström, A.; Blanco, S.; Kangur, A.; Stabo, R.H.; Tarvainen, M.; Ventelä, A.-M.; Søndergaard, M.; Lauridsen, T. L.; Meerhoff, M. (2012). Impacts of climate warming on the long-term dynamics of key fish species in 24 European lakes. *Hydrobiologia*, 694, 1 - 39.

Ginter, Kai; Kangur, Külli; Kangur, Andu; Kangur, Peeter; Haldna, Marina (2012). Diet niche relationships among predator and prey fish species in their early life stages in Lake Võrtsjärv (Estonia). *Journal of Applied Ichthyology*, 28, 713 - 720.

Ginter, Kai; Kangur, Külli; Kangur, Andu; Kangur, Peeter; Haldna, Marina. (2011). Diet patterns and ontogenetic diet shift of pikeperch, *Sander lucioperca* (L.) fry in lakes Peipsi and Võrtsjärv (Estonia). *Hydrobiologia*, 660, 79 - 91.

Kangur, Andu; Kangur, Peeter; Kangur, Külli & Möls, Tõnu. (2007). The role of temperature in the population dynamics of smelt *Osmerus eperlanus eperlanus* m. *spirinchus* Pallas in Lake Peipsi (Estonia/Russia). *Hydrobiologia* 584: 433–441.

Kangur, Külli; Park, Young-Seuk; Kangur, Andu; Kangur, Peeter; Lek, Sovan (2007). Patterning long-term changes of fish community in large shallow Lake Peipsi. *Ecological Modelling*, 203, 34 - 44.