of subsurface biomass maximum layers is also investigated. Second, we prove that the recurrent tidal fronts simulated by ECOSMO corroborate well with those detected from satellite data. Spawning locations of fish (cod, plaice) are spatially associated with fronts system. By utilizing the simulation, we further investigate related characteristics of fronts such as current convergence, periodically mixing, nutrients enrichment and advection, to explain the bio-rich phenomena. The inter-annual variability of the fronts and the related impacts on the ecosystem are also explored.

11-P Assessment of a small lake trophic state in response to nutrient loading changes.

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Most of the lakes in European Russia are significantly affected by pollution. In Moscow Region, only a handful of lakes remain in their natural state, and their number is constantly further decreasing. In those circumstances, it is important to understand the consequences of increasing pressure on aquatic ecosystems, particularly nutrient loading.

Lake Glubokoe, a small mesotrophic lake in Moscow Region, Russia, was targeted as a subject for this research. Lake has no inlets and isn't affected by human activity, allowing to suggest that the lake's natural state is not altered. One-dimensional MyLake model was used to calculate annual dynamics of vertical distributions of water temperature, chlorophyll, and mineral phosphorus concentrations. Data from Mozhaysk weather station was used for meteorological input. The model was calibrated on extensive field data from 2017 and evaluated on less frequent monitoring data from 1991–2015. Model validation showed a good convergence of model output and observations after calibration.

The possible consequences of increasing phosphate loading into the lake were studied by conducting several model scenarios calculations. Phosphate concentrations for different scenarios were set according to Russian standards. These regulations allow different phosphate concentrations in wastewater runoff depending on receiving lake's trophic state. Wastewater discharge was also varied in different scenarios.

Simulation results show the trophic state of Glubokoe Lake to be shifting to eutrophic even when phosphate concentration in wastewater is within the limits set for mesotrophic lakes. If phosphate concentration in wastewater is set according to regulations for eutrophic lakes, the effect of phosphate loading becomes devastating, leading to rapid degradation of the lake ecosystem. It is also shown that phosphate concentration plays a more critical role than wastewater discharge.

The study is financially supported by the Russian Science Foundation (Grant No. 14-17-00155) and the Russian Foundation for Basic Research (Proj. 18-35-00691 mol_a).

12. Paleolimnology and long-term changes in aquatic ecosystems

12-O Paleolimnology meets conservation biology: Developing tools to track long-term dynamics in bird populations.

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Nutrient and contaminant fluxes across ecosystem boundaries via biovectors (such as

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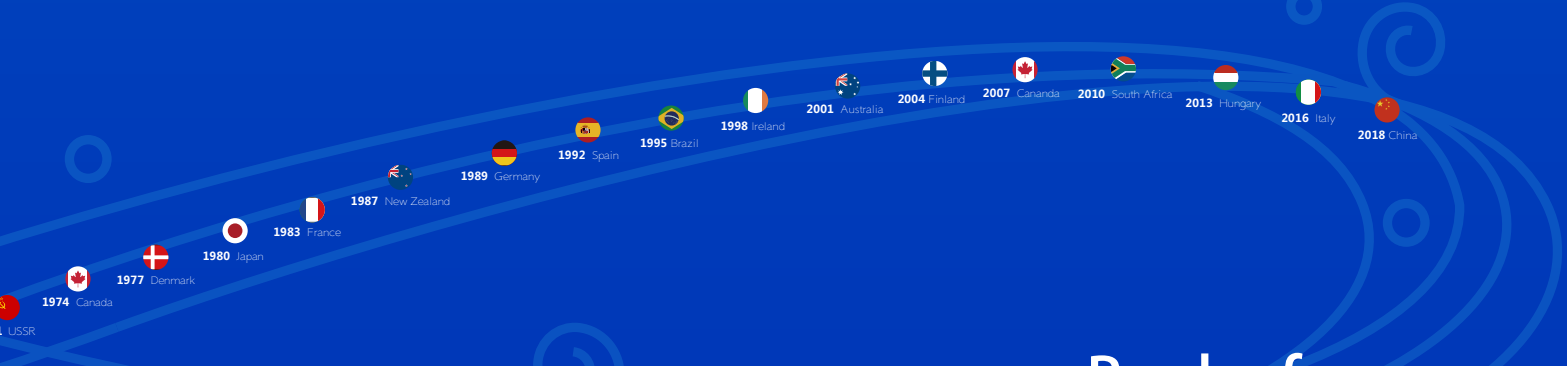

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Baldi Memorial Lecture: Mixing Dynamics: From Hutchinson to the 21st Century. *Sally MacIntyre*

UCSB, United States

The advent of high resolution instrumentation combined with theory, experimentation, and modeling allows us to extend former classifications and understanding of mixing dynamics of lakes. These new approaches remain underutilized but inclusion will enable predictions of mixing and consequences for the fluxes of nutrients, dissolved gases, and plankton. Hutchinson's lake classification schemes considered the duration and timing of events that create or erode stratification. Internal waves occur with stratification. New classification schemes for internal waves predict whether they are seiches or non-linear, and break near-shore or mid-lake. By classifying lakes with these schemes, we will develop improved understanding of the dynamics of dimictic, polymictic and monomictic lakes, whether communities of organisms are layered or dispersed, and whether nutrient supply to the euphotic zone is due to recycling within it or to abiotic processes inducing fluxes from deeper depths. The mixing of incoming plumes of stormwater with their load of nutrients or pollutants depends on the extent of stratification and resultant internal wave dynamics. Convection, that is circulation driven by cooling at the air-water interface, sediments heating overlying water, or horizontal variability in rates of heating or cooling, is now known to be a critical driver of circulation in lakes at all latitudes. Inclusion of these processes enable prediction of whether flows from inshore are concentrated or diluted. Using schemes that contrast time scales of mixing and of advection with time scales of reaction rates will allow us to predict the impacts of changes in land use and climate on species composition, ecosystem productivity, greenhouse gas formation and evasion, and the overall quality of our inland waters.