Aquatic macrocosms datasheet - CEREEP-Ecotron IleDeFrance

Summary and figures

The aquatic macrocosms facility of the CEREEP is composed of 16 experimental (or artificial) lakes oriented north-south and 2 large reservoir lakes for storage and drainage. Lakes are arranged in rows of 4 units (see fig. 1) with interconnection between pairs of lakes north/south thanks to dispersal channels that can be closed or opened according to the needs of the experiment. Every experimental lake hosts an autonomous multiparameter probe system made out of 6 sensors (pressure, dissolved oxygen, temperature, fluorescence, pH and photosynthetically active radiation (PAR)). There are 4 anemometers and 4 net irradiance meters distributed in 4 different lakes of the platform. A weather station registers atmospheric pressure, air temperature, relative humidity, rainfall, photosynthetically active radiation, solar irradiation and wind speed and wind direction. These experimental lakes were designed for long term experiments.

Figure 1: Macrocosms platform. 4 rows of 4 lakes oriented north-south. Storage lake on the south and drainage lake on the north

Ongoing projects

The Experimental Lake Platform is available year round for collaboration on an on-going project (2018-2021), titled “New insights on the links between global changes, community structure and ecosystem stability (ECOSTAB)” funded by the French National Research Agency (ANR) leaded by Dr. Elisa Thebault and Dr. Gérard Lacroix. ECOSTAB aims to experimentally test the consequences of eutrophication and loss of top predators on food-web structure and stability of aquatic ecosystems in the experimental lakes of the PLANAQUA platform.

Since 2015, half of the 16 artificial lakes (750 m^3 each) have been regularly enriched with inorganic phosphorous (KH_2PO_4) to mimic possible water eutrophication due to anthropogenic activity (urban sewage, agriculture, industry., etc.) compared to natural oligotrophic conditions. In winter 2017, different fish communities of several species with or without big predators (pikes) have been introduced in the lakes in a four-factorial set-up crossed with the nutrient manipulation. The heterogeneity (littoral, pelagic and benthic habitats) and unusually large scale of these experimental systems recreate in this way real-size ecological communities with complex food webs.

The main objectives of the ongoing project are to: (i) monitor the main abiotic and biotic parameters and climatic variables of the lakes at fine temporal scales in order to characterize the temporal dynamic community structure and the ecosystem processes. (ii) analyse the effects of nutrient enrichment and top predator loss on the variability of different ecosystem properties (physical/chemical, community responses, and lake metabolism) at different time scales and on the food web topological structure at different seasons. (iii) Investigate the effects of nutrient enrichment and top predator loss on the resistance and resilience of different ecosystem properties to extreme climate events.

These aims will be attended through extensive sampling campaigns during the three years of the project:

Every 3 months samples of phytoplankton, zooplankton and micro-zoo-benthos will be identified to the lowest possible taxonomic level, measured for body size and enumerated by microscopy. Macro-invertebrates will be sampled in the three main zones of lakes (lake sediment, littoral areas, and pelagic zones). Periphyton development and dominant pigment classes will be measured by fluorimetry. Fish populations will be accurately estimated using mark-recapture and removal methods.

Once a month, we will measure total alkalinity, conductivity, turbidity, dissolved O_2, dissolved nutrients: NO_2–, NO_3^-, NH_4^+, PO_4^-, N-tot, P-tot, total Chlorophyll a and cyanobacteria, phytoplankton functional pigment groups as well as zooplankton biomass.

Daily (every 2 hours) in each lake a set of automated sensors will record vertical profiles of water temperature, dissolved oxygen, depth pressure, pH, total chlorophyll and photosynthetically active radiation (PAR). A Campbell weather station automatically records (every 10 min) air temperature, air pressure, relative humidity, solar radiation, photosynthetically active radiation and rainfall of the platform. Four net radiometers and 4 anemometers, installed above the surface of 4 lakes, record data every 30 minutes.

Specification table of the aquatic macrocosms facility

Aquatic macrocosms	
General characteristics	
Design	1. 16 experimental lakes 2. 2 artificial lakes for storage and drainage
Dimensions	1. Artificial lakes: 750 m^3, length 30m x width 15m x depth 2,80m. 2 shallow littoral areas (west and east of each lake) filled with macrophytes: length 30m x width 1,5m x depth 2,80m. 4 series of 4 interconnected lakes . 2. Storage and drainage artificial lakes: 5000 m^3, length 126 m x width 15m x depth 3m.
Replicates	16 replicates
Confinement	None. Platform protected from medium size birds (*ie* cormorants) with a net
Weather and habitat control	
Temperature	No temperature control, natural conditions
Rainfall	No control, natural conditions. Water level can be adjusted with the reservoir lakes
Instrumentation	
Autonomous multiparameter probe	Pressure, dissolved O_2, temperature, fluorescence, pH and photosynthetic active radiation (PAR) every 2 hours at 8 different depths
Pelagic algae	FluoroProbe (BBE-Moldaenke)
Benthic algae	BentoTorch probe (BBE-Moldaenke)
Field portable multiparameter probe	YSI EXO 2 parameters : Temperature / Dissolved O2 / Conductivity / pH/ ORP/ Chlorophyll a / Phycocyanin / Turbidity / Water pressure
Study systems	
Bacteria	Direct sampling
Phytoplankton	Direct sampling
Zooplankton	Direct sampling
Nutrients	Direct sampling
Biofilms	Direct sampling
Plants	Up to small aquatic vascular plants (shoreline species or vegetation rafts)
Animals	Up to small animal predators including insects and top predatory fishes
Communities	Aquatic freshwater ecosystems including fishes from the bottom to the top of the food chain