Celebrating 25 Years

Conference Program and Abstracts

Moving Towards the Future


1993
Mont Rigi, Belgium
6,149 km
1997
Kusatsu, Japan
11,242 km
2002
Irkutsk, Russia
8,793 km
2006
Berlin, Germany
6,106 km
2009
Ohrid, Macedonia
4,722 km
2012
Bogor, Indonesia
8,295 km
2015
Windsor, Canada
12,084 km
2018
Entebbe, Uganda
0 km

SIAL 8

Speciation in Ancient Lakes

Celebrating 25 Years and Moving Towards the Future

29 July–3 August 2018, Entebbe (Uganda)

Conference Program and Abstracts

Justus Liebig University Giessen, Germany

Mbarara University of Science and Technology, Uganda

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Welcome to SIAL 8

Dear delegate,

We warmly welcome you to the international conference "**SIAL 8 – Speciation in Ancient Lakes**" in Entebbe, Uganda. Our conference will cover topics ranging from evolution, (paleo)-limnology, health issues to conservation in those lakes that are unique and global hotspots of biodiversity but that are often endangered these days. It is our particular pleasure to host **SIAL** for the first time in Africa and at the same time to celebrate the 25th anniversary of **SIAL** at the shores of famous Lake Victoria.

The wide range of research fields covered reflects the complexity we face in the lakes systems. **SIAL** offers a great chance to establish crosslinks between disciplines and continents. We hope our meeting will help to foster new research projects and alliances. Moreover, we intend to raise awareness for the urgent need for capacity building and joint and concerted international action regarding challenges that are evident in all of the lakes, but particularly in the African lakes.

We hope you will enjoy the meeting,

the **SIAL 8** Organizing Committee

General Information

Coffee and Tea Breaks

Freshly brewed hot and cold beverages and refreshments with a selection of bites will be available during the morning and afternoon breaks at the lobby in front of the lecture hall. Two bottles of mineral water will be served per day for all participants.

Lunch

A buffet lunch will be available in the *Restaurant* and served for all who registered. Note that evening meals are not included in the conference package.

Conference Dinner

The conference dinner, which is included in the conference package, will take place at *Laico Lake Victoria* (*Poolside*).

Internet Access

All delegates will receive a free voucher with a WiFi access code with their conference package. Fast wireless internet access will be available throughout the meeting.

Meeting Rooms

Several seminar rooms for *ad hoc* discussions and meetings will be available throughout the conference in the immediate vicinity of the lecture halls. Please, contact the conference desk staff for access.

Security and Health Issues

Please, do not leave any valuables including mobile phones, laptops etc. unattended at any time. **We also request you to wear your badge at all times during the conference**. The staff supervising the refreshment and meal breaks has also been instructed to only serve delegates wearing the conference badge. Please, also note that walking at night in Entebbe is not advised. Motorbike taxis (boda bodas) are a fast and cheap but also somewhat dangerous mean of transport. Use reliable taxi services provided by the hotel.

We are virtually at the equator. Please, take health precautions, especially about malaria. The beaches at Lake Victoria might look inviting for a swim. However, it is not advised since chances contracting schistosomiasis are close to 100%.

Restaurants, Pubs and Bars

You will find a range of restaurants and pubs/bars within walking distance of the conference venue. Some hotspot areas for dining have been highlighted on the map on the inner back cover of the conference book, but this is by no means an exhaustive list. More information can be found, e.g. on TripAdvisor.

Service charge is often included in Uganda, so tipping is in recognition of decent service rather than a necessity (not more than 10%). It is very welcome though.

Places to See

Entebbe is located 36 km south of Kampala on a peninsula. The very green and nice town still has quite some administrative facilities and hosts around 90,000 inhabitants. We do not offer a dedicated program for accompanying persons, but Entebbe as the former colonial times capital has a lot to offer. Places worth visiting are for example the *Entebbe Botanical Gardens*. It's a nice place for birding, too. At the lakeshore, you will find the *Uganda Wildlife Education Centre* (*UWEC*), another sight in Entebbe and definitely a tourist highlight. It holds the typical African collection of animals (see picture below), including the largest chimpanzee facility in Africa. The beachside itself in Entebbe has some nice and authentic bars. For shopping, the brand-new Imperial Shopping Mall and Victoria Mall are (more or less) in walking distance (15-20 mins).

Uganda Wildlife Education Centre/Entebbe Zoo © Christian Albrecht

Venue

Laico Lake Victoria is a classical colonial style hotel just 5 min away from the airport. The tropical gardens with lush vegetation of royal palm trees and the views over Lake Victoria will nicely frame our conference.

Laico Lake Victoria © booking.com

Laico Lake Victoria © booking.com

Instructions for Presenters

Oral Presentations

Time slots for regular talks will be 20 mins (15+5), keynote speakers will have 40 mins (30+10). We must request you not to exceed the time slot allocated to your presentation.

Please, make sure that your presentation will run on a PC (PPT, PPTX, PDF files). Contact the conference desk if you wish to check whether your presentation runs smoothly on our computers.

Please, give us a copy of your presentation at the earliest possible time. Please, contact the support staff for uploading your talk onto our computers, latest the day before your talk.

Posters

Posters must be in portrait orientation and should not exceed the A0 format (c. 84 x 119 cm). The official poster presentation will take place on Tuesday. Please, put up your poster at the earliest possible time, so that **SIAL** delegates will have a chance to see the posters before the poster session during the lunch breaks on Monday and Tuesday.

Pins for fixing your poster onto walls are available at the conference desk.

All members of the scientific committee present will select the two best student talks and poster presentations.

Special Events

Icebreaker

Sunday, 29 July, starts at 18:00, *Laico Restaurant*

The icebreaker will bring delegates together in an informal way in order to get into a "conference mood" and allow starting discussions already.

Poster Session & Drinks Reception

Tuesday, 31 July, 16:30-18:00, *Laico Conference Hall II*

Present your poster and take the chance to socialize while having a drink.

Excursions

Wednesday, 1 August

Uganda, our **SIAL** host country, is widely recognized as the "Pearl of Africa" and offers a tremendous range of touristic highlights including both cultural and natural treasures. There is a wealth of opportunities for pre- or post-conference excursions or simply vacation activities, either by individual travelling or guided tours (visituganda.com; visituganda.de). For those who want to visit the famous national parks, please, consult ugandawildlife.org.

The excursion day during the **SIAL** conference will be on Wednesday with an optional boat cruise on Lake Victoria (research vessel and visiting aquaculture facilities on the lake) and a land-based excursion to Jinja (source of the Nile, dam lake Bujagali, Spekes' monument and Kampala).

For those who want to stay in Entebbe rather, both the *Uganda Wildlife Education Center* and the *Entebbe Botanical Gardens* are within walking distances and are definitely worthwhile to be visited.

Independently, one could book a visit to Ngamba Island Chimpanzee Sanctuary (ngambaisland.org) or do a birding trip to Mabamba swamp with almost guaranteed shoebill sighting. For a taste of a typical tropical forest, there is a patch left at Kisubi, also very close to Entebbe.

Evening Lecture
Wednesday, 1 August, 18:00-19:00, *Laico Terrace*

Eric Verheyen: The hazards of oil exploitation in Africa's ancient lakes

Conference Dinner
Thursday, 2 August, starts at 18:00, *Laico Poolside*

Discussion Session
Friday, 3 August, 10:00-12:00, *Laico Conference Hall II*

Ted Lawrence (*ACARE*): Discussing strategies to overcome current and future research challenges on the African Great Lakes.

The newest efforts on large lakes research, especially on the African Great Lakes, are to create long-term processes by engaging the scientific community, to harmonize research efforts, and garner the resources necessary to conduct this research. This joint-discussion will ask participants to submit: 1) their key challenges on conducting research, 2) strategies necessary for them to continue their research effectively in the future, and 3) opportunities to increase collaboration and partnerships. This discussion is for all participants and will generate priority topics and opportunities to address the challenges of research on the African Great Lakes.

Sunday, 29 July

starts at 18:00	ICEBREAKER

Monday, 30 July

09:00-17:00	Registration / Opening / Oral sessions

Tuesday, 31 July

09:00-17:00	Oral sessions
16:30-18:00	POSTER SESSION & DRINKS RECEPTION

Wednesday, 1 August

	Excursions
18:00-19:00	EVENING LECTURE

Thursday, 2 August

09:00-17:00	Oral sessions
starts at 18:00	FAREWELL DINNER

Friday, 3 August

09:00-10:00	Closing remarks / Awards
10:00-12:00	DISCUSSION SESSION

Monday, 30 July

	REGISTRATION	
09:00 - 11:00	Registration desk at *Laico Lake Victoria*	
	OPENING OF CONFERENCE AND WELCOME ADDRESSES	
11:00	**Dean, Faculty of Science** Mbarara University of Science and Technology, Mbarara, Uganda	**Julius B. Lejju**
11:10	**SIAL president** Justus Liebig University Giessen, Giessen, Germany	**Christian Albrecht**
11:30	25th Anniversary of Speciation in Ancient Lakes — A brief history	**Koen Martens**
12:00	**LUNCH**	
	KEYNOTE	
13:30	Understanding adaptive radiation and explosive diversification through cichlid fish genomics	**Walter Salzburger**
	Symposium: COMPARATIVE STUDIES	
14:10	Unraveling African (ancient) lake freshwater sponge radiation, diversity and evolution	**Dirk Erpenbeck**
14:30	Historical diatom material from the East African Great Lakes	**Christine Cocquyt**
14:50	**TEA & COFFEE BREAK**	
15:30	Diversification dynamics in freshwater bivalves (Unionidae) from the East African Rift	**Claudia M. Ortiz-Sepulveda**
15:50	The family Lymnaeidae in ancient lakes: A review and synthesis of data on extant and fossil taxa	**Maxim V. Vinarski**
16:10	Drivers of species diversification vary with temporal scale in continental aquatic gastropods	**Thomas A. Neubauer**

Tuesday, 31 July

	KEYNOTE	
09:00	Tectonic, climatic, and volcanic factors influenced aquatic paleoenvironments at Lake Towuti during the past ~500,000 years	**Hendrik Vogel**
	Symposium: NEW HORIZONS	
09:40	Is differential gene expression in the female brain linked to assortative mating in a mouthbrooding cichlid (*Ophthalmotilapia*) from Lake Tanganyika?	**Maarten Van Steenberge**
10:00	The nature of eco-morphological divergence in the adaptive radiation of cichlid fishes in Lake Tanganyika, East Africa	**Fabrizia Ronco**
10:20	**TEA & COFFEE BREAK**	
11:00	Adaptive morphological divergence in an ongoing radiation of *Lanistes* gastropods from Lake Malawi	**Bert Van Bocxlaer**
11:20	Diatoms in Lake Baikal: Neglected diversity revealed on the basis of molecular and morphological investigation	**Maxim Kulikovskiy**
11:40	Deep amplicon sequencing as a tool to study community structure and speciation in trematodes	**Cyril Hammoud**
12:00	**LUNCH**	
	KEYNOTE	
13:30	Approaching Africa's future fresh water challenges through capacity building and collaboration	**Ted Lawrence**
	Symposium: PALEO-PERSPECTIVES	
14:10	Ostracod community development in a proposed paleo-ancient lake of the Paleogene Nanning Basin, South China	**Manja Hethke**
14:30	A Late Pleistocene mollusc fauna of the north Caspian Sea sheds light on pre-crisis community structure	**Sabrina van de Velde**
14:50	**TEA & COFFEE BREAK**	
15:30	How to distinguish between ecophenotypes and actual species: Viviparid assemblages from supposedly ancient lake Lugu, Yunnan	**Robert Wiese**
15:50	Ecosystem switches over millennia: Diatom assemblages in Lake Towuti paleocores	**Mariam Ageli**
16:10	Community assembly processes and their drivers: A case study in nature over time	**Elena Jovanovska**
16:30	**POSTER SESSION & DRINKS RECEPTION**	

Thursday, 2 August

	KEYNOTE	
09:00	Towards a dynamic equilibrium: Interdisciplinary deep drilling campaign in ancient Lake Ohrid reveals slowdown of speciation and extinction rates over evolutionary time scale	**Thomas Wilke**
	Symposium: CONSERVATION & MANAGEMENT	
09:40	Lake Kivu (East Africa): Recent biogeochemical records from sediment archives	**Fabrice A. Muvundja**
10:00	Impacts of water level fluctuations on fisheries of Lake Turkana: World's largest permanent desert lake	**Kevin O. Obiero**
10:20	**TEA & COFFEE BREAK**	
11:00	Lake Lanao: forgotten and neglected for decades	**Björn Stelbrink**
11:20	East African freshwater fish impasse: Molecular genetic diversity and differentiation of the anthropogenically threatened *Oreochromis niloticus* inferred from microsatellite genotyping	**Papius D. Tibihika**
11:40	Performance of African catfish *Clarias gariepinus* (Clariidae) fry fed on live rotifers, formulated diet and a mixture of rotifers and formulated diet	**Gerald Kwikiriza**
12:00	**LUNCH**	
	KEYNOTE	
13:30	Fish parasites in ancient lakes: An overlooked source for speciation research	**Tine Huyse**
	Symposium: BIODIVERSITY PATTERNS	
14:10	Freshwater mussel radiations reveal ancient rivers existence	**Ilia V. Vikhrev**
14:30	Elevated diversity within the Anatolian drainage basins is a legacy of *in-situ* speciation and less the result of a refugial isolation	**Arthur F. Sands**
14:50	**TEA & COFFEE BREAK**	
15:30	Genomic architecture of adaptation and strong mate recognition of resident three-spine stickleback populations in emerging White Sea coastal lakes	**Nikolai Mugue**
15:50	Genetic characterization of small African barbs in the Lake Victoria drainage system, Kenya	**Violet Ndeda**
16:10	Many fish in small waters: Speciation in Cameroonian crater lakes	**Adrian Indermaur**
16:30	Morphological variations among native populations of the Nile tilapia (*Oreochromis niloticus* L. 1758) in East Africa	**Esayas A. Negash**
18:00	**FAREWELL DINNER**	

Friday, 3 August

CLOSING REMARKS & AWARDS

09:00 **SIAL president** — **Christian Albrecht**
Justus Liebig University Giessen, Giessen, Germany

DISCUSSION SESSION

10:00 Discussing strategies to overcome current and future research challenges on the African Great Lakes — **Ted Lawrence**

Abstracts

Ecosystem switches over millennia: Diatom assemblages in Lake Towuti paleocores

Mariam Ageli[1], Douglas Haffner[1], Paul B. Hamilton[2], James Russell[3] & Hendrik Vogel[4]

[1]Great Lakes Institute for Environmental Research, University of Windsor, Windsor, Canada
[2]Phycology Section, Canadian Museum of Nature, Ottawa, Canada
[3]Department of Earth, Environmental, and Planetary Sciences, Brown University, Providence, USA
[4]Institute of Geological Sciences & Oeschger Centre for Climate Change Research, University of Bern, Bern, Switzerland

Diatoms are key primary producers in lake ecosystems, the types of diatom communities that are present within a freshwater system can provide a wealth of information on the lake's biology. By studying diatom communities in sediment cores from ancient lakes, we can track changes in ecosystems over many millennia. We analyzed the diatom content of two deep sediment cores from ancient Lake Towuti, Indonesia with each core containing two main strata of high diatom content, separated by 7-8 m of sediment. We hypothesized that both strata contain the same absolute and relative abundances of diatom species across both cores demonstrating high resilience. In both cores, the two main diatom strata were dominated by planktonic *Aulacoseira*. In between these two strata, however, the diatom community was dominated by a more benthic community dominated by *Cymbopleura*. Another layer of *Cymbopleura* was also observed near the top of the second core, in a section of the core where sedimentation was modified by the opening of the nearby Mahalona River. Although the reappearance of the planktonic dominant community after thousands of years of domination by a benthic community suggests high resilience, the opening of the Mahalona River appears to have resulted in the food web of Lake Towuti being primarily dependent on benthic primary producers.

Exploring the depths of a tropical deep lake — Biodiversity and environmental change in the profundal of Lake Malawi

Christian Albrecht[1,2], Elena Jovanovska[1], Charo Lopez-Blanco[1], Benjamin Wilden[3], Walter Traunspurger[3], Annett Junginger[4,5], Zuze Delanya[6], Dalitso Kafumbata[6], Catharina Clewing[1], Immaculate Tumwebaze[1], Bert Van Bocxlaer[7,8,9], Claudia M. Ortiz-Sepulveda[7], Timothy G. Bromage[10] & Friedemann Schrenk[11,12,13]

[1]Department of Animal Ecology and Systematics, Justus Liebig University Giessen, Giessen, Germany; [2]Department of Biology, Mbarara University of Science and Technology, Mbarara, Uganda; [3]Department of Animal Ecology, University of Bielefeld, Bielefeld, Germany; [4]Micropaleontology, Eberhard Karls University Tübingen, Tübingen, Germany; [5]Senckenberg Center for Human Evolution and Paleoenvironment, Tübingen, Germany; [6]Department of Geography and Earth Sciences, University of Malawi, Zomba, Malawi; [7]UMR 8198 – Evolution, Ecologie, Paléontologie, CNRS, Université de Lille, Lille, France; [8]Limnology Research Unit, Department of Biology, Ghent University, Ghent, Belgium; [9]Department of Geology, Ghent University, Ghent, Belgium; [10]College of Dentistry, New York University, New York, USA; [11]Paleoanthropology Section, Senckenberg Forschungsinstitut und Naturmuseum, Frankfurt, Germany; [12]Department Paleobiology and Environment, Goethe University Frankfurt, Frankfurt, Germany; [13]Cultural & Museum Centre Karonga, Karonga, Malawi

Research in ancient lakes has historically focused largely on the littoral, mostly due to accessibility and technical limitations. Apart of Lake Baikal, knowledge of life and environmental conditions in greater depths (>50 m) remains very limited in many of the deep lakes. This situation is particularly relevant for tropical lakes, including Lake Malawi. Although, information on life in the profundal of Lake Malawi is scarce, we currently see indications of a creeping biodiversity crisis and pronounced environmental change, likely caused by cultural eutrophication. Moreover, effects of global threats such as climate change and local threats like pollution, increased sedimentation etc. are poorly documented, implying that potentially important limnological changes go unnoticed.

With an international and interdisciplinary research program entitled "Exploring biodiversity and ecosystem change in the depths of Lake Malawi" we aim at a detailed understanding of how biodiversity is distributed along the depth gradient. We further want to quantify the extent and effects of ongoing environmental changes on the patterns of biodiversity. To collect the required data a permanent research platform has been developed and we will use a variety of standard biological and (paleo)limnological proxies in combination with state-of-the-art environmental analyses, such as eDNA and high-resolution microplastic and algae analyses. The obtained results will be framed in the long-term environmental inferences developed by the Lake Malawi deep-drilling project.

We aim to generate a significantly enhanced understanding of biodiversity and the overall ecological status of Lake Malawi in the Anthropocene.

Performance of African catfish *Clarias gariepinus* (Clariidae) fry fed on live rotifers, formulated diet and a mixture of rotifers and formulated diet

Apulnal Beingana[1], Gerald Kwikiriza[2], Gladys Bwanika[3], Ivan Abaho[4] & Andrew Arinaitwe Izaara[5]

[1]Kabale District Local Government, Kabale, Uganda
[2]National Agricultural Research Organization, Kachwekano Zonal Agricultural Research and Development Institute, Kabale, Uganda
[3]School of Biological Sciences, Makerere University, Kampala, Uganda
[4]National Agricultural Research Organization, Bulindi Zonal Agricultural Research and Development Institute, Hoima, Uganda
[5]National Agricultural Research Organization, Mukono Zonal Agricultural Research and Development Institute, Mukono, Uganda

Long larval and fry rearing period due to unreliable live food sources are problematic in fry rearing process affecting aquaculture production in most hatcheries. As a result, this study investigated the performance of African catfish (*Clarias gariepinus*) fry fed on live rotifers, a mixture of rotifers and formulated diet (Ugachick feed 45%). Seven days post hatch fry of *Clarias gariepinus* were reared under three different treatments; A, B and C with triplicates in a complete randomized design in 40 L concrete tanks. Fry in treatments A and C were exclusively fed on live rotifers and formulated feed respectively. In B, the fry were fed on mixture of live rotifers and formulated feed for 15 days. At the end of the experiment, final mean total length (TL), specific growth rates (SGR) and survival rates (SR) were determined. Significantly highest ($p<0.05$) mean length (1.40±0.02 cm) and SGR (0.08%) were observed in treatment B followed by treatment A (1.10±0.02 cm, 0.07%). The least SGR (0.06%) was observed in fry solely fed on the compound diet (0.99±0.02 cm). The results of the study demonstrate a comparatively higher growth and fry survival (82.2%) when fed on the mixture of live rotifers and formulated feed, seven days after hatching.

Since no artificial feed formulation is yet available to completely substitute feeding live prey to young fish, it is concluded that a mixture of live and formulated diets are more suitable for feeding the African catfish fry seven days post hatch.

Endemics at risk and invasives at the doorstep: The current conservation status of Lake Malawi gastropods

Catharina Clewing[1] & Christian Albrecht[1,2]

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[2]Department of Biology, Mbarara University of Science and Technology, Mbarara, Uganda

Ancient Lake Malawi hosts a variety of native and endemic freshwater gastropod species for which the current conservation status is uncertain. This project aimed at an IUCN Red List for all gastropod species native to the Lake Malawi basin. The assessment was based on extensive field surveys conducted mostly along the Malawian shorelines of the lake and additional sampling from the Tanzanian shore. The recent literature on Lake Malawian gastropods has also been consulted for the species mapping and assessments that were carried out based on the guidelines provided by the IUCN. According to the recent assessment of all 38 native species considered to potentially inhabit the basin, a substantial amount has to be listed in the Red List. The number of Data Deficient species could be reduced to 5. Two species turned out to be not present currently. However, in addition to the native species, two globally invasive species have been found in close proximity to the lake. A checklist of species considered to be present in the basin is provided. It is clear that the majority of threatened species is endemic, however, no genus seems to be particularly affected. Deep-water forms are most endangered, and even formerly widespread and common ones seem to decline. Effective management and implementation of conservation strategies are urgently needed in order to improve the situation for the unique gastropod fauna of Lake Malawi, which is vitally important for the people around the lake who depend on the resources provided by Lake Malawi.

Historical diatom material from the East African Great Lakes

Christine Cocquyt[1] & Regine Jahn[2]

[1]Botanic Garden Meise, Meise, Belgium
[2]Botanischer Garten und Botanisches Museum Berlin-Dahlem, Freie Universität Berlin, Berlin, Germany

Algae material from the African Great Lakes was for the first time sampled during the Livingstone mission (1861-1863) at the shores of Lake Malawi; the findings were published by Dickie in 1879. We had to wait for more than forty years, during the Third Tanganyika expedition conducted by Dr. Cunnington (1904-1905), for a sampling in Lake Tanganyika. The results on the planktonic freshwater algae were published by G.S. West (1907) followed in 1954 by the overview work of Van Meel as a result of the "l'exploration hydrobiologique du lac Tanganika (1946-1947)". Among further important scientific missions to the region we must mention the German "Nyassa-See- und Kinga-Gebirgs-Expedition (1897-1898)". Material collected by Fülleborn and assumed to be lost during WWII was discovered in the Botanical Museum Berlin-Dahlem in the 1990's. It concerned samples belonging to the material from which Otto Müller (1903, 1904, 1905, 1910) described over 100 new East African diatom taxa. Re-investigation of this material is needed not only to make Müller's taxa described in German more accessible to the scientific community but also to evaluate possible new or endemic species and to solve taxonomic problems that have arisen since the renewed attention to African diatoms. As the original slides were destroyed, new permanent diatom slides had to be made and lectotypificiation to be done. The presence of unmounted original material has the advantage that in-depth investigation of the taxa by scanning electron microscopy can be conducted. Taxa described by Müller from the genera *Iconella*, *Surirella*, *Cymatopleura* and *Rhopalodia* (Cocquyt & Jahn, 2005, 2007a, b, c, d, 2014, 2018; Jahn et al., 2017) have been the subject of such re-investigations already.

KEYNOTE
TALK
POSTER

STUDENT

Population genomics and stakeholder involvement for the sustainable management of Lake Tanganyika clupeid fishery

Els L.R. De Keyzer[1,2], Maarten Van Steenberge[1,3,4,5], Zoë De Corte[3,4], Joost A.M. Raeymaekers[1,6], Federico C.F. Calboli[1], Nikol Kmentová[7], N'sibula Mulimbwa[8], Massimiliano Virgilio[3,4], Carl Vangestel[3,4], Pascal Masilya Mulungula[9], Maarten P.M. Vanhove[1,2,10,11,12] & Filip A.M. Volckaert[1]

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Worldwide, fisheries are threatened by the consequences of overfishing and climate change. For people inhabiting a developing region, where the local fisheries is often one of the only protein sources, collapse of the fisheries can be insuperable. The Lake Tanganyika fishery feeds millions of people in one of the poorest regions of the world. Lake Tanganyika is known for its endemic cichlid radiation, a model system for biology of speciation, yet most of its fishery target species are pelagic non-cichlids. About 60% of the catch consists of two endemic clupeid species: *Limnothrissa miodon* and *Stolothrissa tanganicae*. Good management of the lake's resources is necessary for the sustainability of the clupeid fishery. Formulation of a good management plan is hampered because of knowledge gaps concerning stakeholder opinions, and biology and population genomics of the target species. We combine modern techniques with classical methods to improve knowledge on fisheries science in a data poor environment, with the help of the local authorities, scientists, and communities. We looked at the genome of *S. tanganicae* to disentangle their population structure, important for the delineation of management units. 96 specimens from three locations over the entire North-South axis of Lake Tanganyika were analysed, through mitochondrial genotyping and RAD sequencing. Results from both methods show a lack of genetic differentiation between the sampling locations, highlighting the need for integrated management. Interviews with stakeholders and key-informants are ongoing to get insight into preferable solutions. The results will be communicated to policy-makers, to allow future integration into management.

The non-haplochromine fishes of Lake Edward: Diversity, biology and fishery

Eva Decru[1,2], Maarten Van Steenberge[1,2,3,4], Konstantine Odongkara[5], Nathan Vranken[1,2], Lindsay Cox[2], Senne Heeren[2], Amber Mertens[2], Annelies Kayenbergh[2], Mbalassa Mulongaibailu[6] & Jos Snoeks[1,2]

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The Lake Edward system includes lakes Edward and George, which are connected by the Kazinga channel, and several rivers feeding these lakes. Lake Edward lies on the boundary between the DR Congo and Uganda and is completely surrounded by protected areas. Fisheries are very productive, providing food and livelihood for many people. In the framework of the HIPE project (Human impacts on ecosystem health and resources of Lake Edward), the ichthyofaunal diversity, and the biology of the economically most important fish species is investigated. Haplochromines have been studied separately given their complex speciation patterns that led to an endemic species flock. Currently, 30 non-haplochromine species have been listed from the drainage system, including some introduced species such as *Coptodon zillii* and *Poecilia reticulata*. A DNA barcoding study (COI, mtDNA) covered 25 out of these 30 morphospecies, and revealed possible cryptic species in the genera *Labeo*, *Labeobarbus* and *Enteromius*.

Preliminary results of stomach content and stable isotope analyses provide first insights into trophic ecology of the six commercially most important species. All species, whether specialized or omnivorous, appear to be opportunistic, which is illustrated by a large variety of prey items in low proportions found in the stomachs.

Sizes at first maturity of *Oreochromis niloticus* and *O. leucostictus* were determined, with *O. leucostictus* appearing to mature faster in Lake Edward than in Lake George.

A socio-economic survey illustrated that demographic changes in the area resulted in fishing malpractices, affecting sustainability of the fisheries and causing a decline in livelihoods of communities.

Diversity of macro-invertebrates and water quality in Lake Kivu tributaries and the Ruzizi catchment

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Among the African Great Lakes, Lake Kivu occupies a special position. It is an ancient lake famous for its extraordinary limnological features. On the contrary, Lake Kivu's biodiversity has always been seen as depauperate, the drivers behind the species poverty have been attributed to the lakes limnological characteristics, including limnic eruptions. The benthic communities of the lake and its catchment have been largely neglected, in-depth studies on community compositions for major macrobenthic taxa are basically absent. Based on extensive sampling carried out between 2013 and 2017, this study aimed at assessing the benthic invertebrates and especially the mollusc diversity as well as water quality using the Tanzania River Scoring System (TARISS). These data were used to assess water quality in Lake Kivu tributaries and effluent River Ruzizi. Based on the Shannon–Wiener Index, macro-invertebrates diversity was found to be moderate in Ruzizi catchment and Kivu tributaries but slightly increased south of Kibuye. At least 5 species of gastropods and 2 species of bivalves were present in the rivers, which is compatible to the overall mollusc diversity described from Lake Kivu itself. Lake Kivu tributaries were found to be moderately polluted, water bodies in the Ruzizi catchment, too. Only rivers passing through the Nyungwe National Park had a significantly better water quality. Riverine habitat types in the Kivu basin are compared in terms of their macro-invertebrate diversity and their environmental correlates. The results are discussed in the context of water quality and public health.

Unraveling African (ancient) lake freshwater sponge radiation, diversity and evolution

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African sponges, particularly freshwater sponges, are largely understudied, compared to demosponges in most other geographical regions, although their taxon richness and ecological importance exceed by far other sessile freshwater filter feeders. Recent morphological studies started summarizing our current knowledge and conclude that the species richness of African freshwater sponges is underestimated and that geographic distribution ranges remain obscure. Freshwater sponges likely share a common ancestor, however their evolution, particularly the radiation into endemic and allegedly cosmopolitan groups is largely unknown. Freshwater sponges of at least 58 species of 17 genera and at least four families are described from Central and Eastern Africa. The discovery of additional, particular cryptic, species is very likely. The MCRA Tervuren hosts one of the largest collections of (Central) African freshwater sponges and their type material. Holotypes in theory constitute ideal targets for molecular taxonomy, however the success is frequently hampered by DNA degradation. We successfully obtained genetic information from a broad range of type material, and use these reference material for comparison with material from Lake Tanganyika and Lake Malawi in order to understand African (ancient) lake freshwater sponge radiation, diversity and evolution.

GBS data confirms past hybridization among congeneric cichlid species from Lake Tanganyika

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The littoral cichlid community of Lake Tanganyika has been severely impacted by paleoclimate-driven lake level changes that have affected their evolutionary history and distribution ranges. Earlier studies using mtDNA and microsatellite data have already shown how this resulted in intra-specific geneflow, which in some cases may have led to the origin of new species via hybridization. This is also the case within *Ophthalmotilapia*, a genus that mtDNA-based phylogenies could not resolve as monophyletic.

To obtain more detailed information on the extent of geneflow within and among species of this genus, we used GBS (genotyping by sequencing) and mitochondrial DNA sequences of over 400 specimens collected from 91 locations along the lake's >1,500 km shoreline. In contrast to the mtDNA phylogeny, the GBS-based tree supports the monophyly of *Ophthalmotilapia*. Beside this, other instances of incongruence between mtDNA and GBS datasets suggest natural hybridisation within the genus. Analysis of the genomic structure of populations of *Ophthalmotilapia*, using the ADMIXTURE software, reveals the presence of several populations of hybrid origin from parts of the shoreline where parent species co-occur. Genomes of these admixed populations do not cluster with those of inter-specific F1 hybrids bred in the lab. Except for instances of suspected past hybridisation, phylogeographic pattern within all *Ophthalmotilapia* species are similar for mtDNA and GBS datasets. Both show substantial geographical differentiation within *O. nasuta*, the species with the largest distribution range, suggesting undescribed taxic diversity. In contrast, *O. boops*, the species with the smallest distribution showed less population structure.

Deep amplicon sequencing as a tool to study community structure and speciation in trematodes

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Trematodes are parasitic flatworms that usually have a snail as an intermediate host and a vertebrate as final host. They are best known for their medical and economical importance as they cause various snail-borne diseases such as schistosomiasis, a neglected tropical disease affecting more than 200 million people worldwide. The Trematoda are a highly diversified and speciose group of organisms (~18,000 species described), where cryptic species abound. Knowledge on the biodiversity of freshwater trematodes and drivers of their evolutionary diversification remains limited, including for ancient lakes where the diversity of potential host snails is substantial. As in other parasitic organisms, host diversification and host switching have been put forward as important drivers of speciation in trematodes. Yet, testing this hypothesis is hampered by fragmentary knowledge of the helminth fauna of freshwater snails and the lack of molecular data for phylogenetic analyses. These limitations somewhat reflect research effort, but mainly the lack of tools to detect and identify these parasites directly from their hosts. To tackle this issue, we are developing a new tool based on multiplexing, pooling and next-generation-sequencing of nuclear and mitochondrial genetic markers targeting snail hosts and their parasites simultaneously. This tool, genotyping by deep amplicon sequencing, will increase the genomic coverage and thus the power to conduct phylogeographic and phylogenetic analyses. Applied to the study of trematodes hosted by populations of snails this tool has the potential to help disentangling the drivers of parasite diversification, snail-parasite co-evolution, and the ecological context of transmission of snail-borne diseases.

Stream-lake divergence and convergence in the Carolina Bay *Fundulus* species complex

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The *Fundulus* species complex of North Carolina streams and Carolina bays (small lakes, here Waccamaw and Phelps) is a modestly studied case of potential convergent evolution with important conservation implications. It was early on suggested that Lake Phelps *Fundulus* were *F. waccamensis* – a distinctive form and a federal species of concern – that had been introduced from Lake Waccamaw. More recently it has been hypothesized that, instead, these two species/populations independently and convergently evolved shallow, terete body shapes due to similar predation regimes. The central aims in this study were 1) to use genomic data to test the hypothesis that the terete *F. diaphanus* (in Lake Phelps) and *F. waccamensis* (in Lake Waccamaw) are independently derived; and 2) to investigate this complex for the trophic trait evolution seen in other fish systems, and thereby further elucidate the ecological factors and selection pressures contributing to diversity in this complex. Based on samples from the two lake populations and a stream/river population adjacent to each, we find that the Lake Phelps and adjacent stream population are most closely related, supporting the convergence hypothesis. In addition, we find that gill raker traits, key trophic characters in fish, exhibit patterns of divergence and convergence similar to those seen for body shape. We conclude that the *Fundulus* populations/species in Lakes Waccamaw and Phelps have likely evolved their phenotypic similarities convergently and, as in some other lake-stream divergences, feeding ecology has contributed to diversification. In light of our findings, both Carolina bay populations merit careful management.

Novel phylogenetic diversification method reveals an increase in equilibrium diversity for Lake Biwa fishes following geodynamically induced lake expansion

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Rates of immigration, speciation, and extinction determine diversity and community composition in insular ecosystems, with a balance among these rates resulting in equilibrium diversity. The general dynamic model of island biogeography (GDM) predicts that these processes depend on area and species richness and vary over the geological life cycle of insular ecosystems such as ancient lakes. While numerous studies have shown a correlation of richness and endemism with ecosystem age, little is known about how geodynamics influence the temporal trajectory of species diversity in lake biotas.

We investigated whether the geological driven increase in area and depth of Lake Biwa (Japan) was accompanied by a shift in immigration, speciation, and extinction rates and in carrying capacity. We extended the DAISIE (Dynamic Assembly of Islands through Speciation and Extinction) phylogenetic method to accommodate a temporal shift in these parameters. Using phylogenetic information on colonization and speciation times for more than 95% of all native fish species in the lake, we found a significant increase in immigration rate at 0.2 Myr. The detected shift in rates of species input and output indicates an increase in source-sink equilibrium diversity following a geodynamically induced lake expansion.

This study not only provides support for the mechanism proposed by the GDM in a young and immigration dominated insular ecosystem, it also presents a new toolbox that can facilitate a shift in focus from diversification in single ancient lake species flocks to the temporal dynamics of evolutionary community assembly of entire lake biotas.

KEYNOTE
TALK
POSTER

Ostracod community development in a proposed paleo-ancient lake of the Paleogene Nanning Basin, South China

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The identification of ancient lakes in the geological past relies largely on comparisons with recent analogues. A possible candidate is the Paleogene Lake Nanning (Guangxi, South China), which formed in a pull-apart basin that accommodated a succession of several hundred metres thick sediments. Its deposits archive the transition from the Eocene greenhouse to the Oligocene icehouse climate that prevails to modern days. A key faunal feature is the presence of a rich ostracod fauna that includes 44 described species in nine genera and four families (Cyprididae, Candonidae, Ilyocyprididae, and Limnocytheridae). This candonid-limnocytherid dominated flock might represent an early-stage ancient lake, while the presence of cyprids indicates a shorter-lived lake or an early phase in lake evolution. The overall species richness is comparable with that of ancient lakes such as Ohrid. However, the apparent ostracod radiation in Lake Nanning represents a time-averaged, Eocene to Oligocene species richness, of which several taxa are currently under revision. In order to evaluate Lake Nanning, we investigate ostracod standing diversity, levels of endemicity and paleocommunity development in two Oligocene sections of the Yongning Formation. Shell morphologies of "ancient-lake" character include mollusc gigantism (e.g. in the gastropod *Margarya*), which we tentatively relate to high nutrient contents, and the ample presence of spines in the ostracod *Chinocythere*; a feature that also occurs in marine ostracods. This might indicate convergent evolution or a phylogenetic relationship with marine biota. We investigate the developmental history by integrating faunal, morphometric, sedimentological, and geochemical proxies.

Fish parasites in ancient lakes: An overlooked source for speciation research

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Studying cichlids enhanced our understanding of speciation and radiation. In contrast, little is known about the evolution of their parasites. Nevertheless, more than half of the species on Earth are parasites. They have to adapt to a 'living habitat' (their host), which renders parasites excellent model organisms for speciation research. Lake Tanganyika's (cichlid) biodiversity and its importance as cradle and reservoir of ancient lineages seeding other radiations has resulted in a significant body of literature. Several invertebrate radiations were also reported from this lake. Remarkably, until recently virtually no research was carried out into the Tanganyika parasite fauna. With our team, we investigated the parasite fauna of a wide range of Tanganyika cichlids, with a focus on the monogenean ectoparasites. This resulted in dozens of new species descriptions and the construction of multi-marker molecular phylogenies. By comparing host and parasite phylogenies we found evidence for co-speciation, within-host (sympatric) speciation and limited host switching. Aside from host divergence, host ecology appears to play an important role in parasite evolution. Investigating different Tanganyika host lineages demonstrated that *Cichlidogyrus* saw different speciation pathways in different cichlid tribes, e.g. with variable levels of host-specificity. The existence of parasite morphotypes unique to Lake Tanganyika underscores the uniqueness of Lake Tanganyika's cichlid flock from a parasitological point-of-view as well. Apart from this overview of over 10 years of research on Lake Tanganyika's cichlid parasites, we will also briefly offer some perspectives on parasite diversity in other ancient lake fishes, such as Tanganyikan clupeids and latids, and Lake Trichonis gobies.

KEYNOTE
TALK
POSTER

STUDENT

Contribution of macrophytes in the conservation of benthic macroinvertebrates in a disturbed littoral zone of Lake Kivu

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Many ecological functions are associated with lacustrine coastal areas for the roles played for macrobenthic and fish communities. In Lake Kivu, this area is affected by changes of the environmental conditions of the lake and its watershed. Actually few studies are devoted to it despite its narrowness (<10% of the lake surface) and the presence of the 15 endemic cichlid species that live there. This study examines ecological functions associated with macrophytes using the characterization of macroinvertebrates in a basin disturbed by anthropogenic activities. The macroinvertebrates were sampled in one season in four sites, two with macrophytes and two without macrophytes, and were analyzed. The stands are characteristic of a coastal zone but differ qualitatively and quantitatively with the presence or absence of the macrophytes. The proportion of macroinvertebrates in macrophyte sites is significantly different from that of those harvested in macrophyte-free sites (χ^2 = 17.38; df = 2 and $p<0.001$). Macrophyte sites are diverse in taxa and (>60% of the abundances) The sites without macrophytes are characterized by the crustaceans which have >70% of the abundances. These preliminary results make that's possible to formulate hypotheses on the spatio-temporal variations of the functionalities of the coastal macrophytes. These should be checked by further and longer-term studies.

Many fish in small waters: Speciation in Cameroonian crater lakes

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For decades the cichlid radiations of the East African Great Lakes have famously proven to be prime model systems to study the processes of speciation and ecological adaptation. Even though first attempts in this direction are under way, these systems, due to their sheer size are notoriously difficult to assess in their entirety.

A series of volcanic crater lakes in Western Cameroon have evolved independent cichlid radiations with estimated ages of several thousand up to one million years and around ten endemic cichlid species each. These systems provide the rare possibility to examine entire species flocks, which have repeatedly evolved in distantly related lineages in the light of very similar ecological backgrounds.

Here we present first results from a multidisciplinary approach assessing the cichlid radiations of the crater lakes Barombi Mbo and Bermin in Western Cameroon. We are using RAD sequencing data for phylogenetic reconstruction and genomic outlier analysis as well as geometric morphometric analysis of body- and LPJ shape and a number of different ecological indicators such as intestine length and stable isotope data to disentangle the speciation processes in the system. Overall we can show high levels of adaptive ecological and morphological specializations, which seem to seem to have evolved convergently between the different systems. The adaptation of the vision system of deep-water adapted species, occurring in both of the systems, provides a particularly striking example in this context.

KEYNOTE
TALK
POSTER

STUDENT

Community assembly processes and their drivers: A case study in nature over time

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The interplay of deterministic processes such as environmental filtering or species competition and stochastic processes like dispersal or extinction govern community patterns in time and space. However, empirical evidence from nature about the relative contributions of these processes and their drivers in time is limited. This may be partly due to the lack of: i) continuous and well-constrained geological records, ii) well-preserved fossils, iii) taxonomical accuracy of both extant and extinct taxa, and iv) phylogenetic and trait-based information.

Here, we provide an empirical framework that integrates both neo- and paleontological information. Using a time-calibrated phylogeny with extant and extinct taxa, community time-series of relative species abundances, species traits, and paleoenvironmental parameters, we explored the phylogenetic community structure and inferred temporal assembly processes in diatoms from a sediment succession of Lake Ohrid (Macedonia/Albania). We found that environmental filtering is the prevailing process throughout the entire limnological history of the lake and identified shifts in the intensity by using change-point analyses. We also tested whether the intensity of assembly processes is determined by global climate and local environmental changes such as glacial-interglacial cyclicity, basin development, and volcanic activities by applying generalized additive models (GAMs). The resulting regression model revealed a significant influence of local environmental variables only.

With this framework, we provide the first empirical evidence for niche-based assembly processes from a natural system. We also revealed the underlying driving forces, thus contributing to a better understanding of evolutionary processes in ancient lakes over a long temporal scale.

Diversification of the diatom genus *Afrocymbella* in the East African rift lakes

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Diversity in unicellular organisms such as diatoms has evolved via multiple colonization events rather than by *in situ* diversification. However, a recent study demonstrated that diatoms may also radiate, and that this mechanism is perhaps most relevant in isolated and long-term stable environments such as ancient lakes. Among others, the endemic diatom genus *Afrocymbella* in the East African rift lakes has been proposed for testing *in situ* diversification.

Here, we present a time-calibrated phylogeny of *Afrocymbella*. We first reconstructed intra-generic relationships among species in the rift lakes to provide information about their phylogenetic status. We then used fossils obtained from the sediment records of both Lake Malawi and Lake Chala to assure the timing of diversification for some *Afrocymbella* species. By using a birth–death-preservation model, we quantified uncertainties in speciation and extinction times related to the fossil appearance in the sediments. Our analysis suggests *Afrocymbella* to be likely a monophyletic group that evolved in situ, but the underlying mechanisms remain poorly understood. Therefore, we will further test whether the speciation events were triggered by global climate and local environmental changes using the sediment records of Lake Malawi and Lake Chala.

This integrative approach is among the first studies on the East African rift lakes biota that combines molecular, paleontological and environmental data in order to accurately infer evolutionary patterns and processes in diatoms over time. Moreover, the approach strengthens recent findings that multiple colonization events are probably not the prevailing process in promoting endemic diversity of protists in ancient lakes.

Diatoms in Lake Baikal: Neglected diversity revealed on the basis of molecular and morphological investigation

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Lake Baikal is the world's deepest lake and contains the world's largest volume of surface freshwater. The lake's basin is situated in the so-called Baikal Lake rift zone. Ancient lakes attract the attention of the evolutionists and taxonomists as water bodies hosting a wealth of interesting plant and animal species. Diatoms are an integral part of the recent ecosystem and of ancient paleoecosystems of Lake Baikal. Results of our research on the Lake Baikal diatoms support the concept of local distributions in case of diatoms and protist species. Some not only species but also newly described genera are so unique in their morphology that can be considered a flagship taxa – species with conspicuous size, morphology – i.e. without a chance for their misidentification and misobservation during floristic studies. Molecular and morphological investigation of diatoms from Lake Baikal will be discussed. Large number of cultures (about 1,000) allow us to reveal a large species diversity on the basis molecular methods. Morphological peculiarities of newly described taxa are discussed.

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Anthropogenic pressures in the Caspian Sea may have caused a local decline of bivalve diversity

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In the Caspian Sea, a water basin rich in endemic species, diversification is influenced by variation in selective environmental parameters such as temperature, salinity and water depth. These environmental parameters were used previously to delimitate three sub-basins: i) North Caspian ii) Middle Caspian, and iii) South Caspian. In the last decades, a biodiversity decline – probably caused by a combination of natural and anthropogenic pressures – was reported from all three sub-basins. In this study, we analyzed the anthropogenic impact of 9 anthropogenic pressures by the use of Cumulative Effect Assessment (CEA) methods. Then, we investigated changes in the number of bivalve species in the Middle and South Caspian after the beginning of anthropogenic activities, comparing data from two expeditions: the first from 1876 and the second from 1986. Our results showed that in the North Caspian, the highest contribution was from poaching (46% of the CEA score), whereas in the Middle and South sub-basins came from pollution and invasive species (48% and 21%, respectively). All these three pressures are considered relevant factors affecting benthic species. In comparison to the first expedition, the second one recorded fewer species in some areas and the complete disappearance of two endemic Dreissenidae mussels, suggesting an impact from anthropogenic activities on the bivalve diversity. For the conservation of endemic species, it is important to assess the overlap of their suitable habitats with areas prone to an accumulation of anthropogenic pressures. Finally, our study may serve as baseline for a more sustainable economic development in ancient lakes.

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KEYNOTE
TALK
POSTER

Approaching Africa's future fresh water challenges through capacity building and collaboration

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The African Great Lakes support millions of people with protein, clean water, and transportation, but also face notable challenges, including climate change, agricultural runoff, deforestation, and overharvest of fish. Attempts to address the challenges facing freshwater resources often fall short due, in part, to the underinvestment in universities and research institutions and a lack of harmonization in research approaches. Environmental problems are often addressed by international agencies targeting short-term objectives, resulting in piecemeal or incomparable results, and driving research that may not be as important to the region. Strengthening research capacity and harmonizing research priorities on individual lakes can bolster long-term, strategic commitments, stable funding, and address ecosystem approaches to resource development and management. This talk focuses on a call from the international community to create centers of excellence to address African freshwater issues, and specifically, to enhance the capacity of riparian nations to conduct ecosystem research and monitoring to support sustainable basin development around the African Great Lakes. This talk discusses the institutional arrangements, objectives, essential features, and scope of an African initiative that can help build and sustain a system of world class research on the African Great Lakes.

25th Anniversary of Speciation in Ancient Lakes — A brief history

Koen Martens

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The 1st international workshop on "Speciation in Ancient Lakes" was organized in Mont Rigi, Belgium in March 1993. At this workshop, it was unanimously decided to permanently establish SIAL as an international organization, with the expressed purpose of stimulating interaction between scientists working on ancient lakes.

As a result of that meeting, a review was bought together that summarized the state of art in the field for the first time since the classical seminal review of Brooks (1950). The proceedings of that meeting were published as a special volume of *Archiv für Hydrobiologie* (Martens et al., 1994).

Besides a summary of both theoretical concepts of evolution in ancient lakes and practical activities in these systems, this publication provided a solid basis that initiated a renewed interest in ancient lake issues.

In the 25 years following that first meeting, all gatherings were organized at institutions with a long-standing history of ancient lake research, rarely far from one of the famous ancient lakes.

The 8th SIAL meeting seems a perfect occasion to look back on the history and development of SIAL as an organization, and its achievements as a unique platform that continues to stimulate the interaction among a growing body of scientists studying these lakes and the unique arrays of life forms they harbor.

The Freshwater Information Platform — An online network supporting freshwater biodiversity research

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Species distribution data are crucial for understanding biodiversity dynamics and the underlying drivers. This is especially the case for freshwaters, which are among the most endangered ecosystems globally. However, a huge body of data gathered by scientists and water managers is currently difficult to access: systematic data publishing practices have not been fully adopted yet and data embedded in scientific papers and research project websites are often challenging to extract. Hence an open science strategy, including open data, is becoming standard in research.

The Freshwater Information Platform (FIP) aims at pooling freshwater related research information from a variety of projects and initiatives to make it easily accessible for scientists, water managers and conservationists as well as for the interested public. The FIP consists of several major components, three of which form its "data publication unit", intended to improve the capacity to protect and manage freshwater biodiversity in the face of global change: The Freshwater Metadatabase (1) collects data characterising and documenting actual datasets. These metadata can easily be published as open access articles in the connected Freshwater Metadata Journal. The Freshwater Biodiversity Data Portal (2) aims at mobilising and publishing freshwater biodiversity data (occurrence records). The use of collected datasets for large-scale analyses and models is demonstrated in the Global Freshwater Biodiversity Atlas (3) that publishes interactive online maps featuring research results on freshwater biodiversity, threats and conservation priorities. In addition, the FIP also holds other components, such as the Freshwater Blog or the freshwaterecology.info trait database.

Cryptic diversity and speciation of endemic *Cytherissa* (Ostracoda, Crustacea) from Lake Baikal (Siberia)

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Lake Baikal is the most ancient and deepest of all ancient lakes on Earth. It holds a (mostly endemic) diversity of thousands of animal species, including ostracods of the genus *Cytherissa*. Baikalian endemic species most likely live in the cradle in which they originated, and this opens perspectives to infer modes of speciation. Non-marine ostracods are not only an important ecological component of ancient lake animals, but ancient lakes also hold at least one quarter of the currently known 2,000 morpho-species worldwide.

In the present study, we tested the hypotheses that either allopatric isolation (different basins) or parapatric ecological speciation (depth, sediment types) are causal to the radiation of endemic *Cytherissa* species in Baikal. We find evidence for the effects of all three of these extrinsic factors. We also find evidence that several morphological species are actually species clusters, comprising various morphological and cryptic genetic species. We used both mitochondrial and nuclear DNA sequence data to test for the presence of cryptic species in more than 20 morphological *Cytherissa* species and subspecies. Our samples come from all three basins of Lake Baikal as well as from the east and west shores, and from different depths and sediments, enabling us to test whether cryptic diversity of *Cytherissa* is present and to which extent it is related to geographic and abyssal allopatry or to ecological separation. Based on our present survey, we estimate that the actual specific diversity of *Cytherissa* in Lake Baikal might easily be double of what is now known.

Genomic architecture of adaptation and strong mate recognition of resident three-spine stickleback populations in emerging White Sea coastal lakes

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White Sea coastal lakes present unique opportunity to study formation of freshwater populations of three-spine stickleback from the origin of the lake to formation of fully adapted resident population. After the end of the glaciation, the White Sea region experienced eustatic raising, giving rise to a unique system of young lakes as bays gradually separated from the sea by fast (4.5 mm/year) uplift of the coastline. From the beginning, young of resident population occurs in the presence of spawning of anadromous stickleback, therefore divergent selection is opposed by strong gene flow. We examine 10 freshwater populations of similar ages (below 800 years old) from the White Sea basin, and study the repeatability of patterns of adaptation in them. Overall, the 65 detected by WGS divergence islands (Dis) tend to reside in regions of low recombination, underlining the role of reduced recombination in their establishment, and 21 out of the 65 DIs are universal; i.e., the frequency of freshwater alleles in them is increased in all ten analyzed populations. We also examine mate recognition in two emerging freshwater populations, in the lakes formed less than 50 years ago, and found evidence of strong assortative mating between anadromous and resident populations, building nests on the same area. If anadromous males do not demonstrate any preference, resident males show strong assortative mating and spawn exclusively with resident females. Genetic mechanisms of observed mate recognition and its consequences will be discussed.

Sturgeons in the Ponto-Caspian — Phylogeny, biogeography, and current status and conservation efforts

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Caspian and Black Seas harbor the most diverse sturgeon fauna. Just one century ago this ancient fish were thriving in the Caspian Sea, but construction of hydroelectric power stations dams cut most of spawning grounds for this anadromous fish and severe overfishing resulted in dramatic deterioration of the previously flourished populations. Here, we present sturgeon phylogeny based on complete mitochondrial genomes of 23 species, including data from GenBank and 13 genomes which were not previously reported. Ten nuclear protein coding genes (long exons of protein-coding genes) were NGS sequenced in 12 species. The origin of sturgeon species with a Ponto-Caspian distribution is probably related to the Paratethys Sea. Despite ancient origin of this group of fishes, recent cases of speciation could be proposed. Russian sturgeon (Acipenser gueldenstaedtii and Persian sturgeon *A. persicus* at large degree share mitochondrial haplotypes and STR alleles, but there is an evidence for restricted gene flow between these two nascent species. Conservation efforts for Caspian sturgeons are based on artificial restocking programs. Special attention should be paid on maintenance of genetic diversity of broodstock and released juveniles.

KEYNOTE
TALK
POSTER

Lake Kivu (East Africa): Recent biogeochemical records from sediment archives

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Several environmental changes have recently reported in Lake Kivu. They include changes in the lake-internal methane production and the food web as a result of climate variability, the introduction of alien species and other anthropogenic activities. This study aims to reconstruct the lake responses to these changes with a particular focus on carbon geochemistry, nutrient cycling and lake productivity, particulate organic matter (POM) sources and its preservation. This was o achieved by analysing several sediment cores using a multiproxy approach made of a set of elemental and stable isotopes, as well as pigment and lipid biomarkers. This revealed remarkable biogeochemical changes, including episodic changes in lake productivity due to important nutrient inputs to the mixolimnion from the deep waters, as evidenced by phytoplankton blooms and enriched δ15N values in particulate matter. These episodic nutrient inputs, which we hypothetically relate to volcanically controlled hydrothermal discharges and subsequent mixing, increased OM accumulation in the sediments and caused re-dissolution of sedimentary precipitates of carbonates, leading to a shift of carbonate preservation. Higher nutrient fluxes to the mixolimnion resulted in episodic increases of the abundance of particular phytoplankton groups, as evidenced by higher concentrations of photosynthetic pigments such as zeaxanthin and β-carotene as well as biogenic silica. On top of a diagenetic signature in the phaeopigments, changes in the concentration of phaeophytin *a* were tentatively linked to an increase of heterotrophic bacteria activity due to enhanced stratification, which has developed over centuries since the last hydrothermal mixing event.

Genetic characterization of small African barbs in the Lake Victoria drainage system, Kenya

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The small African barbs (referred recently to as either genus '*Barbus*' or *Enteromius*) belong to a speciose, taxonomically complex and heterogeneous assemblage of cyprinid fishes (Cyprininae: Smiliogastrini). In the Lake Victoria drainage basin (LVB) in Kenya, ten endemic species of '*Barbus*' are reported, which play a significant role in food security and socio-economic development of the local community. Although these species are identified using morphological characters, confusion may occur when trying to distinguish morphologically similar species. Recent molecular work in the region has also shown evidence of introgression between certain species, further complicating the taxonomy and species identification in the group. In this study, we obtained mitochondrial cytochrome *b* and nuclear Growth Hormone (GH) intron 2 gene sequences of nine '*Barbus*' species sampled in the LVB in Kenya. We conducted maximum likelihood and Bayesian phylogenetic analyses to establish their evolutionary relationships in relation to many other '*Barbus*' specimens from Africa. We did not find instances of hybridization/introgression among the individuals sequenced by us. Our analyses also did not find a sister relationship between '*Barbus*' *profundus*, a species endemic to Lake Victoria, and '*Barbus*' *radiatus*, which is also found in Lake Victoria, despite the fact that these species had been previously synonymized. '*Barbus*' *radiatus* shows instead a sister relationship with a lineage comprised of two species from West Africa. We found several other sister relationships between taxa from the East coast and other ecoregions from Africa, suggesting that past drainage connections and vicariant events contributed to the diversification of this group.

KEYNOTE
TALK
POSTER

STUDENT

Morphological variations among native populations of the Nile tilapia (*Oreochromis niloticus* L. 1758) in East Africa

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Nile tilapia (*Oreochromis niloticus*), a native fish species to the East African freshwater bodies, is an economically and ecologically important resource. Natural populations of Nile tilapia in the region thrive in wide range of habitats from lowland to cooler high-altitude water bodies. Some of these habitats are geographically isolated and have given rise to 7 subspecies previously described employing traditional morphometric methods. However, studies employing the advanced morphometrics like geometric morphometrics (GM) are less documented and restricted to few Nile tilapia populations. Using GM, we analysed the shape of 465 individuals of 12 native populations from Ethiopia, Kenya and Uganda to test the effect of population geographical location in the mentioned three countries for validating significant morphological divergence. Marked shape variation was observed on the orientation of the mouth of the Langano, Edward, Ziway, Chamo, Koka and Kazinga Channel populations. The length of the caudal peduncle and the operculum regions were the major features responsible for the variations among the studied populations. Separation of the Ethiopian and Ugandan populations based on the Canonical Variate Analyses suggest the importance of environmental factors in shaping the genetics and morphology of the populations. Further analysis in the genetic variation of these populations would shade light on whether the variations observed are due to plasticity or local adaptations.

Drivers of species diversification vary with temporal scale in continental aquatic gastropods

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The processes and settings controlling species diversity and diversification are subject of intense research. Especially in the light of the current biodiversity crisis, a more profound knowledge of the parameters influencing speciation and extinction is crucial. A main limitation to deducing drivers has been the fixed temporal scope applied in previous studies. We suppose that the same parameters might have different impact on different time scales. Moreover, it is vital to address the impact and interplay of multiple factors.

The present contribution deals with these issues using the late Cretaceous to Pleistocene fossil record of European continental aquatic gastropods (100.5-0.1 Myr; 3,038 species) and a diverse set of abiotic (temperature, precipitation, altitude and continental land area) and biotic (competition) factors. To account for a potential bias from using global climate data only, we also tested for correlation with regional estimates of temperature and precipitation. Moreover, a novel approach is presented estimating covariation between diversification rates and potential drivers across variable time windows.

Pilot analyses indicate that the drivers of species diversification vary considerably with temporal scale. For the entire period of 100 Myr, precipitation is indicated as the main driver. For time frames of 20-, 40- and 70-Myr duration, however, the most relevant drivers are variably competition, precipitation, global and regional temperature and altitude.

These preliminary results have major implications for the study of diversification dynamics. They show that different parameters drive diversification in different time periods and stress the importance of the temporal scale at which correlations are observed.

KEYNOTE
TALK
POSTER

STUDENT

Impacts of water level fluctuations on fisheries of Lake Turkana: World's largest permanent desert lake

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Lake Turkana is a unique ecosystem, distinguished as the world's largest permanent desert lake and the largest alkaline water body. This system is at the precipice of large-scale changes in ecological function due to climate change and economic development along its major inflowing river, the Omo River. The objective of this study was to predict how the lake's fisheries, which provide an important livelihood and protein source in the region, are impacted mainly by hydrological changes. The fishery is predicted to collapse at a lake level decline of 25 m, regardless of seasonal amplitude magnitude. Breeding vulnerability is predicted to be highest among fish species with the lowest trophic diversity. The lake's total littoral habitat, where fisheries are currently concentrated, will increase in surface area with lake level declines of <25 m. However, the extent of productive, dynamic littoral habitat will decrease with dampening of the lake's seasonal oscillations. The most severe habitat loss will occur in the lake's Turkwel Sector, which hosts the region's highest human population densities, and North Sector, where inter-tribal conflict over resources is common and likely to be exacerbated by lake level decline. In turn, this will have significant negative consequences on resource productivity and the wellbeing of local communities. The continued ecological functioning of Lake Turkana necessitates immediate efforts to develop and apply a transboundary water resource management plan rooted in Precautionary Principle.

Diversification dynamics in freshwater bivalves (Unionidae) from the East African Rift

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Invertebrates are exceptionally diverse, but declining because of anthropogenic changes to their habitat, as exemplified by freshwater bivalves in Europe and North America. Much less information is available for African freshwater bivalves, especially for Unionidae, which comprise 9 genera and ~40 nominal species, many of which are endemic to African ancient lakes. The phylogenetic position of most of these genera and species remains uncertain, and their conservation status unassessed. Here, we present preliminary results of phylogenetic studies on the Unionidae of the East African Rift. We integrate a phylogenetic backbone based on four gene fragments with (1) sampling information to examine geographic patterns of diversity and with (2) geometric morphometrics of shell shape to examine the relation between morphological disparity and molecular diversity. African Unionidae apart from '*Cafferia*' form a monophyletic clade, and the basal splits in this clade occur between the reciprocally monophyletic genera *Pseudospatha* and *Grandidieria*, both of which are currently endemic to Lake Tanganyika. *Mweruella*, *Nyassunio* and *Prisodontopsis* are also monophyletic in the preliminary analyses as is *Nitia*, although this latter taxon is nested within *Coelatura*, which highlights the need of systematic revisions. Biogeographic analyses indicate a statistically significant North-to-South colonization of the East African Rift by *Coelatura sensu lato*. Beyond deep phylogenetic splits among individual clades, limited molecular differentiation is observed within most clades, calling for population genetic studies. Ongoing morphometric analyses suggest strong morphological differentiation among several clades, but substantial disparity in shell shape is observed within many clades, which needs further examination.

KEYNOTE
TALK
POSTER

STUDENT

The nature of eco-morphological divergence in the adaptive radiation of cichlid fishes in Lake Tanganyika, East Africa

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The assemblage of cichlid fishes from East African Lake Tanganyika consists of about 200 described and approximately 50 undescribed species and shows an extraordinary degree of morphological and ecological diversity. The endemic cichlid fauna of Lake Tanganyika thus provides a prime model system to study adaptive radiation in general and in a comparative context in particular as it harbors both extremely species-rich as well as species-poor lineages that have evolved alongside each other within the same lake. We undertake an integrative study of the Lake Tanganyika cichlid assemblage, combining whole genome sequencing with 3D geometric morphometric of the lower pharyngeal jaw bone and stable isotope measurements (as a proxy for ecology) of all ~250 Tanganyika cichlids, making it the most comprehensive examination of a cichlid radiation so far. First results show how the different cichlid species densely filled up a highly diverse (trophic) "morpho-space", whereas the extent of overlap and scattering seems to vary among phylogenetic lineages. As trophic morphology strongly correlates with the ecology of the species, a similar pattern can be observed in niche use. This extensive dataset offers the opportunity to investigate how morphological and ecological differentiation progressed during Lake Tanganyika's cichlid adaptive radiation and will ultimately allow us to disentangle the factors responsible for rapid organismal diversification.

Understanding adaptive radiation and explosive diversification through cichlid fish genomics

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Owing to their spectacular taxonomic, phenotypic, ecological and behavioral diversity and propensity for explosive speciation, the assemblages of cichlid fishes in the East African Great Lakes Victoria, Malawi and Tanganyika are prime role models in evolutionary biology. With the release of five reference cichlid genomes and many additional genomic resources as well as the establishment of functional genomic tools, the cichlid system has fully entered the genomic era. The in-depth genomic exploration of the East African cichlid fauna – in combination with the examination of their ecology, morphology and behavior and information on the geological history of the Great Lakes – permits novel insights into the way how organisms diversify and how adaptive radiations progress.

KEYNOTE
TALK
POSTER

STUDENT

Elevated diversity within the Anatolian drainage basins is a legacy of *in-situ* speciation and less the result of a refugial isolation

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Anatolia is noted for a high concentration of ancient lakes with elevated aquatic species diversity, yet little is known of how and when this diversity arose. Here, lakes and their drainages in Anatolia have been considered a major refugium for temperate aquatic taxa during the Quaternary glacial period. Aided by fluctuating Black Sea salinities during this time period, elevated aquatic diversity in Anatolian lake and drainage systems can easily be attributed to the retreat of species southward (i.e. sink function) or range contraction of widespread species (i.e. museum function) from across the Palearctic. However, Anatolia has undergone immense drainage shifts and habitat changes during the Neogene, which could have driven *in-situ* speciation (i.e. cradle function). Using the widely distributed aquatic snail genus *Theodoxus* as a model, we employed phylogenetic and biogeographical approaches to assess how and when diversity may have accumulated in these lakes and drainage systems. Given the more recent effects of glacial cycles, we expected the majority of extant biodiversity to be the result of the sink and museum functions. Our results partially rejected this. Although we found a transition from the cradle to the sink function at around the onset of the intensified glacial period, we only found little support for the museum function. Furthermore, our results show that most extant species diversity is the result of the cradle function during the Pliocene and Early Pleistocene. This shows that the diversity was mainly driven by topographic changes and habitat shifts to these basins causing *in-situ* speciation rather than by refugial isolation.

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East African freshwater fish impasse: Molecular genetic diversity and differentiation of the anthropogenically threatened *Oreochromis niloticus* inferred from microsatellite genotyping

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The need for enhancing fish productivity in Africa ultimately triggered the transfer of various fish species to non-native ranges, causing dramatic changes to the indigenous host species. A typical example of fish translocations is that of East African *Oreochromis niloticus* (Nile tilapia) which has been dispersed in various non-native homes. Despite the shifts, *O. niloticus* currently dominates in non-native environs at the expense of the dwindled indigenous congenerics, a situation worth investigating. The goal of this study was to characterize and compare *O. niloticus* genetic variability from various localities, with the aim of gaining a better understanding of the populations' genetic structure and inter-relationships. Using 40 and 41 microsatellite loci for the combined East African and all native *O. niloticus* populations respectively, we genotyped a total of 667 samples from Uganda, Kenya, Ethiopia and Burkina Faso. Genetic structure analyses demonstrated three distinct East African *O. niloticus* genetic clusters consistently supported by F_{ST} results. Similarly, the East African populations indicated to be more genetically divergent congruent to migration rates. However, apart from Turkana, pronounced genetic multiplicity was manifested by the non-native populations which indicated non-panmictic. Remarkable genetic diversity in Turkana was deemed to be attributed to adverse environmental parameters. However, the reportedly low genetic diversity in Ethiopian and West African *O. niloticus* was allied to genetic drift resulting from population fragmentation. Among the fish farms, Rwitabingi was more genetically divergent and it was attributed to multiple sources of immigrants. Notwithstanding Lake Kyoga, these results were consistent with our hypothesis that the East African populations particularly, non-natives exposed divergent genotypes.

KEYNOTE
TALK
POSTER

STUDENT

Identity, origin and biogeography of *Schistosoma* intermediate hosts in crater lakes of western Uganda

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The African Great Lakes are not only known for their high levels of biodiversity and degree of endemism, but also for their importance in neglected tropical water-borne diseases. Besides these often large and old lacustrine lake systems, a variety of smaller and younger lakes exist such as the crater lakes of western Uganda, whose biodiversity and role as transmission sites for diseases is less studied. A recent shift in schistosomiasis transmission of above 1,400m a.s.l has sparked interest in these crater lakes. This study therefore investigates 1) the identity and genetic diversity of the intermediate hosts for schistosome parasites and 2) phylogenetic and biogeographical affinities of the species involved in 16 crater lakes of western Uganda. Based on mitochondrial DNA, large-scale phylogenies were reconstructed and a phylogeographical analysis was carried out for the two gastropod genera *Biomphalaria* and *Bulinus*. The phylogenetic analyses revealed that all the crater lakes' populations studied belong to either *Bulinus tropicus* or two species of *Biomphalaria* (*B. sudanica* and *B. pfeifferi*). The genus *Biomphalaria* is therefore the sole intermediate host for human schistosomiasis found so far in the crater lakes. Colonization occurred from either regional species pools such as Lakes Victoria, George and Albert, or from further away. A follow-up study on the presence of other potential *Bulinus* hosts for schistosomes is ongoing. This study does not only examine biodiversity dynamics of gastropods and the prevalence of trematodes on a large scale in the crater lakes, but also determines the drivers along a wide environmental and altitudinal gradient.

Adaptive morphological divergence in an ongoing radiation of *Lanistes* gastropods from Lake Malawi

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The ampullariid gastropod *Lanistes* has occupied the Malawi Basin since the late Pliocene, but the extant, ongoing radiation comprising five nominal species only evolved in the late Pleistocene. Recently, we documented a remarkable hierarchical structure in space and time of differentiation mechanisms in this radiation: neutral and mutation-order processes are older and occur mainly between the northern and southern regions of the basin, whereas more recent adaptive processes drive genetic differentiation within regions. Molecular groups do not coincide completely with morphospecies, however. Here we examine the nature of shell-shape variation in three *Lanistes* morphospecies ('*ovum*', '*solidus*' and '*nyassanus*') from the southern region of the Malawi Basin using common garden experiments in the laboratory. We found significant differences in survival among morphospecies before, and in fecundity during our experiments, in line with expectations for local adaptation. We obtained highly similar reaction norms of shell-shape changes between wild-caught parents, F_1 and F_2 offspring for replicate experiments, indicating our design was robust. Morphological differences observed in the wild persisted in our experiments, but differences between '*ovum*' and '*solidus*' diminished and re-increased in the F_1 and F_2 generation, respectively, leaving these morphospecies poorly distinguishable in model-based clustering. Shell-shape heritability was substantial (h^2 = 0.49; 95 % CI: 0.31-0.88) although it was likely underestimated. Overall, our experiments substantiate adaptive differentiation in the *Lanistes* radiation from the Malawi Basin. Availability of the genome of *L. nyassanus* will soon allow in-depth studies of morphological differentiation and genome-wide effects of neutral and selective processes in this radiation.

KEYNOTE
TALK
POSTER

STUDENT

A Late Pleistocene mollusc fauna of the north Caspian Sea sheds light on pre-crisis community structure

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The species composition, diversity and abundance of the native Caspian fauna are presently under severe pressure from invasive species and anthropogenic impact. However, the magnitude and rate of diversity decline and abundance loss can only be estimated based on comparison with communities that lived before the onset of the crisis. An *in-situ* mollusc fauna retrieved from late Khazarian (early Late Pleistocene) deposits at Selitrennoye (Astrakhan province, Russia) provides a snapshot of a natural Caspian assemblage that lived under similar circumstances as during the current interglacial. The fauna is almost entirely composed of endemic species. In total, 24 gastropod and 17 bivalve species were found. The fauna represents an anomalohaline lake community that lived on a sandy floor at a water depth of approximately 10 m. The richness of the fauna is in great contrast with the largely depleted and invasives-dominated Caspian fauna of today. The Selitrennoye assemblage serves as a natural baseline fauna of pre-invasive influence and underlines the huge magnitude of the current biodiversity crisis.

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Is differential gene expression in the female brain linked to assortative mating in a mouthbrooding cichlid (*Ophthalmotilapia*) from Lake Tanganyika?

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The East African Great Lakes harbour hundreds cichlid species with frequently overlapping ecological niches and distribution ranges. Given their phylogenetic relatedness, and their ability to interbreed, the question remains how such species maintain the integrity of their gene pools.

For this, we investigated the genetic basis for female mate-choice in three species of the mouthbrooding Tanganyika cichlid *Opthalmotilapia*. We used 53 specimens in two mate-choice experiments and sequenced the transcriptomes of six brain parts of 36 females from shorelines for which GBS and mtDNA phylogeographic data revealed introgression events. The first experiment quantified the behavioural differences between females that were exposed to con- or hetero-specific males. Although the transcriptomes of all brain parts of these females shared almost 10,000 genes, significant differential expression between treatments only held for less than 100. Most of these genes were linked to hormonal activity and most differences were found in the diencephalon and the optic bulbs. The second experiment compared the behaviour and gene expression of females that performed oviposition after mating with a con- or a hetero-specific male. Here, the transcriptomes shared over 10,000 genes. Although over a 1,000 genes were differentially expressed between heterospecific females, this held for less than 100 genes when comparing conspecific females that mated with heterospecific males. Unexpectedly, differential gene expression was most pronounced in the cerebellum, a brain region linked to cognitive and emotional conditioning, rather than hormone production. Most genes that were differentially expressed in this brain part have no known link to reproductive or hormonal activity.

A revision of the *Tropheus* complex from Lake Tanganyika: Contemporary species in ancient (paleo)lakes

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The endemic Lake Tanganyika cichlid *Tropheus* consists of highly stenotypic rock dwellers, whose limited capacity for dispersal gave rise to over a hundred, mostly allopatric, colour varieties. This made *Tropheus* an important model for evolutionary research. Yet, its taxonomy is confusing so a revision was carried out. Groups were made using genome-wide AFLP scans from over 200 specimens from around the lake. These were compared to morphological data from 1,186 specimens from 155 locations. When analysing morphology on a lake-wide scale, a large degree of overlap was observed between the groups. This suggested that morphological data was of little value to delineate species in *Tropheus*.

However, when the bathymetry of the Lake was taken into account, this pattern changed. As Lake Tanganyika was, probably repeatedly, divided in at least three different paleolakes, they contain lineages of *Tropheus* that, for long periods of time, evolved in isolation. Hence, these paleolakes are the baseline to explain the complex distributions of contemporary colour varieties. Analysis of the morphology from specimens from the northern two thirds of the Lake retrieved groupings that largely agreed with those obtained from AFLP scans. Yet, for groups from the southern third, this was far less the case. Here, a large amount of morphological overlap was found between putative species, mostly following clinal patterns. As the southernmost part of the lake consists of a large shallow area, this clinal pattern was interpreted as being caused by multiple occasions of admixture between neighbouring lineages caused by fluctuations in water level.

Lake Lanao: forgotten and neglected for decades

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Lake Lanao on Mindanao is the largest permanent freshwater lake in the Philippines and may represent one of the few ancient lakes in Southeast Asia. However, age estimates for this lake differ widely across the literature ranging from 10,000 up to 10 My years. The lake's fauna is best known for its cyprinid radiation comprising a total of 18 species that, unfortunately, has been nearly driven to extinction through various anthropogenic processes. Lake Lanao is also home to various mollusc and other freshwater invertebrate groups, but only little is known about their relationship to the remaining Southeast Asian species. Here, we focus on the diversity in freshwater molluscs, particularly the morphologically diverse viviparid gastropods. We provide first genetic insights into this group in order to test whether the high morphological diversity found in the viviparids is also reflected by the genetic variation. Genetic data suggest that the viviparids form a monophyletic group comprising several morphologically and genetically different (morpho)species. The high diversity found in both cyprinid fishes and viviparids together with the geological and tectonic evolution of Mindanao suggest that Lake Lanao most likely have originated more than 100,000 years ago and thus indeed represents an ancient lake. However, the lake and its biota are under continuous threat, and the development and implementation of sustainable conservation strategies is urgently needed.

KEYNOTE
TALK
POSTER

The hazards of oil exploitation in Africa's ancient lakes

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As six of the top-ten global discoveries of new hydrocarbon deposits in Africa are situated in 'The African Great Lakes Region', this region has become a major target of the oil industry. As a consequence, all countries in the region have developed plans to open up exploration blocks. This process is ongoing in all countries bordering Lake Tanganyika, i.e. Burundi, the DR Congo, Tanzania and Zambia, and is ongoing in several other Rift Lakes, including Lakes Albert and Edward, including the Virunga National Park in the DR Congo.

While these lakes are celebrated for their endemic biodiversity, they also have an immense socio-economic importance for the region. For instance, the annual yield of the mostly small-scale fisheries in Tanganyika is vital to the livelihood for almost 95,000 fishermen and many people in associated small scale enterprises.

As outlined discussed during the 'Cichlid Science meeting' 2015 (Graz, Austria, 2015), 'The Africa, Great Lakes Conference' (Entebbe, Uganda, 2017), and summarized in a 'Oil extraction imperils Africa's Great Lakes' (Science, 4 November 2016), it is legitimate to be very concerned by what will inevitably happen should full scale oil exploitation projects be launched in (or near) these lakes.

We would like to discuss within SIAL how to go about increasing the awareness of the local authorities (i.e. the final decision makers) on this matter, and how to increase the awareness and expertise of local experts to predict, prevent, detect and mitigate adverse environmental impacts of the hydrocarbon exploitation in this region.

Freshwater mussel radiations reveal ancient rivers existence

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The concept of long-lived (ancient) lakes has had a great influence on the development of evolutionary biogeography. According to this insight, a number of lakes on Earth have existed for several million years (e.g., Baikal and Tanganyika) and represent unique evolutionary hotspots with multiple intra-basin radiations. In contrast, rivers are usually considered to be variable systems, and the possibility of their long-term existence during geological epochs has never been tested. In this study, we reconstruct the history of freshwater basin interactions across continents based on the multi-locus fossil-calibrated phylogeny of freshwater mussels (Unionidae). These mussels most likely originated in Southeast and East Asia in the Jurassic, with the earliest expansions into North America and Africa (since the mid-Cretaceous) following the colonization of Europe and India (since the Paleocene). We discovered two ancient monophyletic mussel radiations (mean age ~51-55 Myr) within the paleo-Mekong catchment (i.e., the Mekong, Siam, and Malacca Straits paleo-river drainage basins). Our findings reveal that the Mekong may be considered a long-lived river that has existed throughout the entire Cenozoic epoch.

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KEYNOTE
TALK
POSTER

The family Lymnaeidae in ancient lakes: A review and synthesis of data on extant and fossil taxa

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According to Brooks (1950) and Boss (1978), the Lymnaeidae, the second-most species rich family in the Hygrophila, demonstrate a very low endemicity in ancient lakes, with most lymnaeid taxa recorded from there being not endemic. Does it mean that the Lymnaeidae, unlike Acroloxidae and Planorbidae, are unable to reach a high degree of endemism in ancient lakes? Here, I present a synthesis of data on lymnaeids from ancient lakes, including a review of past adaptive radiations in the Miocene Lake Pannon (East Europe) and the Pliocene Lake Chuyskoe (Siberia, Altay). The data on taxonomy and phylogeny published since 1978 have been taken into account. The taxonomic rank of extant lymnaeids of ancient lakes is, indeed, not high. Endemic taxa are of species (*Radix onychia*, Lake Biwa) or subspecies (*R. auricularia intercisa*; Lake Baikal) rank, and for some taxa (*R. pinteri*, Lake Ohrid) their proper rank (species vs. subspecies) is still debatable. Interestingly, all known cases of endemic lymnaeids, including those of the past, belong to the single genus *Radix sensu lato*. The most diverse endemic fauna of Lake Pannon (with a series of unique genera and even a subfamily) may be derived from a *Radix*-like ancestors. It seems that though the Lymnaeidae are not unable to form species flocks in ancient lakes, this ability is restricted to a single lineage within the family, that is in striking contrast with the Planorbidae. The convergent and parallel evolution has greatly influenced the morphology of lymnaeids in ancient lakes.

Tectonic, climatic, and volcanic factors influenced aquatic paleoenvironments at Lake Towuti during the past ~500,000 years

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Geologic (tectonics, volcanism) and climate-induced changes in the environment exert extrinsic controls on aquatic ecosystems in ancient lakes. Information on the temporal variability of these influences is recorded in sedimentary sequences from ancient lakes, often in exquisite detail and temporal resolution. Scientific drilling in ancient lakes thus provides opportunities to develop sedimentary records that inform our understanding of the phylogenetic history of endemic species flocks.

The Malili lakes comprise a chain of ancient lakes on Sulawesi, Indonesia and are a hotspot of Southeast Asian aquatic biodiversity. Endemism is widespread among different species of fishes, snails, shrimps, and crabs, each with a high degree of substrate specialization. Molecular genetic data indicate riverine ancestry and multiple lake colonisation events. Despite absence of barriers between most of the Malili lakes, species in each lake developed a high degree of endemism, suggesting geographic speciation.

This presentation will provide insights into geologic and climatic factors that shaped aquatic environments in Lake Towuti, the largest of the Malili Lakes, since the early stages of tectonic lake formation. Results derive from the Towuti Drilling Project (TDP), which in 2015 drilled over 1,000 m of sediment core from Lake Towuti. Sediment core data suggest an initial phase of basin subsidence with spatially heterogeneous depositional environments, including shallow lakes, swamps, and rivers prior to ~500-600 kyrs. Following this initial stage, continuous lacustrine conditions prevailed, with variable trophic states as a consequence of climatic changes and possibly volcanic ash falls, as well as relatively recent changes in the connectivity between the Malili Lakes.

KEYNOTE
TALK
POSTER

STUDENT

Tackling a forgotten species flock: The haplochromine cichlids of the Lake Edward system

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Haplochromis is a genus of East African cichlids that is known for its large adaptive capabilities and species richness. Among others, the genus radiated within lakes Albert, Edward, Kivu, and Victoria. They exploited the ecological opportunities within these lakes and gave rise to the Lake Victoria superflock. Each lake is inhabited by a mainly endemic assemblage of *Haplochromis* species. Lakes Edward and George are closely connected and form a single system: the Lake Edward system. Its *Haplochromis* species have remained largely understudied. It is estimated to be inhabited by an assemblage of 100 species. Even though 30 of those have been described, little is known about their biology.

The HIPE-project investigates the human impacts on ecosystem health and resources of Lake Edward. Within the framework of this project, we perform a systematic revision of the *Haplochromis* species assemblage of the Lake Edward system. *Haplochromis* species are known to display a broad range of trophic adaptations. The revision is performed by grouping specimens based on morphological characteristics that suggest a similar ecology. An in-depth morphometric study is carried out for each trophic group by analysing measurements and counts by principal component analyses. Qualitative characteristics are observed, species are delineated, and their ecologies are verified by stomach content observations. Hitherto, we discovered 14 undescribed species that are being described, and five valid species for which redescriptions are being made. The studied species include five paedophages, three oral snail crushers, nine piscivores, and two thick-lipped insectivores.

Diversity of freshwater snails in Lake Mburo and Nakivale, southwestern Uganda: Medical and veterinary implications for wildlife and community health

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Several species of freshwater snails serve as intermediate hosts of various trematode parasites of medical and veterinary importance, especially in tropical countries such as Uganda. This study investigated diversity and cercariae infestation of freshwater snails over two seasons (2012 to 2013) at six selected sites in the Lake Mburo-Nakivale wetland system in southwestern Uganda. Snails were identified using morphometric measurements with the aid of standard identification keys. In addition, cercariae shedding experiments were conducted on each snail sample to establish prevalence of parasite infestation. Results indicated that species from five genera (*Biomphalaria*, *Bulinus*, *Lymnaea*, *Pila* and *Melanoides*) were present in Lake Nakivale, whereas Lake Mburo presented species in only 4 genera (*Biomphalaria*, *Bulinus*, *Lymnaea* and *Pila*). The most abundant snail species belonged to *Biomphalaria* spp. in both Lake Mburo (40.8%) and Nakivale (66.2%). Furthermore, results showed a significant variation in the snail proportions in the two lakes during wet and dry season. Results also indicated a significant variation in the numbers of snails that shed cercariae in wet season and dry season in the two lakes. The highest prevalence of cercariae infestation was recorded in *Bulinus* spp. at 37.5% and 29.7% for Lake Mburo and Nakivale respectively. The snails displayed marked micro-habitat preferences, especially in relation to the physical characteristics of the environment. Results of this study provide quantitative evidence indicative of the level of infestation of primary intermediate hosts with trematode parasites of immense medical and veterinary importance. Implications for wildlife and public health are discussed.

KEYNOTE
TALK
POSTER

STUDENT

Out of Lake Tanganyika: Lake endemic gastropods live in River Lukuga

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Ancient lakes with their endemic species assemblages, like Lake Tanganyika in East Africa, are regarded as hotspots of aquatic biodiversity and as natural laboratories providing insights into evolutionary processes, such as intra-lacustrine speciation. This is particularly exemplified by studies on the origin of species flocks in both cichlids and invertebrates such as gastropods. The origin of the gastropod species (super-)flock in Lake Tanganyika has been debated intensively and remains unclear to date. For the fish community, it is generally assumed that it was derived from ancestors occurring in the Congo River Basin. Recently, a central biogeographical role of the Lukuga River system and the connected Lualaba River has been indicated. In an attempt to tracing the origin of the enigmatic thalassoid gastropods of Lake Tanganyika, the fauna of the Lukuga-Lualaba systems is currently studied. A recent expedition allowed collecting mollusc material from the eastern shores of Lake Tanganyika around Kalemie and down the Lukuga River until Niemba. We found gastropods known to be endemic to Lake Tanganyika living in River Lukuga as far down as 130 km, in populations with reasonable abundances. Based on mitochondrial DNA sequences, these populations are partially genetically distinct from Lake Tanganyika's populations. However, sister taxa to the species flock have not yet been found in River Lukuga. Our results are discussed in the context of intra-riverine evolutionary dynamics over shorter time periods. They will help to understand the biogeographical and evolutionary dynamics within a large spatial and temporal framework, covering Lake Tanganyika and the Congo River system.

How to distinguish between ecophenotypes and actual species: Viviparid assemblages from supposedly ancient lake Lugu, Yunnan

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Due to its comparably diverse gastropod fauna with around 20 different species, Lake Lugu is one of the most promising candidates for an ancient lake among the lakes on the Yunnan Plateau (northwestern Yunnan, China). These lakes are widely known for their diverse and often endemic fauna of fish, oligochaetes and molluscs. While the speciation of fishes in lake Lugu is well-studied, the taxonomy of molluscs in Lake Lugu is poorly known. According to previous studies, the viviparid assemblage of Lake Lugu is diverse even at the genus level. Attempts to systematically clarify the genus *Margarya*, endemic to the lakes of Yunnan, have already been made, but the taxonomy of its sister group, the genus *Cipangopaludina*, remains unclear. This is partly due to the fact that these two genera are commonly used synonymously. Furthermore, investigations on juvenile shells, which bear enormous taxonomic potential, are almost missing.

We provide detailed morphometric analyses of viviparid teleoconchs and protoconchs, collected at Lake Lugu, using size parameter measurements and SEM photographs, combined with fractal geometry analyses applied to 3D models of the shells. The results are compared to DNA analyses in order to clearly distinguish between ecophenotypes and actual species. Once established using modern shells, this method will be applied to fossil gastropod assemblages.

KEYNOTE
TALK
POSTER

STUDENT

Diversity patterns of benthic organisms in ancient lakes with special reference of free-living nematodes

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Are there universal patterns of species diversity? Answering this question requires studies of isolated habitats with environmental conditions that are similar and have not changed for millions of years. This is the case with ancient lakes, such as Lake Baikal, Lake Malawi, Lake Titicaca and Lake Ohrid, which also provide relatively stable habitats for species-rich benthic communities. However, with the exception of Lake Baikal, very little is known about the diversity and ecological patterns of benthic organisms in the profundal zones of these four lakes. We therefore aim to study the profundal sediment communities of Lake Baikal, Lake Malawi, Lake Titicaca and Lake Ohrid in a holistic comparative approach. Samples will be obtained using gravity corers. Abundance and composition of all benthic organisms of Lake Ohrid were analysed and for nematodes, presumably the most common group of metazoan organisms, species will also be identified morpho-taxonomically. Composition, abundance of meiofauna and diversity of nematodes will be compared across the four lakes. The evolutionary strategies of the nematodes will be examined by determining feeding types, sex ratios and reproductive traits. Additionally, molecular techniques will be used to enable analyses of the biogeography of aquatic nematodes and the construction of a database of profundal nematode species that can be used in genetic monitoring.

Towards a dynamic equilibrium: Interdisciplinary deep drilling campaign in ancient Lake Ohrid reveals slowdown of speciation and extinction rates over evolutionary time scale

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What determines species diversity and can ecosystems reach equilibrial species richness? Previous contributions to these puzzling questions came mainly from simulation studies or global analyses with heterogeneous geological, environmental and paleontological records.

These deficiencies call for evolutionary studies in model systems with continuous and high-quality records. A paradigm is the Balkan Lake Ohrid – Europe's oldest and most biodiverse lake. An International Continental Scientific Drilling Program (ICDP) resulted in continuous environmental, climate and fossil records of 152 endemic diatom species, spanning the lake's entire lacustrine phase. Integrating these data, we aimed to i) identify the drivers of diversification, ii) understand the dynamic interplay of environmentally- and diversity-dependent diversification, and iii) test whether the system has reached a dynamic equilibrium.

Our Bayesian birth—death-sampling analyses showed decreasing speciation and extinction rates over most of the time, including a significant rate shift, dividing the lake's history into two evolutionary phases. Diversification rates during the shallow-water phase were mainly driven by geomorphology, environment and species interactions, causing diversity-dependency. During the deep-water phase, diversification rates were primarily determined by species interactions, with the system approaching equilibrium.

Our findings demonstrate that diatom diversification in Lake Ohrid was largely governed by the dynamic interplay of geomorphological/environmental parameters and species interactions. There is strong evidence that the impact of environmental forcing has decreased over times. Finally, we show for the first time that an isolated ecosystem may reach a dynamic equilibrium when both speciation and extinction rates slow down.

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Mbarara University of Science and Technology

Pharm-Biotechnology and Traditional Medicine Center (PHARMBIOTRAC)

Goal

To build a critical mass of specialized and skilled human resource that can advance traditional medicine and Pharm-Biotechnology for socio-economic development of Africa

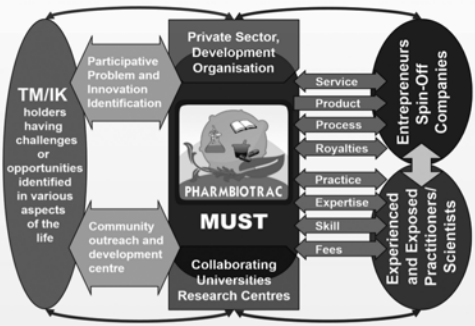
Vision

To be a leading African centre of excellence for training and research in traditional medicine and pharm-biotechnology

Mission

To contribute to documentation, validation and value chain development of traditional medicine and biotechnology products for use in pharmaceutical and nutraceuticals industries in the region through training, research and community services for sustainable development"

Framework



Thematic areas

- Understanding Traditional Medicine Philosophy of Health and Disease Prevention and Control
- Traditional/Herbal Medicine Quality and Safety Standards Herbal Medicine Production/Manufacturing and Quality Control Standards
- Traditional/Herbal Medicine Knowledge and Material Conservation and Propagation - in-situ, ex situ
- Traditional/Herbal Medicine/ Clinical Validation Protocols and Standards
- **Pharmaco**-Biotechnology-Application of Biotechnology to Drug Discovery, and Drug Production
- Pharmaceutical Business Management/Regulation

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Prinipal Investigator: Dr. Ogwang Patrick Engeu, pogwang@must.ac.ug

Chair Innovation & Business: Eng. Anke Weisheit, aweisheit@must.ac.ug

Current Degree Programme (PhD & Masters)

- M Sc. courses in traditional medicine and pharm biotechnology
- PhD programs in the thematic areas

Programs under development for accreditation

Masters:

- M Sc. of Pharmacy (Clinical Pharmacy)
- M Sc. in Pharmaceutical Analysis
- M Sc. in Pharmacognosy & Natural Medicine Science

One short term course:

- Certificate in Traditional/Herbal Medicine

ACE II Eastern and Southern Africa Higher Education Centers of Excellence Project

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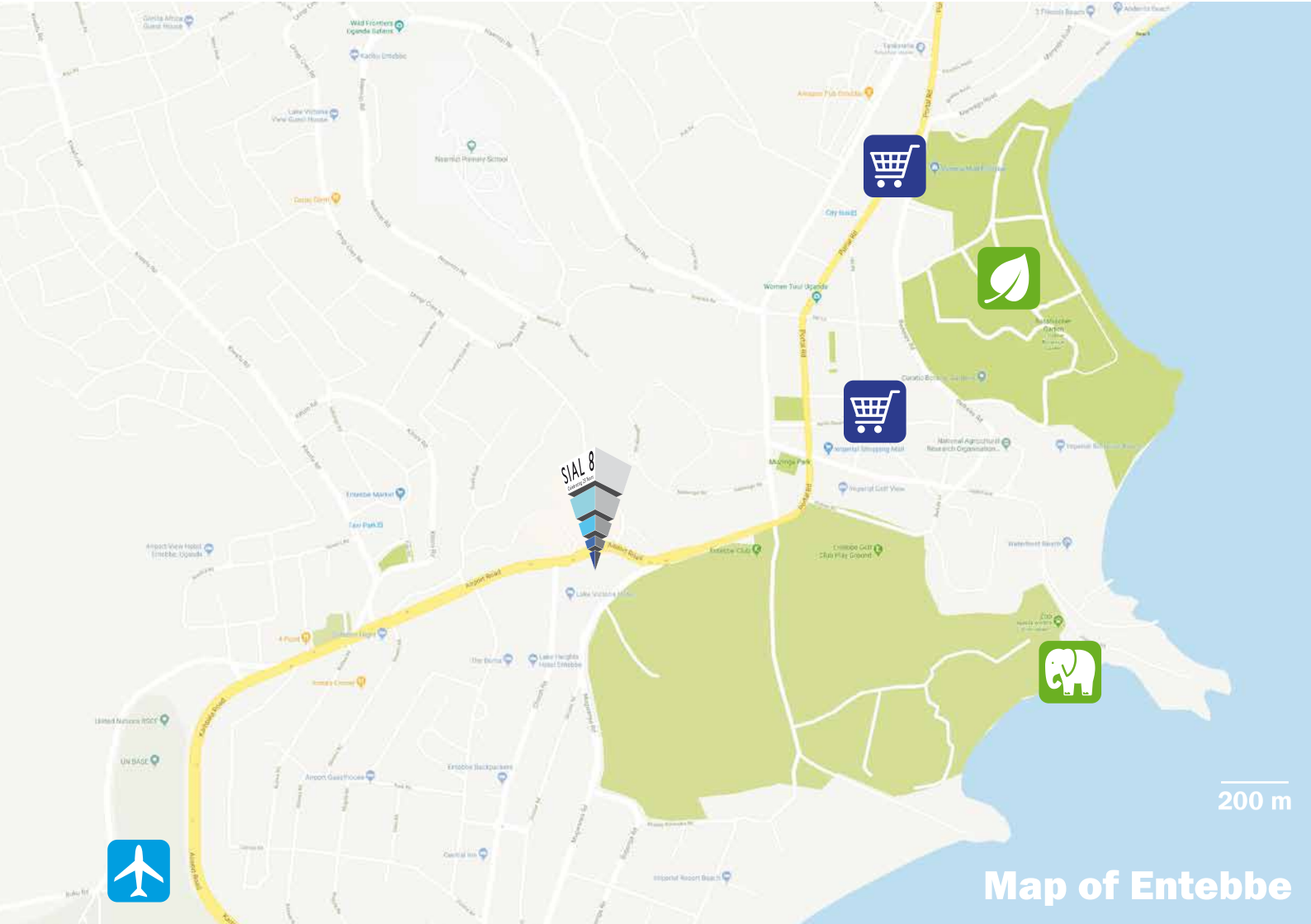
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