

Expedition Boyekoli Ebale Congo 2010

The importance of biological collections for the D.R.Congo

- The information suggesting that the biodiversity in the Congo Basin is high, is dated and insufficient to gain insight in the currently existing biodiversity and its geographic structuring.
- In addition, all existing biological collections from the region are stored in Belgian (and other) foreign natural history institutions. As a consequence, these collections are often inaccessible for Congolese researchers willing to study the biodiversity of their own region. Such studies are gaining importance in view of the growing need for the sustainable exploitation of the natural resources of the D.R.Congo and the impact of global climate changes on biodiversity .

A multidisciplinary expedition on the Congo River - its goals:

- To develop intensive collaboration between Congolese and (primarily) Belgian researchers in order to remedy the issue of the professional isolation of the Congolese scientific community viz. the rest of the world.
- To create, in a joint effort , biological specimen collections for biodiversity research in the D.R.Congo and the Congo basin.
- To implement state-of-the-art methods to study these collections that are destined to be stored, curated and studied in the new 'Centre de Surveillance de la Biodiversité' that is created in Kisangani.
- These collections are the start of a regional reference collection that will be of inequable value for studies addressing the sustainable exploitation of the biological natural resources of the D.R. Congo, including those on the environmental consequences of global climate changes.

Preliminary results

Cartography

- **During the preparation of the expedition**, the CONGORIVES project (UCL, l'Institut Géographique du Congo, RMCA and UNIKIN) realised a cartographical method that allows the rapid integration of high resolution satellite images with old maps, topographical and GPS data collected in the field. It was shown that in approximately 8 weeks high quality maps can be produced; and important result for a country for which most maps are over 40 years old. The maps produced in this project, will soon be made available on-line.
- Using specific data based on almost 40 satellite (SPOT 5) images, detailed maps were made up to facilitate the fieldwork during the expedition between Mbandaka and Kisangani. These maps have – and this is unprecedented for the area - a resolution of 5 meter and were generated in collaboration with the non Congolese governmental organisation OSFAC, based in Kinshasa.
- Finally an interactive site was put on-line, providing a geographically arranged overview of all research projects that are ongoing in the region (<http://edit.br.fgov.be/congorives2/>).

The environment

- **During the expedition**, environmental parameters were continuously gathered (24 hours a day) during the biological sampling period to provide baseline data for recent climate/environmental changes in the region. Meteorological data (T°, atm. pressure, humidity, total radiation, rainfall and wind velocity), as well as water temperatures were recorded. In addition, the local population was

questioned on the environmental and climatological changes they experienced over the last decades.

- Limnologists and biochemists collected samples on more than 53 sites along the stream (25 limnological measures). They demonstrated that the selected water parameters differ significantly depending on the sampled portion of the studied river system: the main stream, its tributaries and the so-called 'black waters'. Such physiological barriers may hamper the spreading ability of aquatic organisms in the entire watershed system.
- To study the presence of macro- and micro-pollutants (traces of locally and globally caused contamination by anthropogenic waste products) water samples were collected in 46 stations, as well as tissue samples of different organisms. This, to explore the distribution of pollutants in the different food chain levels (heavy metals, organic molecules, pesticides) and to evaluate the potential influence of these compounds on the biodiversity in the region. For these analyses, the biological samples were selected in concertation with the biological teams.

Plants, algae and fungi

During the expedition dozens of sites were sampled and in total 1222 plant species were collected for the herbarium collections of Yangambi, the "Centre de Surveillance de la Biodiversité (CSB)" in Kisangani and the National Botanic Garden of Belgium:

- All collected species were photographed in detail, with special attention for the seeds and flowers
- The collected material was stored in silicagel for future DNA analyses
- De gathered seeds (dried or stored in alcohol) were stored for further analyses
- Flowers and fruits were stored in alcohol
- 35 living orchids were collected and transferred to the botanical garden of Kisantu (D.R. Congo)
- A total of 143 slime molds (myxomycetes) were gathered (40 species), of which 15 are new for the D.R.Congo and sometimes even unknown for Africa!
- Approximately 380 samples for the study of phytoplanktonic, epiphytic and epipsammic diatoms were collected, for which microscopic slides will be made in the NBGB
- Approximately 100 woodsamples were gathered for morphological studies
- The fungi collection contains more than 150 specimens and 60 species, including 5 edible and probably also one new species
- Approximately 750 lichens were collected
- Quantitative data were gathered during the study of two transects along a vegetation gradient in Lieki (Lomami river)

Animals

Aquatic invertebrates

Aquatic invertebrates were sampled in approximately 150 localities, in collaboration with other teams, in habitats with different water quality. Primarily zooplankton, phytoplankton, crustaceans and molluscs were targeted. These organisms were collected using a variety of methods and devices. The samples were stored in ethanol in order to allow their combined morphological and molecular (DNA barcoding) identification.

- The most abundant taxa found are: snails, bivalves, aquatic insects, meiofauna, zooplankton, nematods, rotifers and pleuston on waterhyacints.
- It is likely that the collection contains undescribed species.

- The size and content of the collection will allow to develop several multidisciplinary research projects, that can link waterquality, the presence of aquatic invertebrates and zooplankton and trophic diversity of the local fish faunas.
- The present data (based on morphological observations) suggest that differences in the water composition only affects the species composition of gastropods.

Fishes

We collected fishes at 95 localities using scoop nets, gillnets, bow nets and through local fishermen. In total between 5500 en 6000 specimens were gathered (estimated 200 species), of which in total 1467 tissue samples were taken for species identification using DNA methods.

- Selected species were screened for the presence of gill parasites.
- In combination with earlier data, a DNA-barcoding database is being developed to facilitate the inventorisatioon of the fish fauna of the Congo river and its tributaries. This database already contains almost 200 species of the estimated 1000 species ($\pm 20\%$) that have been described for the Congo basin.

Insects and spiders

These groups were sampled using different methods: traps combined with lures (pheromones, manure, light) or via 'fumigation' of tree canopees. It is impossible to even give an approximative estimate of the total number of collected specimens (probably tens of thousands).

- The number of so-called free-living flies (Curtonotidae) was low. The family Curtonotidae, the most studied group, was very rare and only 2 genera were encountered. All specimens are being stored to allow both morphological and molecular analyses (DNA barcoding). Approximately 6000 specimens were labeled and stored as dried, pinned specimens; approximately 8000 specimens were stored in ethanol for later studies by specialists from all over the world.
- One of the 27 new "dance flies" (Hybotidae) that were collected, belongs to a new genus. Ongoing DNA -analyses are comparing this new genus with its relatives to establish its phylogenetic position.
- In total, approximately 156 damselfly species were gathered, which was more than anticipated. This large number of species was especially due to the sampling in pools and flooded forests, at some distance from the main stream. Many of the collected species were not previously found in this region, or are very rare in already existing collections. Because many different habitats were sampled, we obtained a first insight in the ecological requirements of the most commonly collected damselfly species.
- We collected 11 of the 16 described Sepsidae species (black scavenger flies) - see: http://evolution.science.nus.edu.sg/Sepsidae_BoyekoliExpedition.html. The specimens are photographed and a zoomfunction allows to distinguish the morphological details of these taxa. For every species that was put online a DNA barcode was determined. For this group, it seems likely that our collections warrant that 6 new species will have to be described.
- The study of the collected fruitflies allowed to show that the species composition of this group differs markedly depending on the degree of human impact on the study site.
- The number of plants in which insects were observed is suggested to be lower than elsewhere in tropical Africa. The results along a transect suggest that the number of species and infections strongly depends on the type of habitat.
- At least 15 termite species were observed on the 4 sites studied, which indicates that the total number of termite species across the whole region may be relatively high.
- Spiders were collected on the ground (in litter), in canopees (19 fumigations) en under the bark of trees and shrubs. During fumigations an important number of the specimens found, were ants and

orthoptera. From the thousands of specimens that were collected so far, 24 families were identified (based on data for 50% of the sites and 1011 specimens). Among the spiders the Salticidae, the Araneidae and the Ctenidae were the most numerous. It seems likely that some of the species caught have not been described thusfar.

Amphibians and reptiles

In total we collected 700 amphibians (approximately 50 frog species), 100 frog fishes and 150 reptiles (approximately 40 species, mostly snakes) by hand catches during the day and at night time.

- Sound recordings were made of the calls of male frogs (100 hours) that may assist in the characterisation and eventual description of frog species.
- Virtually all animals were photographed, then killed and fixed for morphological research.
- We also took 750 tissue samples for DNA research, diagnostic swabs for the pathogenic fungus *Batrachochytrium dendrobatidis* (300 specimens), skins swabs to screen for the presence of antimicrobial peptides (50 skin samples) and 50 bloodsamples for viral screening.

Mammals

Using hundreds of snap traps, live traps and pitfalls, we collected 195 small mammals (mainly mice, rats and shrews) representing at least 19 different species along both banks of the Congo river, and in different forest blocks, with some additional samples on some of the many islands of the river.

- All specimens were used to collect blood and liver samples, they were sexed, weighted, measured and their reproductive status was checked.
- Presumably, a number of new rat species will be described in the near future, and two shrew species were recorded for the D.R. Congo for the first time.
- The number of external parasites on the collected specimens was remarkably low. Only on the cosmopolitan rats, caught on the expedition boats, fleas were observed. Remarkably, many specimens were found to be infested with endoparasites that remain to be identified.
- Approximately 225 tissues of rodents and shrews are being screened on the presence of a whole series of pathogens (*Bartonella*, *Leptospira*, *Rickettsia typhi*, *Borrelia* cfr *duttoni*, *Apicomplexa*). The collected ectoparasites have not yet been identified.
- Many of the ectoparasites (current emphasis on fleas) are possibly agents causing typhus and the plague; also ticks and lice will be probed for the presence of pathogens.
- In some nematods, bacteria were detected that could be pathogenic as they resemble *Serratia marcescens*.

Bats and birds

We collected 594 bats (19 species) at 10 stations along both banks of the Congo river, with 32 nets and over a period of 22 nights (264 hours). On the same sites, and using the same nets we caught 830 birds (61 species).

- For both groups, we collected tissues samples that are being screened for a series of pathogens (*Bartonella*, *Leptospira*, *Rickettsia typhi*, *Borrelia* cfr *duttoni*, *Apicomplexa*). The collected endoparasites and ectoparasites will be identified.
- At present an important effort of the local scientific community is focussed at gaining insight in the role of fruit-eating bats and birds in the regeneration of the primary rainforest.

Languages

- The linguists organised 82 interviews at 9 localities (a total of more than 61 hours of sound recordings), concerning 4 languages and dialects (basic vocabulary, specific vocabulary about fauna, flora, cooking, ...).
- The most important observation is that Lingala, one of the 4 nationale languages of the D.R. Congo, is very widespread along the Congo stream, to the extent that it seems to repress the local languages and dialects.

Archeology en paleobotany

Archeologists and paleobotanists attempted to infer the history of the local vegetation and culture in the Congo bassin through an interdisciplinary approach. They studied the evolution of the tree species composition, and the preferences in the selection of firewood through time, and thereby, gain insight in the influence of human activities on the local vegetation (and vice versa). To obtain the data to address these questions they organized queries, inspected the ground surface, made test excavations, and full excavations on 24 localities that were also used to draw carbon dated bottomprofiles.

- Several of the sites appear to contain 'old' pottery (resembling the 'Imbonga' style), and the charcaol collected at the sites (washed and quantified), will be used for carbon datings and the identification of the tree species, used as firewood.
- The collected artefacts (mostly pottery) were photographed in detail, and will be described and compare to existing pottery collections from sub Sahara tropical Africa.

Participants/discipline :

- **Biogeochemistry:** Alberto Borges, François Darchambeau (Université de Liège, Belgium); José Nlandu Wabakanhanzi, (UNIKIN, D.R. Congo).
- **Limnology, meteorology, recent climate changes:** Pierre-Denis Plisnier (RMCA, Belgium); Octave Ebosso (UNIKIS, D.R. Congo).
- **Aquatic ecotoxicology:** Vera Verhaert (Antwerp University, Belgium).
- **Higher & lower plants, fungi:** Christine Cocquyt, Steven Dessein, Bart Würsten, Dries van den Broeck, Thomas Janssens, Myriam De Haan (NBGB, Belgium); Camille Couralet (RMCA, Belgium); Alexandra Ley (ULB, Belgium); Christophe Lomba Bosombo Lifindiki, Victor Udar Uyar Iye, Jean-Pierre Agbema Ngbale, (UNIKIS, D.R. Congo), Kitima Elasi Ramazani, Bosco Ndjango Ngona, (INERA Yangambi, D.R. Congo).
- **Aquatic invertebrates:** Koen Martens (RBINS, Belgium); Bert Van Bocxlaer (Ghent University, Belgium); Jean Papy Mongindo Etimosundja, Ernest Tambwe Lukosha, (UNIKIS, D.R. Congo).
- **Fishes and fish parasites:** Emmanuel Vreven, Jos Snoeks, Tobias Musschoot (RMCA, Belgium); Frederik Van den Broeck, (K.U. Leuven, Belgium); Célestin Danadu; Michel Komba Yendema (UNIKIS, D.R. Congo).
- **Insects and spiders:** Dance flies: Patrick Grootaert (RBINS, Belgium); Freeliving flies: Ashley H Kirk-Spriggs (National Museum, Bloemfontein, South Africa); damselflies, Klaas-Douwe B. Dijkstra (NMNH Naturalis, The Netherlands); Black Scavenger flies: Rudolf Meier (National University of Singapore, Singapore); insect-plant associations: Bruno Le Ru (Kenya Museum, Kenya); fruitflies: Virgilio Massimiliano, (RMCA, Belgium); Rosie Emeleme Akia Lekakwa (UNIKIS, D.R. Congo); spiders: Jean-Louis Juakaly Mbumba, Pascal Baelo Likangalele (UNIKIS, D.R. Congo).
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- **Birds:** Dieudonné Upoki Agenong'a, Emile Mulotwa, Assumani Bin Isiaka, José Akaibe (UNIKIS, D.R. Congo)

- **Small mammals, bats (including pathogens and parasites):** Pionus Katuala Gatate-Banda, Sylvestre Gambalemoke Mbalitini, Consolate Kaswera Kyamakya, Guy-Crispin Gembu Tungaluna, Dudu Akaibe, Nicaise Amundala Draso, Patrick Mutombo Kabeya; Prescott Musaba Malangani (UNIKIS, D.R. Congo); Jan Kennis (Antwerp University, Belgium), Anne Laudisoit (SERVA-CODA, Belgium), Erik Verheyen (RBINS, Belgium).
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