

Final Project Evaluation

Your Details	
Full Name	Pierre A. Mvogo Ndongo, Ph.D.
Project Title	Conservation and assessment of the extinction risk of a threatened species of the endemic freshwater crab <i>Louisea nkongsamba</i> , from Mt. Nlonako, Cameroon
Application ID	28462-D
Grant Amount	10,000
Email Address	mpierrearmand@yahoo.fr
Date of this Report	September 2019 – October 2020 (February 2021)

1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Collect field data on population levels and trends, distribution, habitat preferences, and threats for <i>Louisea nkongsamba</i>				<p>Populations of <i>Louisea nkongsamba</i> were reported from the northern, southern and eastern slopes of Mt Nlonako Ecological Reserve in the Littoral Region of Cameroon. These slopes are heavily impacted by human activities. Populations of <i>Louisea nkongasamba</i> are particularly susceptible to fragmentation due to their reproductive strategy which is exclusively by direct development which limits dispersal and tends to isolate populations (Cumberlidge, 2008). However, the differences between the size of populations of <i>L. nkongasamba</i> found on the different slopes of Mt Nlonako cannot be explained only by reproductive isolation and is more likely a consequence of habitat loss due to anthropogenic activities such as habitat destruction, over-extraction of water, pollution from pesticides and fertilisers, and the impacts of climate change on the ecosystem. It is therefore necessary to understand how these events have impacted the diversity and distribution of the freshwater fauna of Mt Nlonako. These anthropogenic threats may alter the ecological conditions found on different slopes of the mountain and probably produce significant effects on the biodiversity of freshwater ecosystems and may even initiate adaptive responses. The magnitude, extent, and duration of the impacts and responses seem to be system and location-dependent, and it is difficult to separate them from other environmental impacts from human activities.</p> <p>During the fieldwork local people were observed to impact the habitats of Mt</p>

Nlonako Ecological Reserve. In addition, environmental data recorded at the target localities revealed the river system to be acidic (pH 4.0-6.5), which is a pH range that is lower than would normally be expected for a tropical freshwater ecosystem (where the majority of aquatic organisms prefer water with a pH range between 6.5-9.0). Furthermore, this study was prompted as a response to extensive ongoing deforestation, intensive agricultural practices, and water flow alterations, including, drainage, climate change, and pollution which are currently impacting major river systems in southern Cameroon. The recorded data revealed a great deal of disturbance that directly affects the habitat of freshwater crabs and shrimps. The biodiversity of Mt Nlonako may be affected in a longer time frame by a number of factors including the variability of the nature, timing, and duration of local climatic conditions. In addition, this impacts the dispersal opportunities for species by presenting barriers to dispersal and altering connections among aquatic systems and challenges the physiological capacity of individuals and populations to cope with new environmental conditions.

Threats to the freshwater organisms and habitats of Mt Nlonako were compared to these from Eboforest ecological reserve. Both areas face similar threats from human activities, and the Eboforest is also home to another threatened crab species, *Louisea yabassi*.



Image of *Louisea nkongsamba* from Nlonako

			<p>Educational purpose</p> <p>The obvious nature and the large scale of the threats to the habitat of <i>L. nkongsamba</i> mean that a conservation action plan needs to be formulated if this threatened species is to be protected from the anthropogenic threats it is facing. Conservation actions include the monitoring of populations, studies of population genetics, and protection against threats. These actions would also include a strategy for communication and education of the stakeholders in the local community about the consequences of engaging in forest destruction, firewood collection, and agricultural encroachment. Local knowledge from indigenous peoples should also form part of the conservation messaging. Conservation action at this small scale was feasible because of its 'low-tech' approach that is necessary (and successful) in the context of rural Africa. The content of the educational messaging was structured to highlight the need for protection and to emphasise the potential advantages brought to the area by increased numbers of visitors (eco-tourists and scientists). The targeted stakeholders in the local communities were brought to understand that <i>L. nkongsamba</i> is found only in the remaining rainforest tracts around Nkonako ecological reserve, and that this habitat is globally unique. The semi-terrestrial lifestyle of <i>L. nkongsamba</i> means that its habitat ranges from permanent streams to seasonal shallow waters and wetlands, all of which are impacted by intensive destructive agricultural practices that degrade and pollute the natural vegetation. The release of pesticides into the environment containing substances that either harm or kill most species of invertebrates and vertebrates (most certainly including <i>L. nkongsamba</i>) were mitigated. In addition, these pesticides have been linked to a wide range of human</p>
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			<p>health hazards ranging from headaches and nausea to cancer, reproductive harm, and endocrine disruption. Pesticides have also been linked to nerve, skin, and eye irritation, dizziness, fatigue, and even sometimes fatal systemic poisoning.</p> <p>The on-going educational component in this project was aimed at encouraging local people to become aware of the negative impacts of agriculture on the freshwater ecosystems on Nlonako Ecological Reserve and the surrounding areas that could negatively impact populations of crabs. As did this in previous pilot projects, before the field studies began, we met with the chiefs of each area/slope. The targets of the educational messaging were the local people living around Nlonako Ecological Reserve where the known populations of <i>L. nkongsamba</i> are found. The main threats to <i>L. nkongsamba</i> were identified as the intensive agricultural practices that degrade and destroy the natural vegetation in many of the Nlonako Ecological Reserve. Unfortunately, the conservation activities had to be postponed due to the global pandemic in March 2020 that restricted travel and required social distancing. As a result, the slopes of the Mount Nlonako Ecological Reserve that include the stream habitat of <i>Louisea nkongsamba</i> are now regenerating</p>
<p>MtDNA loci (COI, 12SrRNA, 16SrRNA) will be used to investigate historical connectivity among populations, to implement the future management of genetic diversity.</p>			<p>This activity has intended to be conducted at the Museum Fur Naturkunde, Berlin, Germany. However, this has been postponed due to the global pandemic. despite this it was possible to carry out studies on the morphological differences between the populations of <i>L. nkongsamba</i> found on the different slopes of Mount Nlonako.</p>

<p>Research of Lost species in Eboforest zone, Littoral Region of Cameroon</p>			<p>Due to the global pandemic the research activities were modified to include the search for another rare species of freshwater crab species found in this area, <i>Louisea yabassi</i> (see figure), which also appears to live in a threatened habitat.</p>  <p>The newly discovered species <i>Louisea yabassi</i> from the Eboforest ecological reserve, whose habitat is also disturbed.</p>
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2. Please explain any unforeseen difficulties that arose during the project and how these were tackled.

The global pandemic of covid-19 restricted domestic and international travel during the project period which meant that it was necessary to postpone the DNA analysis of the specimens collected during this project in Cameroon (which is done in the Museum Fur Naturkunde, Berlin, Germany). It was, however, possible to investigate the morphological differences between populations on Mt. Nlonako.

3. Briefly describe the three most important outcomes of your project.

- a). The habitat preferences, population levels and trends, and threats to three endangered species from Cameroon (four populations of *Louisea nkongsamba*, as well as two other threatened species, *L. edeaensis* and *L. balssi*) have been described. More field data need to be collected to fully understand the breeding cycles of these freshwater crabs, and molecular and morphological investigations need to be carried out on the relationships of the four populations of *Louisea nkongsamba* found on Mt. Nlonako.
- b). Despite the global pandemic of covid-19, the ongoing educational component was effective. This activity began before the peak of the pandemic in Cameroon and messaging was delivered regarding the need to conserve the steep forested slopes (that include the stream habitat of *Louisea nkongsamba*) and keep them safe from the pressures from human activities. In addition, my local field assistants were trained on how to recognise the habitat of *Louisea nkongsamba* and how to collect routine data on behalf of conservation action plan.

c). The rare fourth species of *Louisea* (*L. yabassi*) was rediscovered from the lowland rainforest zone of Mt. Eboforest ecological reserve and (similar to *L. balssi*, *L. edeaensis* and *Louisea nkongsamba*) was also recorded from under small stones or fallen leaves in the shallow waters of a small permanent streams. Preliminary data show that this species also faces similar threats to the other species, also deserves to benefit from the development of a conservation action plan based on an IUCN Red List extinction risk assessment. The collection localities of this species are given below.



Figure 1. Collection localities of the populations of *Louisea yabassi* endemic to southwestern Cameroon. A–Population 1 (circle), population 2 (triangle) both found in the Ebo Forest, population 3 (asterisk) collected between 1900 and 1909 near Yabassi | B–Sampling sites of the newly discovered populations found in the Ebo Forest.

4. Briefly describe the involvement of local communities and how they have benefited from the project.

The local communities involved in this project include farmers, local authorities (chiefs of village and other organisations) and field assistants who were people originating from the villages around Mt. Nlonako. These communities had helped us to accomplish this project in the following points described below. In the ongoing education component, the chiefs of villages and their assistants helped us to reach people that regularly use Mt. Nlonako ecological reserve for their livelihood. Our field research assistants and guides were very active in helping us to collect scientific data and to educate local people using local and national languages. Local farmers provided us with constructive advice. To try to compare threats to other localities, we visited other localities such as the Eboforest Ecological Reserve and collected important comparative data that will be necessary for future conservation actions in this biodiversity hotspot.

5. Are there any plans to continue this work?

Yes. A conservation action plan will be constructed based on an IUCN Red List extinction risk assessment for the two small populations of threatened species of *Louisea* found in the Eboforest Ecological Reserve. The goal would be to conserve the Eboforest's threatened species (and its habitat) through surveying and monitoring aimed at collecting data on distribution, population, habitat, and threats necessary for an IUCN Red List assessment. In order to maintain and/or restore the population levels of this threatened species and other endangered species found in this zone, community training to build awareness and involve locals in the management of their aquatic and forest resources would be also planned for a favourable conservation status and to ensure the long-term conservation.

6. How do you plan to share the results of your work with others?

The results of this project will be presented at the national and international conferences, meetings or seminars once restrictions from the global pandemic have been lifted. The results will also be published in international scientific journals. The results of earlier parts of this project have been made available to the world scientific community via publications in *Zootaxa*:

Mvogo Ndongo PA, von Rintelen T, Cumberlidge N (2019) Taxonomic revision of the endemic Cameroonian freshwater crab genus *Louisea* Cumberlidge, 1994 (Crustacea, Decapoda, Brachyura, Potamonautidae), with descriptions of two new species from Nkongsamba and Yabassi. *ZooKeys* 881: 135–164.
<https://doi.org/10.3897/zookeys.881.36744>

Mvogo Ndongo PA, von Rintelen T, Tomedi-Tabi Eyango M, Cumberlidge N (2020) Morphological and molecular analyses reveal three new species of the freshwater crab genus *Buea* Cumberlidge, Mvogo Ndongo, Clark & Daniels, 2019 (Crustacea: Brachyura: Potamonautidae) from a rainforest biodiversity hotspot in Cameroon, Central Africa.

Journal of Crustacean Biology 40(3): 288–300, 2020.
<https://doi.org/10.1093/jcbiol/ruaa019>

Mvogo Ndongo PA, von Rintelen T, Cumberlidge N (2021) A new species of the freshwater crab genus *Potamonemus* Cumberlidge & Clark, 1992 (Crustacea, Potamonautidae) endemic to the forested highlands of southwestern Cameroon, Central Africa. ZooKeys 1017: 111–125. <https://doi.org/10.3897/zookeys.1017.60990>

7. Timescale: Over what period was the grant used? How does this compare to the anticipated or actual length of the project?

My second booster grant was planned to run from September 2019 to October 2020. With a series of monthly surveys at Nlonako ecological reserve and additional surveys at the Eboforest wildlife reserve (to study *Louisea yabassi*, a fourth species of this phylogenetically separate endemic genus). However, due to the global pandemic the project was extended until February 2021. In addition, we revised some activities.

8. Budget: Provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used. It is important that you retain the management accounts and all paid invoices relating to the project for at least 2 years as these may be required for inspection at our discretion.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Ethanol (70-90%) for preserving specimens	60	60		as initially budgeted...
Jars, boxes, field sampling equipment	80	80		as initially budgeted...
£6 a day for two field guides for 180 days field research. For each month, I will work for a total of 14 days (fieldwork+ ongoing education to people encountered in the field) + 1 full day for a public educational session.	1520	1520		Due to the global pandemic, we were not able to carry out this activity as initially budgeted. However, we modified the activity.
Ongoing basis educational sessions and the subsequent implementation of the conservation actions.	1200	1200		Due to the global pandemic, we were not able to carry out this activity as initially budgeted. However, we modified the activity.

Hotel in Nkongsamba for myself for 180 days.	1100	1100		Due to the global pandemic, we were not able to carry out this activity as initially budgeted. However, we modified the activity.
12 roundtrip bus trips Douala to Nkongsamba for me.	100	100		Due to the global pandemic, we were not able to carry out this activity as initially budgeted. However, we modified the activity.
180 roundtrip trips Nkongsamba to Nlonako for 3 persons (me and my two field assistants).	1700	1700		Due to the global pandemic, we were not able to carry out this activity as initially budgeted. However, we modified the activity.
£3x3 (9) per a day for subsistence for three persons my two field guides) & (myself for 180 days. We will be working a full day and need energy for our work.	1500	1500		Due to the global pandemic, we were not able to carry out this activity as initially budgeted. However, we modified the activity.
Preliminary research of conservation action plans in Eboforest area to search for the Lost species and compare the human action to the forest	2000	2000		This activity was planned in the application. However, we subsequently assigned enough funding due to the situation we experienced during the field.
Contribution to the field material	740	740		A new camera, GPS, nets, etc were important to access the biodiversity around the studies areas.
Total amount from the Rufford Small Grant.	10000	10000		
Fees for publications supported by the Museum Fur Naturkunde, Berlin Germany. They are still supporting other manuscript.				

9. Looking ahead, what do you feel are the important next steps?

The next steps will be the development of a conservation action plan and Red List assessment of two populations of *L. yabassi* re-discovered during the project from Eboforest Wildlife Reserve, a threatened habitat in the Littoral Region of Cameroon.

10. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

Yes, I have used the Rufford Foundation logo in my several official documents, in the materials produced for this project, posters and I have acknowledged the support of the RF in my publications. The Rufford Foundation will also be thanked in all other upcoming manuscripts.

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

Same members as in the previous projects.

Field assistants and guides: their role was to guide me and help collect data in the field and to talk with local people on behalf of educational activities.

Dr Thomas von Rintelen (Museum für Naturkunde, Germany), and **Dr Christian Albrecht** (University of Giessen, Germany): both provided with constructive advice during fieldwork and helped analysed data reported. They also are helping me to share results with other stakeholders and other international researchers.

Prof. Neil Cumberlidge (Northern Michigan University, USA): I received substantial support from Prof. Cumberlidge who is the Chair of the IUCN's Freshwater Crustacean Specialist Group. He provided constructive advice during this project not only with the taxonomic and ecological aspects of this research but also with respect to ethical considerations and policies required to work with endangered species. He also provided me with important strategies for messaging and the education of local people.

Other sources of input for the project were the chiefs of villages, and other freshwater ecosystem field researchers in Cameroon.

12. Any other comments?

The project helped to establish important links with traditional and administrative authorities around all the surveys localities and to get further experience for educational activities.

The work supported by Rufford Small Grant included the collection of several other non-target species of crustaceans that were used by faculty and students at the Institute of Fisheries and Aquatic Sciences and Engineering at the University of Douala in Cameroon.



CRUSTACES MENACEES D'EXTINCTION DONT LA SURVIE DEPEND DES ACTIVITES DE L'ISH



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RESUME

Les ressources halieutiques sont élevées ou cultivées pour deux buts:

- ❖ Préservations ou de conservation des espèces menacées,
- ❖ Alimentation.

Les espèces menacées ont une probabilité de disparaître supérieure à 50 % sur 5 ans.

Les travaux de recherches menés listent 10 espèces de crustacés du Cameroun menacées dont la survie dépend maintenant de l'ISH à travers ses filières: **Gestion des Ecosystèmes Aquatiques, Gestion des Pêches et Aquaculture.**

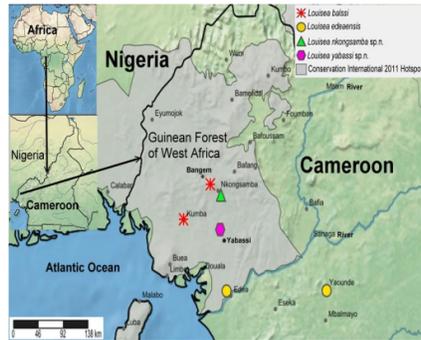


Fig. 1. Localisation des espèces du genre *Louisea*

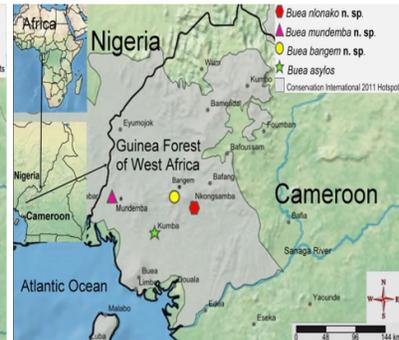


Fig. 2. Localisation des espèces du genre *Buea*



Fig. 3. *Louisea balssi* (Bott, 1969)
CR, IUCN



Fig. 4. *Louisea nkongsamba* Mvogo Ndong, von Rintelen & Cumberlandige, 2019
Threatened, IUCN



Fig. 5. *Buea asylos* (Cumberlandige, 1993)
Threatened, IUCN



Fig. 6. *Louisea yabassi* Mvogo Ndong, von Rintelen & Cumberlandige, 2019
Threatened, IUCN



Fig. 7. *Macrobrachium varians*
Threatened, IUCN



Fig. 8. *Louisea edaensis* (Bott, 1969)
EN, IUCN



Fig. 9. *Buea nlonako* Mvogo Ndong, von Rintelen & Cumberlandige, 2019
Threatened, IUCN



Fig. 10. *Buea bangem* Mvogo Ndong, von Rintelen, Tomedi-Tabi & Cumberlandige, 2019
Threatened, IUCN



Fig. 11. *Buea mundemba* Mvogo Ndong, von Rintelen & Cumberlandige, 2019
Threatened, IUCN



Fig. 12. *Sudanonantes tiko* Mvogo Ndong, Schubart & Cumberlandige, 2017
Threatened, IUCN

Utilisation standard de ces crustacés par les filières **GESTION DES ECOSYSTEMES AQUATIQUES ET GESTION DES PECHES** (Conservation in-situ)

Caractérisation écologique
Bio-indication
Suivie écologique

Développement des projets et de l'écotourisme dans les localités de: **BUEA, EDEA, BANGEM, NKONGSAMBA, MUNDEMBA, KUMBA, YINGUI et TIKO.**

Utilisation standard de ces crustacés par la filière **AQUACULTURE** (Conservation ex-situ)

Développement des projets et l'écotourisme à l'échelle nationale.

REMERCIEMENTS



REFERENCES

- Mvogo Ndong, P.A., von Rintelen, T., Cumberlandige, N. 2019. Taxonomic revision of the endemic Cameroonian freshwater crab genus *Louisea* Cumberlandige, 1994 (Crustacea, Decapoda, Brachyura, Potamonautidae), with descriptions of two new species from Nkongsamba and Yabassi. *Zookeys*, 881: 135–164. <https://doi.org/10.3897/zookeys.881.36744>
- Mvogo Ndong, P.A., von Rintelen, T., Tomedi-Tabi Eyango, M., Cumberlandige, N. 2020. Morphological and molecular analyses reveal three new species of the freshwater crab genus *Buea* Cumberlandige, Mvogo Ndong, Clark & Daniels, 2019 (Crustacea: Brachyura: Potamonautidae) from a rainforest biodiversity hotspot in Cameroon, Central Africa. *Journal of the Crustacean Biology*



VALORISATION PAR L'ISH DES CRUSTACÉS D'INTERET ALIMENTAIRE AU CAMEROUN

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RESUME

Le Cameroun dispose un réseau hydrographique riche en ressources halieutiques d'intérêt alimentaire.

Contrairement aux poissons, l'élevage et la production des crustacés restent négliger au Cameroun. Pourtant 100 g de certaines de ces espèces peut contenir ca. 14 à 35% de protéines et d'acides aminés essentiels.

Les travaux de recherches menés listent plusieurs espèces de crustacés d'intérêt alimentaire qui peuvent aussi causer des accroctés sur la santé des populations. L'ISH à travers ses filières **Gestion des Ecosystèmes Aquatiques, Aquaculture et Transformation de Contrôle Qualité** doit travailler pour améliorer l'alimentation des Camerounais tout en les évitant des maladies.



Fig. 1. Sites d'échantillonnage des crustacés au Cameroun

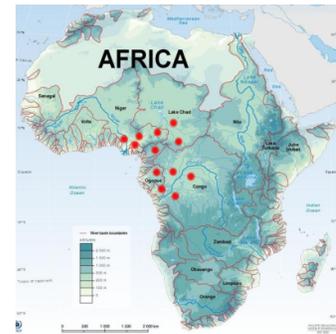


Fig. 1. Aire de distribution des crustacés du Cameroun



Fig. 3. *Sudanonantes afrivannus*



Fig. 4. *Sudanonantes aubryi*



Fig. 5. *Macrobrachium vollenhoveni*



Fig. 6. *Macrobrachium dux*



Fig. 7. *Atya scabra*



Fig. 7. *Atya gabonensis*



Fig. 8. *Atya africana*



Fig. 10. exemple de plats des crustacés



Fig. 11. *Macrobrachium dux*, male.

Utilisation standard de ces crustacés par la filière **GESTION DES ECOSYSTEMES AQUATIQUES**

Contrôle des maladies parasitaires (paragonimose), hydriques (cholera) etc.

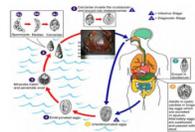


Fig. 12. Parasite cycle (IFMT, MS, Jun 2004)

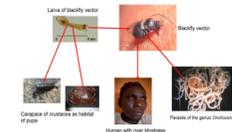


Fig. 13. a complex life cycle of the blackfly

REMERCIEMENTS:



Utilisation standard de ces crustacés par la filière **TRANSFORMATION ET CONTROLE QUALITE**

Valorisation de la valeur nutritionnelle de chaque espèce de crustacés
Science Alimentaire

Utilisation standard de ces crustacés par la filière: **AQUACULTURE**

Elevage, production et/ou domestication des crustacés au Cameroun

RÉFÉRENCES:

- Mvogo Ndongo, P.A., Schubart, C.D., von Rintelen, T., Tamesse, J.L. & Cumberlidge, N. 2017b. Morphological and molecular evidence for a new species of freshwater crab of the genus *Sudanonantes* Bott, 1955 (Brachyura: Potamoidea: Potamonautidae) from Cameroon, with notes on its ecology. *Zootaxa*, 4242: 161–173.
 Mvogo Ndongo, 2018. Diversity, systematics and geographical distribution of freshwater decapod crustaceans from coastal zone of Cameroon. Doctoral/Ph.D Thesis, University of Yaounde 1. 156p.