

Project Update: August 2017

This work was carried out under the supervision of Dr Thomas von Rintelen (Museum für Naturkunde, Germany), Dr Christian Albrecht (University of Giessen, Germany), and Prof Neil Cumberlidge (Northern Michigan University, USA; and Chair of the IUCN's Freshwater Crustacean Specialist Group). Other sources of input for the project were the chiefs of villages, and other freshwater ecosystem field researchers in Cameroon. The results of the research done in 2015 and 2016 that was supported by my first Rufford Small Grant and by a grant from the Congo Basin Program as well as part of this grant from 2nd Rufford were made available to the world scientific community via a publication in *Zootaxa*: Mvogo Ndongo P.A., von Rintelen T., Schubart C.D., Albrecht C., Tamesse J.L. & Cumberlidge N., 2017a. New data on the taxonomy, ecology, and conservation of the rediscovered *Louisea edeaensis* (Bott, 1969) (Brachyura: Potamoidea: Potamonautidae), an endangered freshwater crab from Cameroon. *Zootaxa* 4231 (2): 273–280.

I. Background

The potamonautid freshwater crab genus *Louisea* Cumberlidge, 1994, is endemic to southern Cameroon and includes two species, *L. edeaensis* (Bott, 1969) and *L. balssi* (Bott, 1959) (Cumberlidge, 1994, 1999; Mvogo Ndongo *et al.*, 2017a). Until now, all known specimens of the two species had been collected between 1900 and 1910 and deposited in museum collections in Germany and Austria. The extinction risk of both species was assessed using the International Union for the Conservation of Nature (IUCN) Red List protocols, and both were assigned to the endangered (EN) category (IUCN, 2003, Cumberlidge, 2008a, b; Cumberlidge *et al.*, 2009).

The first known specimen of *L. edeaensis* was a male from Edea, Cameroon collected in 1910 and deposited in the Zoologische Staatssammlung München, Germany (ZSM1118/1), where it remained unidentified until it was described 59 years later by Bott (1969) as *Globonantes macropus edeaensis* Bott, 1969 (Mvogo Ndongo *et al.*, 2017a). Twenty-five years later, Cumberlidge (1994) transferred this species to *Louisea* and recognised it as a valid species, *L. edeaensis* (rather than a subspecies of *G. macropus* (Rathbun, 1898)). Two unidentified specimens from Yabassi, Cameroon in the Museum für Naturkunde Berlin, Germany (ZMB 21575) collected between 1908 and 1909 were assigned to *Louisea balssi* by Cumberlidge (1999). While three unidentified specimens from Yaounde, Cameroon in the Naturhistorisches Museum Wien, Austria (NHMW 1877) collected in 1907 were assigned to *L. edeaensis* by Cumberlidge (1997).

The pilot project in 2015 supported by the 1st Rufford Small Grant and Congo Basin Grant made the dramatic discovery of the 'lost species' *L. edeaensis* on an island in Lake Ossa after more than a century of being lost to science. This finding inspired a preliminary conservation effort aimed at protecting the small newly rediscovered population of *Louisea edeaensis* (which was funded by my 2nd Rufford Small Grant) with the benefit to the whole ecosystem of Bedimet Island of Lake Ossa. The conservation initiative consisted of the collection of preliminary ecological and population data on the species together with educational messaging for the local population aiming at reducing threats to the species such as stopping intensive agriculture and the uncontrolled use of pesticides.

Taxonomic examination of the specimens rediscovered from Bedimet Island of Lake Ossa guided the reassignment of misidentified specimens of *L. balssi* from Yabassi to *L. edeaensis* (Mvogo Ndongo *et al.*, 2017a). In addition, the first ever DNA sequence data for *L. edeaensis* has helped to resolve the longstanding question of the subfamily assignment of the genus *Louisea* Cumberlidge, 1994 (Mvogo Ndongo *et al.*, 2017c). The molecular evidence presented in Mvogo Ndongo *et al.* (2017c) strongly (Fig. 1) supported the inclusion of *Louisea* as a valid genus in Potamonautinae within Potamonautidae, in a clade that includes all the other sub-Saharan African genera currently assigned to Potamonautinae. Furthermore, *Louisea* (which is endemic to Cameroon) was recovered as a well-supported sister-lineage to *Liberonautes* (which is endemic to West Africa from Senegal to Ghana).

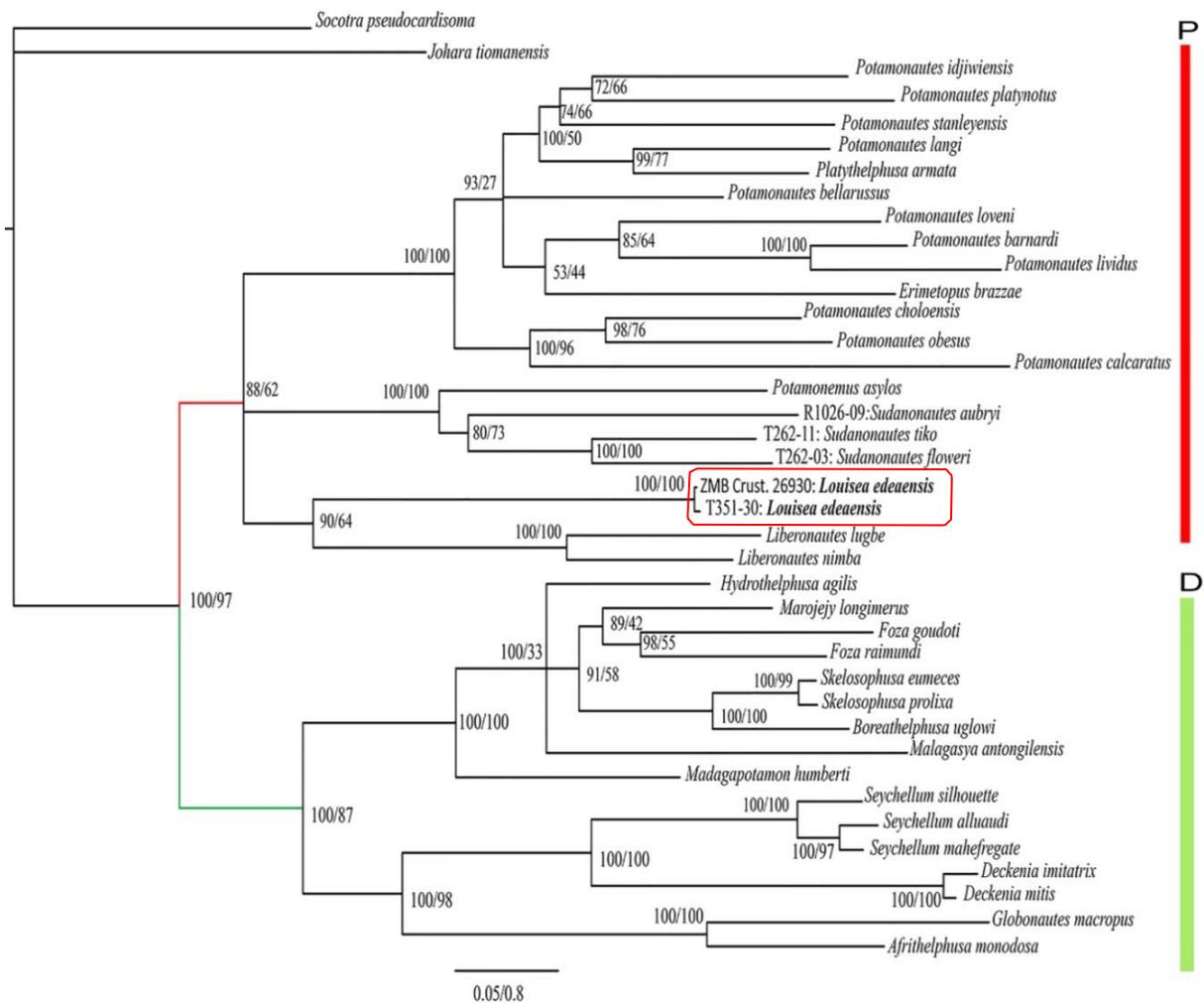


Figure 1. ML tree topology for selected Afrotropical freshwater crab genera derived from DNA sequences corresponding to four loci (partial 16S rRNA, 12S rRNA, COI mitochondrial genes and H3 nuclear gene). This study was aimed at discovering the relationship of *L. edeaensis* to the other genera found in Africa and Madagascar. The statistical values on the nodes indicate ML/BI posterior probabilities or bootstrap support, respectively (%). Red branch refers to the subfamily Potamonautinae Bott, 1970 (P); green branch refers to the subfamily Deckeniinae Hilgendorf, 1869 (D). (Mvogo Ndongo *et al.*, 2017c).

II. Species' functions & value

Louisea edeaensis performs an important ecological role in the food webs of Lake

Ossa stream and its streams, in the form of nutrient recycling in these aquatic ecosystems by these crabs that are detritus feeder that break down leaf litter. This species also feeds on live prey, such as millipedes (Fig. 2) as well as on plants. *Louisea edeaensis* in turn also serves as prey for other organisms such as crab-eating mammals, birds, and reptiles, as well as ants (see update March 2017 in Fig. 3).



Figure 2. *Louisea edeaensis* in its natural habitat and feeding on a millipede

III. Demographic analysis

Accurate population estimates based on mark recapture studies were difficult to do for *L. edeaensis* (Fig. 3). But conservative estimates based on extrapolation from samples caught during the ten monthly transects collected 70 individuals from the wild (and returned them unharmed after gathering biological data from them) after being studied in aquaria (Fig. 4). The estimated population density of *L. edeaensis* ranged from 1 to 12 individuals/transect during our surveys, and the population consisted mostly of juvenile and sub-adult individuals, with a male to female ratio of 1:1. No ovigerous females or females carrying hatchlings were encountered during the study so there is still no basic reproductive information available on the number of eggs laid, and the number of hatchlings produced, and when the breeding season occurs. We suspected that ovigerous females of *Louisea edeaensis* may hatch inside the hole of the trees (Fig. 5). But at this stage of conservation action plan, of this species, I do not need to destroy their biotopes to search ovigerous females inside the hole of the trees.



Figure 3. *Louisea edeensis*



Figure 4. Specimens of *L. edeensis* retained in aquaria during the field work



Figure 5. *Louisea edeaensis* carrying out the prey in its biotope.

IV. Habitat and threats reported during after two months of this project.

All specimens of *Louisea edeaensis* were reported from water bodies such as puddles near small permanent streams as well as the damp conditions under fallen leaves on land adjacent to streams, and it is noteworthy that no specimens were found in nearby streams with 10 months-round flow. A number of threats to the continued survival of *L. edeaensis* were identified during the first two months of this project including those that impact its habitat. Many parts of Bedimet Island (including the locality where this species was collected) have been cleared of natural forest cover to make way for agriculture, with the result that the vegetation is now dominated by shade-tolerant tropical plants of the family Amaranthaceae that grow well in moist soils, cultivated fields, and wastelands. Apart from the substantial disturbance of the original vegetation on Bedimet Island, pesticides applied to the crops may drain into the aquatic habitats inhabited by *L. edeaensis*, which could well have a serious impact on this species. Furthermore, the clearing of original forest (Fig. 6) cover has exposed the aquatic systems on Bedimet Island (and the freshwater invertebrates that live there) to direct sunlight, and this is reflected in the high average daytime water temperatures of up to 30°C recorded during this study (compared to average water temperatures in streams shaded by forest cover of between 22–26°C). In addition, our water chemistry data indicate that the marginal aquatic habitats on Bedimet Island have a very low average pH of 4.5, indicating seriously acidic conditions at these localities well outside of the preferred pH range (6.5–9.0) for most freshwater organisms (Robertson-Brayan, 2004). This is of concern because acidic conditions may influence hatching and survival of *L. edeaensis* and other aquatic invertebrates whose larval and/or juvenile stages are often more

sensitive to low pH than are the adults. The immediate threats from habitat disturbance, altered water chemistry, and pollution all clearly raise questions about the long-term existence of *L. edeaensis* at this specific locality.

The rediscovery of *Louisea edeaensis* after more than 100 years at Bediment Island of Lake Ossa has expanded the range of this species, because in addition to this locality a second locality was included from a previously misidentified specimen that was included in this species following comparison with the new material. The result is the addition of two new locations for this species (IUCN, 2003, Cumberlidge *et al.*, 2009; Cumberlidge, 2011). These four locations allowed the calculation of a revised geographic range estimated based on the calculation of the extent of occurrence (EOO, the area contained within the minimum convex polygon around all sites of present occurrence). It also allows for an estimate of the amount of habitat occupied (the Area of Occupancy, AOO, the area within the EOO that is actually occupied by the taxon). The EOO and AOO estimates based on point locality data using GeoCAT (<http://geocat.kew.org>; Bachman *et al.*, 2011) give a revised EOO of 6,780 km² and an AOO of 16 km² (estimated by overlaying a 2 × 2 km grid and summing the area of occupied cells). If considered alone, this revised estimate of the EOO would assign this species to either the vulnerable (VU) or EN categories. However, given the new knowledge of its specific habitat requirements and the existence of immediate threats to its habitat, however, this species was more likely to be upgraded to critical (CR) if a formal IUCN Red List extinction risk assessment were to be carried out. Our educational component on the human negative impacts (see below) has helped to save this species from extinction. The newly-reported threats to an already endangered species area cause for concern and they underlined the need for further studies on behalf of conservation action plan in southern Cameroon.



Figure 6. Aspects of the habitat of *Louisea edeaensis* from Bedimet Island of Lake Ossa

V. Education component

The on-going education component in the project was aimed at encouraging local

people to become aware of the negative impact of agriculture on the freshwater ecosystems on Bedimet Island that could impact populations of crabs. Before the field studies began we met monthly with the Chiefs of the Villages in Lake Ossa (Mevia part) that includes Bedimet Island. The targets of the educational messaging were the local people who are owners whose families live on Bedimet Island in Lake Ossa where the only known extant populations of *Louisea edeaensis* are found. The main threats were identified as the intensive agricultural practices that degrade and destroy the natural vegetation and this is happening in many of the islands in the Lake Ossa complex. Our 1st educational message to local farmers from Bedimet island of Lake Ossa was that, most freshwater invertebrates found in Bedimet Island in Lake Ossa are semi-terrestrial and are found in a range of habitats from puddles near small permanent streams to unstable shallow waters. Many of these invertebrates are not found anywhere else in the world, and so they need to be protected from extinction by stopping the intensive agricultural practices that degrade the natural vegetation, and by ending the use of pesticides. These actions will bring benefits to the local communities (people around Lake Ossa) who can host and guide tourists and scientists from other regions of Cameroon and from all around the world that are attracted there by their interest in Lake Ossa's intact natural tropical ecosystem and the unique wildlife that is found there. In addition, the local markets and local houses for rent around the Lake Ossa would benefit from the increased flow of foreign customers and this will contribute to the development of the local community. Our 2nd educational message alerted the people working on Bedimet Island in Lake Ossa to the dangers of releasing pesticides into the environment that contain substances that either harm or kill most species of invertebrates and vertebrates (and may cause the extinction of threatened species). We emphasized that pesticides are linked to a wide range of human health hazards ranging from short-term impacts (such as headaches and nausea) to chronic impacts (like cancer, reproductive harm, and endocrine disruption). Pesticides can cause nerve, skin, and eye irritation and damage, dizziness, fatigue, and even sometimes fatal systemic poisoning. The goal here was to get the people working in Bedimet island of Lake Ossa to change their activities and keep this ecosystem healthy.

Another important outcome of this project is that I have training my local field assistants on how to recognise the habitat of *Louisea edeaensis* and how to collect this species. We are recommending that farmers focus their attention on land that has already been used for cultivation, and we direct the farmers away from the vegetation and streams that form the habitat of *L. edeaensis*. We do not ask them to stop their farming activities, but we ask them to respect the vegetation cover and to try not to use pesticides near to the sensitive habitats. Between November 2016 to August 2017 the above two educational messages were delivered to local farmers encountered on Bedimet Island in Lake Ossa. One problem that I'm encountering with this project was that I did not include a provision for the ongoing educational component (in the Bedimet Island) that could offset losses by farmers who abandoned their agricultural activities in the areas we have seen specimens of *Louisea edeaensis*. The compensation we supplied to the farmers took the form of basic food supplies (bread, soup, meat, rice, and some money to help them start new farm away habitats of *Louisea edeaensis* etc.) that was well received, and which earned us their full attention. We were obliged to take this compensation from the money budgeted to cover local workshops that were aimed at reinforcing the ongoing education component. It should be noted that without this compensation the local farmers would not have ceased practicing farming in the areas where we

encountered specimens of *Louisea edeaensis*.

We are convinced that our conservation actions aimed at protecting the habitat of *L. edeaensis* have been successful through the monitoring efforts we done during field trip. We have monitoring step by step the great education efforts including compensation for local farmers carried out at the end of each fieldwork. This was easy for us to do because we were working only on the Bedimet Island. The local farmers concerned with the compensation have definitively removed their farms from areas where we have seen specimens of *L. edeaensis* and where we are sure this species occurs. The changes from of all our education efforts were noticeable only after 7 months of work (i.e., in May 2017). We now intend to have discussions with the Cameroonian Government (Ministry of Forest and Wildlife) so that the areas where *L. edeaensis* occurs can become a RED ZONE and be protected by the local laws.



Figure 7. Bedimet Island of Lake Ossa, ongoing education component during fieldtrip.

During our discussions with local farmers on Bedimet Island, one of them let us know that similar destructive agricultural practices are also being carried out at other lakes in Cameroon such as Lake Manengouba (southwestern Cameroon) that has a similar habitat (with small streams) that could support freshwater crabs. With this in mind, I spent 2 days at Lake Manengouba to compare the conditions there with the current conditions from Bedimet Island of Lake Ossa, because there are no conservation projects in this place. Interestingly, the small stream in the forest near this lake (Fig. 9)

was home to a second species of *Louisea* (*L. balssi*) (Fig. 10) that was also listed by the IUCN Red List as an endangered species. The comparisons of these two sites revealed that the conservation work done at Bedimet Island of Lake Ossa has slowed the pressure on freshwater habitats from human activities. It is clear that these relatively simple conservation actions on the ground that include local stakeholders may also be effective in other areas of Cameroon where species that are threatened with extinction are living in unprotected areas.



Figure 8. Pierre A. Mvogo Ndongo in the remote freshwater ecosystem on Bedimet Island in Lake Ossa, Cameroon.



Figure 9. Lake Manengouba



Figure 10. Recently discovered specimen of *Louisea balssi* from Lake Manengouba. CW =16mm. Specimen collected for taxonomy purpose.