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### RESEARCH ARTICLE

#### KNOWLEDGE OF SHRIMPS' COMPOSITION AND THEIR IMPLICATION IN FOOD SECURITY IN DRYLAND AREA IN BURKINA FASO (WEST AFRICA)

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#### Abstract

In West Africa, particularly in Burkina Faso, shrimp are an important natural resource with high economic and nutritional value for rural populations. However, the knowledge of shrimp composition and their potential use in fisheries are still very limited in Burkina Faso. To fill this gap, we examined the shrimp's composition and addressed their potentiality in fisheries, and for farming in Burkina Faso. To do so, key environmental variables were measured, and shrimp were collected using a hand net and a cast net, and identified using taxonomic manuals and keys. From our findings, seven species belonged to genus (*Macrobrachium*) were identified, with two more species reported for the first time in Burkina Faso. The results showed that dryland lakes bear a high shrimp's species richness due to good habitats' conditions, and many efforts need to be done to boost shrimps' production, both artificially and naturally in rural areas of Burkina Faso, where hunger and malnutrition are the recurrent issues. Thus, the implementation of water resources policy by promoting crustaceans' fisheries, encouraging scientific researches and providing technical and financial supports might be the future challenges for scientists and policy makers to boost shrimp fisheries and cultivation for the well-being of poor population in rural areas.

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#### Introduction: -

Shrimp resources are highly diversified and support a large range of fisheries (Bondad-Reantaso et al., 2012; Davis et al., 2021). Thus, for poor and vulnerable households, shrimp fishing is an important source of cash and employments. Due to high demand of shrimp proteins over the world, shrimps' fisheries are constantly developing (Joffre et al., 2018). Indeed, shrimps are also valued as food by man with high nutritional value in protein, lipids and minerals (Adeyeye and Adubiaro, 2004; Bondad-Reantaso et al., 2012; Tee et al., 2022).

In West Africa, shrimps occur throughout the region from coastal to inland water and play an important role in aquatic ecosystems functioning, and are also used as indicators of ecological condition (Kelleway et al., 2010; Tchakonté et al., 2014; Tampo et al., 2021). But, overexploitation, habitats fragmentation and pollution due to human activities have contributed to decline shrimps' diversity in West Africa (N'Zi et al., 2008; Kaboré et al., 2016b). In coastal countries of West Africa, studies have been devoted to shrimps, and are based on ecology,

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growth, fishing and farming (Laroche and Siaviri, 1995; Zabbey et al., 2010; Gangbè et al., 2016; Djirieuolou et al., 2017; Ajeegah et al., 2018; Gangbè et al., 2019), among others. In addition, others studies show that shrimp community are also influenced by local physical habitat, chemical variables, water quality and land use (Saito et al., 2012; Tchakonté et al., 2014; Djirieuolou et al., 2017; Koussovi et al., 2021) which can negatively affect the shrimp species and abundances.

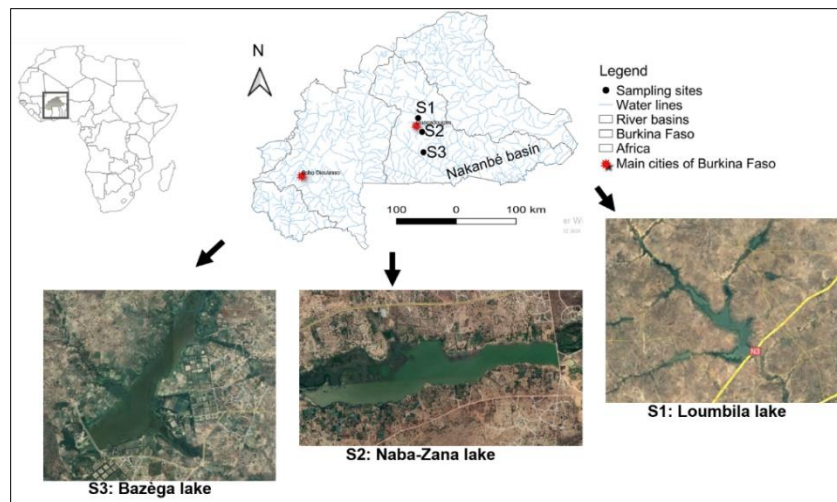
However, information's about shrimp community structure, ecology and biology, as well as, shrimp fisheries and farming in Sahel area, particularly in Burkina Faso are still incipient or non-existent, despite that authors have demonstrated that high number of species encountered in *Macrobrachium* genus are commercially very exploited in fisheries and aquaculture (Griessinger et al., 1991; Abadilla et al., 2020). Because of lack of knowledge on shrimps' community, and the unknown of their potential use in aquaculture, the shrimp sectors still under exploited in Burkina Faso compared to those of fish. While, the very small-scale artisanal shrimp fisheries can contribute to local rural economic development, in terms of food, income, and employment, as confirmed by others authors (Ollabodé et al., 2021; Joffre et al., 2018). These economic and nutritional values have led to a fast growing of shrimps farming in Asia, as demonstrated in many studies (Umesh et al., 2010; Thitamadee et al., 2016; Bir et al., 2017; Dorber et al., 2020; N'Souvi et al., 2021; Thitamadee et al., 2022; Hou et al., 2022), and recently in some west African countries (Boguhe et al., 2016; Tchakonté et al., 2014; Koussovi et al., 2020). Despite these enormous benefits that shrimp sector provides, shrimps potentiality in fisheries and aquaculture remain poorly documented and many obstacles inhibit the development of shrimps' sector in Burkina Faso.

To meet challenges of food security due to high population demand, and climate change, crustaceans could be a good alternatives food resources in Sahel area. Therefore, intensive works are needed to provide deeper insight in ecological and biology of shrimp. In addition, address issues in shrimp sector are crucial for the sustainable management of fishery resources and aquaculture in Burkina Faso. The keys aim of the present study were to 1) identify and describe the composition of shrimps in Burkina Faso, 2) explore the relationship between water variable and shrimps' abundances, and 3) discuss implications of shrimps' resources in fisheries in Burkina Faso.

## Methodology:-

### Study area

Biological data and physico-chemical variables were collected every fourteen days during four months from June to September 2021 in three sampling lakes (Figure 1). Bazèga lake located at the coordinates 11°44' N (latitude) and 1°21' W (longitude) is devoted to fishing activities, as well as, vegetables farming during the dry season. Loumbila lake located at the coordinates 12°30' N (latitude) and 01°22' W (longitude) supplies clean water for the city Ouagadougou, capital of Burkina Faso, and also plays an essential role in the socio-economic development of the local populations (e.g., fishing, crops and vegetables farming activities are practiced). Nabazana lake is located at the coordinates 12°12'10" N (latitude) and 01°21'17" W (longitude) in the Koubri area. Nabazana lake riparian land is devoted to rain-fed agriculture and vegetables, as well as, the main fisheries of the area.



**Figure 1:** - Map of Burkina Faso showing the hydrographic of the study areas and the three sampling sites.

Most of all riparian's zones of sampling lakes are used during the rainy period for rain fed agriculture and during the dry period for irrigated vegetables farming. Hence, lakes are facing to intense agricultural practices including a high siltation, and additional nutrient input and pesticides that posing potential threat to the survival of shrimps in lakes. Artisanal shrimp fisheries activity is recently growing in these areas, with less interest for fishermen and local population due to the lack of knowledge about shrimp sector. These important fisheries are vital for local community because they never dry out during the dry season.

### Measurement of physico-chemical variables

In situ keys physico-chemical such as, pH, electrical conductivity, temperature, dissolved oxygen (O<sub>2</sub>) and total suspended solids (TDS) were measured with field multimeters (WTW 340i) and TDS-conductimeter before the shrimps' collection. In addition, 1.5 L of water was taken in a plastic bottle, stored on ice for chemical parameters analysis in the laboratory within 48 hours after collection. Nutrients including nitrate, phosphate, nitrite and ammonium was determined by UV-spectrophotometric method, and calcium and magnesium were determined by titration method using HACH DR/3900. All these parameters were measured in "Laboratoire de la Direction Générale des Ressources en Eau du Burkina Faso" with an accuracy ranking from 1 to 2%. All chemicals analysis followed the standard methods described in Rodier et al. (2009).

### Shrimp sampling and identification

Shrimps were sampled with a hand net (rectangular opening: 25 cm x 25 cm, mesh size: 500 µm), following the multi-habitat sampling approach described in Kaboré et al. (2016b). The sampling units were allocated to each habitat. The coarse substrates were removed, macrophytes and wood debris were shaken to dislodge and collected shrimps. Additional data were obtained from professional fishermen using cast net. The samples were fixed in the alcohol (90%) for detailed examination in the laboratory. Prior to sorting out the organisms, then samples were sieved and the animals were separated, and identified to the species level using dichotomic shrimps' keys and manuals (Monod, 1980; Powell, 1982; Gooré Bi et al., 2002).

### Data analysis

Shrimps' community structures were described through relative abundance and diversity parameters (Dajoz, 2000; Piérou, 1969; Shannon et Wiener, 1949). The relative abundance is the percentage of individual particular taxon by total number of all taxa. Total species richness was simply taken as a count of number of species present in each sample, and frequency of occurrence is the percentage of samples in which each specie occurred. The diversity index of Shannon-Weiner and Piérou equitability index were calculated following the equations (1 et 2).

$$\text{Shannon- Wiener diversity} = - \sum_{i=1}^s p_i \ln p_i \quad (1)$$

where  $p_i$  is the proportion of individuals in the "ith" taxon of the community and  $s$  is the total number of taxa in the community

$$\text{Equitability} = \frac{H'}{\ln S} \quad (2)$$

Where  $H$  was the Shannon-Wiener index,  $S$  was the number of species in samples.

To characterize the lakes conditions, the mean and standard deviations were calculated for all physico-chemical variables. A significance level of  $p$ -value  $< 0.05$  using Kruskal-Wallis test was computed. After all, correlations between environmental variables and taxa abundances (response variables) of shrimps was determined using Spearman correlation analysis. All data analyses were done using PAST (version 3).

## Results:-

### Water variables

Table 1 summarizes the mean values of environmental variables recorded in the three lakes. The pH values observed ranged from  $(5.55 \pm 0.18)$  at Bazèga lake and  $(6.46 \pm 0.66)$  at Nabazana, thus showing that the water was slightly acidic at some sites. Water mean temperature fluctuates between  $(26.93^\circ\text{C} \pm 0.77)$  at Nabazana and  $(28.19^\circ\text{C} \pm 0.24)$  at the Loumbila lake, indicating that the lakes water was slightly warm, thus characterizing arid tropical freshwater condition. The high mean value  $(65.53 \pm 4.85 \mu\text{S. cm}^{-1})$  of electrical conductivity was observed at Loumbila lake, while low value of  $(43.06 \pm 5.07 \mu\text{S. cm}^{-1})$  was recorded at Bazèga, thus expressing the degree of water

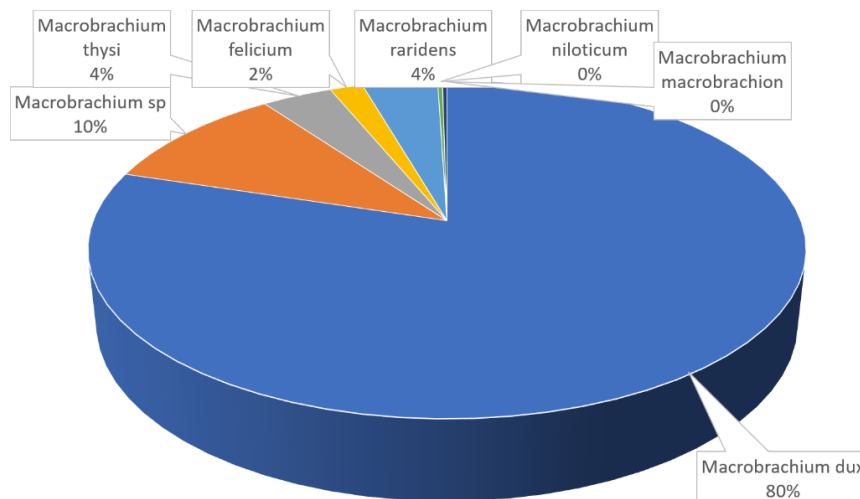
mineralization and salinity. The dissolved oxygen varies on average of (23.51%  $\pm$ 10.84) at Bazèga and (29.95%  $\pm$ 22.84) at Nabazana. For total dissolved solids, the lower mean value (18.42  $\pm$ 2.51 ppm) was recorded at Bazèga lake while the high mean value (32.78  $\pm$ 2.24 ppm) was found at Loumbila lake. The calcium mean value of (7.97  $\pm$ 1.53 mg. L<sup>-1</sup>) was reported at Loumbila lake, while low value of (4.76  $\pm$ 0.21mg. L<sup>-1</sup>) was observed at Bazèga lake. The magnesium shows the same trend with high mean value of (3.1 $\pm$ 0.76 mg. L<sup>-1</sup>) at Loumbila lake and low value of (1.34  $\pm$ 1.63mg. L<sup>-1</sup>) at Bazèga lake. For the nutrients, the high mean values of phosphate (7.76  $\pm$ 0.00mg. L<sup>-1</sup>) and nitrate (6.86  $\pm$  1.52mg. L<sup>-1</sup>) were recorded at Naba-Zana Lake. The ammonium and nitrite values were found at less of 1 mg. L<sup>-1</sup> at all sites, excepted at Bazèga lake where the value reaches (1.27  $\pm$ 1.33mg. L<sup>-1</sup>). The TDS, Dissolved Oxygen (%), conductivity, nitrate, ammonium, magnesium and calcium showed significant differences within lakes (Kruskal-Wallis Test, p<0.05), but pH, nitrite and phosphate did not reveal a significant difference among lakes.

**Table 1:** - Mean and Standard deviation of environmental variables evaluated at each sampling station during the study period. n indicates the number of replicates.

Water variables	Loumbila	Naba-Zana	Bazèga
	n=2 $\times$ 4		
pH	5.84 $\pm$ 0.43	5.79 $\pm$ 0.74	5.50 $\pm$ 0.55
Temperature (°C)	28.19 $\pm$ 0.72	27.69 $\pm$ 0.84	27.33 $\pm$ 0.64
Conductivity ( $\mu$ S. Cm <sup>-1</sup> )	65.33 $\pm$ 7.51	62.16 $\pm$ 1.72	35.33 $\pm$ 2.17
Dissolved Oxygen (%)	24.51 $\pm$ 12.68	52.79 $\pm$ 25.07	31.16 $\pm$ 16.40
Total Disolved Solid (ppm)	32.77 $\pm$ 3.49	31 $\pm$ 0.89	17.88 $\pm$ 0.92
Calcium (mg/l)	7.97 $\pm$ 1.53	7.52 $\pm$ 0.41	4.76 $\pm$ 0.21
Magnesium (mg. L <sup>-1</sup> )	3.1 $\pm$ 0.76	2.06 $\pm$ 0.15	1.34 $\pm$ 1.63
Ammonium (mg. L <sup>-1</sup> )	0.43 $\pm$ 0.33	0.08 $\pm$ 0.01	0.24 $\pm$ 0.12
Phosphates (mg. L <sup>-1</sup> )	0.50 $\pm$ 0.67	7.76 $\pm$ 0.35	0.17 $\pm$ 0.11
Nitrate (mg. L <sup>-1</sup> )	1.58 $\pm$ 1.42	6.86 $\pm$ 0.43	0.86 $\pm$ 1.25
Nitrite (mg. L <sup>-1</sup> )	0.05 $\pm$ 0.03	0.06 $\pm$ 0.02	1.27 $\pm$ 1.33

### Shrimps' community composition and structure

Figure 2 shows the composition of the seven freshwater shrimp species. All sites were dominated by *Macrobrachium dux* (80%). *Macrobrachium sp* made up 10% of abundance followed by *Macrobrachium raridens* (4%), *Macrobrachium thysi* (4%) and *Macrobrachium niloticum* (2 %). *Macrobrachium Macrobrachion* and *Macrobrachium niloticum* were less represented (<1%). All species belonged to one family (Paleamonidae) and one genus (*Macrobrachium*).



**Figure 2:** - Relative abundances of shrimp species collected at the three lakes during the study period.

Table 2 shows an overview on species richness and diversity indices. The high species richness was encountered at the Nabazana lake (06 species), followed by Loumbila lake (05 species) and Bazèga lake (03 species). *M. dux*, *M.*

*sp.*, and *M. thysi* were the commonest species (FO > 50%) found at all the sampling lakes, while *M. felicium* was frequently (FO < 50%) found in the majority of sample stations, and then *M. macrobrachion*, *M. niloticum* and *M. raridens* were rare (FO < 25%)

**Table 2:** - The list of shrimps' species and diversity indices found at the three sampling stations. (\*) indicate frequency of occurrence of the species. Commonest species (\*\*\*, FO > 50%); frequent species (\*\*, FO < 50%) and rare species (\*, FO < 25%).

Family	Species	Acronyms	Loumbila	Nabazana	Bazèga
Paleamonidae	<i>Macrobrachium felicium</i> Holthuis, 1949	<i>M. felicium</i>	**	**	**
	<i>Macrobrachium macrobrachion</i> Herklots, 1851	<i>M. macrobrachion</i>	*	*	*
	<i>Macrobrachium niloticum</i> P. Roux, 1823	<i>M. niloticum</i>	*	*	*
	<i>Macrobrachium raridens</i> Hilgendorf 1893	<i>M. raridens</i>	*	*	*
	<i>Macrobrachium dux</i> Lenz, 1910	<i>M. dux</i>	***	***	***
	<i>Macrobrachium sp</i> Monod, 1978	<i>M. sp</i>	***	***	***
	<i>Macrobrachium thysi</i> (Powell 1980)	<i>M. thysi</i>	***	***	***
Species richness			5	6	3
Shannon-Weiner			1.67	2.06	1.09
Equitability indice			0.85	0.51	0.84

### Influence of environmental variables on shrimps community structure

Species and water variables displayed strong correlation (Table 3). *M. dux*, *M. thysi*, *M. felicium*, *M. raridens*, and *M. niloticum* showed a strong positive correlation with dissolved oxygen, pH, nitrate, phosphate, calcium and magnesium, excepted the temperature and the ammonium. *M. sp* is negatively associated to nitrite, while *M. macrobrachion* is positively associated with ammonium.

**Table 3:** - Summary of Spearman correlation ( $R^2 > 0.10$ ) between shrimp abundances and environmental variables.

	M. dux	M. sp	M. thysi	M. felicium	M. raridens	M. Niloticum	M. macrobrachion
pH	0.16	0.46	<b>0.55</b>	0.33	0.33	<b>0.58</b>	0.41
Conductivity	0.19	-0.13	-0.13				0.25
DissolvedOxygen	0.26		<b>0.52</b>	0.48	0.48	0.25	
TDS	0.48		0.10	0.26	0.26	0.25	0.41
Temperature		-0.49	<b>-0.70</b>	<b>-0.65</b>	<b>-0.65</b>	<b>-0.58</b>	0.41
Calcium	0.41	0.28	0.32	<b>0.51</b>	<b>0.51</b>	0.41	
Magnesium	0.37	0.10	0.43	0.34	0.34		0.25
Ammonium		-0.37	<b>-0.70</b>	<b>-0.77</b>	<b>-0.77</b>	<b>-0.51</b>	<b>0.60</b>
Nitrate	0.54	<b>0.65</b>	0.29	0.11	0.11	<b>0.58</b>	0.41
Nitrite		<b>-0.61</b>	0.13	0.35	0.35		
Phosphate	<b>0.64</b>	0.15		0.17	0.17	<b>0.58</b>	0.42

### Discussion: -

Water variables are important key factors that control the shrimp community in tropical inland waters. Here we cover several water quality variables that might have an influence on shrimp community structure. Indeed, the values of conductivity show that all sites were in the range of natural freshwater, which varies from 0.5 to 1.500  $\mu\text{S}\cdot\text{cm}^{-1}$  (Rodier et al., 2009). The average values of conductivity obtained across sites are lower compared to those of Tampo et al. (2021), reflecting the low salt content of studied lakes, and showing good water quality. In the present study, these water bodies are suggested to be good habitats for the shrimp community which are often vulnerable to high concentration of salt in water (Tchakonté et al., 2014; Tampo et al., 2021). Tampo et al. (2021) have demonstrated that the dissolved oxygen is an excellent indicator of water quality, because it is likely to be affected

by anthropogenic pressures. Thus, the values obtained here indicate a fairly good oxygenation of waters in the three reservoirs during the study period due to man-induced activities. These results corroborate those of Bancé et al. (2021b) who found the same values in other lakes in Burkina Faso, and might affect shrimp community structure. Shrimps' species are sensitive to pH variation (Tchakonté et al., 2014), but the pH range obtained in this study are within the limits of shrimps' life. Here, shrimp are well adapted to local condition, but Tampo et al. (2021) argued that low or high pH values could be associated with lower diversity. Our findings lie in the same line with those reported in previous studies in Burkina Faso (Ouedraogo et al., 2018; Bancé et al., 2021a, b). The values of organic nutrients including nitrate, ammonium nitrite and phosphate fluctuation are indicator of water quality problems which have been associated with eutrophication caused by nutrient loading from intense agricultural practices (Kaboré et al., 2022b). But, in the present study these values remain low-to-moderate levels of pollution, and *Macrobrachium* shrimps are taking advantage in profiting from limited eutrophication (Kaboré et al., 2016b). The amount of calcium and magnesium concentration found in study lakes are often associated with high diversity of shrimps. This could be explained by the fact that many inorganic elements in the body of shrimp are associated with the skeletal structure and biochemicals involved in vital physiological functions, thus shrimps are capable of extracting some of these elements from water (Brown et al., 1991; Adeyeye and Adubiario, 2004; Anger, 2013). Our results are also in accordance with those of Foto et al. (2013) who showed that calcium and magnesium are the essential components of shrimp growth in freshwater bodies.

Because of the favorable habitats' conditions, seven freshwater shrimp species were identified in dryland water in Burkina Faso for the first time. The species richness in the present study is slightly high than those of Djiriéoulou et al. (2017) who have recorded (06 species), but slightly low (09 species) than those of (N'Zi et al., 2008) from coastal areas. This difference is probably due to several reasons: (i) the geographical situation of study area. In fact, coastal countries are well known to harbor high diversity of crustacean species because they have their larval stages in brackish or marine water (N'zi et al., 2008; Tchakonté et al., 2014). As well as, this study was conducted only in three months, and covered three lakes in central part of river Nakanbé, which is threaten by multiple anthropogenic pressures (Kaboré et al., 2018; Kaboré et al., 2022a). Thus, extending the sampling to more lakes including others rivers basins and habitats types may help to increase the number of shrimps species in Burkina Faso. For example, one specie "*Caridina Africana*" of Atyidae were recorded for first time in upper Mouhoun river in very low impacted areas (Kaboré et al., 2016b). According to Tchakonté et al. (2014), some species from Atyidae can be found in well oxygenated water bodies and high canopy coverage. But our species richness is the same to those recorded by Tchakonté et al. (2014) in Camerom. This is probably due to the positive effect of allochthonous material which enhance foods condition in lakes, and availability of heterogenous habitats for shrimps because of rain during the sampling period, and that lead to reduce inter and intra competitions among species (Kaboré et al., 2016a, b; Bancé et al., 2021a). Three species (*M. macrobrachion*, *M. niloticum*, *M. ravidens*) have shown a very low occurrence and abundance due to their complex amphidromous life cycle making them more vulnerable to anthropogenic disturbances such as construction of impoundments, water pollution, overexploitation, and introductions of exotic species, as confirmed in others studies (Bowles et al., 2000). However, the three common species; *M. dux*, *M. sp* and *M. thysi* recorded here is due to their wide distribution in inland water, thus supporting a large range of environmental variables and maybe successful in restocking to support local fisheries in Burkina Faso. But further studies need to be done to refine our results by taking into account seasonal dynamics of shrimp species, their reproduction and cycle life, and the potential amplification of species.

In regard of Spearman analysis, diversity, abundance and regularity of macroinvertebrés, particularly shrimp in water bodies obey to physicochemical and ecological requirements (Djiriéoulou et al., 2014; Ajeegah et al., 2017; Bancé et al., 2021b). We found that *M. ravidens*, *M. niloticus*, *M. filicium* and *M. sp* prefer organic nutrients because of their feeding habits on periphyton, thus algal biomass increases due to eutrophication. While Ca, Mg were found to be important for *M. dux* reflecting the need for particular ions such as magnesium or calcium for the growth and eggs development. We found that our lakes exhibit environmental gradients that favor the recruitment of a variety of *macrobranchium* species, as confirmed by others studies who showed that abiotic factors influence shrimp community structure and biology much more (Rashed-Un-Nabi et al., 2013; Tampo et al., 2021).

#### **Food security: shrimps' fisheries and for aquaculture diversification in Burkina Faso**

The freshwater shrimps of the genus *Macrobrachium* are distributed throughout inland and dryland regions of the world (Shenoy et al., 1993; Anger, 2013; Fauzi et al., 2021; Hiraga et al., 2021). In Burkina Faso, like others Western African countries, many species of shrimps occur in different aquatic habitats ranging from lotic to lentic waters, and have a high economic importance, both in artisanal fisheries and aquaculture (Boguhe et al., 2016; Tchakonté et

al., 2014; Lauria et al., 2018; Paul and Vogl, 2011; Chaikaew et al., 2019; N'Souvi et al., 2021). We found many species of the genus *Macrobrachium* in our study lakes, revealing that they are well adapted to Sahel local environment. In West Africa countries, efforts were undertaken to boost shrimps' production, in Benin (Dagoudo et al., 2022), in Côte d'Ivoire (Boguhe et al., 2016), in Ghana (Amenyogbe et al., 2018), as well as, in Nigeria (Ogah et al., 2022; Adetoyinbo et al., 2022), where these shrimps are exploited to satisfy the local high animal protein demand. But, in Burkina Faso, shrimps farming and their artisanal fisheries have a weak historical recital, and are very rarely developed, up to now. Only artisanal fisheries are practiced, but limited at a very small scale, in Koubri located in central part of Burkina Faso.

The lack of clear directives of shrimps' fisheries and its resources management and inconsistent national policies have led to conceal shrimps' sector policy management compared to those of fish. Many scientific investigations and projects have been undertaken on sustainable management of fish in Burkina Faso (Melcher et al., 2012; Meulenbroek et al., 2019; Minoungou et al., 2020; Ouedraogo et al., 2021; Compaoré et al., 2021), among others. While shrimp sector is very poorly documented that making them unknown aquatic resources despite their high nutritional and economical values. Here, our first findings showed that many shrimps species are occurring dryland water bodies, and are abundant, reproducing actively during the rainy and flooding periods, and may have success at domestication (Koussovi et al., 2020; Kaboré, 2022).

As Burkina Faso is among the least developed countries, hunger and malnutrition are recurrent issues, the national animal protein demand cannot be only covered by fish production (Hundscheid, 2019; Sanon et al., 2020). Therefore, diversification of aquaculture including crustaceans and restocking shrimps appears today as a response to food insecurity crisis in Burkina Faso. Accordingly, some authors argued that aquaculture has become the fastest growing food production sector and can contribute to food security (Ahmed et al., 2013; Béné et al., 2016; Ogello and Munguti, 2016; Drakeford et al., 2020; Tran et al., 2022). Thus, shrimps farming can contribute to recover shrimp populations by producing juvenile shrimp for recolonization of water bodies. We noticed that shrimp's activity easily provides income to poor people in rural area, but, initially, investments are necessary to intensify scientific investigation in shrimps' ecology and biology, field experimentation, training in shrimp farming. Indeed, to improve livelihoods of the poor in rural areas and achieve food security through the establishment of sustainable local fisheries, technical and financial supports are also needed to raise the skills of shrimps' production in Burkina Faso, thus overcoming to the reduction of poverty and food insecurity in rural Sahel region. For the well-being of poor local population and fragile children in rural areas, we encourage local governments, non-governmental organizations (NGOs), and international partners to also pay more attention in shrimps' fisheries and farming in poor rural areas by reinforcing collective skills including local stakeholders for endogenous development of shrimps' sector in dryland area for better sustainable intensification of shrimp's production.

### **Conclusion:-**

The present study reveals that the lakes bear a high diversity of shrimp. This diversity results from good environmental conditions, but some further steps need to be done to refine our results by taking into account (seasonal dynamics of shrimp's communities, reproduction or feeding strategies etc.) which have not been addressed here. To meet food security and the substantial need of animal protein in Burkina Faso, it would be interesting to intensify research on shrimps bioecology and aquaculture by identifying important factors and challenges of socio-environmental situation.

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### **Ethical Statement**

The procedures and methods used in the study followed the ethical guidelines of University Joseph KI-ZERBO (Laboratory of Animal Biology and Ecology)

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### **Conflict of Interest**

The authors have no conflicts of interest to declare. All co-authors have seen and agree with the contents of the manuscript and there are no financial and other interests to report.

#### Author contributions

KABORE Idrissa: Conceptualization, Methodology, Formal analysis, Validation, Investigation, Writing - Original Draft, Review & Editing. KABORE Boudnoma Laetitia: Methodology, Formal analysis, Investigation, Visualization, Review & Editing. BANCE Victor: Methodology, Formal analysis, Investigation, Visualization, Review & Editing. SAWADOGO Lassané: Formal analysis, Investigation, Writing - Review & Editing. OUEDA Adama: Methodology, Supervision, Visualization, Validation, Review & Editing.

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