

Fishing and Food Security among Niger's Lake Chad Riparian Communities

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Abstract

Fishing is a major socioeconomic activity for the Nigerien communities living along Lake Chad. This article aims to analyze its contribution to the food security of these communities. The methodological approach adopted is mixed, with both descriptive and analytical objectives, combining a literature review and field surveys of stakeholders in the sector. The study sample consisted of 166 fishermen and 90 fish vendors. The results highlight the presence of a diverse fish fauna comprising nineteen (19) species, namely: *Oreochromis niloticus*, *Clarias gariepinus*, *Clarias anguillaris*, *Heterotis niloticus*, *Lates niloticus*, *Gymnarchus niloticus*, *Labeo senegalensis*, *Alestes baremoze*, *Alestes dentex*, *Hydrocynus brevis*, *Bagrus bajad*, *Barbus batesii*, *Labeo cubie*, *Malapterurus electricus*, *Mormyrus caschive*, *Mormyrus rume*, *Polypterus senegalus senegalus*, *Protopterus annectens*, and *Clarias theodora*. This species diversity ensures the supply of local and external markets and promotes diversification in fish consumption for the benefit of both riparian and non-riparian populations. The study also reveals the dual socioeconomic role of fishing both as a source of income and a means of subsistence contributing to job creation and enhanced food security. The results indicate that 96% of the catch is sold, while only 4% is for personal consumption. Furthermore, the fish trade provides more than 50% of the income for 71.1% of the merchants surveyed, enabling them to support their households; 38.9% of them are entirely dependent on this income.

Keywords

Diffa, Niger's Shores, Lake Chad, Fishing, Food Security

1. Introduction

Fish is an important source of essential nutrients. It is rich in vitamins (D, A, and

B), as well as minerals, particularly calcium, iodine, zinc, iron, and selenium, especially when consumed whole. It provides high-quality protein that is easily absorbed by the body and contains all essential amino acids. The global growth in fish production has enabled the world population to consume more diverse and nutritious foods (FAO, 2016, p. 73) [1]. In many coastal and landlocked countries, the exploitation and enhancement of fisheries resources constitute an essential lever for food security and economic development, contributing to GDP and to the balance of payments (Weigel J.Y., 1998, p. 3) [2]. Globally, over the last 50 years, the supply of fish intended for human consumption has increased at a faster rate than the world population, resulting in a significant increase in apparent per-capita fish consumption. This increased from an average of 9.9 kg per person in the 1960s to 14.4 kg in the 1990s and 19.7 kg in 2013, exceeding 20 kg during 2014 and 2015. In developing regions, it rose from 5.2 kg in 1961 to 18.8 kg in 2013. In low-income food-deficit countries, it increased from 3.5 kg to 7.6 kg over the same period (FAO, 2016, p. 2) [1]. In sub-Saharan Africa, nearly 10 million people depend directly or indirectly on fisheries, including 7 million in West and Central Africa, although some of these contributions remain insufficiently reflected in national statistics (FAO, 2006, pp. 3-4) [3]. West Africa occupies an important position in Africa's fisheries sector, accounting for 21% of African production and 57% of sub-Saharan African production. This sector is also a driver of regional economic development, contributing more than 15% of GDP and providing livelihoods for nearly 3% of the economically active rural population (ECOWAS, 2019, p. 12) [4]. In Niger, fishing directly or indirectly affects more than 50,000 people. Niger's fish consumption is approximately 3 kg per person per year (RECA, 2014, p. 2) [5]. In the Diffa region, fishing is the leading economic activity, generating income, employment, foreign exchange, and public revenue, and supporting the livelihoods of numerous communities (MHE/LCD, 2006, p. 8) [6]. Despite the deterioration of the security situation, regional production of smoked fish exported to Nigeria reached 20,572.885 tonnes in 2024, equivalent to approximately 82,291.54 tonnes of fresh fish, with an estimated value of CFAF 30,859,327,500 (DRE/LCD, 2024, p. 60) [7]. In addition, the region currently supplies several major Nigerien cities with fresh fish, with an average flow of 37.44 tonnes of fresh fish per week, mainly marketed in Niamey and Zinder, generating substantial income for stakeholders (Elh Kaka Adam E. L. and Kiari Fougou H., 2025, p. 417) [8]. These figures demonstrate the continuing importance of the fisheries sector in the regional economy and in supplying food to populations. In a context characterized by fish availability, constraints on access to fishing areas, and the restructuring of marketing channels, it is relevant to analyze the contribution of fishing to the food security of populations living along the Nigerien shores of Lake Chad.

2. Study Area and Methodology

2.1. Presentation of the Study Area

The Nigerien Lake Chad region is characterized by a Sahelian climate with highly

variable rainfall. Improved ecological conditions, resulting from better hydrological conditions in Lake Chad and its northern tributary, the Komadougou Yobé River, together with the sensitive security context linked to the presence of the armed group Boko Haram, play a determining role in the dynamics of fisheries resources and in the organization of fishing activities, which are vital to riparian communities. The study area covers the immediate periphery of Lake Chad, mainly the municipalities of N'Guigmi, Kabélawa, and Toumour, as well as the city of Diffa (**Figure 1**).

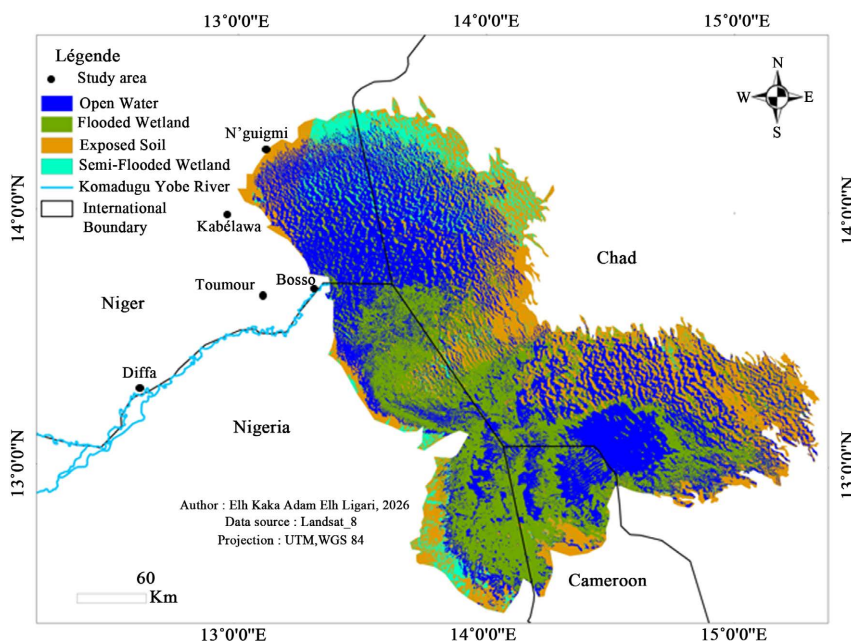


Figure 1. Location of the study sites (Source: Elh Kaka Adam and Kiari Fougou H., 2026, modified).

2.2. Methodology

To address the issues raised in this study, a mixed descriptive and analytical methodological approach was adopted, combining a literature review and field surveys. The topics investigated included the ichthyological inventory, fish availability and accessibility, perceptions of fishing's contribution to food security, and changes in the sector and its marketing channels.

Two fieldwork phases were conducted: the first between 2023 and 2024, and the second between December 2025 and March 2026, in order to update the scientific questions. Sampling was conducted using a purposive method, taking into account the spatial dispersion of the population, time constraints and difficulties in accessing certain sites, stakeholder availability, and the security context specific to the study area. Data on sales and household consumption are based on estimates reported by fishers and traders during the mission conducted from December 2025 to March 2026. To ensure the feasibility of the survey under these particular field conditions, a sampling rate of 10% was applied to actors directly involved in the sector, namely fishers and traders. The final sample comprised 166 fishers and 90 fish traders. **Table 1** presents the distribution of respondents.

Table 1. Determination and distribution of the sample of fishers and traders by municipality.

Municipality	Fishers (parent population)	Fisher sample (10%)	Traders (parent population)	Trader sample (10%)
N'guigmi	800	80	250	25
Kabélawa	300	30	150	15
Bosso	230	23	200	20
Toumour	180	18	100	10
Diffa	150	15	200	20
Total	1660	166	900	90

For direct actors, data were collected using a structured questionnaire covering household sociodemographic characteristics, including age, sex, and education level; the contribution of fishing to food security and household support through own consumption and fish trade; and the economic performance of value chains.

In addition, 23 commission agents and other actors involved in fish marketing and distribution were interviewed randomly according to their presence and availability. These included 34 transporters, 4 teams of dockers, 18 packers, 13 ice sellers, including 4 fixed and 9 mobile sellers, and 16 fish scalers. The purpose was to assess the economic contribution of these indirect activities in the fisheries sector to household support. These qualitative data were collected through interviews and concerned the types of activities performed and the income generated according to their frequency. Data processing involved sorting, entry, and descriptive analysis using Microsoft Excel spreadsheets. Microsoft Word was used for writing, while ArcGIS and ENVI software were used for map production. Results are presented in tables and figures.

The analysis aims to assess the contribution of fishing to food security through four dimensions: fish availability, profitability of the activity, the distribution between own consumption and sales among fishers and traders, and income and related activities along the value chain, including distribution and marketing.

3. Results

3.1. Sociodemographic Characteristics of Fishers

The surveys show that fishing in the Nigerien part of Lake Chad is exclusively carried out by men. Women, however, play an important role in post-harvest activities. The findings also show that fishing is mainly practiced by Nigeriens, who account for 47% of the fishers interviewed, followed by Nigerians, who represent 32% of the sample and are largely refugees who left their places of origin because of the conflict, and finally Chadians, who account for 21%. Analysis by age group shows that fishers under 50 years of age represent 89% of respondents, compared with only 11% aged over 50 years (**Figure 1**). The low proportion of older fishers is largely explained by the deterioration of the security situation in the study area, which has profoundly changed fishing conditions. Indeed, changes in the security

context have made the activity more restrictive and physically demanding, especially due to restrictions on motorized transport and canoe use imposed under the state of emergency, which has limited the participation of older people. In addition, 75% of fishers interviewed have more than ten years of experience in this activity, while 25% have practiced it for less than ten years (Figure 2). Regarding marital status, almost all fishers are married: 35% are in polygamous marriages, 61% are in monogamous marriages, and only 4% are single (Figure 3). This highlights the importance of fishing in the livelihood strategies and household support systems of communities living along Lake Chad.

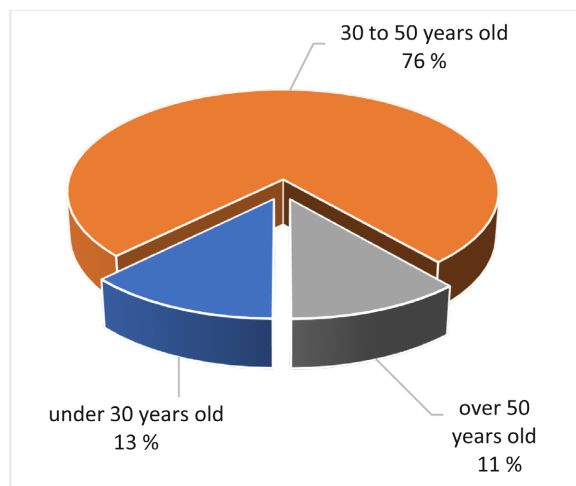


Figure 2. Distribution of fishers by age group.

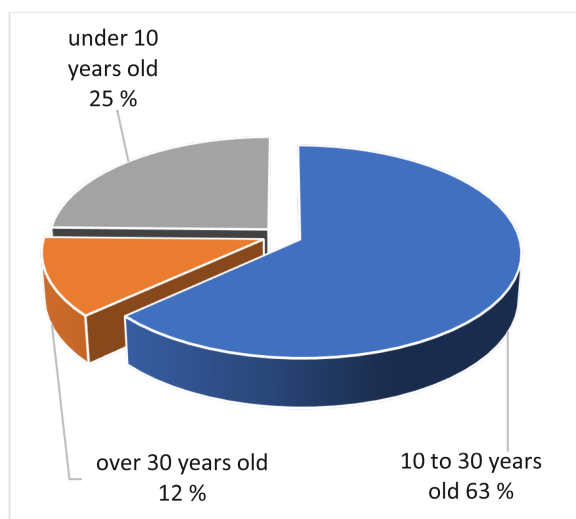


Figure 3. Distribution of fishers by level of experience.

3.2. Diversity of Fish Species and Food Security

Survey results reveal a diversity of fish species both in fishers' catches and in the markets and sales points visited. In total, nineteen (19) species were identified: *Oreochromis niloticus*, *Clarias gariepinus*, *Clarias anguillaris*, *Heterotis niloticus*,

Lates niloticus, *Gymnarchus niloticus*, *Labeo senegalensis*, *Alestes baremoze*, *Alestes dentex*, *Hydrocynus brevis*, *Bagrus bajad*, *Barbus batesii*, *Labeo cubie*, *Malapterurus electricus*, *Mormyrus caschive*, *Mormyrus rume*, *Polypterus senegalus senegalus*, *Protopterus annectens*, and *Clarias theodora*. This ichthyological diversity provides populations with a broad range of food choices and directly contributes to food security through the availability, accessibility, and consumption of diverse species. It also contributes indirectly through income from fish marketing, which enables households to purchase other food products. Species such as *Lates niloticus*, *Oreochromis niloticus*, *Clarias gariepinus*, and *Heterotis niloticus* are of major importance both for food and trade. These species are in greater demand among consumers and are traded in large quantities, both nationally in fresh form and in regional trade as smoked fish exported almost exclusively to Nigeria.

3.3. Fishing as a Source of Income and Access to Food

Survey results reveal that a small proportion of fish products are intended for household consumption, both among fishers and traders. Among fishers, 96% of catches are intended for sale, compared with only 4% for household consumption. This share also remains low among traders: 66.7% allocate less than 10% of their products to household consumption, while 33.3% allocate between 10% and 15%. Despite the small share directly intended for consumption, the activity plays a major role in meeting household needs. Indeed, 61.1% of traders surveyed derive more than half of the income needed to support their households from this activity, and 38.9% depend entirely on it (**Table 2**).

Table 2. Level of contribution of fish trade to household support.

Level of contribution	Number	Percentage
Less than 25%	12	13.30%
25% to 50%	14	15.60%
More than 50%	29	32.20%
100%	35	38.90%
Total	90	100%

Source: Field data, March 2025.

These findings highlight the importance of fishing both as a means of subsistence, through direct fish consumption by households, and as a source of income, mainly through marketing, thereby indirectly contributing to food security.

3.4. Economic Performance of Value Chains

Although the Boko Haram crisis has profoundly reshaped fishing conditions, fishing remains one of the main socioeconomic activities of Nigerien communities

living along Lake Chad. Since activities resumed in 2019, diversification in methods of value addition has been observed, combining fresh fish sales with processing, which was previously marginal. This development reflects an adaptation strategy to new market opportunities. However, profitability varies according to species and form of presentation: 76% of fishers consider smoked fish to be more profitable and more employment-generating. At the same time, the share of fresh fish in household income has increased significantly. Overall, 78% of fishers consider fish trade to be a source of substantial income, with average monthly income estimated at CFAF 161,588 (**Table 3**). The profitability rate is 74.6%, equivalent to CFAF 74.6 in gross profit for every CFAF 100 invested in operating costs, confirming the economic profitability of fishing.

Table 3. Operating account of fishers.

Item	Value in CFAF
Turnover (fish sales)	94,500
Total Expenses	94,500
Intermediate expenses	37,400
Preservation	3660
Taxes	3493
Transport	4940
Losses	4610
Total expenses	54,103
Average weekly income = 94,500 – 54,103 = 40,397	

Source: Field data, May 2025.

Fish from the lake is highly appreciated by consumers. In addition to the traditional smoked-fish channel destined for Nigeria, Lake Chad fisheries supply Nigerien cities, particularly Niamey, with fresh fish.

Beyond direct actors, namely fishers and traders, a variety of stakeholders participate in the fish marketing chain, contributing to the sector's dynamism and income generation. The integrated fish value-chain circuit is presented in **Figure 4**.

Table 4 presents the income earned by selected indirect actors throughout the fisheries value chain.

Analysis of **Table 4** reveals that the fisheries sector generates numerous indirect jobs, contributing significantly to the local economy. Daily income varies from CFAF 900 to CFAF 15,000 depending on the activity performed. Dockers, who earn CFAF 15000 per loaded vehicle shared among team members, receive the highest income, reflecting the arduous and occasional nature of their work. Packers, ice sellers, and fish scalers earn modest daily incomes ranging from CFAF

1500 to CFAF 5000, which are characteristic of daily subsistence activities. Commission agents receive CFAF 900 per bag sold, illustrating a commission system proportional to the volume sold and encouraging them to increase sales. According to the surveys, these incomes are largely used for food, health care, education, and participation in social events such as weddings, baptisms, and funerals. These post-harvest activities, although often informal, constitute an important socioeconomic safety net for young people and women and demonstrate the major role of the fisheries sector beyond fishers and traders alone.

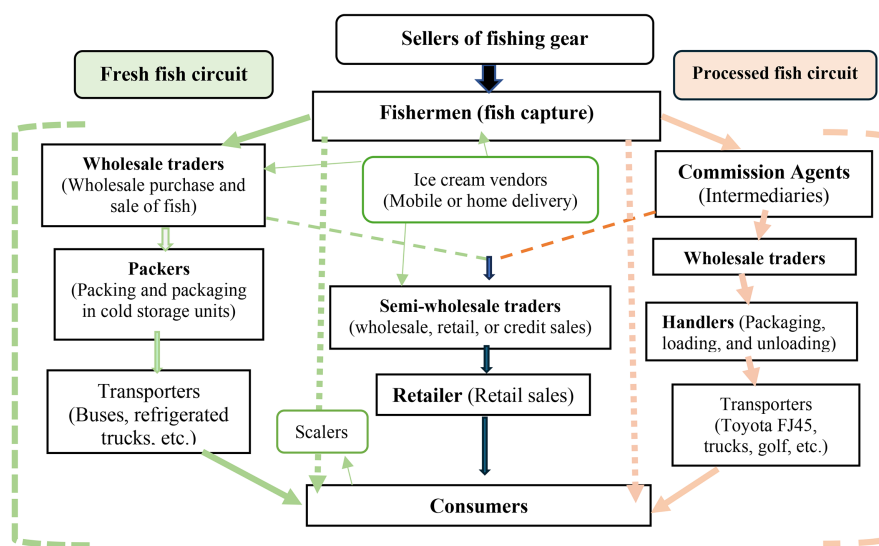


Figure 4. Integrated fresh and processed fish distribution chain.

Table 4. Income of selected indirect actors.

Actors	Activities performed	Income	Unit
Commission agents	Intermediation and facilitation of smoked fish sales	CFAF 900	Per bag sold
Packers	Fish packing and packaging in bags and coolers	CFAF 1500 to 3000	Per day
Dockers	Loading fish into vehicles	CFAF 15,000	Per vehicle/team
Dockers	Tying and securing bags with ropes	CFAF 2500 to 5000	Per vehicle/team
Ice sellers	Mobile or home-delivery ice sales	CFAF 2000 to 5000	Per day
Fish scalers	Scaling and preparing fish for consumers	CFAF 1500 to 3000	Per day

Source: Field data, May 2025.

4. Discussion

Fishing in the Nigerien part of Lake Chad is a major socioeconomic activity. It contributes not only to food security through the availability and diversity of fish in urban and rural markets, but also to income and employment creation throughout the value chain. Analysis of the results shows that fishing is an exclusively male activity, largely practiced by young people under 50 years of age, who represent

89% of the sample, compared with only 11% over 50. This is due to the physically demanding nature of fishing, exacerbated by the deterioration of the security situation in the Lake Chad basin. Women, meanwhile, play an important role in post-harvest activities. These results are similar to those of Mabouloum, A. M. *et al.* (2023, pp. 340-344) [9], who show that in the Ocean Department of Cameroon, marine fishing is also an essentially male activity, practiced mainly by young people aged 31 to 40, representing 65% of fishers, because of the physical nature of marine fishing activities.

The authors also emphasize that this activity is an important source of income for the Kribi community, generating numerous jobs throughout the value chain, from fish landing to marketing to final consumers, thereby contributing to improved living conditions for stakeholders. Similar trends are observed in the municipality of Adjohoun, in southeastern Benin, where young people occupy a predominant place in fishing, with a rate of 75.26%, compared with 24.74% for people over 50 years of age. This is explained by the inability of older people to deploy sufficient physical strength to use active fishing gear. Women, most of whom are fishers' wives, are mainly responsible for selling fish products. In addition, 87.6% of fishers indicated that catches were intended for sale, while 12.4% were intended for household consumption (Allagbe, E. O., Yabi, I., and Yabi, F. B., 2020, pp. 380-382) [10].

Similarly, in the Nigerien part of Lake Chad, a small proportion of products is intended for household consumption among both fishers and traders. For fishers, 96% of catches are intended for sale, compared with only 4% for own consumption. Meanwhile, 61.1% of traders obtain more than half of the income needed to support their households through fish trade, while 38.9% depend on it entirely. This shows that fishing is both a source of income and a means of subsistence.

Furthermore, based on the average surface area of the lake during the 1995-2020 period, estimated at approximately 10,000 km², the order of magnitude of exploitable production could exceed 72,000 tonnes per year according to literature on tropical lake fisheries in variable environments, and could provide livelihoods for more than 35,000 fishing families (Kiari Fougou H. and Lemoalle J., 2022) [11]. With related employment in fish trade, processing, transport, and other activities, fishing could provide livelihoods for more than 100,000 families. It is likely that fishing density in many parts of the lake exceeds two fishers per km², which helps to increase production. Fishers earn an average of CFAF 161,588 per month. The profitability rate of 74.6% indicates that this activity is highly profitable. In addition, Elh Kaka Adam E. L. and Kiari Fougou H. (2025) [8] show that, since fishing resumed in the Nigerien part of the lake in 2019, the sale of fresh fish to inland areas of the country, particularly Niamey, has been more economically profitable and has enabled value-chain actors to generate substantial income. For each 100-kg cooler of tilapia sold, traders earn a net profit of CFAF 49,000. The estimated profitability rate is 72.06%, or approximately CFAF 72 in profit for every CFAF 100 invested in operating costs.

From fish capture to consumption, several related activities are generated within the value chain, including processing, marketing, transport, packaging, loading and unloading, gutting, scaling, and cold-chain services. All these activities contribute to income generation, improving stakeholders' living conditions and enabling them to meet their essential social needs. The results of this study are consistent with a trend observed by Djibrina Ada S. (2022, pp. 59-63) [12]. According to that study, around the Dan-Doutchi pond in the rural municipality of Bagaroua, 75% of fishers' catches are intended for sale, while 25% are intended for consumption and sale. In addition, fishers' average monthly income, estimated at CFAF 41,780.30, is largely devoted to household needs: food purchases (16%), clothing (15%), health care (14%), education (14%), baptisms (12%), renewal of fishing gear (11%), marriage (9%), and transport (9%).

It should be noted that along the shores of Lake Chad, socioeconomic and food conditions are marked by population resilience in the face of the Boko Haram security crisis. The work of Crenn C. *et al.* (2023, pp. 67-68) [13] shows the initial impact of this crisis on riparian populations. The displacement of populations from the lake area profoundly degraded their diets. The authors highlight a shift from a diversified diet, including maize, fish, vegetables, milk, and meat, to a less valued subsistence diet based on millet and cowpeas. This marked a sudden loss of food sovereignty and nutritional impoverishment. Moreover, according to the study conducted by Elh Kaka Adam E. L. and Kiari Fougou H. (2026, pp. 328-329) [14], since 2022, improvements in both the level of Lake Chad and the security situation, including the easing of coercive measures and improved conditions for access to and use of lake resources by Boko Haram fighters, have promoted the recovery of activities, particularly fishing. Fish production reached 136,529.8 tonnes of fresh fish in 2025, exceeding the pre-crisis level, and fishers' catches became more diversified. This recent momentum in fishing represents a major asset for the food security of populations living along the Nigerien shores of Lake Chad. It makes it possible to move from a situation of vulnerability to genuine economic recovery driven by the fisheries sector.

The direct effects of fishing on household food and nutritional security were not quantified. Nevertheless, the study reveals an indirect contribution through food availability and the economic profitability of the sector, which generates income and facilitates populations' access to food.

5. Conclusions

This study shows that fishing is a strategic sector for the food security of populations living along the Nigerien part of Lake Chad. Its contribution is reflected in the availability of fish and improved dietary diversity. In addition, the high proportion of catches intended for sale reveals that fishing is an important source of income and employment for actors in the sector, enabling them to meet their households' essential needs.

The results of this study provide a scientific basis for guiding public policies

aimed at improving the technical and commercial performance of fishing and structuring support for stakeholders, in order to strengthen its contribution to food security and socioeconomic development in the Nigerien part of Lake Chad, which has been heavily affected by the Boko Haram crisis.

In light of these findings, the study could contribute to the decision-making needed to improve catch conditions and marketing practices, as well as support for stakeholders, in order to consolidate fishing's contribution to food security and socioeconomic development in the Nigerien part of Lake Chad, which has been severely affected by the consequences of the Boko Haram crisis.

Author Contributions

Elh Ligari Elh Kaka Adam drafted the research proposal, collected the field data that were subjected to statistical analysis, and wrote the manuscript for the article. Hadiza Kiari Fougou contributed to drafting the outline of the article, supervising data collection and analysis, proofreading the manuscript draft, and translating it from French to English.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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