

## Fishery in the Pendjari River (Benin): fishermen, regulations and conflicts

Fischerei im Pendjari (Benin): Fischer, Vorschriften und Konflikte

Timo Moritz<sup>1,2\*</sup> & Philippe Laléyé<sup>3</sup>

<sup>1</sup> Deutsches Meeresmuseum, Katharinenberg 14-20, 18439 Stralsund, Germany

<sup>2</sup> Institute of Systematic Zoology and Evolutionary Biology, Friedrich-Schiller-University Jena, Erbertstr. 1, 07743 Jena, Germany, timo.moritz@meeresmuseum.de

<sup>3</sup> Laboratoire d'Hydrobiologie et d'Aquaculture, Faculté des Sciences Agronomiques, Université d'Abomey-Calavi, Benin, laleyeph@yahoo.fr

**Summary:** The Pendjari river harbours a diverse and productive ichthyofauna. Conflicts of utilizing these fish stocks may arise for several reasons: the river forms over 150 km the border of Benin and Burkina Faso; it flows through areas with different states of protection; and fishery is performed by locals and non-locals in various intensities for money-generation or only for subsistence. Questionnaires were conducted between October and November 2006 on the Benin side of the Pendjari River including 40 fishermen and 46 occasionally fishing persons from six villages. Furthermore eight long-distance traders and four local fish sellers have been interviewed, as well as ten persons related to the park management. Three groups of fishermen can be distinguished: professionals (68% non-natives), semi-professionals (61% non-natives) fishing only during the dry season, and occasional fishermen. Within the Pendjari National Park several special regulations apply and fees have to be paid for the use of professional fishing equipment. Violation of park regulations occurs regularly. About 80% of the catch from the Pendjari River is sold to traders. Profit is mainly generated by non-locals. To ensure a future sustainable utilisation of the Pendjari fish stocks by locals and to ensure, at the same time, the conservation of the aquatic diversity in the Pendjari region, a set of measurements is proposed: more stringent application of existing regulations and laws, establishment of bi-national agreements on regulations, strengthening of local fishermen, and creation of a local fishermen organization.

**Key words:** Africa, freshwater, protected areas, Pendjari National Park, Volta basin

**Zusammenfassung:** Im Pendjari findet sich eine vielfältige und produktive Fischfauna. Konflikte über die Nutzung dieser Fischbestände haben verschiedene Ursachen: Der Fluss bildet über eine Länge von 150 km die Grenze zwischen Benin und Burkina Faso, er fließt durch Gebiete mit unterschiedlichem Schutzstatus und Fischerei wird von einheimischen und nicht-einheimischen Fischern in ganz unterschiedlichem Ausmaß betrieben, zum Gelderwerb oder nur zur Subsistenz. Zwischen Oktober und November 2006 wurden auf der Beniner Seite des Pendjaris Befragungen mit 40 Fischern und 46 Gelegenheitsfischern in sechs Dörfern durchgeführt. Darüber hinaus wurden vier lokale Fischhändler und acht Fischhändler, die ihre Ware über längere Strecken transportieren, sowie zehn Personen im Umfeld der Parkverwaltung befragt. Drei Gruppen von Fischern konnten unterschieden werden: professionelle Fischer (68 % nicht-einheimische), halb-professionelle (61 % nicht-einheimische), die nur während der Trockenzeit fischen, und Gelegenheitsfischer. Im Pendjari-Nationalpark gelten besondere Regelungen und Gebühren für die Verwendung von professioneller Fischereiausrüstung. Verstöße gegen diese Regeln finden regelmäßig statt. Etwa 80 % der Fänge aus dem Pendjari werden an Händler verkauft. Der Gewinn wird dabei überwiegend von Nicht-Einheimischen erwirtschaftet. Um eine nachhaltige Nutzung der Fischbestände des Pendjari durch Einheimische zu gewährleisten und gleichzeitig die Erhaltung der aquatischen Vielfalt im Pendjarigebiet zu gewährleisten, wird eine Reihe von Maßnahmen vorgeschlagen: striktere Durchsetzung bestehender Vorschriften und Gesetze, Verabschiedung bi-nationaler Regulierungsübereinkommen, Stärkung der lokalen Fischerei sowie die Schaffung einer lokalen Fischereiorganisation.

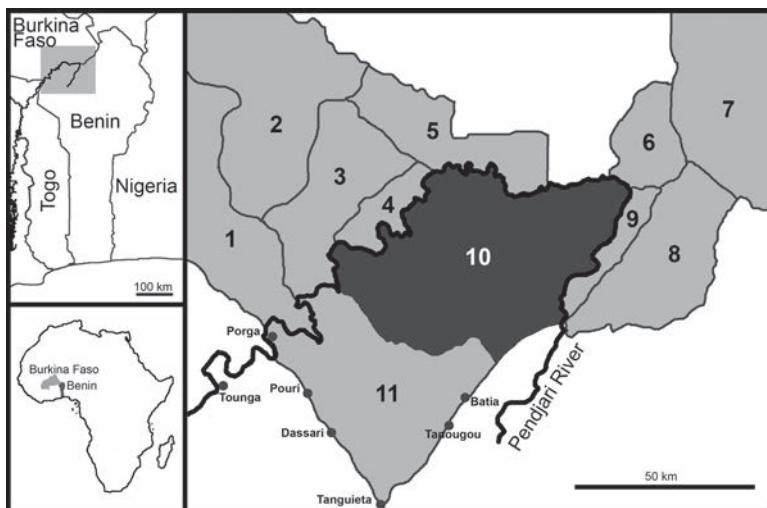
**Schlüsselworte:** Afrika, Süßwasser, Schutzgebiete, Pendjari-Nationalpark, Voltabecken

## 1. Introduction

Inland fishery plays an important role for protein supply and income generation all over the world, but knowledge on these systems is scarce and often overfishing of natural resources occurs unrecognized (ALLAN et al. 2005; COOKE et al. 2016). At the same time freshwater ecosystems worldwide are highly threatened by human impacts (DUDGEON et al. 2006). We studied the fishes, fishermen and fishery on the Benin side of the Pendjari River, the westernmost river of the Volta basin, in detail to obtain reliable data for a well substantiated evaluation of different aspects on this topic for the region. In this first study we concentrate on some aspects of socioeconomic conditions of the fishermen from the study area.

The Volta basin is the second largest river basin in West Africa with a catchment area of about 390 000 km<sup>2</sup> (PETR 1986) and one of the most anthropogenically modified and threaten-

ed basins in the region (THIEME et al. 2005). The conservation status of the Volta's ecoregion is regarded as critical, however, based only on "medium" quality data (following THIEME et al. 2005). The Pendjari River is the eastern most affluent of the Volta basin and is originating in the Atakora Chain in north-western Benin (fig. 1). It flows for about 80 km in north-eastern direction before turning sharp left to continue in western direction. From this turn on it forms the frontier between Burkina Faso and Benin for about 150 km before it crosses Togo, where the river's name is changed into "Oti", and finally flows into Lake Volta in Ghana. About 200 km of the Pendjari are situated in protected zones, but nevertheless it is subject to intense fishery. Conflicts arise from ethnics, nationalities and background of fishermen, as well as differing regulations for fishery in different areas and the aims of the management of the respective areas. This study gives some aspects of the socio-economic importance of fishery on the



**Fig. 1:** Protected areas with different status around the study site. 1 – Réserve Partielle de Fauna de Pama, 2 – Réserve Total de Faune de Singou, 3 – Réserve Partielle de Faune de l'Arly, 4 – Réserve Totale de Faune de Madjori, 5 – Réserve Totale de Faune de l'Arly, 6 – Réserve Partielle de Faune de la Koutiougou, 7 – Par Régional du W, 8 – Zone cynégétique de la Mékrou, 9 – Zone cynégétique de l'Atakora, 10 – Parc National de la Pendjari, 11 – Zone cynégétique de la Pendjari.

**Abb. 1:** Gebiete mit unterschiedlichem Schutzstatus im Untersuchungsgebiet. 1 – Réserve Partielle de Fauna de Pama, 2 – Réserve Total de Faune de Singou, 3 – Réserve Partielle de Faune de l'Arly, 4 – Réserve Totale de Faune de Madjori, 5 – Réserve Totale de Faune de l'Arly, 6 – Réserve Partielle de Faune de la Koutiougou, 7 – Par Régional du W, 8 – Zone cynégétique de la Mékrou, 9 – Zone cynégétique de l'Atakora, 10 – Parc National de la Pendjari, 11 – Zone cynégétique de la Pendjari.

Benin side of the river, the resulting conflicts and discusses possible solutions. Another study already elucidated the importance of freshwater oyster exploitation (AKELE et al. 2015).

## 2. Material and Methods

The data presented in this study were mainly obtained by questionnaires conducted between October and November 2006 on the Benin side of the Pendjari River. 40 fishermen and 46 occasionally fishing persons from six villages, Porga, Pouri, Dassari, Tiélé, Tounga and Tanongou (fig. 1), were interviewed. Additionally eight long-distance traders and four local fish sellers have been interviewed, as well as ten persons related to the park management. The questionnaire consisted of three parts: the first dealing with general information on age, sex, country of origin and ethnic group. The second part assessed the importance of fishery for the interview-

ed person in comparison to other activities. The third part contained sixteen questions on fishery practice, like fishing techniques, captured and targeted species, yields and destination of products, but also if they are aware of regulations and which problems they recognized in the field of fishery in the region.

## 3. Results

### 3.1. The fishermen of the Pendjari region

On the Benin side of the Pendjari River there are roughly 200 fishermen coming originally from Benin, Mali, Nigeria, Niger, and Ghana (fig. 1). Based on the fishing techniques and the attitude of the fishermen towards fishing three principal types – professional, semi-professional and occasional – can be differentiated. In this article “fishermen” refers only to the professionals and semi-professionals in contrast to only

**Tab. 1:** Composition of fishermen on the Benin side of the Pendjari region, season November 2005 to May 2006.

**Tab. 1:** Zusammensetzung der Fischer aus der Pendjari-Region innerhalb von Benin im Zeitraum November 2005 bis Mai 2006.

	professional	semi-professional	occasional
Interviewed in this study	22	18	46
Estimated total number			
male / female	22 / 0	18 / 0	23 / 23
<b>Ethnic group</b> (of sample)			
Berba	7	6	46
Haussa	4	8	0
Boso	3	3	0
Ewé	6	0	0
Dendi	0	1	0
Others	2	0	0
<b>Nationality</b> (of sample)			
Benin	7	7	46
Niger	2	1	0
Mali	3	3	0
Togo	2	0	0
Ghana	6	0	0
Nigeria	2	7	0
<b>Age composition</b>			
20 – 30	9	5	15
30 – 40	8	6	13
40 – 50	5	5	8
50 – 60	0	1	8
> 60	0	1	2

occasionally fishing persons. The professional fishermen are the only group using seines, but they also use modern traps, cast nets, gill nets and long lines. Most of them are not native to the area (about 68%) and are instead coming from Ghana, Niger or Mali (tab. 1), but have settled now in the Pendjari region. Furthermore some professional fishermen from Mali stay only during the fishing season from November to May in the Pendjari region. These fishermen obtain their modern fishing equipment via the fish traders. Semi-professional fishermen on the other hand are fishing during the dry season and are farmers during the rainy season. Also this group, usually using gill nets and long lines, is mainly not native (about 61%) and thus has no Benin nationality, but lives permanently in the Pendjari region. Finally, there are many people from the local ethnic group, the Berba, practicing fishery only occasionally and with rather rudimentary equipment, i.e. baskets and stream barriers. The latter group usually does not generate income by fishery, but uses the catch for self-supply countertrade within their community.

### 3.2. Fishery regulations

The fishery in the Pendjari region is regulated by national laws for inland fishery and special regulations for the respective areas having different status of protection. In Benin the law n° 20/PR/MDRC/SP from 25.04.1966 bans the use of toxic substances and explosives for fishing purposes in freshwater water bodies, as well as depleting complete water bodies, and forbids the exploitation of juvenile fish. The regulation n° 183/PR/MDCR from 25.04.1966 goes more into details and sanctions the use of seines in freshwaters, if more than two persons are needed to use them, it prohibits the blocking of streams with nets for more than two-thirds of their length, the introduction of new species, and it furthermore enables the ministry to enact additional spatial or temporal regulations on fishery. Such regulations have been made for certain water bodies in the south of Benin (e.g. n° 714/MDR/MISAT from 25.11.1992 for the Lake Ahémé and the lagoons of Ouidah,

n° 067/MDR/DC/CC/CP from 12.03.1997 for the Lake Toho), but no such additional regulation exists for the Pendjari River. Its geographical position, however, between Benin and Burkina Faso demands for agreements between both nations to avoid conflicts due to disparate regulations.

Traditional regulations had existed, restricting fishery, but became obsolete during the last years due to the modern fishing techniques introduced by non-natives. Additional regulations are issued by the park directories in both countries. On the Benin side the directory of the Pendjari National Park allows fishery only during the hunting season, i.e. from December to May. Until 2006 fishery was restricted to the first 40 river kilometres within the complex, thus it has been restricted to the hunting zone. As a reaction to the fishing practice on the Burkina Faso side of the river, fishery on the Benin side is now also allowed from km 40 of the river up to the Hotel Pendjari inside the park, at about km 125. In fact, fishery is now practiced over the complete length of the Pendjari River where it forms the frontier between both nations. Additional regulations issued by the directory of the Pendjari National Park are among others:

- fishermen camps can be installed between first of December and April 30<sup>th</sup>,
- camps may not be inhabited by more than 24 persons,
- camps have to be kept clean and calm,
- accidental bush fires have to be prevented,
- it is not allowed to collect fresh fire wood, and
- fish, not sold to the traders, has to be smoked in the villages.

These regulations are controlled by the guards of the national park on the Benin side. Every year at the beginning of the fishing season the park directory of the Pendjari National Park informs all riverine fishermen on the Benin side in a conference about the up-to-date regulations.

### 3.3. Commercialisation of fish catches

Fishery without boat is for free. For fishery with boat inside the park fishermen have to

pay a tax of 30.000 FCFA to the CENAGREF (Centre National de Gestion des réserves de faune) per fishing season, which usually lasts from December to April. A fishing licence is valid for one fisherman with one boat and up to two assistants.

About 80% of the catch from the Pendjari River is sold to traders, specialized in transporting the valuable specimens to Ouagadougou, the capital of Burkina Faso. On the Benin side of the Pendjari there are nine such traders of which eight are of Burkina Faso nationality. When a truck is leaving towards Ouagadougou its load is about 2.8 tons of cooled fish (average estimate from 24 transports of eight traders). The traders deliver fish to fish stores (“poissonerie”) as well as directly to hotels and restaurants. Each time the fish traders enter the park they have to pay 120,000 FCFA to the CENAGREF and 50,000 FCFA to the AVIGREF (Association Villageoise de Gestion des Ressources Fauniques).

Depending on their price, the fishes can be divided in three categories: the first contains only the most valuable species, the Nile perch *Lates niloticus*, for which the fishermen get 750 FCFA (equal to 1.14€/December 2016) per kg from the traders. In Ouagadougou it will be sold for about 2,000-2,500 FCFA per kg (3.05-3.81 €). The second category contains *Gymnarchus niloticus* at the price of 400 FCFA (0.61 €) per kg inside the park. For most of the remaining species, which are dominantly catfishes, the traders will pay 300 FCFA (0.46 €) per kg if the individuals exceed a certain size. The second and third category of fish will be sold for 1200-1,500 FCFA (1.83-2.29 €), respectively 700 to 1,000 FCFA (1.07-1.52 €) in the capital of Burkina Faso. Smaller specimens, i.e. of about 100 g and less, are smoked and sold to local fish traders. Such traders had to pay a tax of 20,000 FCFA per entry into the park, but smoking inside the park is now not any longer allowed.

### 3.4. Conflicts between fishermen

Formerly there have been not many conflicts between the fishermen of the different ethnics

and nationalities. Maybe due to the low number of Benin fishermen and the high productivity of the Pendjari River there were no reasons for conflicts with the foreign fishermen. But this has changed with the utilisation of highly effective fishing techniques, like the use of seines, by professional, mostly non-local fishermen. Semi-professional fishermen are harvesting significantly less fish per time and in total, i.e. in average about 15 kg vs. 80 kg per day. Accordingly these fishermen have the feeling to be treated unfair, as they have to pay the same taxes for a fishing license. This holds also true for the minority of Benin fishermen, as a fishing licence in neighbouring countries is less expensive for natives, e.g. in Burkina Faso a fishing licence costs 7,000 FCFA for a native fishermen, but 30,000 FCFA for other nationalities.

### 3.5. Conflicts between fishery and park management

The management of the national parks aims to guarantee a sustainable conservation of the fauna and flora of the respective area. Although fishery is regulated and allowed to a certain degree conflicts arose from this issue. Even if the fishermen respect the given regulations, they will get by-catch other than fish, namely monitors (*Varanus niloticus*, *Varanus ornatus*), snakes (*Python* spp., *Grayia smythii*, etc.), turtles (*Cyclanorbis senegalensis*, *Pelomedusa subrufa*), crocodiles (*Crocodylus niloticus*), and probably also birds and mammals. We cannot quantify the respective losses, as fishermen understandably prefer to keep quiet about this problems, but several times we saw such “incidents”, where by-catches were not released, even if they survived catching. Furthermore, for the preservation of smaller fish specimens, wood is needed to smoke them, which led to partial destruction of the gallery forest. Yet recent regulations did not longer allow fish smoking within the area of the national park. Most conflicts, however, arose from different degree of violation of the existing regulations. Fish traders are only allowed to drive inside the park at night, but violation

of this rule is common and regarded as minor offence, as the traders have to transport perishable goods. To name just a few further examples of such violations: 1. fishermen commonly use forbidden seines, sometimes they fish outside the allowed time frame and they also enter zones of total protection, 2. the places of fishermen camps are often polluted, e.g. by wasted batteries, 3. caught animals, others than fish, are usually eaten by the fishermen, even if they survived catching thus being actually an act of poaching, 4. the prohibition of smoking inside the park was never respected, 5. the assigned places for fishermen camps were not respected and several additional illegal camps have been installed, 6. even bushfires were set on purpose by fishermen.

If regulations are violated, different sanctions or punishments can be imposed, e.g. interdiction to fish for a certain time, penalties from 50,000 to 500,000 FCFA, and even jail in severe cases. Such a severe offence may be fishing in totally protected areas or fishing with poison. We heard even reports of fishing with modern pesticides, i.e. DDT, but never saw it ourselves. The impact of such forms of fishery for the environment and also the fish consumers is obvious and needs no further comments. In March 2007 violation of rules by fishermen cumulated to a degree that the park directory decided to stop fishery immediately for this fishing period. In May, however, fishermen again got the allowance to fish for two additional weeks inside the park, which was also not respected and prolonged to three weeks.

## 4. Discussion

### 4.1. Fishery conflicts in the Pendjari area

Fishery in the Pendjari region plays an important role for income generation and protein supply of the local population and also for the income generation of the managed and partly protected areas. Therefore total fishing bans in all zones of different degree of protection are not reasonable. Furthermore, laws and regulations in force, like fishing gears, fishing areas or fishing periods, are often violated, as also reported from

the same river further downstream in Ghana (AKONGYUURE et al. 2015). ABE et al. (2004), however, stated that unsustainable fishery is so far “confined to the lacustrine portions and the coastal deltaic zone of the Volta river” (p. 65). We cannot confirm this view, but are rather convinced that the present available data for fishery in riverine portions is too limited to allow clear statements. In any case a decline of fish stocks is reported from other parts of the Volta basin (AMU-MENSAH et al. 2014). Standardized fishery surveys, sustainable regulations and management plans are of urgent need for an optimal utilization and protection of riverine fish stocks in the Volta basin also for the future. This includes inclusion of socio-economic aspects: our study showed that most profit from fishery in the Pendjari region is generated by non-locals, i.e. fish traders and seasonally and fully professional fishermen from other countries. Sustainable utilization of natural resources is, however, most likely accepted by local stakeholders.

### 4.2. Conclusions and possible ways to solve conflicts

For a good balance of socio-economic and nature conservation aspects, we propose the following measures:

- The already existing regulations for the practice of fishery in Benin in general and in the Pendjari region in particular have to be controlled strictly.
- Bi-national agreements between Burkina Faso and Benin have to be achieved to guarantee concordant regulations on both sides of the river to allow the effective implementation of measurements for a sustainable utilisation of the natural fish stocks. In a second step such agreements for the Pendjari River should also include Togo and Ghana, as fish migrations might play an important role in this river system, although it is not sufficiently studied yet.
- The status of local fishermen should be strengthened, e.g. by lowering their taxes for access to the fish stocks or the installation of “locals only” fishing zones, to offer them the opportunity for a sustainable use of their own



resources without being ousted by foreign professional fishermen.

- To allow a clear assignment to fishermen-groups local fishermen have to organize themselves in an association.

Indeed, fishery activities are an important source of income for the organisations managing the wildlife in Benin (CENAGREF and AVIGREF) and Burkina Faso. Thus it seems difficult to put the Pendjari's aquatic fauna under total protection. Nevertheless, unsustainable use of natural fish stocks, will lead to lower fish availability, which will lead to lower income from fishing permits and may also lead to increased use of other wildlife resources, e.g. poaching (BRASHARES et al. 2004). But as the demand of fish for the local population is still relatively low, further management measures could be introduced relatively easy and also with agreement of the locals, as they recognize the danger from over-exploitation by professional fishermen.

The fishery methods, their application, resulting problems and respective measurements for sustainable conservation of the fish community of the Pendjari River will be the issue of a separate article.

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