German society for freshwater biology (DGL) - proceedings 2002 (Braunschweig), Werder 2003

Contribution to the fish fauna of the Pendjari national park in Benin (Western Africa)

JOACHIM SCHWAHN
Environmental services Dipl. Biol. J. Schwahn, Dorfstr. 28, 24247 Rodenbek
joachimschwahn@onlinehome.de

Keywords: Fish fauna, Pendjari national park, Volta, Benin, western Africa, periodic waters

1 INTRODUCTION

Pendjari national park, in the north of the Republic of Benin, has existed since 1961, initially protected as a game reserve in 1954. It is part of an approx. 2,86 million hectare complex of protected zones, that stretches across the border areas of the states of Benin, Burkina Faso and Niger (fig. 1). Since 1986 the national park with its core zone and its hunting zones has had the additional status of a biosphere reserve (MAB/UNESCO). The status as a world natural heritage site is currently under discussion.

Up to now the fish fauna of the Pendjari national park was regarded as insufficiently investigated. The following results were elaborated within a two week investigation in February 2002 (during the dry season) which had the overall aim of capturing zoo-ecological base data for previously not, or insufficiently investigated animal groups. The findings are supposed to enter the management plan of the national park that is under development at this time by the German federal office for nature conservation in cooperation with the Beninese nature conservation authorities.

2 MATERIALS AND METHODS

In the presented work the Pendjari river which forms a tributary to the river Volta, and 6 Mares (large, partly periodic flat water bodies) were investigated with respect to their fish fauna. A gill net 50m long and two 5m long weirs were used. Selected chemical-physical parameters were measured. Due to the shortness of the stay each water course was only examined once except for one river which was investigated at two points which, with respect to the abiotic factors and morphology strongly different characteristics (quiet water, flow).

3 CLIMATE AND VEGETATION

The climate of Western Africa is determined by the position of the inter-tropical convergence zone (ITCZ). At Pendjari there are two seasons: the 8-month dry season (October until May) and the 4-month rainy season (June until September). The annual rainfall sum rests at 1100 mm. The maximum daytime temperatures exceed mostly 30°C. In the dry season a strong northeast wind (Harmattan) cause a nocturnal cooling on down to 19°C. The area is situated in the vegetation belt of the Sudan zone, that is characterised by grass-, shrub- and tree-savanna. These vegetation forms have been heavily influenced by human-caused bush fires for several millennia.

4 RESULTS

4.1. PHYSICO-CHEMICAL FEATURES OF THE WATERS

The waters are marked in total by a small conductivity (Tab.1), which is to be explained by the high geological age of the surrounding ground and rocks (BEADLE 1981). In the river both the values and the day amplitudes of water temperature and oxygen content are smaller than in the Mares. The pH-values are close to neutral and the measured hardness degrees and nutrient contents are low. The low viewpoint depths (Secchi-depths) of just 50 cm in the flowing water and in 4 cm the Mares, which are situated near to the river, is an expression of the high activity of fish, crocodiles and hippopotami. Mare Bori, which is not connected at any time with the river, and which is fed by a clear source creek from the near by Atacora mountain range forms an exception with viewpoint depths of more than 80 cm.

Parameter	River	Mares
Tw [°C]	21 - 24	20 - 30
O_2 [mg/l]	5,5 - 6,1	3,7 - 7,2
O_2 [%]	59 - 64	21 - 94
L_{25} [µS/cm]	49 - 60	32 - 43
pH	6,8	6,0 - 7,5
Transparency [cm]	48	4 - >80
KH [°d]	<3	0 - <3
GH [°d]	<3	<3
NO_2 [mg/l]	0	0 - <1
NO_3 [mg/l]	<10	0 - >10/<25

Tab. 1: Physico-chemical features.

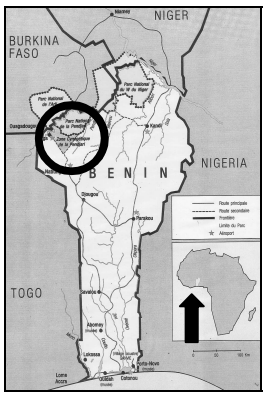

Fig. 1: Situation of the Pendjari national park in Benin (Western Africa).

4.2. FISH FAUNA

In February 2002 a total of 41 fish species (8 new proofs) were caught from 34 species and 17 families. These results were fit together with those of three unpublished investigations, which were provided in the archive of the national park administration in Tanguiéta (SAYER & GREEN 1977, GREEN 1979, LALEYE et al. 2001). As a result, the following numbers are to be presented for the Pendjari national park (table 2, column 3). For comparison purposes the numbers for western Africa (LEVEQUE et al. 1990, 1992) and for the whole Volta bassin (PAUGY et al. 1994) are indicated. According to GREEN (1979) 85 fish species are possibly to be reckoned on in the Pendjari national park.

	Western Afrika	Volta bassin	Pendjari 1977-2002	Pendjari 2002	New proofs
Families	50	24	20	17	1
Genus	163	63	41	34	5
Species	528	139	67	41	8

Tab. 2: Number of families, genus and species in western Africa, in the Volta bassin and in the Pendjari national park. In the last two columns the results of the own investigation.

The species numbers determined in the present investigation for the Pendjari national park are distributed as follows among the fish families (fig. 2): the *Mormyridae* are the most species rich family (with 8 species / 20 %), followed by the *Cichlidae* (5 species / 12 %), the *Characidae* and the *Mochokidae* (in each case 4 species / 10 %) and the *Bagridae*, the *Cyprinidae* and the *Citharinidae* (in each case 3 species / 7 %). The *Polypteridae* are present with two species (5 %) and the remaining families with only one species in each case (2 %).

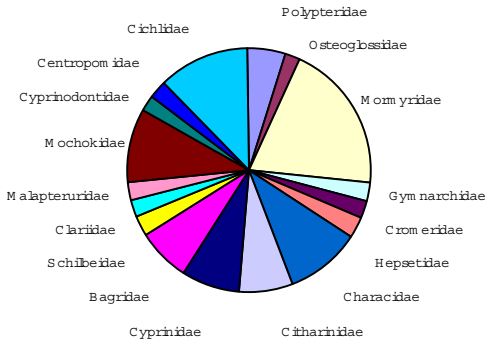

Fig. 2: Part of the fish families at the entire species spectrum of the catch in February 2002.

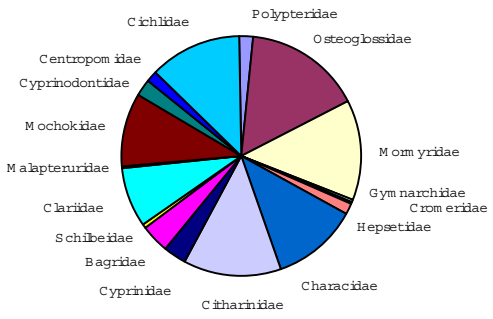

Fig. 3: Part of the fish families at the entire catch (Frequency) in February 2002.

The families most frequently present in the whole catch (fig. 3) are the *Osteoglossidae* with 52 individuals (19 %), followed by the *Mormyridae* (43 Ind. / 13 %), the *Citharinidae* and the *Cichlidae* (42 and 41 Ind. / in each case approximately 13 %), the *Characidae* (37 Ind. / 11 %), the *Mochokidae* (33 Ind. / 10 %) and the *Clariidae* (26 Ind. / 8 %). The frequencies for the remaining families are in each case under 5 %.

From the examined waters the river is the most species rich biotope (fig. 4), followed by the larger and deeper Mares. In the flatter, shallower, seasonally draining Mares the species number is by far smaller. Here the seasonal aspect might particularly affect the composition of species: especially species which survive the dry season in rest stages are to be expected here in the rainy season. Also the aspect of predation by water birds (Heron, Marabu etc.) might particularly affect the species composition and population density of the small and flat Mares.

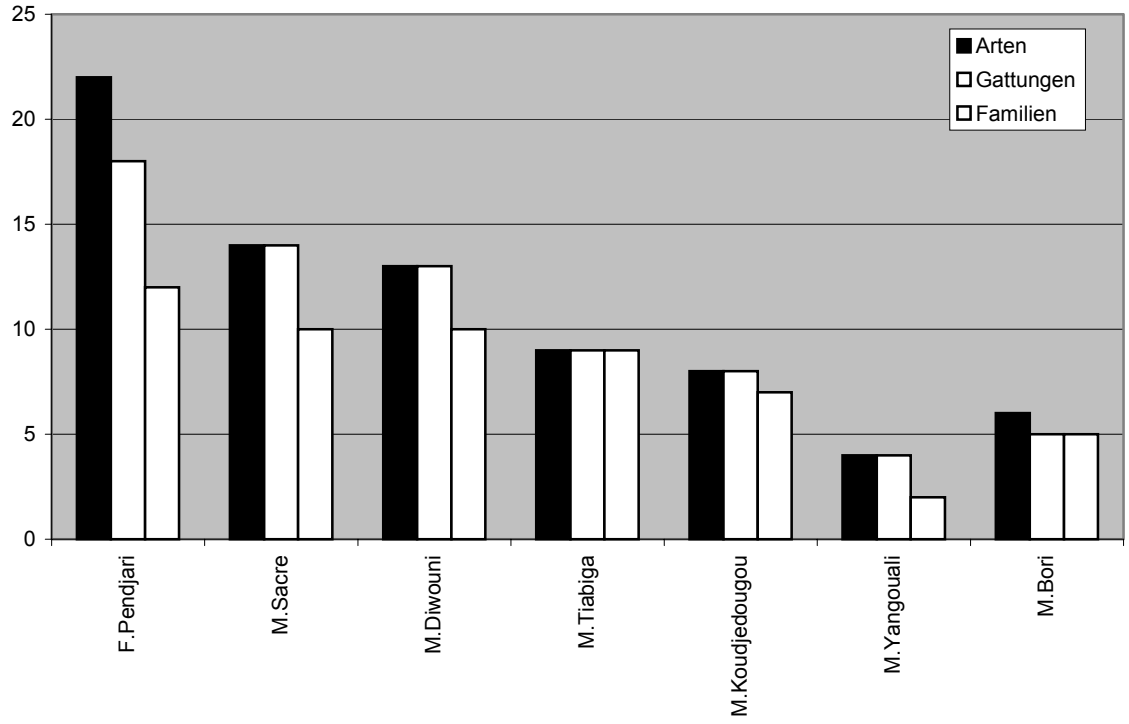

Fig. 4: Number of species, genera and families in the river Pendjari and in the examined Mares in February 2002.

The predominant part of the fish fauna occurs both in the river and in the Mares. On the other hand individual species or families show a limitation or at least a preference of specific waters (fig. 5). The families of the *Osteoglossidae, Hepsetidae, Cyprinodontidae, Centropomidae* and *Cichlidae* are limited to the Mares. Also the families of the *Polypteridae, Mormyridae, Citharinidae*, *Cyprinidae*, *Bagridae* and *Clariidae* show a close affinity to the Mares. However the families of the *Cromeridae* and *Malapteruridae* were found exclusively in the flowing water. The flowing water is also favoured as habitat by the families of the *Characidae* and *Mochokidae*. The families of the *Gymnarchidae* and *Schilbeidae* appear to be indifferent to water flow conditions.

The species occurring in both the flowing water and in the Mares do not differ seriously from each other with respect to their species related standard lengths. Evidently the growth conditions in the flowing water for these species do not differ from those in the Mares during the dry season.

In comparison to the "quiet water" of the flowing rivers the "flow" shows clear differences (Abb 6). The families of the *Polypteridae, Gymnarchidae, Cyprinidae* and the *Malapteruridae* were found only in the quiet water. The families of the *Cromeridae, Schilbeidae* and *Clariidae* occurred only in the flow. From the families occurring in both flowing sections the *Mormyridae, Characidae* and

Citharinidae favoured the quiet water while the *Bagridae* and *Mochokidae* were more frequent in the flow.

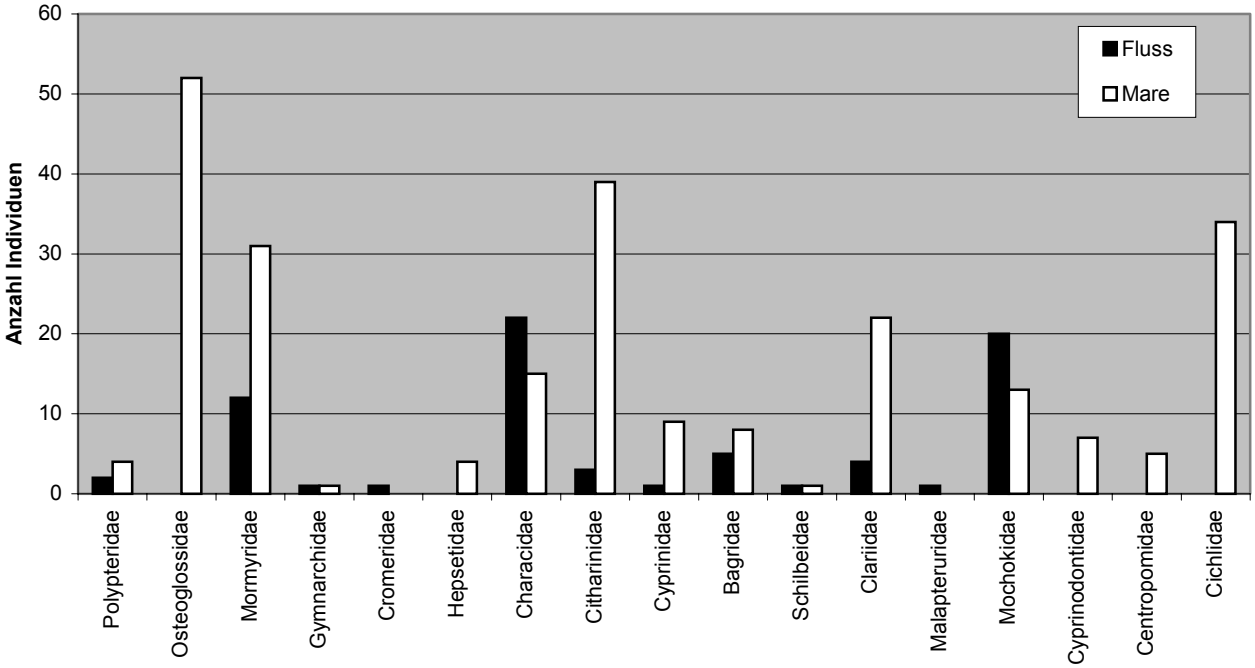

Fig. 5: Individual numbers for the fish-families in the river Pendjari and in the Mares examined in February of 2002.

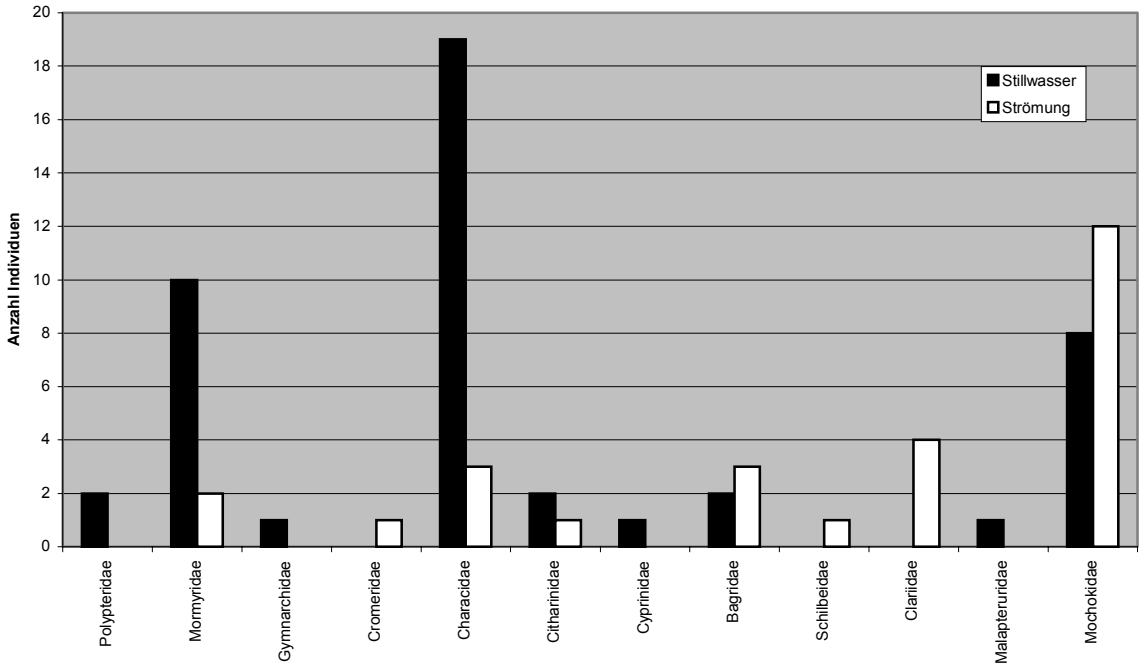

Fig. 6: Individual numbers of the fish families in the quiet water and/or in the flow of the Pendjari in February 2002.

If one considers the same question at the species level (fig. 7), it proves to be that the preference for the quiet water of the *Characidae* is based on the species *Hydrocynus forskalii*. The limitation of the *Clariidae* to the flow is caused by the species *Clarias anguillaris*. Both species are "super-predators", i.e. they have no further enemies within the fish fauna. It seems as though the occurrences of the two species are stictly separated from each other. The determining factor appears in this case to be the depth of water since *Hydrocynus forskalii* was found also in the

deeper Mares while *Clarias anguillaris* was also found in the shallower Mare. *Hydrocynus forskalii* is dependent on the hunting in the free water against which *Clarias anguillaris* can come in the higher risk of draining that the shallower waters contain, since the species is capable of air respiration through a suprabranchial organ and can move across land for quite a long distance by using its strong fin thorns as legs.

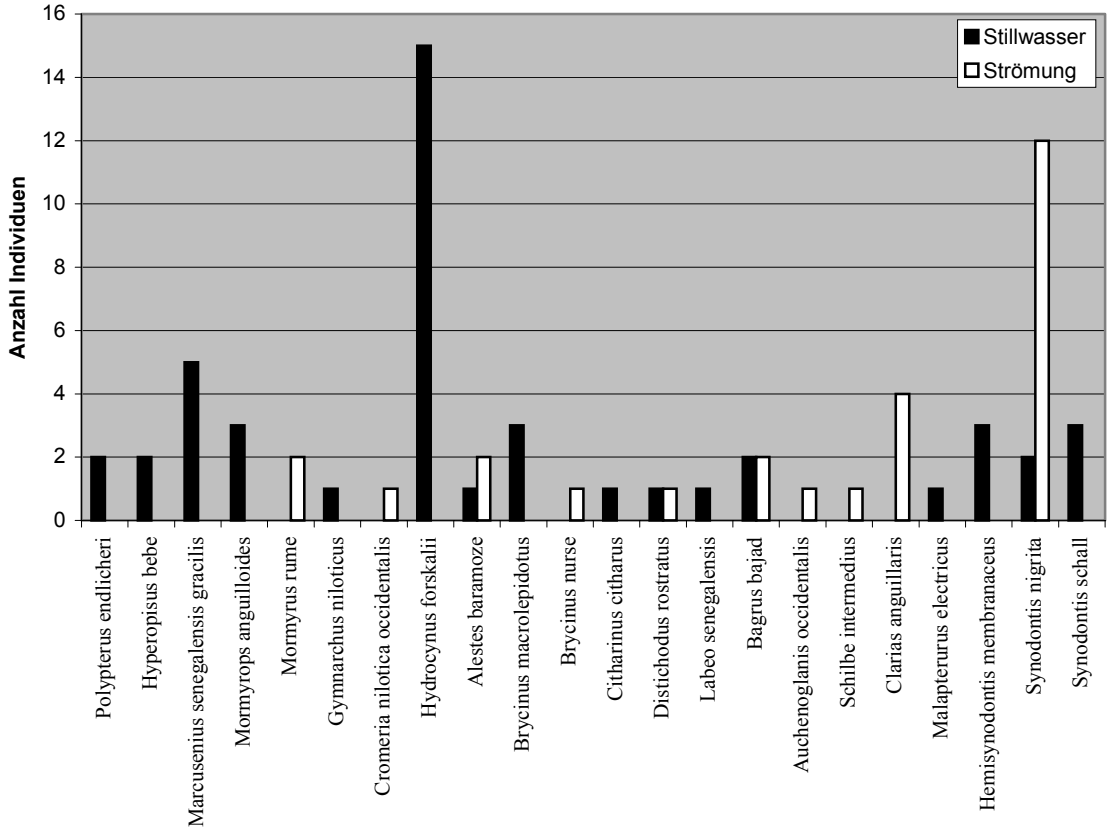

Fig. 7: Individual numbers of the fish species in the quiet water and/or in the flow of the Pendjari in February 2002.

5 SUMMARY OF THE RESULTS

The fish fauna of the Pendjari national park is to be designated as species rich in the regional comparison of western Africa. Further new species are expected to be discovered. The fish fauna consist of typical representatives of the sahelo-sudanian zone (cf. BEADLE 1981, PAUGY et al. 1994). Of all waters the flowing rivers show the highest number at species, genera and families.

There are differences, however, also overlaps, in the species spectrum of flowing water and Mares. The *Osteoglossidae, Cyprinodontidae* and *Cichlidae* occur exclusively in the Mares while the *Cromeridae* and the *Malapteruridae* are to be found exclusively in the flowing water. For species which occur in both habitats, the growth conditions are apparently identical in the flowing water and in the Mares during the dry season, for their species related standard lengths don't differ seriously from each other.

There are clear differences in the fauna of the river sections which have "flow" and "quiet water". While the *Mormyridae* and the *Characidae* prefer the deep quiet water sections, the catfish families (*Bagridae, Schilbeidae, Clariidae* and *Mochokidae*) show a preference for the flatter flow sections in the river. A determining factor for the ecological niches of the species is the depth of water during the dry season, as shown by the example of the species *Hydrocynus forskalii* and *Clarias anguillaris*.

6 OUTLOOK

An investigation limited to two weeks can only give a snapshot like picture. In order to complement the presented results, a continuation of the investigation is planned for September 2003 (during the

rainy season). The emphasis is intended to rest on the investigation of the temporary waters and their seasonal fish fauna.

REFERENCES

BEADLE, L. C. (1981): The inland waters of tropical Africa. An introduction to tropical limnology. (2nd ed.). Longman, London, New York, 475 S.

GREEN, A. A. (1979): Développement des Parcs Nationaux: La Rivière Pendjari (Parc National de la Pendjari). Rapport prépare pour le gouvernement de la République Populaire du Bénin. Cotonou.

LALEYE, P., A. CHIKOU & P. VANDERVALLE (2001): Faune ichtyologique de la rivière Pendjari au Bénin. Rapport de mission scientifique. Université Nationale du Bénin, Faculté des Sciences Agronomiques, Laboratoire d´Hydrobiologie et d´Aquaculture. Cotonou, 18 S.

LEVEQUE, C., D. PAUGY, G.G. TEUGELS (Eds.)(1990): Faune de poissons d´eaux douces et saumâtres de l´Afrique de l´Ouest, Tome 1. – Mus. R. Afr. Cent., Ed. ORSTOM, Coll. Faune tropicale no. XXVIII, 1-384. Tervuren/Paris.

LEVEQUE, C., D. PAUGY, G.G. TEUGELS (Eds.)(1992): Faune de poissons d´eaux douces et saumâtres de l´Afrique de l´Ouest, Tome 2. – Mus. R. Afr. Cent., Ed. ORSTOM, Coll. Faune tropicale no. XXVIII, 385-902. Tervuren/Paris.

PAUGY, D., K. TRAORÉ & P. S. DIOUF (1994) : Faune ichtyologique des eaux douces d'Afrique de l'Ouest. In : TEUGELS, G. et al. (eds.)(1994): Diversité biologique des poissons des eaux douces et saumâtres d'afrique. Synthèses géographiques. Ann. Mus. r. Afr. Centr., Zool., 275: 35-66. Tervuren.

SAYER, J. A. & A. A. GREEN (1977): Plan Directeur: Parc National de la Pendjari. Document du Projet FAO/PNUD, Aménagement de la Faune et des Parcs Nationaux, Natitingou.