

Short note / Kurze Mitteilung

Fishery impact on bichirs (Polypteridae, Teleostei) in the Pendjari River (Benin)

Auswirkungen der Fischerei auf Flösselhechte (Polypteridae, Teleostei)
im Pendjari (Benin)

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Zusammenfassung: Reusenfänge von *Polypterus endlicherii* Heckel, 1847 und *Polypterus senegalus* Cuvier, 1829 aus dem Pendjari in Benin wurden untersucht. Beim Vergleich von Gebieten mit Fischerei und ohne Fischerei zeigte sich, dass beide Arten in den ungestörten Gebieten häufiger sind und in Gebieten mit Fischerei im Durchschnitt eine geringere Standardlänge aufweisen. Letzteres ist bei *P. endlicherii* besonders stark ausgeprägt; es scheint, dass diese Art (und möglicherweise auch andere große *Polypterus*-Arten) besonders empfindlich auf Fischereiaktivitäten reagieren. Um dies zu belegen, wären weitere vergleichende Untersuchungen hierzu nötig, jedoch sind völlig ungestörten Flussabschnitte in der westafrikanischen Savanne so gut wie nicht mehr zu finden..

The family Polypteridae is endemic to and widely distributed in African freshwaters. Some species show a wide distribution, e.g. *Polypterus endlicherii* and *Polypterus senegalus*, occurring from the Nile basin to all over West Africa, the latter species even in the Katanga area of the Southern Congo basin (GOSSE 1984). During ichthyologic fieldwork in the Pendjari National Park in Benin there was a unique possibility to study an undisturbed river stretch of the Pendjari River. Fish sizes and densities remarkably differed to catches from other sampling points of the Pendjari River. This especially holds true for two *Polypterus* species of the area. Thus, in this note three sample locations within the Pendjari National Park were compared: a lake and a river section, which are exploited by fishermen, and a river section in an almost undisturbed area. The Pendjari National Park is limited in its western and northern direction by the Pedjari river, which is the eastern most tributary of the Volta basin. At the same time the Pendjari river forms along its northern shore the frontier to Burkina Faso. Fishery is conducted from both countries along the

Pendjari River, also within the national park (MORITZ & LALÉYÉ subm.).

Sampling took place in the Pendjari National Park, Northern Benin, between November 2004 and Mai 2005. Three locations on which repeatedly sampling took place are included here: the “Mare Diwouni”, a lake close to the border of Burkina Faso, “Pendjari-Hotel”, a river section affected by fishery, where the Pendjari forms the boundary between Burkina Faso and Benin, and “Pendjari-Bondiagou”, an undisturbed river section in the south-western part of the Pendjari National Park. Although there are several lakes along the river close to the border of Burkina Faso, we unfortunately did not find a lake without traces of fishery, i.e. nets, net-holding sticks, hook-lines, fishermen or boats.

Three-chambered double fykes (= hoop traps), 11 mm mesh size in the last chamber, with 5 m leader net with 18 mm mesh size were applied; leading net and fyke opening were 40 cm. The double fykes were installed in water depths of 0.5 to 1 meter. Whenever possible, fykes were installed in a way that the last chambers

of a trap allowed access to surface in order not to drown obligate air breathers (e.g. crocodiles, snakes, turtles, lungfish, and bichirs). Caught fish were measured by standard length (SL) and total length, and weighted. After that procedure, they were released on the collection point, with the exception of very few voucher specimens.

Both river sections showed similar shore vegetation, gallery forests, but at Bondiagou the treetops of both sides get in contact, which is not the case at “Pendjari-Hotel”. Thus, Bondiagou is almost impossible to reach by boat and thus fishery seems excluded, as fishermen enter the Pendjari upstream by boats (MORITZ & LALÉYÉ subm.). Additionally, ichthyological investigations are very difficult due to a risky combination of dense vegetation and high abundance of hippos (*Hippopotamus amphibius*). The high fish abundance can be seen even distant from the water: big *Brycinus macrolepidotus* (Alestiidae) are swimming often close to the surface and air-breathing fishes often gulp air on the surface. This investigation concentrates on *Polypterus*, as the traps of the undisturbed area were mainly stuffed with big predators, i.e. *Polypterus* spp., *Clarias* spp., *Auchenoglanis occidentalis*, *Malapterurus electricus*. Non-predatory fishes like alestids, mormyrids and mochokids, except of some big *Hemisynodontis membranaceus*,

were present only as remnants, e.g. fins, heads, bones, in the fykes.

Results are summarized in table 1; statistics are performed with the programm PAST 2.17 (HAMMER et al. 2001): Both *Polypterus* species seem to be more common in the undisturbed area, by comparing the average number of specimens per trap and day. In Bondiagou *P. senegalus* was present in two out of three traps; *P. endlicherii* was represented by more than two specimens per trap. Sizes were smaller in areas with fishery, which is most accented in *P. endlicherii*: the average standard length in areas with fishery was only two-thirds of the length found in undisturbed areas (fig. 1). Furthermore, the total ratio between specimens of *P. endlicherii* and *P. senegalus* differed from 1:2.71 in the Mare Diwouni over 1:1.25 in the Pendjari river at “Hotel” to 1:0.30 at Bondiagou.

The results show not only differences between the disturbed and undisturbed areas, but also differences between the two species. The smaller *P. senegalus* was more common in the lake than in the river; it is often found also in wide distances from the main river (pers. obs.) and often the only bichir managing to migrate into small reservoirs (pers. obs.). In *P. endlicherii* there is no abundance difference in the investigated lake and the neighbouring river.

Tab. 1: Sampling sites and respective catches; SL – standard length.

Tab. 1: Untersuchungsstellen und zugehörige Fangdaten; SL – Standardlänge.

location	Mare Diwouni	P-Hotel	P-Bondiagou
biotop	lake	Pendjari River	Pendjari River
fisheries	yes	yes	no
trap-days	56	56	18
<i>P. endlicherii</i>			
specimens	7	8	40
fish per day and trap	0.125	0.143	2.22
average SL	252.57	257.50	375.35
max SL	311	295	530
average weight	126	139	505
<i>P. senegalus</i>			
specimens	19	10	12
fish per day and trap	0.339	0.179	0.667
average SL	215.84	229.90	253.42
max SL	320	280	275
average weight	95.3	92.1	119.9

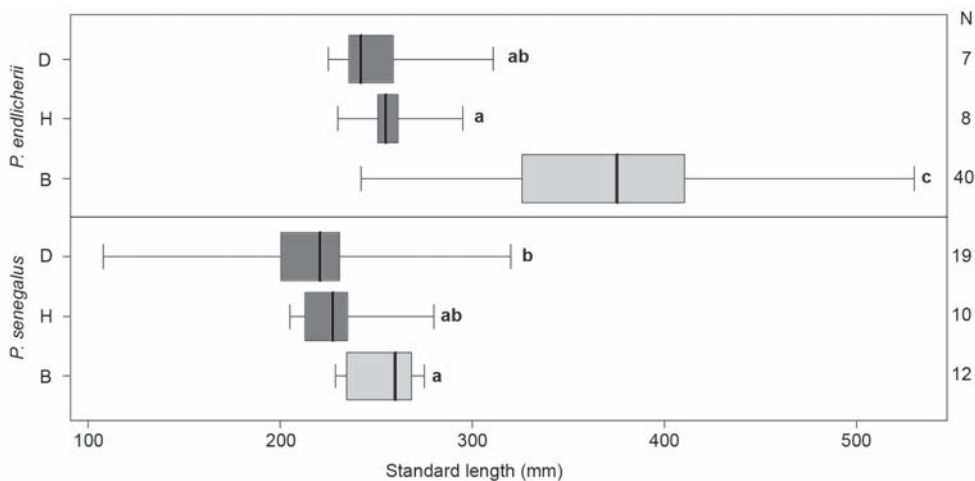


Fig. 1: Standard length of *Polypterus* species from Pendjar River at Bondiagou (B), the Hotel (H) and the lake Mare Diwouni (D); areas with fisheries (dark grey) and undisturbed area (light grey). Letters indicate statistical differences (Kruskal-Wallis-test, $p < 0.05$).

Abb. 1: Standardlänge der *Polypterus*-Arten vom Pendjari bei Bondiagou (B), Hotel (H) und im Mare Diwouni (D); Gebiete mit Fischerei (dunkelgrau) und ungestörtes Gebiet (hellgrau). Buchstaben geben statistische Unterschiede an (Kruskal-Wallis-test, $p < 0,05$).

Fishery may have a high impact to certain species, even if the actual fishery activity seems low. This became evident during the last decades especially for some deep-sea species expressing a rather slow life mode with slow growth, high longevity, late sexual maturity and probably also low numbers of offspring, e.g. *Hoplostethus atlanticus* (BOYER et al. 2001, BRACH 2001, CLARK 2009) and *Dissostichus eginoides* (COLLINS et al. 2010). Examples from freshwaters may be sturgeons, for which however additional treats like blocking of migration routes further affect their decline (BIRSTEIN et al. 1997). For tropical freshwaters such informations are limited and often restricted to vague comparisons of single reports of former times and today. NEUMANN et al. (2016) for example discussed possible changes in the fish community of the Main Nile, but also for this important water body time series from fishermen catches or ichthyological monitoring programs are not available and conclusions have to be estimated based on single reports of former decades. Even if a heavy decline seems to be substantiated, it seems almost impossible to reconstruct the reasons

for these trends: high sensitivity to fishery at all, heavy overexploitation, habitat alteration or pollution are only some possible reasons.

The comparison of only three localities in the herein presented study can only be a snapshot and does not allow any statistically confirmed statements. But it should be regarded as an alarming signal. A study which would aim to investigate the primary fishery impact on freshwater fish communities in West Africa will likely be doomed to fail, due to the virtual absence of totally undisturbed water bodies. The Bondiagou river stretch of the Pendjari gave an impression how undisturbed West African savannah rivers may have looked like: during dry season the remaining water body is stuffed with fish – many of them predators. The fishes of the savannah regions are undoubtedly adapted to severe conditions, e.g. high temperatures, fluctuating food availability, risk of desiccation, and many are adapted to this environmental stress among other things by producing high numbers of offspring and by quick growing during good conditions. These are optimal conditions for high productive fishery – but the systems will work only as long as there are

enough big adults producing the high offspring numbers. Should these conclusions be correct it is absolutely inevitable to establish totally protected zones, from which fishes can recolonize areas of intense fishery (MORITZ & LINSSENMAIR 2004), not only to protect the big species itself, but also to guarantee sustainable and profitable fishery. A further necessity for sustainable biodiversity protection is profound and detailed information on the life history of each species. We are for example not aware if large *Polypterus* species undertake spawning migrations. There are reports that they perform lateral migrations, i.e. from the main river bed to flood plains (DAGET 1954), but migrations inside river systems are not yet known. During a field trip to Sudan in 2016, a fisherman very reliably reported that large *Polypterus* species occur only during certain times of the year at the White Nile of Kosti (Mohammaed Abakar Abdallah, Fisheries Reserach Institute Khartoum, Apr. 2016). Thus, it seems that our knowledge on the life history of bichirs is still only fragmentary.

The herein reported observations may indicate that *P. endlicherii* is highly sensitive to fishery impact immediately responding with alteration in size-spectrum. This could be due to several reasons. One possible reason could be a high sensitivity for fill nets: bichirs are mainly nocturnal predators, which may be unable to detect gillnets visually. With their armoured, only slightly compressible body they usually push obstacles aside, instead of obviating them (pers. obs. in captivity). They are forceful, but not very persistent. Therefore, the bichirs are predestined to entrap themselves in gill nets and as they are obligate air breathers they soon will drown. As gill nets are size depending fishing gears, species with bigger minimum maturation size will be more affected. The minor decrease in size and abundance of *P. senegalus* in the present study is in conformity with the hypothesis that fishery highly affects large bichir species like *P. endlicherii*.

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