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Fouling of externally attached radio transmitters in an African river

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Short communication

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Abstract

Fouling of externally attached tags is an important consideration in long term tagging studies as it may affect fish behaviour and well-being. Two externally attached radio transmitters on African tigerfish Hydrocynus vittatus were covered with short grown green algae, after the fish were recaptured 49 and 64 days after tagging in the Kavango River, Namibia. This is the first observation of fouling on external radio transmitters from any African river which highlights the importance of conducting studies that evaluate the various behavioural effects resulting from tagging.

Text

Electronic tagging of fishes (i.e. telemetry) can provide valuable information on the spatial ecology, migration, and response to environmental changes and, hence, is the preferred method to study freshwater fishes worldwide (1, 2). External transmitters are commonly used in telemetry studies, however, tissue damage, reduced growth, increased mortality and decreased swimming performance are associated potential negative effects (2). Externally attached transmitters change the stream-line body shape of fishes, and reduced swimming performance from additional drag has been experimentally demonstrated for *relatively small Atlantic salmon Salmo salar smolts (3), juvenile rainbow trout Oncorhynchus mykiss (4) and juvenile white sturgeon Acipenser transmontanus (5). In adult S. salar however, Thorstad et al. (6) reported no* difference in swimming performance between fish with externally attached transmitters vs. untagged controls. Interestingly, during a different study by Thorstad et al. (7) the relatively poor condition factor of an adult farmed *S. salar* fitted with an externally attached transmitter was attributed to additional drag resulting from transmitter fouling with green algae, mussels, seaweed and *Balanus sp.*

Here we report on the observed fouling of external transmitters attached to African tigerfish *Hydrocynus vittatus*, Castelnau 1861, in the Kavango River, Namibia. These fish were part of a larger study involving the movement behaviour of 49 tigerfish (8). The tagging procedures were as follows. Tigerfish were anaesthetized using 2-phenoxy-ethanol (0.3 ml/L) and fitted with external radio transmitters (Model F2120 Advanced Telemetry Systems, Inc., Isanti, MN, USA) that are encapsulated in 3M Scotchcast and the antenna was nylon coated, weigh 16 g in the air and measure 55 × 20 × 11 mm. Transmitters were attached with orthopaedic wire (0.65 mm diameter) threaded horizontally through the pterygiophore bones in the dorsal musculature. The external transmitters were secured by twisting and locking the ends of the wire against a flat plastic back-plate on the adjacent side of the transmitter. The tags were attached tightly to the body of the tigerfish to minimize the risk of snagging, fouling and to minimize possible drag. After tagging, fork length (L_F) was measured to the nearest mm and total body mass (g) were recorded and all fish were released at their capture site.

Two tigerfish with L_F 510 mm and 588 mm, and weight 2800 g and 3530 g were recaptured by anglers, 49 and 64 days after being radio tagged. The first tigerfish was recaptured in the Mahangu Game Park by angling scientists 6.34 km downstream from its tagging location. At recapture, the tigerfish measured L_F

515 mm and weighed 2890 g. The second tigerfish was recaptured 80.6 km downstream from the tagging location by a professional angling guide in the Okavango Panhandle, Botswana. No physical measurements were recorded for the second recaptured tigerfish. In both cases, however, the transmitter, antenna, attachment wire and plastic back-plate were overgrown by green algae (Figure 1). In addition, both tigerfish had signs of some dermal abrasion approximately one scale row below the position of the transmitters (Figure 2). Although, no clear infection was observed, redness of the dermis probably resulted from irritation between the transmitter and the dermis which is often expected with externally attached transmitters (9). This irritation in severe cases may lead to infections that could result in mortality of the tagged fish (10). As a result, alternative attachment methods such as the silicone-mound method (11) that has been used successfully on golden perch (*Macquaria ambigua*) and common carp (*Cyprinus carpio*) may be considered. In addition, internal transmitters have previously been used in tigerfish by Baras et al. (12), although a relatively short study (one month), no effects from tagging was reported and the application of this method may be explored.

To the authors' knowledge, this is the first observation of fouling of externally attached radio transmitters in any African river. Although reduced swimming performance from additional drag has been experimentally demonstrated for juvenile and small *fish species,* we conclude that the observed growth on the transmitter would not have significantly influenced tigerfish behaviour in our main study on adult tigerfish (8) as transmitter weight combined with additional algae growth from fouling remained far less than the recommended 2% tag weight to body weight "rule" (13). In addition, the first recaptured tigerfish increased in length and weight which may suggest that the general health of the fish was not negatively influence by the tag. While the observed fouling was less severe than the green algae, mussel, seaweed and *Balanus* sp. fouled tags reported to influence *S. salar* behaviour (7), our observations nevertheless suggest that tag fouling and its potential effects on the behaviour of smaller fish and require further research.

List Of Abbreviations

ml/L – millilitres per litre

L_F - fork length

mm – millimetres

g - gram

Declarations

Ethics approval

This research was authorized by the Namibian Government under the Ministry of Fisheries and Marine Resources (Inland Fisheries Resources Act 1 of 2003 ref/INTERNAL/21MAY2017) to provide for the conservation and protection of aquatic ecosystems and the sustainable development of inland fisheries resources, to provide for the control and regulation of inland fishing; and to provide for related matters.

Consent for publication

The authors all give consent for publication

Availability of data and material

Not applicable.

Conflict of interest

The authors declare no competing financial interests.

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Authors' contributions

FJJ conceived the paper with, OLW, EMU, CH, and TFN. FJJ collected and analysed data, and wrote the paper. OLW, EMU, CH, and TFN contributed valuable comments to the manuscript.

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Figures

Figure 1

Fouling by green filamentous algae observed on the externally attached radio transmitter, antenna, attachment wire and plastic back plate on tigerfish recaptured 49 days after tagging in the Kavango River, Namibia.

Figure 2

Visible dermal irritation approximately one scale row below the position of the externally attached radio transmitters which was probably caused by movement of the transmitter on a tigerfish recaptured 49 days after tagging in the Kavango River, Namibia. The green algae had to be removed from the transmitter to reveal the tag number.