Reporting on the recapture of electronic tagged fish by fishers in the Xingu River, Brazilian Amazon

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Historically, studies on movements of migratory fishes in the Amazon basin using conventional and electronic tags were not feasible due to high costs and the challenges of tracking or recapturing fish in such a large area (reviewed in Val and Almeida-Val, 1995). Godoy (1979) was the first to attempt using mark-recapture techniques to study the movements of a migratory fish, focusing on movements of piramutaba (*Brachyplatystoma vaillantii*, Valenciennes, 1840) in the Amazon estuary. However, the study was conducted on a small spatial scale and it was not successful, with recapture rates below 1% (Godoy, 1979). Decades later, Barthem and Goulding (1997) conducted extensive analyses of fishery catches data to investigate the migrations of the giant catfish (*Brachyplatystoma* spp.) in the Amazon. The findings suggested the use of large extensions of rivers and floodplains (over 3000 km) by dourada (*Brachyplatystoma rousseauxii*, Castelnau, 1855) and piramutaba (*Brachyplatystoma vailantii*) to complete their lifecycle (Barthem and Goulding, 1997; Ruffino et al., 2000; Harvey and Carolsfeld, 2003). However, since the pioneering studies of Barthem and Goulding (1997), the movement ecology of migratory species in the Amazon River and its major tributaries (e.g. Madeira, Purus, Xingu, and Tapajós Rivers) remain largely unknown. Acknowledging the need for such information, three large hydropower projects in the Madeira (Santo Antônio and Jirau Dams) and Xingu Rivers (Belo Monte Dam) commissioned biotelemetry studies on the movement ecology of migratory species.

A large-scale study on migratory fishes using cutting-edge biotelemetry technology (first in South America using CARTs: Combined Acoustic and Radio Transmitters) has recently been initiated in the Xingu River along the area that will be affected by the Belo Monte Dam. The project is entitled "Movement and habitat use by migratory fishes in the Xingu River revealed by biotelemetry", and its main objectives are: i) to identify and describe the movements of migratory fish between downstream and upstream stretches of the Big Bend (locally known as "*Volta Grande do Xingu*"), before and after dam construction; ii) to determine the timing and seasonality of these movements; and iii) to determine the maximum distances traveled by migratory fishes. A critical component of this project is the participation of fishers through the reporting of recaptured fish. Such reporting provides additional information about tagged fish movements and their condition several days to months after release. This note describes the recapture and reporting of electronic tagged fish in the Xingu River and discusses the role of fishers in providing information about fish migration in this large river system.

Fieldwork was conducted between February 2013 and February 2014, in the middle and lower Xingu River, Brazilian Amazon. Individuals of *Brachyplatystoma filamentosum* (Lichtenstein, 1819; piraíba/filhote, n=10), *Phractocephalus hemioliopterus* (Bloch and Schneider, 1801; pirarara, n=121), *Pseudoplatystoma punctifer* (Castelnau, 1855; surubim, n=62), *Prochilodus nigricans* (Agassiz, 1829; curimatá, n=153), and *Myleus rhomboidalis* (Cuvier, 1818; pacú-de-seringa, n=55) were captured using gill nets and longline fishing. Fish were anesthetised by immersion in clove oil, and internally (Wagner et al., 2011) or externally tagged with coded combined acoustic and radio transmitters (Lotek Wireless CART Series®, models MM-MC-16-50 and MM-MC-16-33), depending on their size and body shape. In addition to the transmitters, fish (n = 214) captured from October 2013 to February 2014 were also marked with hydrostatic anchor tags (Hallprint©, model standard TBA) to facilitate identification and return of transmitters and/or tagged fish recaptured by fishers. Fish were weighed, measured, sexed, photographed, and then released at the same or near the capture sites. Permits to capture and tag fish were issued by the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (Permit N.145/2012).

Local media (radio, television, newspapers) and brochures were used to promote the report of the fishers on fish recaptures and return of transmitters (starting in February 2013 and ongoing). Fishers that reported on recaptured fish were rewarded with souvenirs and certificates

Table 1. Tagged and recaptured fish information.

Species	Release date	Recapture date	Days after release	Distance (km) from release site	Upstream/ Downstream release site
*P. hemioliopteru*s	11/13/13	11/28/13	15	5	Upstream
P. hemioliopterus	2/22/13	3/31/13	37	0	RS
P. hemioliopterus	11/21/13	1/19/14	59	1	RS
P. hemioliopterus	10/28/13	12/31/13	64	0	RS
P. hemioliopterus	11/21/13	1/31/14	71	0	RS
P. hemioliopterus	2/20/13	6/30/13	130	0	RS
P. hemioliopterus	2/19/13	8/13/13	175	0	RS
P. nigricans	3/20/13	3/31/13	11	0	RS
P. nigricans	1/14/14	1/31/14	17	1	RS
P. punctifer	2/12/14	4/24/14	71	8	Downstream
P. punctifer	11/18/13	2/15/14	89	160	Upstream
P. punctifer	2/22/13	2/28/14	371	73	Upstream

RS= ≤ 1 km from release site.

for their contribution to the study and the conservation of migratory fish in the Xingu River.

As of April 2014 (15 months after fish tagging started), 12 fish (curimatá=2, pirarara=7, and surubim=3; 3% of total tags) were recaptured and reported by fishers in the Xingu River (Table 1). Most of the fish (n=10) were recaptured at distances ≤ 8km from the release site, whereas two surubim were recaptured, 73 and 160 km upstream of the release site. Recaptures occurred between 11 and 371 days after release.

All recaptured fish had been internally tagged with the transmitters. Information about the condition of the incision site was provided for three (25%, all pirarara) of the recaptured fish. According to fishers, the incision site was completely healed and sutures were not present (for the pirarara recaptured, 59 and 64 days after release) or the incision site was healed but sutures were still present (for the pirarara recaptured, 15 days after release).

Seven out of 12 recaptured fish had anchor tags attached to the base of the dorsal fin. According to fishers, two pirarara were released back to the river after visualisation of the anchor tags and recording of the tag number. Indeed, the use of anchor tags makes it easier to identify fish carrying transmitters, increasing the chances of returning tagged fish alive to the river and reporting of the recapture.

Data about recapture of electronic tagged fish and return of transmitters by fishers has been reported in other biotelemetry projects in Brazil and ranged from 13 to 54% (Godinho and Kynard, 2006; Godinho et al., 2007; Hahn et al., 2011; Pesoa and Schulz, 2010), values that are greater than observed so far in the Xingu River. The return of transmitters is important because it not only makes it possible to reuse the tags in other fish, but also because fishers will provide information on the use of habitats beyond the limits of study area and after the transmitter battery runs out. In the Uruguay River a tagged dourado (*Salminus brasiliensis*; Cuvier, 1818) was recaptured 300 km downstream of the study area after the monitoring was over (Hahn et al., 2011). In the Madeira River, a radio tagged dourada was recaptured by a fisher 150 km downstream of the study area (L. Hahn, personal observation).

The collaboration of Xingu River fishers has been very important up to this phase of the biotelemetry project to understand the effects of handling and tagging on post-release healing and survival. In the near future, recaptures might also help to elucidate the movements outside the study area, as identified in other projects in Brazil, and the reproductive condition of recaptured fish (potentially helping to identify reproductive migrations). Coupling high-tech tracking tools with recapture information will generate important results that may prove useful for the future management of migratory fishes in the Xingu River.

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