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Short Note

Tagging Giant Otters (*Pteronura brasiliensis*) (Carnivora, Mustelidae) for Radio-Telemetry Studies

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The giant otter (*Pteronura brasiliensis*) is an endangered, social carnivore endemic to the freshwater ecosystems of South America (Rosas et al., 2008; International Union for Conservation of Nature [IUCN], 2010). The species depends on good water quality and preserved riverine habitat to survive (Rosas et al., 2008); and as a top predator, it regulates prey populations. The species was extensively hunted for its pelt until the 1960s and was almost extinct in some areas of its distribution. Today, the destruction of natural habitats is the main threat to giant otters (Rosas, 2004; Rosas et al., 2008). In spite of the species' conservation concern and ecological importance, there are few studies focusing on the ecology and conservation of free-ranging giant otters (Duplaix, 1980; Carter & Rosas, 1997; Staib, 2005; Utreras et al., 2005; Garcia et al., 2007; Rosas et al., 2007; Leuchtenberger & Mourão, 2008). This is probably related to the difficulties of following giant otter individuals and groups during the entire hydrological cycle; their habitat is seasonally flooded and the animals disperse throughout extensive and dense flooded forests during the high-water season. During the dry season, despite the fact that encounters with giant otter groups tend to increase, navigation of several water bodies is extremely difficult due to low water, precluding following giant otter movements and estimating reliable home-range sizes by direct observation (Rosas et al., 2007).

Radio-telemetry is one of the most frequently used methods to acquire demographic, behavioral, and ecological data for cryptic species (White & Garrott, 1990). This technology has brought two major advantages to wildlife research: (1) the ability to identify individual animals and (2) the possibility to locate each individual when desired (Mech & Barber, 2002). Here, we employed this tool to gather data on giant otters to overcome the challenges of conventional methods. Capturing and tagging an animal depends on a good understanding of the species' behavior and ecology. The expertise required to tag individuals for telemetry is often underestimated (Ebner, 2009). Otters are unsuited to standard collar-mounted transmitters due to the similar circumference between their neck and head (Ó Neill et al., 2008). In the case of the social giant otters, a collar would likely be easily removed by the radio-tagged animal or by other members of its group during their extensive grooming behavior. In European otters (*Lutra lutra*; Ruiz-Olmo et al., 1995), river otters (*Lontra canadensis*; Hoover, 1984; Hernandez-Divers et al., 2001), sea otters (*Enhydra lutris*; Garshelis & Siniff, 1983; Williams & Siniff, 1983), beavers (*Castor canadensis*; Davis et al., 1984), grizzly bears (*Ursus arctos*; Philo et al., 1981), and black bears (*Ursus americanus*; Jessup & Koch, 1984)—species with similar characteristics—surgically implanted transmitters have been used as an alternative to collar-mounted transmitters.

In this paper, we describe how to capture and surgically implant radio-transmitters into giant otters and discuss our preliminary success in following two individuals.

The study areas were situated in two protected areas along the Araguaia River: Cantão State Park in Northern Brazil (S 09° 21' 32.2, W 49° 58' 36.4) and the Meandros do Araguaia Reserve in central Brazil (S 12° 38' 51.7, W 50° 41' 04.4). The Araguaia River, originating in the Cerrado and running northward to the Amazon biome, is 2,115 km long and one of the main watercourses of Central Brazil. The relatively well-preserved riverside habitats along the Araguaia River harbor important giant otter populations for Brazil.

To obtain information about the presence of giant otters in the study areas, giant otter territories were visited during the day by boat to find giant otter dens. The dens were classified as "in use" or "not in use," according to the criteria described by Groenendijk et al. (2005) and Rosas et al. (2007). Following this diurnal survey, one den was chosen for capture based on confirmed presence of the animal inside, location, and favorable characteristics (den with few entrances, entrance not too wide, entrance of the den not too near the water, and little vegetation at the entrance) that minimized the likelihood of accidents or injuries to either the animal or the researchers involved. Giant otters were captured using a funnel-shaped net (2.40-m long and mesh of 5 × 5 cm) fixed on an oval metal hoop (0.40 to 0.50 cm × 0.30 to 0.35 cm of diameters) with a door that opened into the net (Figure 1). The trap was installed at the entrance of the den and firmly fixed to the trees and roots around it. The trap door was kept open by a rope held by one person during the whole procedure. To ensure that giant otters within the den did not perceive the entrance as blocked, the net was kept as stretched as possible. This procedure was conducted before dawn while the giant otters were sleeping inside the den, ensuring that the only available exit was where the net was fixed. Any other entrances, as well as air holes, which are usually located above the den chamber, were closed with foam of 1 to 3 cm of thickness, quantity, and size as needed to cover the holes. The animals were captured upon leaving the den (Figure 1). When the giant otter entered the net, the rope that kept the trap door open was released, closing the door. Due to a lock system, the door did not allow the animal to move back out of the trap. Since the animals usually hesitated after perceiving the net, it was necessary to introduce some smoke through one of the air holes to induce them to leave the den through the netted opening.

Two capture seasons were carried out, and two adult giant otters, one male and one female, were captured, one in each study area (100% success rate). Once inside the net, each animal was transported in a metal cage to the research base, 15 to 30 min by boat, where the surgery for radio-transmitter implantation was performed. For surgery, the giant otters were anesthetized intramuscularly with 3.0 mg/kg of a combination of tiletamine and zolazepam (Zoletil®, Virbac, Carros-Cedex, France). In the captured female, to minimize the stress due to capture observed in the male captured earlier, the giant otter was sedated with half the anesthesia dose immediately after being captured, and the second half of the dose administered immediately before the surgery.

The implanted radio-transmitters (Advanced Telemetry Systems, Inc., Isanti, MN, USA) consisted of the transmitter and battery in a cylindrical silicone case measuring 102 mm × 20 mm and weighing 42 g, which represents approximately 0.2% of the body mass of a medium-sized adult giant otter (Rosas et al., 2009). Surgery for implantation of the radio-transmitter in the peritoneal cavity was carried out following techniques previously described by Ruiz-Olmo et al. (1995) and Williams & Siniff (1983). The giant otters were placed on the surgical table in dorsal recumbency, and the surgical area was shaved; disinfected with water, soap, alcohol, and povidine-iodine; and covered with a sterile disposable surgical drape with a small aperture (~10 cm). The radio-transmitter and surgical material were sterilized by submersion in a glutaraldehyde solution and washed with a sterile solution of sodium chloride.

The abdominal cavity was accessed via an incision of approximately 3.5 cm in length, located below the umbilical scar. The subcutaneous tissues, fat, and muscle were sharply transected until reaching the peritoneum; after transecting the peritoneum, the implant was inserted freely into the peritoneal cavity (Figure 2). The abdominal muscle layer was closed with polygalactin 2.0 using an interrupted suture pattern; the subcutaneous layer was closed with polygalactin 2.0 using a continuous suture pattern; and the skin was closed with nylon 0.0 using an intradermal continuous suture pattern. Surgical metylmetacrilate adhesive was used to cover the surgical incision to provide a waterproof seal. Penicillin was given intramuscularly (0.5 ml; Veterinary Pentabiotic®, Fort Dodge Animal Health, Campinas, Brazil), and an anti-inflammatory was given subcutaneously (2 mg/kg; Ketoprofen 1%, Merial Animal Health, Paulínea, Brazil). The implantation procedure lasted between 40 to 80 min.

In addition to the implantation procedure, each giant otter was also weighed and measured. Blood samples were taken, and physical and oral

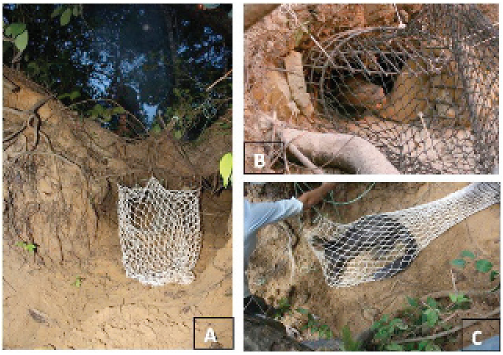

Figure 1. Funnel-shaped net adapted at the entrance of giant otter dens (A and B), and the giant otter inside the net (C)

Figure 2. Radio-transmitter being inserted in the peritoneal cavity

examinations were conducted. The male giant otter weighed 26 kg, and the female weighed approximately 22 kg. Radio-transmitters represented 0.16 and 0.19% of their body mass, respectively. Biometric measurements are presented in Table 1.

Table 1. Biometric measurements of two giant otters captured for radio-telemetry studies along the Araguaia River

Measurement (cm)	Male	Female
Total length	172.0	152.5
Head circumference	32.5	33.0
Neck circumference	32.5	36.5
Head length	22.0	19.0
Body length	107.0	97.0
Tail length	65.0	55.5
Ear length	2.2	2.2
Ear width	2.0	2.0
Hind foot length	21.0	19.0
Height	33.0	28.0

Both tagged giant otters were released at their respective capture sites after they recovered from the anesthesia. Because the male was captured early in the morning, it was released in the afternoon of the same day. Capture of the female took longer and, consequently, her surgery was performed in the afternoon. Thus, this animal spent the night in a cage to recover and was released early the next morning. The male joined its family group within 48 h, and the female rejoined her family group within 5 h of release.

Tagged individuals were visually observed after release, and we observed no impediments to the giant otters, physically or behaviorally, because of the implant, supporting the results also obtained by Ó Neill et al. (2008) for the Eurasian otter. The giant otters did not seem to care about the incision site; there was no hemorrhage; and the skin suture did not become damaged or infected. Also, during the monitoring period, the animals presented normal activity patterns for the species.

Both giant otters were tracked for 12 mo, after which the radio-transmitter battery failed as expected. We accumulated 636 radio-telemetry locations for the male and 119 locations for the female during these months of tracking. While the male's group could be directly observed frequently after being located by radio telemetry, the female belonged to a shy, unsociable group that became very withdrawn when sensing our presence. The localizations of the female's group were only possible through radio-tracking, without visual observation of the group.

This study demonstrates the potential and efficacy of intraperitoneally implanted radio-transmitters for behavioral and ecological studies of giant otters. Although widely used in other otter species (Garshelis & Siniff, 1983; Williams & Siniff, 1983; Hoover, 1984; Ruiz-Olmo et al., 1995; Hernandez-Divers et al., 2001), this was the first time a radio-transmitter was implanted in a giant otter. Other methods for capturing otters include padded foothold traps (Serfass et al., 1996; Férnandez-Morán et al., 2002) and modified floating gill nets (Williams & Siniff, 1983). The method described here was shown to be safe and effective. It is important to capture one animal at a time to prevent animals from inflicting each other with injuries inside the net. Furthermore, as the giant otter is an endangered species, pregnant or nursing females should be immediately released, considering the stress and risks of a capture.

We experienced no complications with the anesthetics used, but as the administration of the anesthetic in half of the dose after the capture and half before the surgery did not provide adequate immobilization and analgesia, we recommend the administration of the whole dose of the anesthesia right after the capture and administration of a supplemental dose if needed. It is extremely important that biologists with knowledge of giant otter behavior accompany the capture and that qualified veterinarians perform the implantation of the radio-transmitter.

Effective conservation of an endangered species requires a full understanding of its habitat use, home ranges, and seasonal movements (Ebner, 2009). Radio-telemetry allows us to gather this information on the giant otter, data that probably could not be obtained by other methods because of habitat limitations and animal access. The techniques described will contribute to facilitate the accumulation of baseline information to design adequate conservation strategies for the species.

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