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First data on the presence of *Lutra lutra* in Bosco Incoronata Natural Regional Park (Apulia, South Italy)

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Abstract

The Eurasian otter, *Lutra lutra*, is a protected species in Italy since 1971 and it is threatened mainly by fragmentation and loss of habitat. Otter's conservation plans started in 2010 and areal extension was found to consist of two small and disjointed nuclei. Recent research confirmed the expansion of occupied areas, especially in Abruzzo and along Apulian River basins. We studied the otters in the Bosco Incoronata Natural Regional Park (in the north of Apulia region) by means of line transects and camera-traps techniques. Our results confirm the persisting presence of individuals. On this evidence, further studies are recommended in the entire river basin and whole Tavoliere area to better define the *status* of the species.

Keywords: *Lutra lutra*, presence, range expansion, Parco Naturale Regionale Bosco Incoronata, Apulia.

Riassunto

In Italia, la Lontra euroasiatica (*Lutra lutra*) è una specie protetta fin dal 1971 e la minaccia principale è costituita dalla frammentazione e distruzione dell'habitat. I piani di conservazione relativi alla specie avviati dal 2010, hanno restituito risultati incoraggianti circa l'estensione dell'areale, che inizialmente risultava composto da due nuclei piccoli e isolati. Recenti ricerche hanno confermato l'espansione delle aree occupate, specialmente nei bacini abruzzesi e pugliesi e

in questo contesto si inserisce il presente lavoro da cui si è evinta la presenza stabile della specie nel Parco Naturale Regionale Bosco Incoronata (nord-Puglia). Quest'evidenza incoraggia la prosecuzione delle ricerche nell'intero bacino fluviale e in tutta l'area del Tavoliere al fine di incrementare le conoscenze circa lo *status* della specie.

Parole chiave: *Lutra lutra*, areale, Parco Naturale Regionale Bosco Incoronata, Puglia

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Introduction

During the XX century, the Eurasian otter, *Lutra lutra*, was one of the most threatened species in Italy, mainly because of hunting and loss of habitat caused by riverbanks modification and water pollution. This condition reached its peak during the '70s - '80s (Prigioni et al., 2005c, 2007; Kalby et al., 2003; Reggiani & Loy 2006) and led to the total species disappearance in the Northern Italy while causing the severe decline and range reduction in the rest of the Peninsula (Macdonald & Mason 1983b; Cassola 1986). Since the '90s, signs of otter's presence were reported in central and southern Italy. In 2011, ISPRA (Istituto Superiore per la Protezione e la Ricerca Ambientale) described two small and isolated *nuclei*: the "*meridionale nucleus*", which covers Calabria, Basilicata, Apulia, and Campania regions, and the "*molisano nucleus*", which covers Molise and Abruzzo (Extent of Occurrence, sensu IUCN 2001). At present, recent evidence demonstrated the presence of *Lutra lutra* in northern Italy (Loy et al., 2015; Lapini et al., 2020), and the species seems to expand its areal in the southern parts of the peninsula (Marcelli & Fusillo

2009; Prigioni et al., 2005a, 2007; Reggiani & Loy 2006; Belinesi et al., 2019; Buglione et al., 2020a).

Lutra lutra is an indicator species of wetlands and freshwaters ecosystems (Lunnon & Reynolds 1991). Its presence depends on environmental integrity, which is generally affected by anthropic activities and habitat fragmentation and modification. The otter's *status* can be described through monitoring plans and the development of specific management guidelines.

Since 2007, an increased number of reports on dead individuals and findings of faecal samples in Apulia (southern Italy) indicated the presence of otters in this region (Buglione et al., 2020a). This especially referred to the Tavoliere area (north of Apulia) (Marrese et al., 2014; Giovacchini et al., 2018); signs of presence were discovered in Fortore, Candelaro, Carapelle and Ofanto rivers, while several road-killed individuals were found in Manfredonian (Fig.1A) and Ionian Gulf. Furthermore, in 2020, a camera-trap caught a one-snap image of an individual in Bosco Incoronata Natural Regional Park (Parco Naturale Regionale Bosco Incoronata or PNRBI; Gaudiano unpublished) (Fig. 1B).

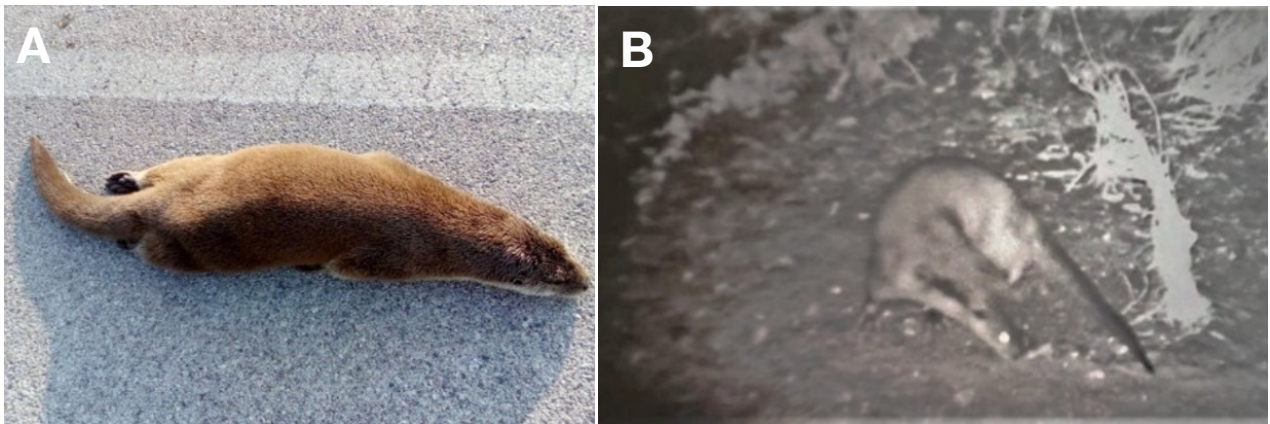


Figure 1: A) Road-killed male otter in Manfredonia territory (V. Talamo unpublished, 2018). **B)** First presence of otter in PNRBI (Gaudiano 2020, pers. obs.).

The present study aimed to confirm the presence of *Lutra lutra* in PNRBI and characterize its *status* to define whether the species is occasionally or permanently present in the investigated area as this park plays an important role in the geographical disposition of the species range expansion. PNRBI is part of the Community Importance Site (SIC) IT9110032 "Valle del Cervaro - Bosco dell'Incoronata", which extends from the Apennine area to Incoronata village (Tavoliere area, territory of Foggia), and conservations plans are consistent with the protected area's goals.

PNRBI is a little patch of humid lowland forest along the Cervaro river and it is characterized by gallery forest and dense riparian vegetation surrounded by intensive farming fields, human activities, and paved roads (Fig. 2). The Tavoliere Plain is almost completely cultivated with cereals and partially with vegetables, vineyards, and olive tree groves. An extensive road and rail network crosses the entire area. Furthermore, the third largest town of the Apulia region, Foggia, is only 12 km far from PNRBI. The Park is located between two otter's *nuclei*, and between two major

Apulian protected areas (Alta Murgia National Park and Gargano National Park) and Subappennino area. Being crossed by the Cervaro river, it represents a connecting zone and a hotspot where otters from both *nuclei* can find shelters, food, and potential territory for reproduction.

The Cervaro river is characterized by a variable water flow among seasons: during winter it floods where the riverbanks are lower and undefined. During summer, it dries almost completely, except for some ponds, and the riverbanks are more than three meters high (Fig. 3). The vegetation close to the water stream is typically the Mediterranean, with dense and tangled shrubs hindering the access to the riverbed.

Methods

The work was conducted from May to November 2021 and the entire Park area along the river course (5,6 km length) was investigated using -when necessary- a little boat, adjusting PACLO (Piano d'Azione Nazionale per la Conservazione della Lontra, or otter's national action plan) guidelines based on the standard method (Reuther et al., 2000) to the PNRBI layout.

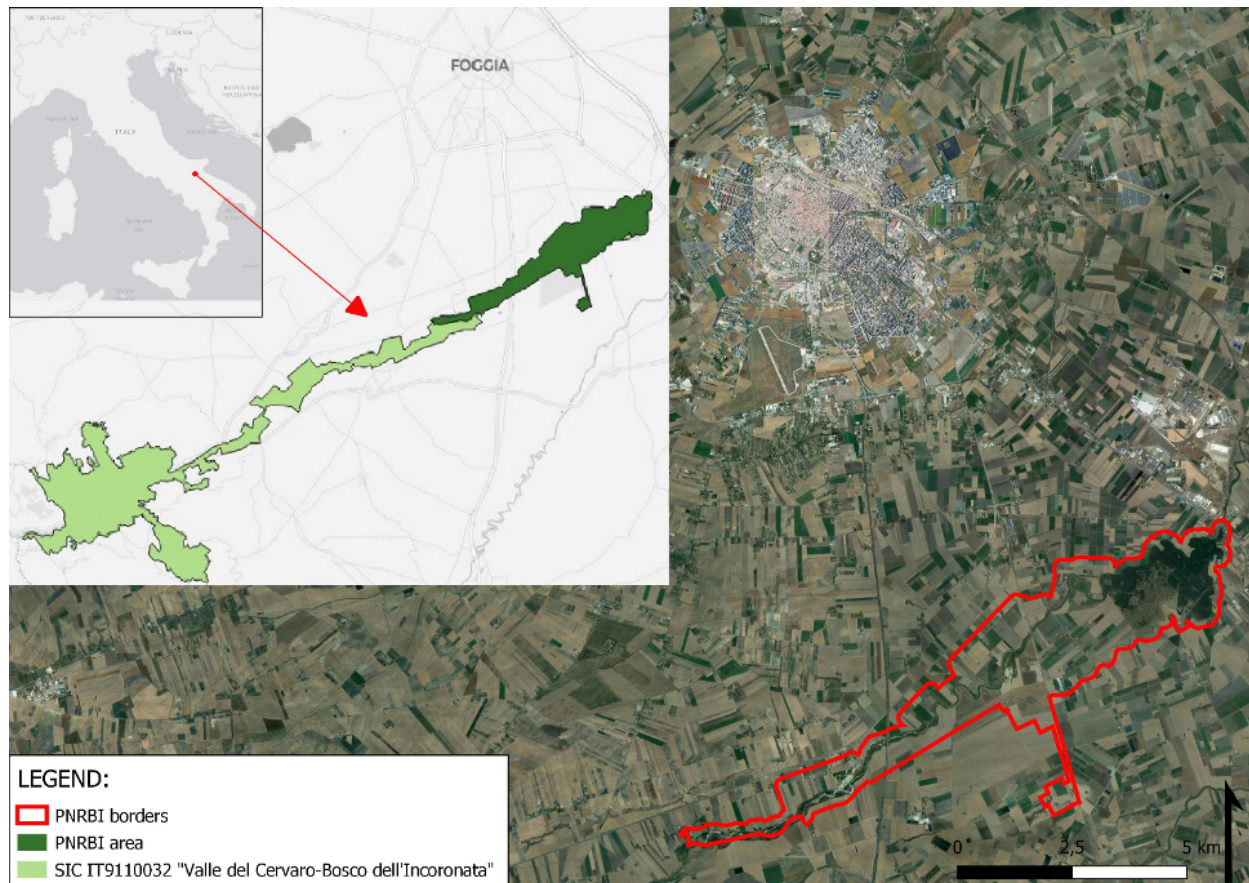


Figure 2: SIC IT9110032 "Valle del Cervaro-Bosco dell'Incoronata" in light green; Bosco Incoronata Natural Regional Park (PNRBI) in dark green; Bosco Incoronata Natural Regional Park (PNRBI) borders in red.

The sampling methods involved line transects and camera-traps techniques. Monitoring was divided into two phases: the first -from May to August- consisted of the analysis of territory, while the second -from August to November- included sampling in line transects. Camera-trap activity was conducted in both phases.

The river course was divided into five line transects from approximately 1 km length each and they were investigated twice walking through the riverbed. The check was carried out in five fieldwork days to collect faecal samples, footprints, tracks, and other signs of presence. Faecal samples were gathered for further diet analyses, and was associated with an alphanumeric code. In

order to outline which environmental variables influence the choice of the marking site by otters, six parameters have been considered, such as riparian vegetation cover, water flow speed, substratum, bank slope, depth of the river, rocky outcrops. Each one has been recorder within a 5 meters radius from the spraint. All the information and the related GPS positions have been recorded in a specific field datasheet.

The camera-trap activity was conducted using 5 camera-trap equipped with PIR and LED sensors, placed near to the otter's most probable passageways, set on working time from 18:00 to 8:00 of the following day, with 20 sec. length video-mode.



Figure 3: Cervaro riverbed during summer. The river dries up most of the way, except for few remaining ponds.

All data were collected in a specific datasheet, and two databases have been created (camera-trap DB and faecal sample DB).

Results

Fifty-one spraints have been collected in three months, 14 of which were found fresh (laid within a week) generally on rocky outcrops. They were found along the entire river course, but the most in the middle part of it, where vegetation cover is abundant and the riverbank is unreachable by people, thus the anthropic disturb is very low.

The predominant environment parameters are shrubby and arboreal vegetation, absent or standing waterflow on a rocky substratum, gentle bank slope

and shallow depth of the river with a medium grade of rocky outcrops (Fig. 4). The sprainting activity abundance has been calculated using KAI (Kilometric Abundance Index) (Vincent et al., 1991; Buckland et al., 1993) and it corresponds to 0.91 spraint/100 m. The result is consistent with previous studies carried out by Prigioni in Pollino National Park (Prigioni et al., 2005a), who described 3.2 spraint/100 m (32 spraint/km) in 32 stretches (mean length 673 m).

Preliminary spraint content analyses (Fig. 5) detected a major presence of amphibians and fish bones and scales and a minor presence of invertebrates, such as the crustacean *Potamon fluviatile*. Regarding camera-trap activity, three videos confirmed the presence of the species. In particular, the videos were recorded on 7

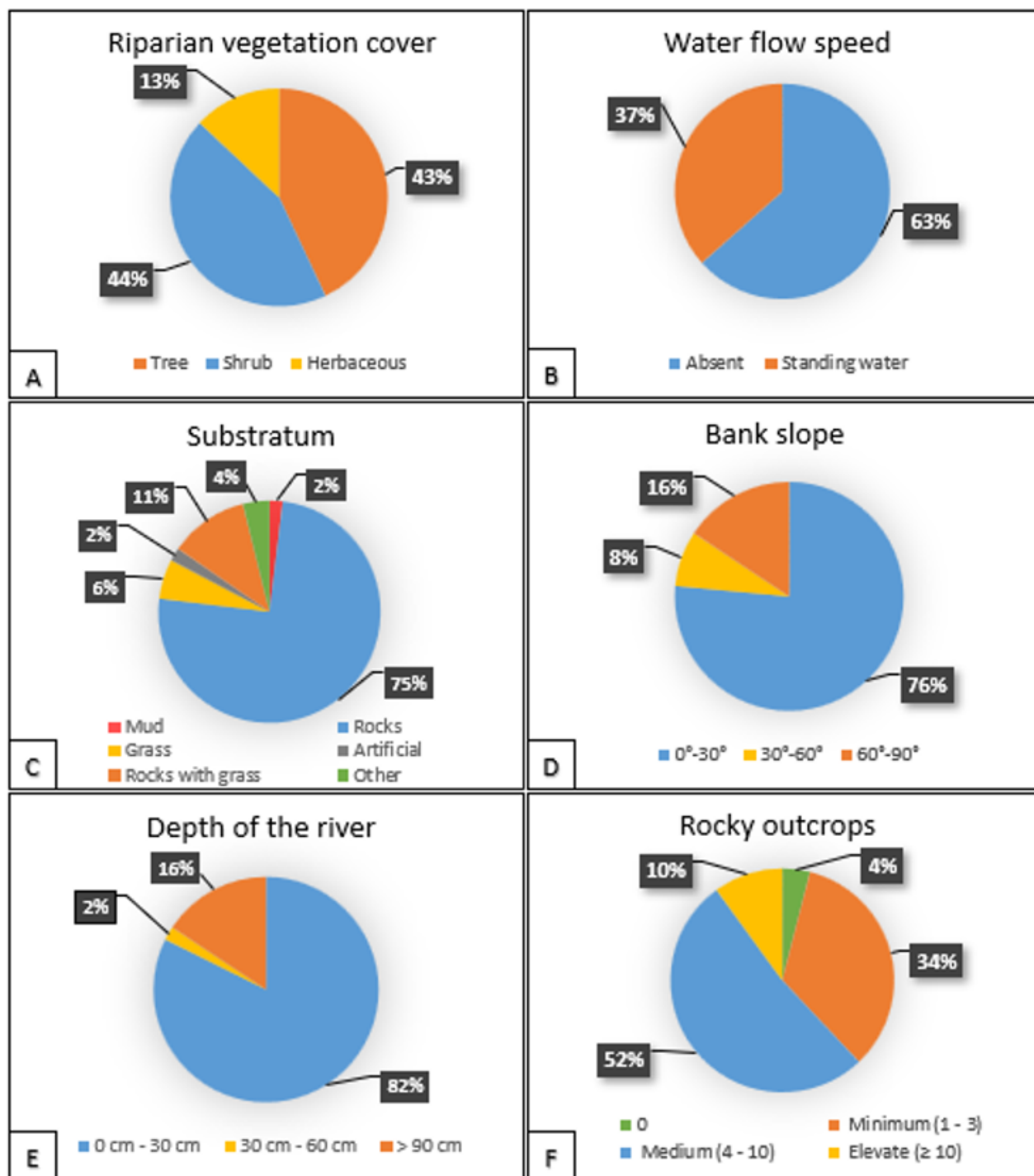


Figure 4: Results of environmental parameters analyses. **A)** Riparian vegetation cover classified by Tree, Shrub or Herbaceous. **B)** Water flow speed classified by Absent or Standing water. **C)** Substratum classified by Mud, Grass, Rocks with grass, Rocks, Artificial, Other; **D)** Bank slope classified by 0°-30°, 30°-60°, 60°-90°. **E)** Depth of the river classified by 0-30 cm, 30-60 cm, >90 cm. **F)** Rocky outcrops classified by 0, Medium (4-10), Minimum (1-3), Elevate (≥ 10).

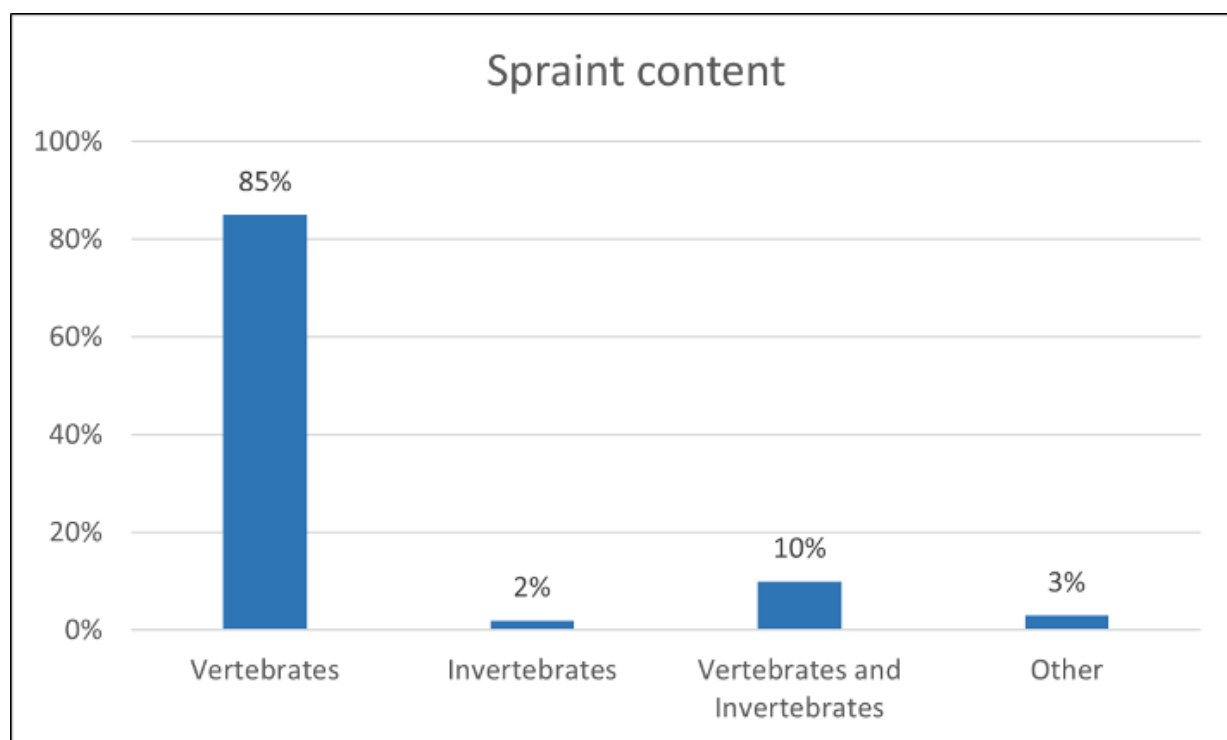


Figure 5: Percent contribution of the remains of different groups in spraint content, such as Vertebrates (85%), Invertebrates (2%), Vertebrates and Invertebrates (10%) and Others (3%).

October 2021 from the same camera-trap, at a two-hour interval. The first and the second videos are subsequent and captured two individuals moving together toward the camera; the third shows an otter while hunting in the underlying pond (Fig. 6), where 10-15 cm long fish were found.

Discussion

Our survey confirmed the presence of *Lutra lutra* in PNRBI and suggests that the species is settled in the area with a minimum of two individuals.

The analyses of the environmental data outline an ecological framework compatible with the habitat' species: dense riparian vegetation (Adrian 1985; Ruiz-Olmo & Delibes 1998; Prenda et al., 2001) where otters can find shelter, small or medium sized watercourse with rocky substratum and

gentle bank slope (Chanin 2003) where to hunt. During summer, few remaining ponds promote a greater concentration of fishes, crustaceans and amphibians and are used by otters for feeding (Remonti et al., 2008; Fusillo 2006) and Cervaro river in his PNRBI section is characterized by absence of waterflow and numerous ponds. This survey confirmed that the otter's diet is flexible and dependent on prey availability (Prigioni et al., 1991a, b, 2005b; Cannetiello et al., 2005; Fusillo 2006; Buglione et al., 2020b). When possible, fish is the most important trophic source, followed by amphibians and crustaceans, although further studies on the diet composition of this population are needed.

KAI shows a high level of presence of the species in the PNRBI area and fresh spraints collected in the entire sampling time suggest otters frequent the area regularly. Since isn't

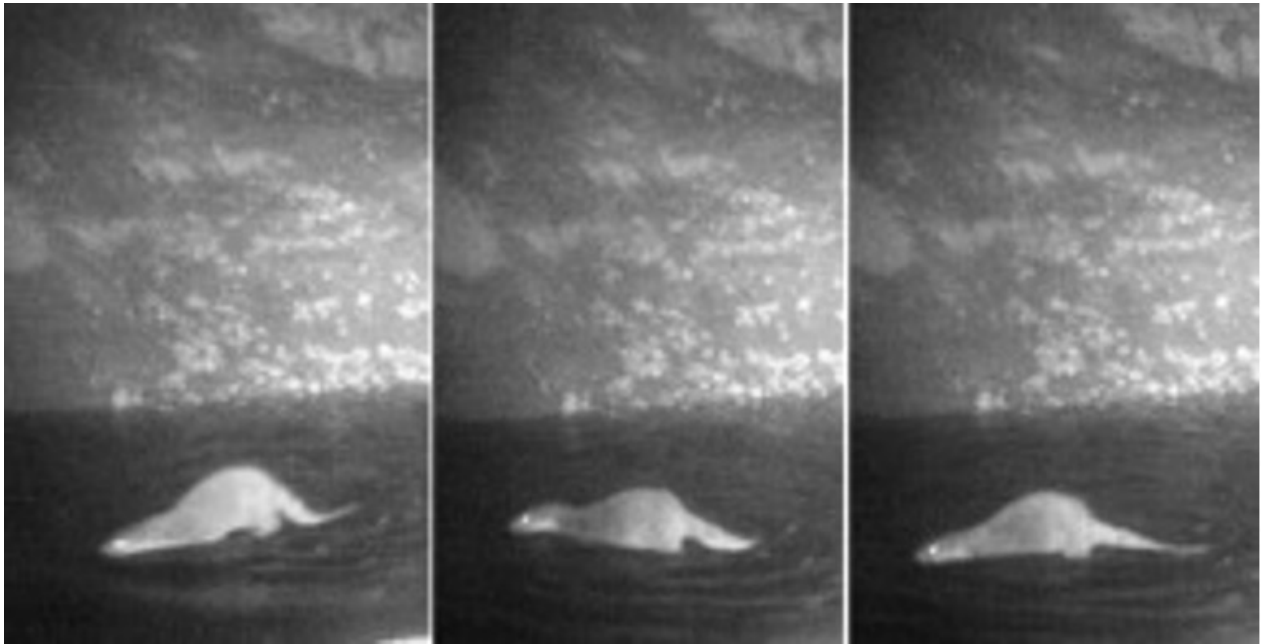


Figure 6: Frames of a video in which an individual is shot while hunting in a pond in PNRBI. The video was recorded during the survey's activity on 7 October 2021 at 22:33.

possible to correlate the sprainting activity abundance to the number of individuals within an area (Panzacchi et al., 2010), this latter information is available only by camera-trap activity, from which is possible to confirm a minimum of two adult individuals.

PNRBI, due to its position, represents a connecting zone of the two *nuclei* and their merge represents an effective areal expansion and increase of genetic variability. This contributes to the improvement of the Italian otter population's *status*.

The study area comprised a small portion of the entire Cervaro area, and further research should cover the entire river basin and Tavoliere area to obtain comprehensive knowledge on the status of the otter population in the north Apulia.

Confirmation of otter's presence in PNRBI paves the way to further studies on this species, its biology and ecology, but also on general environmental *status*. It is of great importance to safeguard this species in

order to preserve the total biodiversity of PNRBI. Indeed, the otter is also considered an "umbrella" species (Bifulchi & Lodé 2005), and its protection helps to protect the entire wetland and freshwater ecosystems. This seems especially important in the PNRBI area, which is constantly threatened by nearby villages, human activities, and intensive agriculture. Its presence in the proximity of a large city, such as Foggia, should be of great concern in the city's development from a green and sustainable perspective, demonstrating that human activities and natural environments are connected and mutually supported.

Author contributions

Planned the sampling: L. Guadiano.

Performed field work and data entry: L. Guadiano and A. Cascella.

Ran the analysis and wrote the first draft: P. Lerario and A. Cascella.

All the authors have read the draft and have accepted responsibility for this manuscript and approved submission.

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