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Population trends and Status of Smooth-Coated Otters (*Lutrogale perspicillata)* in Tungabhadra River ecosystem, Karnataka, India

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ABSTRACT

In an increasingly disturbed and fragmented environment of the Tungabhadra River in Karnataka, we conducted a study to record the current status and population trends of Smooth-coated Otters. The goal was to identify regions with a lack of information on current status, gather information to create baseline data, and understand the otter species in this river. A total of 31 sampling stations was surveyed for two years from February-2018 to February-2020. The study area selected starts from Kudli, near Shivamogga in Karnataka to Kurnool of Andhra Pradesh, spread for 531/km. While surrounded by human-modified landscapes, the Tungabhadra River remains a significant habitat for flora and fauna, including otter species. Significant parts of the Tungabhadra river ecosystems lie beyond the security offered by protected areas; In these areas where existing conditions are poorly understood; New and accurate information on otter status and population trends are created using locally appropriate methodologies such as: documenting population trends, conflict incidents from local communities by questionnaire interviews and surveying for direct sightings and indirect credible evidence (spraints, footprints, den sites, food remains, and carcasses) to document the distribution of otters in the study area. The study reveals vital localities and hotspots of smooth-coated otters in the Tungabhadra River to promote conservation, restoration, and potential re-establishment in their ranges.

Key words: *Tungabhadra River, Smooth-coated otters, Hotspots, Protected areas, Population trends, Karnataka, Carcasses.*

Introduction

The top predator is vitally essential in controlling and perpetuating environmental processes in ecosystems (Sunquist *et al.,* 1999). Because of its top-level trophic status and predatory behavior, these are considered predictive indicators of the ecosystem's fate (Noss *et al.,* 1996; Estes *et al.,* 2001; Faeth *et al.,* 2005; Crooks *et al.,* 2010). Carnivores need large undisturbed habitats with an adequate prey base to raise young ones and ensure long-term genetic and reproductive viability. (Seidensticker and McDougal, 1993; Karanth and Sunquist, 1995). The role of otters in river ecosystems is significant as carnivores and meso-carnivore occupy critical positions in the food-web (Roemer *et al.*, 2009). Smooth-coated otters play an essential role in maintaining freshwater habitats as a top predatory animal (Sivasothi, 1995). As an apex predator, the otter is known to be an indicator of the health of aquatic habitats (Foster-Turley *et al.*, 1990; Yoxon, 2007). Being so vital in the food web of riverine ecosystems, meagre information is available on the status of otter populations in India. This is because of a

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rapid decline in their number due to habitat loss and extensive trapping (Hussain, 1999; Nawab, 2007, 2009; Nawab and Gautam, 2008).

Ironically, despite their crucial role in the ecosystem, many species of otters have witnessed a large scale of population decline (Gomez and Bouhuys, 2018). There are 13 species of Otters found worldwide out of these three species of Otters viz., Eurasian otter *L. Lutra*, Oriental small-clawed otter *Aonyx cinereus*, and Smooth-coated otter *L. perspicillata* are found in India (Pocock, 1941; Mason and Macdonald 1986; Hussain 1999; Nawab 2007). Among the three Otter species, Smooth-coated Otters are widespread in the Indian subcontinent. All three species suffer from a lack of awareness and conservation attention (Chackaravarthy *et al.*, 2019). The populations are currently isolated and severely fragmented, mostly restricted to protected areas (Hussain 1999; Nawab 2007, 2008).

Smooth-coated Otters are protected in India under the Schedule II Part II of the Indian Wildlife (Protection) Act, 1972 (Hussain, 1999). The IUCN rates it as 'Vulnerable' - facing a high risk of extinction in the wild, following a 50% reduction in population over the last ten years, resulting from the loss of habitat and direct exploitation for pelt (IUCN). In 1997, this species was placed on CITES Appendix II and all other otters. Since August 2019. Now it is included in CITES Appendix I, thus strengthening its protection in regards to international trade (CITES 2019).

Considering their threatened status, there is an urgent need to develop conservation strategies to protect the remaining otter populations across their range (Hussain and Choudhury, 1997). Although systematic distribution surveys are crucial, it is also essential to report otters' confirmed presence in 'new' areas and follow up with proper surveys in such new places, which would be helpful for conservation planning, to promote restoration, and potential re-establishment. This approach is particularly relevant for species such as the smooth-coated otters (*Lutrogaleperspicillata*) since its range falls mainly outside India's designated protected areas (Chackaravarthy *et al.*, 2019). Here, the aim was to recognize and document the viable population and habitats of otters present in this highly modified Tungabhadra River Ecosystem (TRE). Based on the results of interviews with local fishermen, other stakeholders, and extensive field surveys, we come up with a detailed overview of the status and population trends of smooth-coated otters in the Tungabhadra River to provide underlying support for developing an effective conservation policy for this apex predator.

Study area and methods

Study area: The rivers Tunga and Bhadra originate in Gangamoola in Western ghats, and these rivers travel 147 km and 171 km respectively, till they join at Kudali (14° 00'30.7" N 75° 40'29.8 "E), at an elevation of about 610meters (2001ft) about 15 km from

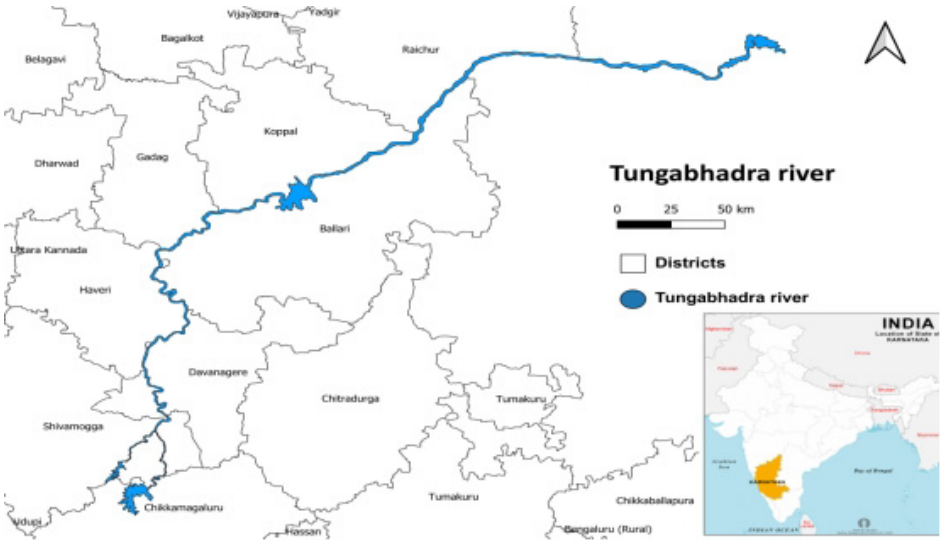

Fig. 1. The river Tungabhadra's map from Kudli (Karnataka) to Kurnool to form river Krishna in Andhra Pradesh.

Shivamogga; to form a major river, Tungabhadra. Tungabhadra meanders through the plains to a distance of 531 km and joins with the river Krishna at Gondimalla, near the famous Alampur village (5° 55′36.0" N 78° 10′12.7" E) at the elevation of about 264meters (866fts) in Mehaboobnagar district of Telangana. Tungabhadra river is the largest tributary of the river Krishna, contributing an annual discharge of 14700 million m3 at its conûuence point to the main river. The river has several dams built across it; the larger ones are the Gajanur dam, Bhadra dam, and the Tungabhadra dam in Karnataka. It has a drainage area of 71,417 km2 out of which 57,671 km2 lies in Karnataka State, after owing for a distance of 293 km and the remaining downstream part lies in the state of Andhra Pradesh and Telangana (Fig. 1)

In compliance with Section 36A of the Wildlife Protection Act vide Notification No. FEE 66 FWL 2015 dated 25-04-2015, Tungabhadra Otter Conservation Reserve, Karnataka; country's first-ever otter reserve, was notified. The Smooth-coated otter is a species specified in Schedule 2 of the Wildlife Protection Act, 1972. Tungabhadra Otter Conservation Reserve extends from Hole mudlapura near TB Dam at the Koppal Taluk to TB River Bridge at Kampli, at Hospet Taluk, Bellary District, over 34 km of Tungabhadra River stretch (Forest Department of Karnataka, 2019).

Materials and Methods

The survey of a wildlife population is essential in the management and conservation of a species. As a result of distribution and abundance, knowledge derived from these systematic surveys must form policy decisions in the next level. Monitoring of wildlife populations is incredibly vital if the conservation of key species to be maintained or restored (Macdonald *et al.,* 1998). Otter surveys are troublesome due to challenges in the direct identification of individuals in their natural habitats and associated with vast areas to be covered by rugged terrain and therefore difficult to access, hence, indirect methods of recording evidence such as spraints, footprints, den sites, food remains, carcasses have become standard protocol for occupancy estimation.

The survey conducted for otters was from February, 2018 to February, 2020, and it was designed after referring to the methods used by various authors; the procedure followed the standards for otter surveys recommended by the IUCN/SSC Otter Specialist Group (Macdonald and Mason, 1983; Kruuk *et al.*, 1994; Hussain and Choudhury, 1997; Reuther *et al.*, 2000). Suitable changes were made in number and spreading of survey sites (Reuther and Roy, 2001**)**. Surveys were undertaken at the time of year when water levels and vegetation were low, and otter signs are therefore more visible. Surveys are avoided from June to October because then the river was flooded with water filled by monsoon rains. During these months, the Tungabhadra River starts to flood, and the visibility of otters is reduced. Thirty-one sites in ten stations along the river Tungabhadra were surveyed for otters' presence (Fig. 2). All survey sites and their coordinates are shown on a topographic map. Inter-site distance varied according to accessibility; the average distance between study stations is 63.44km. Some parts of the river were surveyed by boat and the rest by walking along the bank. Signs of otters, such as spraints, footprints, den sites, food remains, and carcasses, were searched for along the banks and islands. The distance searched varied from 600 m to 2 km, depending on accessibility.

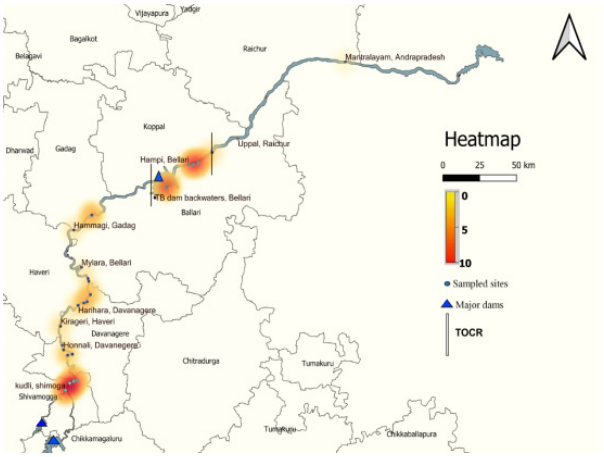

Fig. 2. Heat map, visualizing the presence of otter by the sum of all direct sightings, indirect sightings, and Interviews (Done by using QGIS it is a free and open-source cross-platform desktop geographic information system application)

The details about all the ten study stations and 31 sampled areas and their GPS coordinates are available in Table 1.

In this study, we tried to explore the existing fishermen and the Smooth-coated Otters relationship and their attitude towards the otters in the

Tungabhadra River ecosystem. We conducted a detailed semi-structured questionnaire interview for 80 fishermen, and other stakeholders who were frequently associated with the river across the sampled areas, out of which 92% of the interviewed were fishermen. Further questions were asked to know the population trends are as follows

1. How often do you see otters in the river?
2. Are you seeing more otters than it was before?
3. Is anybody hunting otters in your community? And so, on

Results and Discussion

Based on the interviews and field surveys, a comprehensive overview of the status and population trends of otters in the river Tungabhadra is obtained. Only 10 out of the total of 31 sampled areas have had positive sightings. And these were located only in areas where water was abundant during the sampled time. Those include the places like Kudli, Anveri, Chikkbasur, Maknur, Dheetur, Hammagi TB pull up-dam, Mudlapura, Hampi waterfall, and Anegundi. These places with positive evidence revealed direct and indirect sightings, and hence these sampled areas considered promising habitats for otters. Although the habitat promises the presence of otters, no sightings and evidence were reported in the other 21 surveyed regions that have been mentioned in Table 1, and the survey yielded negative results. Mudlapura, one of the sampled areas, lies in the backwaters of Tungabhadra Dam (Table 1), which is also the starting point of Tungabhadra Otter Conservation Reserve. Here, the terrain has the least number of human activities among the sampled areas and revealed the maximum number of indirect evidence for the presence of otters. Maximum direct sightings occurred in Kudli, Shivamogga, and probably this is the reason for the highest rate of conflict between fishermen and the otters in this region.

Study stations with high disturbance have not noticed the otters.

1. Areas with high disturbance: Anaveri, Honalli, Benakanahalli, Konayakanahalli, Harihara bridge, Hirebidari, Garbhagudi, Kuruvatti, Mylara, Mylara bridge, ittagisaslwada lift irrigation, Hampi waterfall, Chakra tirtha, Kampli, Mantralayum, Karnool.
2. Sand Mining areas: Holalur, Honalli, Konayakanahalli, Uppal- Animals not sited

Otters are well known within the fishing community in the Tungabhadra River. They are referred to as NeerNayi(Waterdogs) in Kannada, Cheer Nayi in Bellary regions, Hud, Ood, and Uda in Hindi and Marathi. Discussions with local fishermen have revealed the drastic decrease in the frequency of sightings. Compared to the records, the recent sightings have become rarer, and they're sighted in only a few localities mentioned in the records. Otters were reported to be checking the fishing nets installed by the fishermen during the dawn and the dusk for an easy catch. However, in our survey, only available evidence for this phenomenon was recorded in Kudli.

Conclusion

According to fishermen interviewed in the study, area otters were once widespread and common in the Tungabhadra River, but this is not the case today. The otter population has become dwindled and become rare in some parts of the river.

The entire river stretch can be divided into three distinct regions based on water availability viz:

a) Region of surplus water: This area comprises the area from the point of origin to the Gajanur Dam and Bhadra Reservoir Project. Tunga meets Bhadra at Kudli and flows through Honnali, Harihar and this portion contains water around the year, and hence this area supports otters in more numbers.

b) Controlled Flow Region: This is the area from Harihar till Tungabhadra Dam at Hospet. During the monsoon period, this region has natural flows while in lean periods the flows are governed by an agreement with the TB board. The population of otters varies according to water availability.

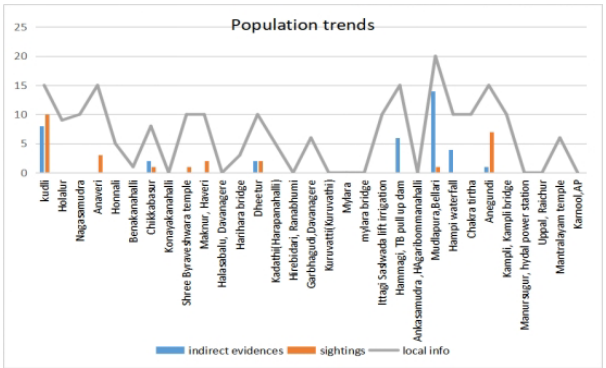

Fig. 3. Population trends of Smooth-Coated otters in sampled areas of Tungabhadra River (indirect evidence, sightings, and local information).

Table 1. Study stations, sampled areas, Conditions, and Population trends of Tungabhadra River.

Sl No:	Study stations	Sampled areas	Latitude	Longitude	Indirect evidences	Sightings	Local info	Conditions	Remarks	Availa-bility	Distri-bution	Popu lation trend
1	kudli, Shivamogga	Kudli	13.999653	75.664539	8	10	15	Sand-mining, Human activity	Retaliatory killing	A	W	I
		Holalur	14.041553	75.691486	0	0	9	Sand-mining	-	A	W	D
		Nagasamudra	14.052825	75.715448	0	0	10	-	-	F	L	S
		Anaveri	14.057034	75.736264	0	3	15	Human Activity	Hunting	F	L	D
2	Honnali,	Honnali	14.239019	75.652463	0	0	5	Sand-mining, Anthropological activity	-	F	L	D
	Davanegere	Benakanahalli	14.213196	75.707538	0	0	1	Human Activity	-	F	W	D
		Chikkabasur	14.207469	75.678756	2	1	8	Sand-mining, Anthropological activity	-	A	W	S
		Konayakanahalli	14.266319	75.643747	0	0	0	sandming, Anthropological activity	-	R	L	D
3	Kirageri, Haveri	Shree Byraveshwara temple	14.379454	75.63325	0	1	10	Human Activity	-	R	L	D
4	Harihara, Davanagere	Maknur, Haveri	14.502836	75.743929	0	2	10	low fish availability	-	F	L	D
		Halasabalu, Davanagere	14.516763	75.78018	0	0	0	-	-	N	S	U
		Harihara bridge	14.524091	75.800544	0	0	3	High pollution, Anthropogenic activity	-	R	S	LU
		Dheetur	14.566096	75.821067	2	2	10	Sand-mining	-	F	L	D
		Kadathi (Harapanahalli)	14.661619	75.80549	0	0	5	-	-	R	L	D
		Hirebidari, Ranabhumi	14.645385	75.810645	0	0	0	Water pumps, sand-Human activity mining,	-	N	U	U
5	Mylara, Bellari	Garbhagudi,Davanagere	14.728148	75.765262	0	0	6	Human activity	Retaliatory killing	F	L	D
		Kuruvatti (Kuruvathi)	14.781854	75.701813	0	0	0	Human activity	-	R	S	D
		Mylara	14.798851	75.677459	0	0	0	Human activity	-	N	U	U
		mylara bridge	14.826826	75.674276	0	0	0	Human activity, water pumps	-	N	S	D
6	Hammagi, Gadag	IttagiSaslwada lift irrigation	14.948782	75.716709	0	0	10	Human activity	-	F	L	D
		Hammagi, TB pull up dam	15.038019	75.829495	6	0	15	-	-	A	W	S
7	TB dam backwaters, Bellari	Ankasamudra, Hagaribommanahalli	15.140351	76.226113	0	0	0	-	-	N	S	D
		Mudlapura, Bellari	15.205023	76.302044	14	1	20	Sand-mining	Dead otter	A	W	S
8	Hampi, Bellari	Hampi waterfall	15.337888	76.44076	4	0	10	Human activity	-	A	W	D
		Chakra tirtha	15.336432	76.467922	0	0	10	Human activity	Hunting	R	L	D
		Anegundi	15.348329	76.497195	1	7	15	-	-	A	W	I
		Kampli, Kampli bridge	15.408395	76.585777	0	0	10	Human activity	-	R	L	D
9	Uppal, Raichur	Manursugur, hydel power station	15.489277	76.746846	0	0	0	pumps	-	R	L	D
		Uppal, Raichur	15.735119	76.924723	0	0	0	sandming,pumps	-	N	S	L
10	Mantralayam, Andhra Pradesh	Mantralayam temple	15.94508	77.421356	0	0	6	Human activity	-	R	S	L
		Kurnool,AP	15.866629	78.135656	0	0	0	Human activity	-	R	S	D

(Acronyms) Availability: Abundant-A, Frequent-F, Not found- N, Rare-R. Distribution: Localized- L, Seasonal-S, Unknown-U, Widespread-W.
Population trends: Decreasing-D, Increasing-I, locally unavailable- LU, Stable- S, Unknown-U.

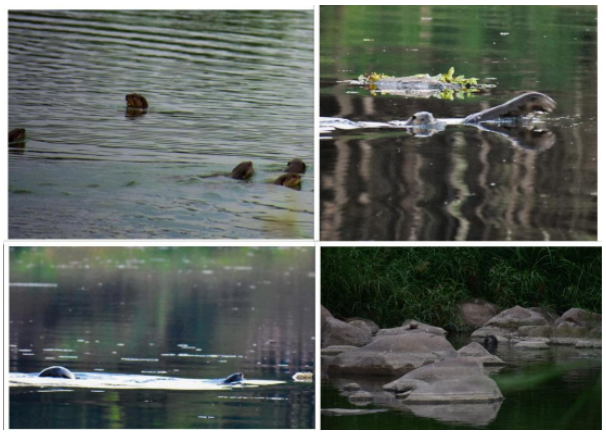

Fig. 4. Direct sightings of smooth-coated otters in the Study area.

Fig. 5. Indirect sightings (spraints, footprints, den sites, and carcasses)

Fig. 6. Interviewing and Documenting threats, retaliatory kills during the survey.

c) Region of Deficit: This region is marked from Tungabhadra Dam till the confluence with river Krishna. Downstream TB Dam there are 12 anicuts on the left and right banks of the river to facilitate water extraction for irrigation. The changes in the water flow regime after the impounding water at TB Reservoir. It can be observed that the water flow downstream has undergone extreme variations and has insignificant flow (Lenin Babu and Harish Kumara, 2012). Hence sightings of otters in this area are rare. Sampled areas (Table 1) like Harihara, Davanagere; Mylara, Bellari; Hammagi, Gadag; comes under in "Controlled Flow Region" of Tungabhadra River and Uppal, Raichur; and Mantralayam, AP comes under the "Region of Deficit", these two regions during dry months except for some patchy ponds there will no water. This also affects the population of otters in these regions. Hence no otter signs have been noted. But, the presence of the Tungabhadra dam in the part of a deficit has become a reason for the abundance of water in this particular region has turned out to be a niche for smooth-coated otters. From this, we can conclude that otters have adapted to many human-modified regions, but population trends showed denser in plenty of water and prey abundant areas. Based on the findings of the survey, otters (*Lutrogaleperspicillata*) are found outside the Tungabhadra Conservation Reserve, but their distribution is sparse and patchy. An intensive action of conservation and extensive programs required to protect otters in the Tungabhadra riverine ecosystem and its adjoining tributaries.

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Conflict of interest: All authors declare that they have no conflicts of interest.

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