

AGAINST THE CURRENT



Otters in the River Cauvery, Karnataka

Kausalya Shenoy



OTTER RESEARCH GROUP
JAPAN

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Kausalya Shenoy

March 2003

An Occasional Report of a Conservation Survey conducted by the Wildlife Trust of India
Supported by the Otter Research Group, Japan



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PREFACE

Although carnivores have fascinated man through the ages, carnivorous mammals that dominate riverine landscapes have never excited the human mind as lions and tigers have done. Otters have always played second fiddle. However, ecologically, otters are a highly adaptive, social and intelligent group of animals that deserve better study and protection.

When Ando Motokazu of the Otter Research Group, Japan wrote to me of his desire to hold an otter workshop India, we were happy as an organization based in Delhi to provide logistical support to him. The workshop was held in March 2002 and discussed many ways of conserving otters. One of the eager young participants of this workshop was Kausalya Shenoy.

After the workshop ended, WTI found that it had a small amount of money left over from the amount given by the Otter Research Group.

As the money had come in specifically with the request that it be used for otter conservation, WTI supported Kausalya to conduct this otter survey in the Cauvery. Her work has highlighted the areas that are important for otter conservation along this stretch and if the Coorg Wildlife Society and other bodies that do commendable work in the area can take this up, an off-ignored group of animals can get the protection they deserve.

December 27, 2004
New Delhi

Vivek Menon
Executive Director
Wildlife Trust of India

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EXECUTIVE SUMMARY

This survey was designed to understand the distribution of otter populations along the River Cauvery in southern India. Factors limiting their distribution were examined. Methods used included searching banks and islands for spraint sites and pugmarks of otters, and interviews with local people at fifty sites along the river. Sites were chosen randomly among forested and non-forested regions. This short-term work revealed interesting facts about otters in the River Cauvery.

1. Two species of otter were recorded in the survey and their niches were clearly separated.

The oriental small-clawed otter (*Amblonyx cinereus*) was found to occur in a wet evergreen forest patch. Smooth-coated otter (*Lutra perspicillata*) was found to occur in discontinuous stretches in the plains. No signs of Eurasian otter (*Lutra lutra*) were encountered in the stretch of river surveyed. Oriental small-clawed otter (*Amblonyx cinereus*) was found to occur near the Talakavery sacred forest, where the river originates. The spraints of this species consisted mostly of crab remains. Smooth-coated otter (*Lutra perspicillata*) occupied mostly the plains and the spraints consisted entirely of fish remains.

2. Areas for conservation of otters along the River Cauvery were identified.

Chunchankatte, Gendehosahalli, Sattegala, and the stretch from Kootle to Sangam, which includes Cauvery Wildlife Sanctuary, are some of the important areas for *Lutra perspicillata* and Talakaveri sacred forest is a good habitat for *Amblonyx cinereus*.

3. **Threats to otter survival in the Cauvery are high levels of poaching, fishing, encroachment of the river-banks and human activities along the river.**

Local people feel that the otter population is declining over the years. Sand is removed from the riverbed as well as from banks and islands. A curb on poaching activities, the spreading of awareness against the use of otter derivatives and regulation of fishing along the river could ensure the revival of otter populations in the Cauvery.

Based on the findings, the following are recommended for aiding in the management of the otters and their habitat along the Cauvery:

1. **There is an urgent need to set aside areas for *in-situ* conservation of otters taking into account all the factors threatening the population, as well as foreseeable future threats.**
2. **Thinning of bank-side vegetation and burning of pastures must be prevented and cattle grazing must be regulated.**
3. **Sand mining brings must be limited to riverbeds and not extended to islands.**
4. **Talakaveri sacred forest is a good habitat for *Amblonyx cinereus*, the only Indian otter species that is a Schedule I animal in the Wildlife (Protection) Act, 1972. Fishing should be regulated here.**
5. **Governmental and/or non-governmental agencies should step in to combat poaching and trade as well as other threats to otter populations.**
6. **Poaching of otters and illegal trade in pelts must be curbed.**

1. INTRODUCTION

Otters form the sub-family Lutrinae within the mammalian family Mustelidae and are adapted to a semi-aquatic mode of life. Of the five species found in Asia, three are found in India - *Lutra perspicillata* (smooth-coated otter), *Lutra lutra* (Eurasian otter) and *Amblyonyx cinereus* (Oriental small-clawed otter) (Foster-Turly and Santiapillai, 1990; Hussain, 1993; Prater, 1998; Reuther, 1999; Menon 2003).

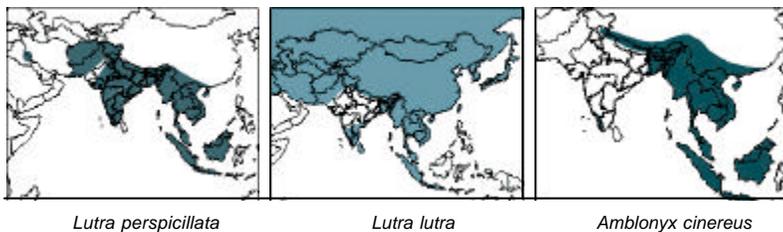


Figure 1: Pan-Asian distribution of the three species of otters (Source: Hussain, 1999)

Lutra perspicillata is found throughout India from the Himalayas southward (Figure 1). They have been reported from eleven states in the country and from all geographical regions (Hussain, 1993; Prater, 1998; Nagulu *et al.*, 1999b). *Lutra lutra* is essentially an otter of cold hill and mountain streams (Prater, 1998, Menon 2003). It is found in the foothills of the Himalayas and in the hills of south India (Hussain, 1993; Prater, 1998; Nagulu *et al.*, 1999b) (Figure 1). *Amblyonyx cinereus* is distributed discontinuously in the Himalayan foothills, Himachal Pradesh eastward to the North-Eastern states, and in south India in the hill ranges of Coorg, Goa, Nilgiris and Palni hills (Foster-Turley and Santiapillai, 1990; Prater, 1998; Nagulu *et al.*, 1999b, Menon, 2003) (Figure 1).

The existing populations of the three Indian species of otters and their habitat have never been systematically surveyed throughout India

(Hussain and Choudhury, 1997). Though otters are widely distributed and play a major role in the wetland ecosystem as a top carnivore species (Sivasothi, 1995), not much attention has been given to understand their ecology. They are suitable indicators of the health of a wetland ecosystem as they are sensitive to degradation along the food chain (Erlinge, 1972).

Major threats to otter survival in India are the loss of wetland habitats, reduction in prey biomass and pollution. Developmental projects such as dams and barrages, and aquaculture activities have taken their toll on wetlands and consequently on the otters. Another reason for the decrease in otter populations is poaching. Otters are hunted for their pelts, meat, fat and other body parts (Nagulu *et al.*, 1999a; Meena, 2002). Different indigenous people have different medicinal uses for various body parts of the otter (Nagulu *et al.*, 1999a; Meena, 2002), but none are scientifically proven. Many are killed in conflicts with humans especially when they steal fish from fishermen's nets.

The Eurasian and smooth-coated otters are listed as Vulnerable in the IUCN Red List of Threatened Species (IUCN Red List of Threatened Species, 2001), and their survival is conservation-dependent. There has been a decline in population over the last ten years (Foster-Turley and Santiapillai, 1990). The Oriental small-clawed otter is listed as Near Threatened; it could qualify for threatened in the near future (IUCN Red List of Threatened Species, 2001). The Eurasian otter is listed in Appendix I, and the smooth-coated and Oriental small-clawed otter are listed in Appendix II of CITES. The Indian government offers protection to all the three species under the Wildlife (Protection) Act, 1972; the Oriental small-clawed otter is included in Schedule I, the Eurasian and smooth-coated otters in Schedule II.

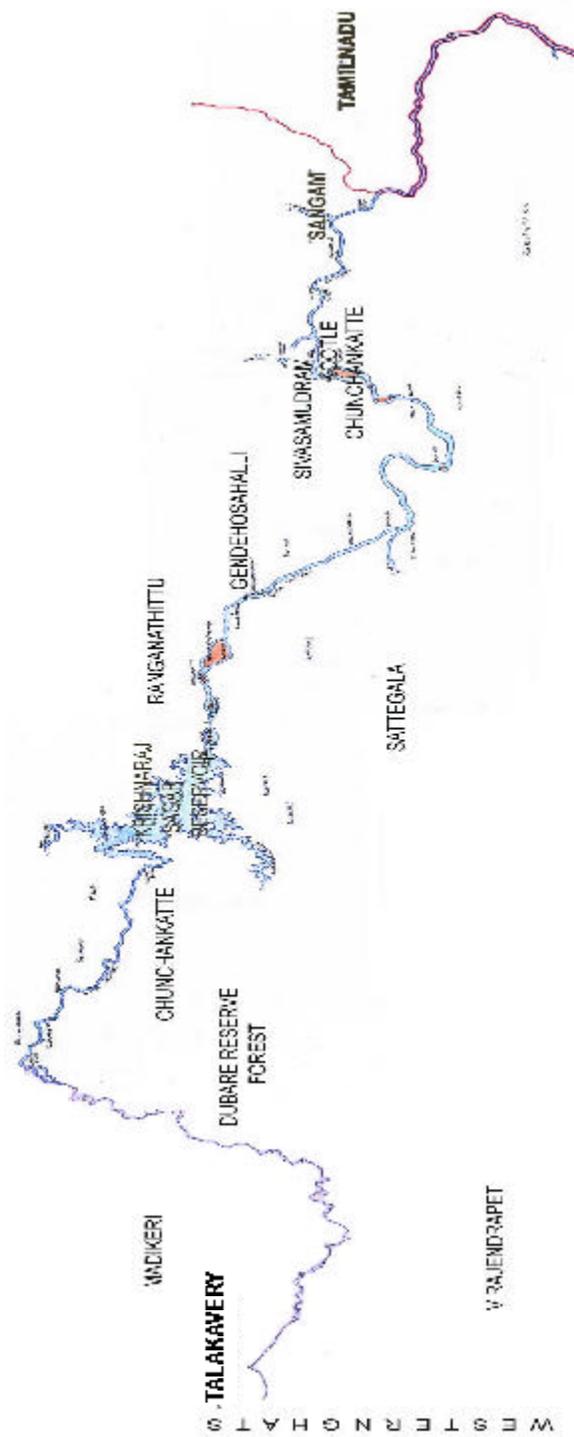


Figure 2: River Cauvery, an important river system in Southern India (Map not to scale);
 Source: Redrawn from various sources

Preliminary studies in Periyar (Anoop, 2001) and in the Cauvery Wildlife Sanctuary (Shenoy, 2002) have elucidated basic factors governing habitat selection by smooth-coated otters in southern India. More systematic knowledge about the distribution of the populations will help in determining and prioritizing areas to be brought under protection for the conservation of otters in India. Knowledge of the effects of anthropogenic pressures on otter populations and their ecology will also be useful in chalking out an efficient management plan for the conservation.

2. OBJECTIVES

1. To document the distribution of otter species along the River Cauvery
2. To understand the factors governing their distribution
3. To study the influence of forested and non-forested regions on the distribution

3. PROJECT AREA

The Cauvery is an important river system in southern India that provides water to most areas in the states of Karnataka and Tamil Nadu (Figure 2). It is the eighth largest river of the subcontinent, and ranks as a medium river on a global scale (Jayaram, 2000). The river has a profound influence on the cultural life of the people of peninsular India and the economic development of this region (Rajamani, 1994) and has recently been at the centre of political and social tension and unrest with respect to the sharing of its waters. Ten important urban centers are located in the river basin of the Cauvery (Jayaram, 2000).

The Cauvery originates at Talakaveri (12° 25' N, 75° 34' E), in Kodagu district, in the Western Ghats at an altitude of 1341 m (Jayaram, 2000). From the edge of the Western Ghats, within sight of the Arabian Sea, to the Bay of Bengal, the river traverses nearly 770 km in a roughly North-West to South-East direction. It passes through the Western Ghats, the Deccan Plateau and the Eastern Ghats, crossing diverse habitats ranging from high altitude shola forests to the dry scrub jungles of the plains (Jayaram, 2000) (Figure 3). It has 29 major tributaries and distributaries (Jayaram, 2000). The river basin houses a diverse mammalian fauna which include the Asian elephant (*Elephas maximus*), tiger (*Panthera tigris*), gaur (*Bos gaurus*), sambar (*Cervus unicolor*), chital (*Axis axis*), leopard (*Panthera pardus*), dhole (*Cuon alpinus*), grizzled giant squirrel (*Ratufa macroura*), Smooth-coated otter (*Lutra perspicillata*) and sloth bear (*Melursus ursinus*).

The temperatures in the Cauvery basin vary roughly around 25°C except for some parts in Kodagu district where the temperatures are below 22.5° C due to higher elevations (Jayaram, 2000). A part of the river basin receives rain from the South-West monsoon, and part of it from the North-East Monsoon. Bhagamandala (Kodagu district), which is in the Cauvery Basin, receives an annual rainfall of 603 cm (Jayaram, 2000). Most rainfall in the Kodagu district is due to the South West monsoon and occurs between June and September (Jayaram, 2000). The river basin in the Mysore and Mandya districts come in the rain shadow area and receives relatively less rainfall. This middle region of the Cauvery basin has a semi-arid climate, with annual rainfall ranging from 60 to 100 cm (Jayaram, 2000). The retreating monsoons bring rain to the western part of the basin between October and November. The delta of the Cauvery receives an annual rainfall of 100 cm and the coastal region receives 140 cm (Jayaram, 2000). The length of the River Cauvery in Karnataka is

318 km. It flows through five districts viz. Kodagu, Hassan, Mandya, Mysore and Bangalore. This survey was carried out between Talakaveri and Sangam (Arkavathi) (12° 17'N, 77° 26'E) (Figure 2). Roughly 13% of the survey area is under forest cover, the rest being used for agriculture and human settlements.



Figure 3: The River Cauvery meandering through hills of dry scrub jungle

Three Protected Areas are located along the river in Karnataka, viz. Talakaveri Wildlife Sanctuary, Ranganathittu Bird Sanctuary and Cauvery Wildlife Sanctuary. Besides this, reserve forests such as Talakad Reserve Forest and Dubare Reserve Forest also lie along the river. In Kodagu, the river flows for 89 km through plantations, agricultural land and villages. From Kushalnagar town up to Shivasamudram Falls (193 km), the river flows through towns, villages and agricultural land. From there on, the last 36 km of the river is through forested land, with very few human settlements along its course. This is contrary to the land use practice prevalent thirty years ago. The Survey of India topographical sheet of the area (1973) shows the entire region to be forested with few settlements and villages along its course.

4. METHODS

The survey methodology was designed after referring to the methods used by various authors (Teplov, 1952; Melquist and Hornocker, 1979; Macdonald and Mason, 1983; Kruuk *et al.*, 1994; Lee, 1996; Hussain and Choudhury, 1997; Madsen and Gaardmand, 2000). Suitable changes were made wherever necessary.

The survey was carried out between 25 February 2003 and 21 March 2003. Fifty sites along the River Cauvery were surveyed for the presence of otters (Figure 2). Inter-site distance varied according to accessibility, the average distance being 5 km. At each site, some part of the river-bank was walked or surveyed by boat, whichever was convenient. Signs of otter, such as spraints and pugmarks were searched for along banks and islands. The distance searched varied from 200 m to 2 km, depending on accessibility.

At each site, a description of the river, its surrounding habitat, land use pattern and nature of anthropogenic pressures, if any, was made. Wherever spraints were found, the substrate of spraint site, distance from water, height above water, extent of spread of spraints, distance between spraint sites, canopy level above spraint site, decay state of spraints, and major contents of spraints were recorded.

Wherever pugmarks were found, length and breadth of pugmark, presence or absence of claw marks, number of sets of tracks etc. was noted. Other distinctive features like shape and length of fingers were also recorded. Specifications of pugmarks and spraint sites were used for identification of otter species (Kruuk *et al.*, 1993). At each site, local people were interviewed (Appendix I). Feedback was used to confirm species

of otter in the region, as well as to get an estimate of population, its presence around the year, history, and levels of poaching and other threats to otters.

5. RESULTS

Of the 50 sites surveyed, evidence of otter presence was found only in 12 sites. However, local people have observed otters in as many as 40 sites, of which, recent sightings (for the past one month) were only in 17 sites. In 16 sites, otters were seen only during the rainy season, while in 7 sites otters had not been sighted for the past one-year.

5.1 Habitat Characteristics

The Talakaveri sacred forest is a wet evergreen forest patch. Here the river is a narrow stream flowing between rocks and boulders, forming rocky pools along its course. The forest is dense and anthropogenic disturbances are minimal. A tribal colony is situated close by and its inhabitants use the stream on a regular basis. This is, however, minimal compared to other places. This habitat is typical of areas inhabited by *Amblonyx cinereus* in southern India (Figure 4).



Figure 4: Rocky streams in forests: habitat of *Amblonyx cinereus*



Figure 5: Deeper sections of the river preferred by *Lutra perspicillata*

The river flows out of the forest into agricultural fields and plantations, assuming the form of a canal with sandy banks. From there on, the river steadily increases in width and depth.

The signs of *Lutra perspicillata* were at lower elevations where the river was deep and wide, with large rocks, boulders and islands (Figure 5). The islands were sandy, and often with thick undergrowth of grasses, sedges and shrubs. Rocks and boulders also provided adequate cover for the otters. Otters were found to use islands and rocks for sprainting more often than the riverbanks.

The sites upstream from Shivasamudram (12° 17'N, 77° 09'E) had agricultural fields and human habitations on at least one bank of the river, and in most cases on both banks. There was, however, at least a thin belt of trees along the river separating it from the fields and villages. Downstream from Shivasamudram, the river is bounded on both sides by dry scrub forests and hills, with riparian belt sometimes present along the riverbanks. There are few human habitations near the river.

5.2 Distribution of Species

In the Talakaveri sacred forest where the Cauvery has its source, a 1.5 km stretch of the river was walked. Fresh spraints of *Amblonyx cinereus* were found at an average interval of 230 m. The spraints were always deposited on large conspicuous rocks near a pool and consisted almost entirely of crab remains, as is commonly encountered in the case of this species (Lekagul and McNeely, 1988; Estes, 1989). The pugmarks were distinctive in not having claws, and its shape and size were characteristic of *Amblonyx cinereus* (Kruuk *et al.*, 1993) (Figure 6). Some very old spraints were found 15 km downstream from this point. The spraints consisted of crab remains, and from local people's description of the otters they had seen in the area, they appear to be from *Amblonyx cinereus*.

Lutra perspicillata was found to be distributed at lower elevations. The distribution was discontinuous, one site being 42.5 km upstream from Krishnaraj Sagar dam (KRS), and two sites, Sangam and Medini, being 18.5 and 86.25 km downstream from KRS respectively. From Sattigala (12°14'N, 77°00'E), which is 95 km downstream from KRS, and which is close to Kollegal (12°09'N, 77°07'E), the distribution of otters appears to be continuous. In all these places, spraints and pugmarks characteristic of *Lutra perspicillata* were found.



Figure 6: Pugmarks of *Amblonyx cinereus*



Figure 7: Pugmarks of *Lutra perspicillata*

The average size of pugmarks was 7.38 cm across and 9 cm ($n = 8$, std. dev. = 0.74 cm) in length, and in clear prints showed claw marks. The shape was characteristic of *Lutra perspicillata* (pers. obs., Kruuk *et al.* 1993) (Figure 7). Spraints consisted almost entirely of fish remains (Sivasothi, 1995; Hussain, 1993; Anoop, 2001; Shenoy, 2002). Spraints were deposited on conspicuous rocks near the deepest parts of the river, the rocks being sufficiently large to roll on and sufficiently close to a patch of vegetation for security (Procter, 1963; Macdonald and Mason, 1987; Rowe-Rowe, 1992; Melisch *et al.*, 1996; Hussain and Choudhury, 1995; Hussain and Choudhury, 1997).

5.3 Seasonal Presence

Animal populations are resident or migrant depending on presence or absence of favourable conditions (Neville, 1968; Yoshiba, 1968; Kano, 1972; Makwana, 1978; Maruhashi, 1982; Macdonald, 1983; Melquist and Hornocker, 1983; Hussain, 1993). At different times of the year, the same group may reside in different parts of the river, or perhaps only expand or contract their home range as conditions may dictate. It appears that otters visit some sites only during the rainy season. Sixteen such sites were identified along the Cauvery. Most of these sites were along stretches

upstream from KRS, including the reservoir itself, and in Kodagu district. As signs of the animals were not found in these areas, it was not possible to identify which species visit these areas during the rains. The descriptions from the local people indicate the populations near Bhagamandala (12°22'55"N, 76°32'11"E) to be *Amblyonyx cinereus*, and those lower down the river to be *Lutra perspicillata*, but this is to be confirmed by more solid evidences.

5.4 Sprainting Sites

Sprainting sites of *Amblyonyx cinereus* were on large conspicuous rocks by the sides of pools along the river (Figure 8). Inter-spraint site distance for all spraints was on an average 100 m (n = 16, std. dev. = 138 m), and 230 m for fresh spraint. Number of spraint sites was 10.7 / km for all spraints, and 2.7 / km for fresh spraints. Spraints were deposited at an average height of 80 cm (n =14, std. dev. = 34 cm) above the water level, and at an average distance of 79 cm (n = 15, std. dev. = 72.4 cm) from the water. The mean extent of spread of spraints at each site was 0.46 m² (n = 13, std. dev. = 0.62 m²). The canopy above spraint sites were mostly thin.



Figure 8: Spraints of *Amblyonyx cinereus* showing remains of crab carapace



Figure 9: Spraints of *Lutra perspicillata* that contained mostly fish

Sprainting sites of *Lutra perspicillata* were found on large rocks or sandy islands near the deep sections of the river (Figure 9). Rocks were always conspicuous, and large enough for the otters to roll on. The absence of canopy was distinct. Thick undergrowth of grasses, sedges and shrubs was always present near the sprainting site, which provided sufficient security to the animals while sprainting, grooming, eating, etc. An average of 4 spraint sites per km ($n = 9$, std. dev. = 6) was found in the sites where *Lutra perspicillata* was present. Spraints were deposited at an average height of 94 cm ($n = 15$, std. dev. = 36.7cm) above the water, and 3.3 m ($n = 15$, std. dev. = 1.4m) from the edge of the water. The average extent of spraints at each spraint site was 39 m² ($n=14$, std. dev. = 86 m²).

5.5 Disturbances

The Cauvery region being a highly populated river belt, human disturbance is inevitable all along the river. In Kodagu, the river flows through plantations and agricultural fields, (Figure 10) with villages and small towns close to the banks. In this district, there are two forest patches

along the river - Talakaveri sacred forest, and Dubare Reserve Forest. In the Mysore and Mandya districts, the river flows mainly through agricultural fields and villages and small towns.

Ranganathittu Bird Sanctuary, though a Protected Area, is still disturbed due to the high rate of tourist visits. Gendehosahalli, also a part of the Ranganathittu Bird Sanctuary, is less disturbed. Beyond Shivasamudram, the river meanders through relatively undisturbed hills of scrub forests.

The river and its banks are subjected to various forms of anthropogenic activities as described below (Figure 11):

Poaching: Evidence of poaching was obtained from local people's accounts. Of the 50 sites surveyed, 11 (22%) sites were subject to poaching of otters. Of the 17 sites where otters were present during the survey, poaching was prevalent in 6 sites (35%).

Sand mining: The river has substantial sand resources, which is exploited heavily in many places. This was encountered in 10 of the 50 sites surveyed. Otters continued to inhabit only one of these sites.



Figure 10:View of a heavily disturbed stretch of the River Cauvery

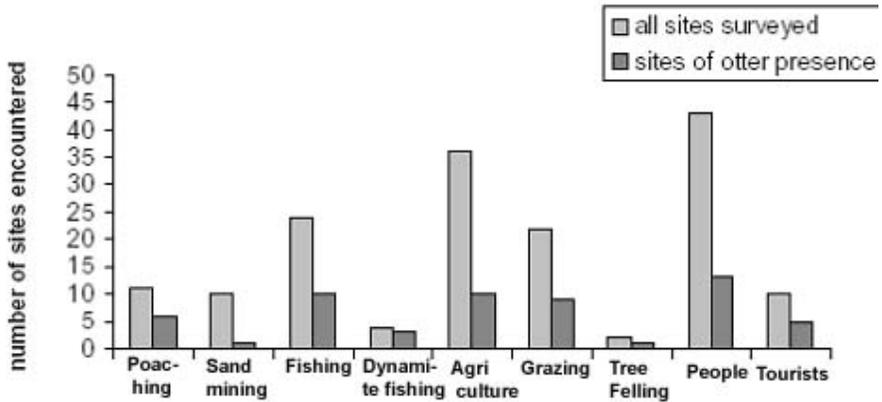


Figure 11: Anthropogenic activities along the River Cauvery; (All sites surveyed include sites of otter presence)

Fishing: Fishing occurred on various scales, in some places fulfilling only local needs, whereas in other places meeting market demands. In all places where fishing was prevalent, resident fishermen were present. However, in some places, nomadic fishing communities resided, and moved camp depending on the availability of fish. Twenty-four of the 50 sites were fishing areas, of which 10 were also home to otters. Dynamite fishing was not very common, and occurred in 4 of the 50 sites, of which 3 had otters.

Agriculture: A large part of the river flows through agricultural land, including plantations. Thirty six of the 50 sites had agricultural on at least one bank of the river. Otters were present in 10 of these sites.

Cattle grazing: Cattle are a common feature of Indian villages. All along the Cauvery belt, large populations of cattle were widespread. Twenty-two of the 50 surveyed sites experienced grazing pressures. Of these 9 have otter populations.

Felling: Vegetation along the riverbanks has a significant functional role as a buffer between the riverine ecosystem and the adjoining human world. Felling of trees would expose the animals of this ecosystem to hostile conditions. Though this was not rampant along the Cauvery, it was encountered in two sites, of which one site was home to a resident population of otters.

Use of water source: The river flows through many settlements and the inhabitants utilize the water for various domestic purposes. Washing clothes, utensils and animals, and bathing are common sights. The presence of people is certainly a disturbance factor of some importance. These activities were seen in 43 of the 50 surveyed sites and 13 of the otter sites. Ten of the surveyed sites were also tourist sites, of which otters inhabited five.

6. DISCUSSION

Records of the presence of the three species in different parts of the country are available, though not in detail. *Amblyonyx cinereus* and *Lutra lutra* have been documented in the colder high-elevation hill streams and rivers of the country, whereas *Lutra perspicillata* is known to be widespread over regions of lower elevation and plains (Kruuk *et al.*, 1994; Prater, 1998; Menon, 2003). The two otters of the cold regions are known to co-exist in some areas, like in Coorg (Kodagu) (Prater, 1998; Nagulu *et al.*, 1999b). In other Asian countries where the three species exist, co-existence of all the three has been recorded (Kruuk *et al.*, 1993; Kruuk *et al.*, 1994).

This survey did not find any sympatric species in the Cauvery. Only two species were found, and their ranges were distinctly separated. In

Kodagu district, *Amblonyx cinereus* was found in the river where it has its source in the hills. Here, its habitat is typical of its kind (Prater, 1998, Menon 2004). Being a crustacean eater by preference (Kruuk *et al.*, 1994; Estes 1989) it was found in shallow rocky streams and pools (Figure 4). It does not require large deep rivers as is the case with the piscivorous *Lutra perspicillata* (Figure 5). The first site where *Lutra perspicillata* was found indubitably was Chunchankatte (12°30'N, 76°18'E) and beyond that the species was found only downstream from KRS. The river in these regions is wide and deep as compared to the little stream it starts off as in Talakaveri.

Fishes are abundantly available all along the Cauvery, as is evident from the number of fishermen that survive along the river. The river has sandy banks and islands, with many large rocks and boulders jutting out of the river. Such islands and rocks are ideal for otters to use. As most of these sites are near human habitations, there is constant disturbance along the banks. The otters need to come to land for various activities like feeding (Burton, 1968; Chanin, 1985), sleeping (Chanin, 1985; Nolet *et al.*, 1993), grooming (Nolet *et al.*, 1993), playing (Shariff, 1984) and territory marking (Kruuk, 1992; Green *et al.*, 1984).

Since the river banks are not always safe, islands and rocks in the middle of the river are ideal, and even more so if there is undergrowth to provide cover for them. All the 15 sites where *Lutra perspicillata* was found had islands and/or rocks. Spraint sites were almost always found on islands. *Amblonyx cinereus* also requires safe places for its activities on land, but as it inhabits more forested areas with relatively less human disturbance, it does not require areas with islands. Besides, since it is found in rocky streams with large rocks and boulders on the sides, the crevices provide sufficient cover. Spraint sites of both the species were found

under relatively less dense canopy. This may be associated with grooming and basking behavior.

It is prey availability that is probably crucial in deciding distribution of the otters. It is a well-known fact that animals follow their food abundance gradient and alter their home ranges accordingly (Macdonald, 1983). Fish must be available year round if otters are to remain as permanent residents in an area (Melquist and Hornocker, 1983). Though a prey availability test was beyond the scope of the present study, it is to be assumed that fish, in greater sizes and quantities, are found in the deeper sections of the river, at lower elevations, especially during the dry season. This is substantiated by the fact the fishermen haul better catches in the deep sections of the river during this season. During and after the rains, these nomadic fishing communities do not restrict fishing to small ranges, and rather, are spread along the length of the river. Towards the onset of summer, as water levels decrease, large bodies of water can be expected only in areas downstream rather than upstream, and in sections where the depth is great. The south-west monsoon breaks in June. Once the rains begin, the water levels increase drastically. Fishes are no longer restricted to small areas and are free to extend their ranges. Accordingly, the otters will also extend their ranges in order to follow their prey. This is probably the reason why, in many of the sites, the local people had seen otters only in the rainy season. Again, during the rainy season, when the river swells, it is no longer possible for people to wade across the river, as is the practice during the dry season in many sites. This, coupled with the increased width of the river, decreases the relative disturbance along the river. The rains also make it difficult for local people to frequent the river.

Population estimates could not be arrived at. This is mainly due to the shy

nature of otters (Melquist and Hornocker, 1979; Macdonald and Mason, 1983) and a direct estimate of population size and structure was impossible. Methods suggested by authors until now (Teplov, 1952; Melquist and Hornocker, 1979; Kruuk *et al.*, 1986; Kruuk and Conroy, 1987; Sutherland, 1997) are prone to error, as they themselves concede, and other authors opine (Melquist and Hornocker, 1979; Macdonald and Mason, 1983; Macdonald and Mason, 1985; Kruuk *et al.*, 1986; Kruuk and Conroy, 1987; Sutherland, 1997). Interviews with local people revealed that otter populations are declining over the years. Presence of anthropogenic disturbance has been known to affect otters negatively (Foster-Turley, 1992). *Lutra perspicillata* is rather more tolerant to human presence than the other two species (Shariff, 1984; Shariff 1985; Foster-Turley, 1992; Anoop, 2001). Human habitations were encountered in almost all the sites surveyed along the Cauvery.

Poaching appears to be the strongest threat to the otter populations along the Cauvery. Various accounts have been furnished by local people regarding poachers. In Kodagu district, nomadic tribes, called "Wodru" by the local people, come annually to catch otters. It appears that they come from Hassan district of Karnataka. They camp for days along the riverbanks and catch as many otters as they can before they leave. The numbers culled annually is not known. Tibetans from the refugee settlements near Kushalnagar (12°25'N, 75°57'E) are known to deal in otter pelts. Lower downstream, tribes hailing from Andhra Pradesh and Gujarat poach. These tribes are nomadic as well and come annually, camp on the riverbanks, cull about twenty otters at a time in each location, and leave. They mostly use leg-hold traps. Pelts are sold and the meat is eaten. Other uses are not known locally. The local people of Sattigala are well-known in the neighboring villages for catching otters and dealing in pelt trade. These people have perfected the art of catching otters and offer

their services to interested and prospective customers.

Fishing is rampant all along the Cauvery; in some places commercially and in others for local consumption. This depletes the prey of otters. Fishermen also pose a threat to otters in that the animals get caught in the fishing nets left overnight and sometimes drown. The fishermen chase away otters because they tear through fishing nets and steal the catch. Dynamite fishing occurs in very few areas. Local fishermen attribute the local decrease in otter populations to this. In Nisargadhama and Amangala, where the fishes are protected and angling is a commercial sport, crackers are used to chase away the otters.

Sand mining is one of the major commercial activities associated with the River Cauvery. Wherever abundant reserves of sand are available, it is exploited. Roads have been made in many places, especially in remote locations, for the sole purpose of transporting sand, thus increasing the number of access points to the river. Sand is removed from the riverbed as well as the banks and islands. The depletion of sand from islands and banks decreases the number of sites where otters can groom and bask (Kruuk and Balharry, 1990; Anoop, 2001; Shenoy, 2002).

The river belt forms a fodder pastureland for cattle, especially during the dry season. This attracts large populations of cattle. There is heavy browsing and grazing along the banks, and once this resource begins to diminish, they move to islands, especially since water levels are low making it easy for the cattle to wade across. The mere presence of the cattle itself may dissuade the otters from landing. The local people also resort to burning of undergrowth in order to enhance the growth of fresh crops of fodder. The net result is that the islands and banks are denuded of vegetation cover for the otters, making it too open for them to come on to land

escaping the predators.

Agriculture on the banks adds to the number of people frequenting the river. Chemical pesticides and fertilizers pollute the river. Otters being the top carnivores of riverine ecosystems, are at a risk of accumulating these in their systems. Studies are required to identify the levels of bio accumulation of hazardous chemicals in otters. Expansion of agricultural lands leads to encroachment into the thin green belt of trees and shrubs along the riverbanks. Felling of trees also adds to this. This denudation of the protective vegetation deprives the otters of a crucial factor for survival.

The distribution of otters suggests that prey availability governs their place of residence. Otters are highly territorial and do not tolerate the presence of non-family members (Chanin, 1985) in their home range which could be anywhere between 5 and 10 km of river length and sometimes more (Watson, 1978; Melquist and Hornocker, 1983; Green *et al.*, 1984; Hussain, 1993). The home range of an adult male *Lutra perspicillata* was found to be 17 km in the National Chambal Sanctuary, and 5.5 km for a female with pups (Hussain, 1993). The increase in adverse conditions in some areas forces the otters to move to areas that may already be populated by a resident family group. This accentuates competition and there is an increased demand for limited resources. They are often forced to inhabit a hostile environment simply because of prey availability. These factors ultimately cause populations to dwindle.

7. RECOMMENDATIONS

1. There is an urgent need to set aside areas for *in-situ* conservation of otters.

A conservation plan must take into account all the factors threatening the population, as well as foreseeable future threats. This can be achieved by declaring areas with important populations as otter sanctuaries. Chunchankatte, Gendehosahalli, Sattegala, and the stretch from Kootle (12°17'N, 77°10'E) to Sangam, which includes Cauvery Wildlife Sanctuary, are some of the important areas for *Lutra perspicillata* (Figure 2). Talakaveri sacred forest is a good habitat for *Amblonyx cinereus*. Fishing and disturbance may be regulated in these areas.

2. Thinning of bank-side vegetation along the River Cauvery must be minimized.

Otters being shy animals, the thinning of bank-side vegetation has serious effects on their behavior. Stringent measures must be taken to ensure that trees and shrubs in this belt are not felled or cleared, and the belt not be encroached upon by agricultural lands. Steps must be taken to reforest this belt with fast growing trees.

3. Sand mining, especially on islands must be minimized in sensitive areas. In addition burning of pastures must be prevented and cattle grazing must be regulated.

4. Poaching and illegal trade in otter skin must be curbed.

In most places where otters are present, the forest department personnel lack awareness regarding the functional role of otters

in the ecosystem, and are not aware of otter poaching. Otter poaching is also perhaps of secondary importance in the protection regimes. Governmental and/or non-governmental agencies should step in to impart relevant and adequate training to combat poaching and trade, as well as other threats to otter populations. The market for otter products must be curbed through active campaigning and awareness programmes at the local and regional level.

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Appendix I

List of sites surveyed

The following are the sites surveyed during the study. Presence of otters has been mentioned if signs of their presence were found, or if information from local people revealed that they were present in the region during the past one year, and not earlier.

#	Location	Species	Populn. Size	Nature of Disturbance	Habitat
1	Nagathiritha (Talakaveri sacred forest)	<i>A. cinereus</i>	7*	People movement, Poaching.	Wet evergreen forest
2	Cherangala	<i>A. cinereus</i>	Unknown	Poaching, Agriculture ² .	Plantations & agrl. lands.
3	Bandikadavu	No otter	NA	Agriculture.	Plantations.
4	Balmaveti	<i>A. cinereus</i>	Unknown	People movement, Agriculture, cattle	Plantations & agrl. lands
5	Emmamadu	No otter	NA	Agriculture, cattle grazing.	Plantations & agrl. lands.
6	Napoklu	No otter	NA	Agriculture.	Plantations, agrl. lands & town.
7	Balamuni	No otter	NA	Sand mining, fishing, agriculture.	Plantations, villages.
8	Bethri	No otter	NA	Agriculture, fishing, sand mining.	Plantations, villages.
9	Kondangeri	<i>Lutra perspicillata</i> ?	5 ^o	Sand mining, fishing, cattle grazing	Villages, agrl. lands.
10	Hachinadu	<i>Lutra perspicillata</i> ?	Unknown	Agriculture, Sand mining, fishing - local.	Plantations, agrl. lands & village.
11	Guhya	Unknown	Unknown	Agriculture, People movement, cattle.	Plantations, agrl. lands & village.
12	Siddapura	No otter	NA	People movement, sand mining, agriculture, cattle.	Plantations and town.
13	Baradi	No otter	NA	Agriculture, Sand mining, fishing - local.	Plantations, villages.
14	Vainur & Ammangala	<i>Lutra perspicillata</i> ?	Unknown	Agriculture, cattle, fishing, angling for sport.	Plantations, agrl. lands & villages, Dubare Reserve Forest.

#	Location	Species	Populn. Size	Nature of Disturbance	Habitat
15	Dubare	Unknown	Unknown	Agriculture, poaching, cattle.	Plantations, agri. lands & villages, Dubare Reserve.
16	Guddehosur	No otter	NA	Agriculture, cattle, poaching ¹ .	Plantations, agri. lands & villages.
17	Nisargadhama	No otter	NA	Agriculture, poaching ¹ , fishing, tourists.	Plantations, agri. lands & villages.
18	Kaniwe	Unknown	Unknown	Sand mining, agriculture, fishing.	Agri. lands and villages.
19	Thorenuru	Unknown	6*	Agriculture, cattle.	Agri. lands and villages.
20	Ramanathpur	<i>Lutra perspicillata</i> ?	Unknown	Agriculture, temple tourists.	Agri. lands and town.
21	Rudrapatna	<i>Lutra perspicillata</i> ?	10	Agriculture, cattle.	Agri. lands and villages.
22	Keralapura	Unknown	Unknown	Agriculture, poaching*, cattle.	Agri. lands and villages.
23	Chunchankate	<i>Lutra perspicillata</i>	7*	Agriculture, fishing, felling of trees & bamboo. Poaching used to occur 2 years ago.	Agri. lands and villages.
24	Sanyasiपुरा	<i>Lutra perspicillata</i> ?	5*	Sand mining, Agriculture, people movement.	Agri. lands and villages.
25	Sangampura (Hemavathi)	No otter	NA	Agriculture, cattle.	Agri. lands and villages.
26	Tippuru	<i>Lutra perspicillata</i> ?	8*	Agriculture.	Agri. lands and villages.
27	Minakshipura	Unknown	1*	Fishing.	Bare open land.
28	Hale Mundavadi	Unknown	1*	Fishing.	Bare open land.
29	Ranganathitu	No otter	NA	Tourists, agriculture.	Agri. lands on banks, forested islands.
30	Ganiam	Unknown	Unknown	Tourists, cattle.	Villages and open land.
31	Sangam Srirangapatna	<i>Lutra perspicillata</i>	8*	Tourists, fishing, dynamite fishing, cattle, agriculture. Poaching used to occur years ago.	Agri. lands & villages.
32	Mahadevपुरा	<i>Lutra perspicillata</i>	6*	Fishing, agriculture, poaching.	Agri. lands & villages.
33	Gendhosali	<i>Lutra perspicillata</i>	15*	Cattle.	Forested islands, agri. lands and villages on banks.
34	Bidarhalhundi	No otter	NA	Agriculture, cattle.	Agri. lands & villages on banks, forested islands.
35	Bannur	No otter	NA	Agriculture, fishing.	Agri. lands and villages.

#	Location	Species	Populn. Size	Nature of Disturbance	Habitat
36	Somanathpur	No otter	NA	Agriculture, fishing, felling of trees, cattle.	Agri lands and villages.
37	Hale Sosalie	<i>Lutra perspicillata</i> ?	Unknown	Agriculture, fishing, cattle.	Agri lands and villages.
38	Maradipura	<i>Lutra perspicillata</i> ?	6 ^a	Agriculture, fishing. Sand mining used to occur earlier.	Agri. lands and villages.
39	Hemmige	No otter	NA	Fishing, agriculture.	Villages, agri. lands.
40	Kaveripura	No otter	NA	People movement, sand mining.	Villages.
41	Medini	<i>Lutra perspicillata</i>	10 ^a	Fishing, agriculture, poaching, cattle.	Agri. lands and villages.
42	Yeddakuri	<i>Lutra perspicillata</i> ?	5 ^a	Agriculture, cattle, dynamite fishing.	Agri. lands and villages.
43	Saitegala	<i>Lutra perspicillata</i>	10 ^a	Agriculture, fishing, poaching.	Agri. lands and villages.
44	Gagana chukki (Shivanasamudra)	<i>Lutra perspicillata</i> ?	2 ^a	Fishing.	Villages and dry scrub forests.
45	Kootle	<i>Lutra perspicillata</i>	10 ^a	Fishing	Dry scrub forests.
46	Doddamalki	<i>Lutra perspicillata</i> ?	unknown	Fishing, tourists.	Dry scrub forests.
47	Hathimodu	<i>Lutra perspicillata</i>	5	Cattle.	Dry scrub forests.
48	Muttatti	<i>Lutra perspicillata</i>	5	Tourists, cattle.	Dry scrub forests & village.
49	Galibore	<i>Lutra perspicillata</i>	12	Tourists, angling as sport.	Dry scrub forests.
50	Sangam (Arkavathi)	No otter	NA	Tourists.	Scrub forests on right-bank, village on left-bank.

* Breeding

^a Non-breeding

1 Poaching of otters in these areas used to occur some years back when other populations were present. They do not exist now, either having been locally exterminated, or having moved to other grounds.

2 Agriculture (under the heading of "nature of disturbance") includes all kinds of farming, including agricultural fields and plantations. Agri. has been used as a short form of "Agricultural".

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Two species of otter are found along the River Cauvery. While the Oriental small-clawed otter inhabits the forested stretches of the river in the upper reaches, the smooth-coated otter inhabits the lower tracts. Limiting human disturbances along these stretches and curbing the poaching of otters and illegal trade in pelts are vital for the conservation of otter populations in this region.



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