

Progress Report

Habitat Ecology and Conservation of *Lutrogale perspicillata* in Narayani River, Chitwan National Park, Nepal

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Abstract

A survey was conducted in 2008 in Narayani River within Chitwan National Park to assess the distribution and habitat ecology of *Lutrogale perspicillata*. Searching of otter signs was carried out in every 1.5 to 2 km transect of the 75 km stretch of the river. The area between Gidha to Bhosarghat (Zones II & III) recorded a large number of otter signs due to shallow water course with dense *Saccharum spontaneum* cover and patches of sandy islands on the banks. Absence of otter signs in downstream from Amaltari-Tribeni (zones IV, V and VI) is due to habitat fragmentation, human disturbances, few sandy islands, cliffs, high fishing pressure, and barrage. Tracks were recorded on the sandy and muddy substrate. Spraint sites were observed mainly in the sandy islands in between the shallow channels. High human disturbance is the major threat responsible for the habitat loss and declining populations. The park management should adopt appropriate conservation measures to improve habitat quality and maintain the viable population of the smooth coated otter.

Key words

Lutrogale perspicillata, shallow channels, sandy bank, otter signs, human disturbances

Introduction

Nepal harbors two species of otter, namely Eurasian otter, *Lutra lutra*; and Smooth-coated otter, *Lutrogale perspicillata* (Acharya *et al* 2010).

The smooth-coated otter is found in the major river basins of Nepal: Koshi, Narayani, Karnali and Mahakali (Shrestha, 2003). The species was also reported from Bahunne creek of Suklaphanta Wildlife reserve and Babai river of Bardia National Park (Pers. Comm. Uba Raj Regmi, 2011). It was also sighted in Khaura River (Pers. Comm. N.B.M. Pradhan, 2008).

Its population is declining as a consequence of loss of natural habitat and persecution (Acharya *et al* 2008). There has been little investigation on status and distribution of otters in Nepal. Recently otter signs have been also recorded from river Rapti near its confluence with the river Narayani (Acharya, 1998).

Although little information is known about the ecology of this species, it is known to occur in a variety of habitats, from mangrove to freshwater wetlands and large forested rivers (Foster-Turley *et al.*, 1990). Generally, this species occurs in the lower, slow-flowing parts of the river, and in artificial lakes (Kruuk *et al.*, 1994; Kruuk, 2006). In the River Narayani, the status of smooth coated otters had been investigated by Evans *et al.* (1985) in relation to fish distribution and otter predation upon them. These authors estimated that 8-10 family groups were present.

Although being a top predator and a flagship species of the health of aquatic habitats in the South-east and South Asian regions (Foster-Turley *et al.*, 1990; Yoxon, 2007), there have been no conservation efforts in Nepal towards otter protection. Therefore, it is necessary to understand more about the habitat preferences and ecological requirements to identify conservation problems which could serve as a scientific basis for conservation and management of this mustelid (Kruuk, 2006; Acharya and Rimal, 2007; Acharya *et al.*, 2010;

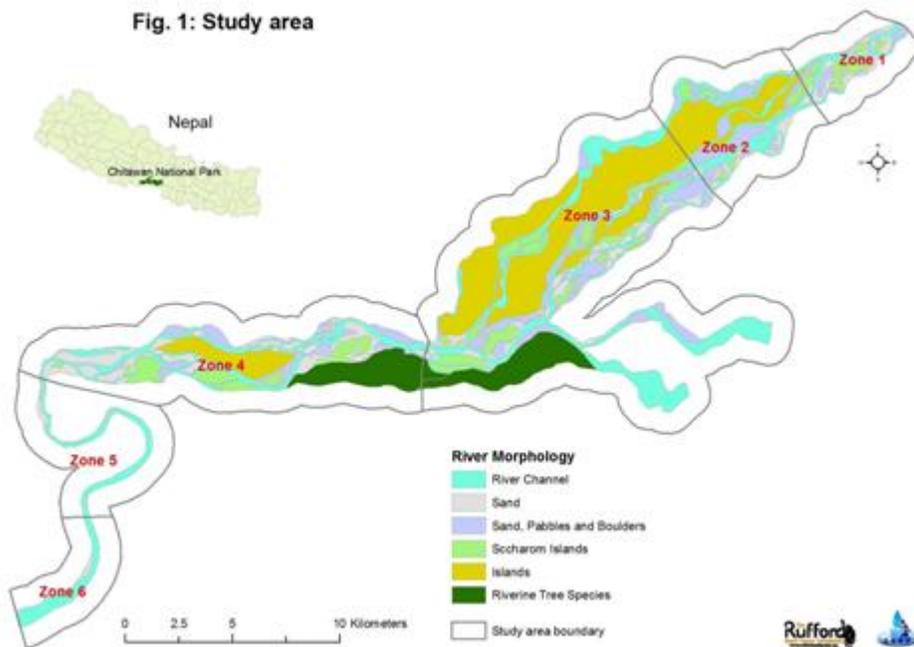
Acharya and Lamsal 2010).

This paper assesses the habitat ecology of *Lutrogale perscipillata* in Narayani River of Chitwan National Park.

Materials and methods

Study area

The study was carried out in Narayani River of Chitwan National Park (27° 34' to 27° 68' N and 83° 87' to 84° 74' E) including the buffer zones from northern boundary of park (Sikrauli) to Tribeni barrage at international border with India. Chitwan National Park is renowned for the conservation of some of the world's most endangered species, including rhinoceros, tiger, gaur, gangetic dolphin, otter and gharial crocodile in their natural habitat. The Park occupies an area of 932 km² in the Rapti Valley of the Siwalik physiographic region, while the buffer zone (27° 28' N to 27° 70' N and 83° 83' E to 84° 77' E) extends in an area of 750 km² (Figure 1).



The climate of Chitwan is subtropical with a summer monsoon from mid-June to late September and a relatively dry winter. The average annual rainfall is about 250 cm, with most precipitation occurring between June and September. The post-monsoon season between November and January is cool with the daily average temperature reaching 24 °C during the day and dropping to about 7 °C at night.

Methods

Survey over 75 km stretch was conducted by canoes to assess the distribution of otters by checking 600 m stretch of river with 50 m width in every 1 or 1.5 km transect on both banks of the river. The sampling was conducted from Sikrauli to Tribeni.

During the survey, the presence of otter was determined by different signs such as footprints, spraints, holts (dens), slides, and grooming sites. GPS location of otter signs was recorded. The habitat parameters such as substrate type, distance from bank, water depth, escape cover etc. were measured to know the relationship of these parameters to otter occurrence.

Footprints were measured with a ruler, taking the greatest width, i.e. across toes one and five.

Fishermen, nature guides, park rangers and game scouts, local communities were interviewed to generate information.

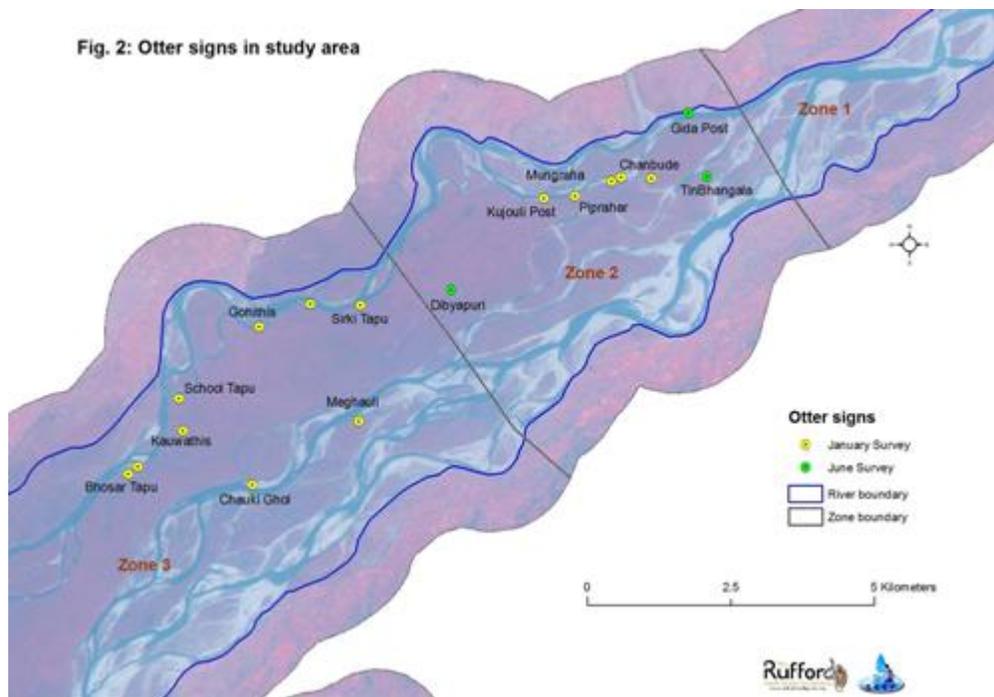
Arc View GIS 9.0 was used to map the distribution of the otters in the park.

Results

Observation of otter signs

The survey in January 2009 recorded a large number of otter signs mainly tracks, scats, grooming, and resting sites in the western channel of Narayani river draining along the side of Nawalparasi district in the shallow channels with Sandy Island, muddy sand and elevated banks. Otter signs were also recorded in the eastern main channel of Narayani (Meghauli and Chauki Ghol).

The survey in June, 2009 recorded otter signs largely tracks in shallow braided channels near Gidha , Teen Bhangala, and Dibyapuri of the channel draining along the Nawalparasi district. The tracks were mostly found on the bank within park banks adjoining the confluence of shallow channels with the main river, mud/sandy islands in between the shallow channels with dense coverage of *Saccharum spontaneum* (Figure 2).



Tracks

During the January 2009 tracks were recorded in large number along the edge of the park, mainly in muddy sand, sandy islands in between the shallow channel, main and shallow channel with good cover of *Saccharum spontaneum*.

During the June 2009, tracks were only recorded in Gidha, Baluwaghat, Teen Bhangala, and Dibyapuri areas especially in shallow water channels as well as in the vicinity of confluence of small channels or marshes with main channel of Narayani.

Table 1: Tracks and habitat features recorded in January 2009

Location	Latitude	Longitude	Depth (m)	River width (m)	Substrate	Distance from Bank (m)
Meghauli	27°37'14.7 "	84°12'26.3"	6.96	272	sandy	1.5
Chaukigho	27°36'39.8 "	84°11'18.4 "	1.21	150	sandy	0.6
Mungraha Bhangala	27°39'32.1 "	84°15'07"	2.12	22.5	muddy sand	0.6
Kujauli Post	27°39'21.0"	84°14'24.0"	1.5	45	muddy sand	0.6
Kujauli	27°39'21.8"	84°14'40.9"	0.6	39	sandy	0.9
Sirki Tappu	27°38'20.6"	84°12'27.5"	1.5	36	muddy	1.5
Sirki Tappu	27°38'23.8"	84°12'05.7"	1.8	36	sand	0.9
School Tappu	27°38'8.4"	84°11'23.2"	2.12	22.5	sand	0.3
Gohithis	27°37'09.5"	84°10'34.4"	0.6	36	sand	0.9
Gohithis	27°38'21.3"	84°11'55.7"	1.8	33	sand	1.2
Kauwathis	27°36'45.2"	84°09'39.9"	1.5	45	sand	0.9
Kauwathis	27°36'49.3"	84°10'05.9"	1.8	35	sand	1.5
Bhosarghat	27°37'27.9"	84°10'32.1"	2.12	75	sand	0.9
Mean			1.97	65.15		0.943
±			1.4	67.77		0.362

Table 2: Tracks and habitat features recorded in June 2009

Location	Latitude	Longitude	Depth (m)	Substrate	Distance from Bank(m)
Teen Bhangla	27°39'24.2"	84°15'35.3"	1.2	boulder	1.5
Teen Bhangla	27°39'33.3"	84°16'07.9"	1.2	sandy	0.9
Teen Bhangla	27°39'33.9"	84°16'07.4"	0.9	sandy	0.9
Gidhapost	27°39'43.7"	84°15'36.0"	1.35	muddy sand	0.6
Gidhapost	27°39'53.7"	84°15'39.8"	0.45	sandy	0.9
Dibyapuri	27°39'30.0"	84°13'25.2"	0.9	muddy sand	1.5
Dibyapuri	27°39'29.7"	84°13'24.7"	1.5	muddy sand	0.6
Dibyapuri	27°39'30.5"	84°13'26.3"	0.45	muddy sand	0.6
Mean			0.99		0.57
±			3.04		0.54

Otter footprints occurred mostly on either muddy or sandy shorelines of channels which are 0.45-6.96 m (1.60 ± 1.31 , N = 21) deep and 22.5-272 m (65.15 ± 67.77 , N= 13) wide. All fresh tracks were located between 0.3 and 1.5 m (0.943 ± 0.362 , N = 21) from the water, especially next to marshes or the confluence of small channels with the main watercourse along the western boundary of the park in Nawalparasi district (Tables 1 & 2).

Table 3: Measurement of tracks

Location	Latitude	Longitude	Distance from Bank (m)	Total Length (cm)	Total width (cm)
Meghauli	27°37'14.7"	84°12'26.3"	5	9.5	8
Chaukighol	27°36'39.8"	84°11'18.4"	2	9.5	7.5
Mungraha bhangala	27°39'30.3"	84°15'07.0"	2	9.5	8
Kujauli Post	27°39'21.0"	84°14'24.0"	2	7	7
Kujauli Post	27°39'21.8"	84°14'40.9"	3	11	7
Sirki Tappu	27°38'20.6"	84°12'27.5"	5	10	7
Sirki Tappu	27°38'23.8"	84°12'05.7"	4	10	8.5
Sirki Tappu	27°38'23.8"	84°12'05.7"	3	9	8
School Tappu	27°38'8.4"	84°11'23.2"	1	9	7
Gohithis	27°37'09.5"	84°10'34.4"	3	10	7
Gohithis	27°37'09.5"	84°10'34.4"	4	9	7
Kauwathis	27°36'45.2"	84°09'39.9"	1.5	8	7
Kauwathis	27°36'49.3"	84°10'05.9"	2	7	8
Bhosarghat	27°37'27.9"	84°10'32.5"	3	10	8
Bhosarghat	27°37'27.9"	84°10'32.5"	1.5	9.5	7.5
Bhosarghat	27°37'27.9"	84°10'32.5"	2	9.5	8
Mean				9.22	7.53
±				1.05	5.14

The Footprint length ranged between 7 and 11 cm (9.22 ± 1.05 , N= 16), while width ranged between 7 and 8.5 cm (7.53 ± 5.14 , N= 16). As the size of footprints can vary with the texture of the substrate, all recorded measures are likely to correspond to adult specimens (Table 3).

Scat/scent marking sites

Scats were recorded from 8 sites (Table 4). These areas could be considered as key otter habitats because of presence of shallow braiding channels, low depth of water, low current supported by plenty of root and tree debris. Spraints were mainly recorded in dry sandy banks in islands characterized by dense coverage of *Saccharum spontaneum*, near channel confluences, presence of root debris, and logs along the bank. A single spraint was seen on sandy islands between shallow channel and main channel on elevated sand banks. The shape of the scat observed was cylindrical. The sprainting site was supported by large number of fresh tracks. In Gohithis island urination mark was observed in single spraint site. Rolling in single spraint was observed in Mungraha.

Table 4: Scat Location and habitat features

Location	Depth (m)	DFEW*	HFWL* (m)
Meghauli (27°37'14.7."N,84°12'26.3"E)	2.1	7.2	2.4
Chandbude (27°39'32.1"N,84°15'32.5"E)	1.8	1.8	1.3
Chirchire (27°39' 30.2."N,84°15'31.4"E)	2.1	1.8	1.2
Mungraha (27°39'32.8"N,84°15'13.2"E)	2.1	5.1	2.1
Piprahar (27°39'22.2"N,84°14'44.0"E)	1.8	6.0	0.9
Kujauli Post (27°39'21.0"N,84°14'24.0"E)	1.5	2.1	0.9
Sirki Tappu (27°38'23.8"N,84°12'05.7"E)	2.4	2.4	0.9
Gohithis (27°37'09.5"N,84°10'34.4"E)	0.75	3.6	1.2
Mean	1.82	3.75	1.36
±	0.48	1.97	0.54

DFEW*=Distance from water edge (m)

HFWL*=Height from water level (m)

Marking sites were 1.8-7.2 m (3.75 ± 1.97 , N= 8) from deep stretches of the river, 0.75-2.4 m (1.82 ± 0.48 , N= 8) in depth. The smooth coated otter has been reported to mark well above the waterline (Kruuk 2006). Accordingly, the height above water level of sprainting sites was 0.9-2.4 m (1.36 ± 0.54 , N= 8).

Grooming sites

Seven grooming sites were recorded on sandy islands and banks (Table 5). The grooming sites were characterized by patch of sandy islands between the shallow channels or islands near the river confluences and elevated sandy shorelines along the main river channel with some woody debris.

Table 5: Grooming sites with habitat parameters

Location	DFW*	ECD*	Substrate
Sirki Tappu (27 38'23.8"N, 84 012'03.7" E)	1.8	18	sand & mud
SchoolTappu (27 38'8.4N, 84 0 11'23.2" E)	2.1	15	sand
Gohithis (27°37'09.5"N,84°10'34.4"E)	9	1.8	sand & barren mud
Gohithis (27°37'09.5"N,84°10'34.4"E)	5.4	1.8	sand & mud
Kauwathis (27°36'45.2"N,84°09'39.9"E)	0.9	31.5	sand
Mungraha (27 39' 32.8"N 84 015'13.2"E)	7.8	7.5	sand & mud
Meghauli (27 37'14.7"N, 84 012'26.3"E)	7.8	7.5	sand & mud
Mean	4.97	6.4	
±	3.1	14.0	

DFW*=Distance from Water in m

ECD*=Escape Cover Distance in m

Grooming sites were found between 0.9 and 9 m (4.97 ± 3.1 , N= 7) from water. The escape cover distance ranged in between 1.8 m – 31.5 m (6.4 ± 14.0 , N=7).

Discussion

The occurrence of large number of otter signs like tracks, spraints, grooming and resting place were recorded in zone II and III. These areas are preferred by otters due to the presence of escape cover (*Saccharum spontaneum*), shallow water channels, sandy islands between shallow channels, which may provide plenty of fish and resting place during monsoon as compared to the main course of the river (Acharya *et al* 2010). Otter distribution agrees with the reported otter preference for the most favorable habitats found in the lowland marshes, swamps and bogs interconnected with meandering streams (Melquist & Hornocker, 1983). Suitable river otter habitat must also provide sufficient food as food influences the extent to which different habitats are used (Melquist and

Hornocker, 1983). The presence of otters favored suitable habitats such as shallow water, moderate current, sloppy sand and clayey riverine banks with good escape cover (Acharya, 2006). A survey carried out in Terai and lower Himalayan regions indicated the presence of otters positively co-relating the riparian vegetations and prey availability (Hussain, 2002). In the Periyar Tiger Reserve, the otters preferred shallow, gently sloping areas close to the outflows of the stream (Anoop and Hussain, 2004).

The low number of otter signs recorded in June with respect to January is due to high river discharge resulting in the submersion of riparian habitats thereby reducing their habitat requirements. These unfavorable conditions lead the otters to migrate to shallow water course and swamps within the park. Most of the otter habitats that were recorded in January were fully submerged in June with occurrence of few signs. In the Terai areas of the Upper Gangetic Plains in India and Nepal, the seasonally flooded swamps are extensively used by the otters during monsoon and early winter (Hussain, 2002). Melquist and Hornocker (1983) found that the availability of food and shelter determined the habitat selection by the otters.

The absence of otter signs downstream from Amaltari to Tribeni (Zones IV, V & VI) could be due to high human disturbances, over fishing, grazing, sand and boulder extraction, less escape cover and sandy islands, deep water course with low current due to dam, rocky cliffs and boulders on the edge of the river. The areas from Kolkatta Tappu to downstream is characterized by stagnant condition with the shoreline having rocky cliffs, presumably less habitat preference to otters.

Moreover, in this part of the river there is a large dam, the Gandak barrage which impedes the fish migration and constraint the fishing activity of otters (Kruuk, 1995; Holmquist *et al*, 1998; Collares-Pereira *et al*. 2000).

Despite of the intensive fishing pressure and other human disturbances in the zones II and III, the otters are tolerant to human activities. They are active during the time when human activities are minimum. Such behavioral activity was also observed by Shariff (2004); Anoop & Hussain (2004).

The tracks were mostly recorded in muddy sand banks near the shoreline of flooded marsh or small channel adjacent to main channel. However, it is not appropriate to judge the abundance on the basis of footprints, because old tracks are also preserved due to dry climatic condition. The impression of the footprints on the muddy substrate was more remarkable with clear webs and claw marks. The tracks on the sandy areas were less distinct. Therefore, the size of the footprints can vary with the texture of the substrate. The tracks of the three species are readily recognized (Kruuk *et al* 1993). The smooth otter has very large round footprints, often > 8 cm across, with rather long fingers.

Spraints were cylindrical, and when fresh, were black colored and have a pleasant, sweet musky smell. Old scats were grey to white. Spraints were mainly on dry sandy banks of the islands covered by *Saccharum spontaneum* and next to the confluence of river branches. The occurrence of a single spraint deposited high up on the elevated sandy banks in between the shallow channel and the main channel. Large sprainting and holt sites were found only on the undisturbed banks within the protected area (Houghton, 1987). In Cauvery Wildlife Sanctuary in southern India, spraints of *Lutrogale perspicillata* is found to be deposited on rocks well above the grooming sites (Shenoy *et al*, 2006). Melquist and Hornocker (1983) observed that otters often regularly defecate at conspicuous sites such as exposed logs, logjams, sandbars, large boulders, and elevated banks.

Marking sites were observed about 1.8 to 7.2 m away from the water channels with depth ranging from 0.75 to 2.4 m. The smooth coated otter has been reported to mark well above the water surface (Kruuk, 2004).

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Otters dried themselves and maintain the insulative quality of their fur by frequent rubbing and rolling on grass, soil and logs. (Melquist & Hornocker 1983; Anoop & Hussain 2004). In Narayani River, the grooming sites were found mainly on the sandy areas close to the shallow water courses. Such sites were also marked by the presence of some single scats. The grooming sites observed were composed of mostly sand followed by mud 80%: 23 % in average. Grooming sites were found in between 0.9 to 9 m from water. The otters show fidelity for grooming and sprainting activities, but some sites were used once or in one season only (Gormn *et al*, 2006; Kruuk *et al*.,

1986; Mason & Macdonald, 1986; Hussain & Choudhury, 1997).

In Narayani River, increasing human disturbances and Gandak dam are the main threats responsible for habitat loss and fragmentation. It is urgent to implement the appropriate conservation efforts to improve the habitats.

Threats

The populations are largely threatened due to overfishing, poisoning, industrial pollution, high movement of people for resource extraction, grazing, boulder and sand extraction, illicit timber cutting. Fishing was the major threat in most of the studied sites.

Fishing

Fishing practice was rampant throughout the river basin. Chitwan National Park have provided the fishing license to fishermen living on fringe of the river to regulate fishing, human movement, and exploitation of aquatic resource and improvement of crocodile habitats. These fishermen such as Majhi, Bote's, Musahar were involved in fishing activities from Bhosarghat to Dibyapuri. In Srigajaghat, Jogimara about 10 to 12 fishing boats were seen thus showing high fishing pressure.

Mullah fishermen from Tribeni and India use the large stretch of water from Tribeni to Bagan for fishing. They use Tiyari jal (large gill net) for fishing which collect many small to large fish. Occasionally, Gharial and otters may entangle in these nets.

Mullahs from Tribeni use large nets (Tiyarii fishing net) to collect all the fish from the specific area which further threatens the fish assemblages, otters, and crocodiles.

Small sized mesh nets are often used which removes both adult breeding stock and fingerlings from the populations reducing the possibilities of future breeding and recruitment from the areas. Poisoning in the marshes and swamps connecting to main river channel have affected the otter populations and caused habitat degradation.

Industrial Pollution

There is a little doubt that pollution could be the cause of otter population decline. Discharges from the Gorkha Brewery and Bhrikuti Paper and Pulp factory and Pharmaceutical and Gill Mary were the major sources of pollution in Narayani River affecting otters, crocodiles, fish and other fauna.

Grazing

High grazing pressure was recorded in Gohithis, Badraughat, Ratanpur, Gaidakhasa and Seri. Lacks alternative places for cattle grazing, inadequate awareness and inadequate patrolling have seriously disturbed the riverine habitat thereby threatening the otter populations.

Sands and Boulder extraction

Sand and boulder extraction were observed around the key otter habitat near Gidha Post. Such activities were also observed in between Gohigajara and Tribeni. These activities may severally affect otter habitats.

Recommendations

- The exact spatial and temporal distribution of otters in Narayani could be obtained only through undertaking detailed research to investigate status, habitat requirements, population size, feeding habits, breeding, ,
- The zone between II and III should be protected as an otter sanctuary of park through strict patrolling and monitoring by local Game Post Offices.
- Promote level of awareness to local licensed fishermen/ fishermen of crocodile project about

importance and values of otter in river system

- Community based otter group should be established in local level under the supervision of park's warden to monitor key otter habitats, and enhancing the awareness level to local communities/ buffer zone CF users, rangers, game scouts, water users about otter conservation.
- The industries located in the catchments of river e.g. Gill Mary Distillery, and Pharmaceutical Industries should follow the proper treatment process and maintain the standards and monitor the consequences of discharge to aquatic systems in consultation with Chitwan National park
- CNP should dialogue with Valmiki Tiger reserve authorities regularly to solve the issues of river basin management and mugger crocodile and gharial conservation and poaching of wildlife
- The CNP should make a monitoring plan to study the impact of Gandak barrage in the migration and movement of fish, dolphin, gharial, marsh crocodile and otters

Conclusion

Signs of otters mainly track, scats, resting site, grooming/rolling site and holts were found in abundance along the length of Narayani within the park from Gidha post to Bhosarghat (zones II and III). The large numbers of otter signs on the sandy islands of protected bank of the river in between these two zones were due to prevalence of sandy islands, shallow water courses, woody debris, patches of islands in between the channels.

The absence of otter signs downstream from Amaltari to Tribeni barrage may be attributed to several reasons such as stagnant condition of river, due to impact of dam, rocky cliffs and boulders on shoreline, less escape coverage and high fishing pressure. Some areas like Kathona and Vellogi in downstream reaches have few sandy islands but otter signs were not recorded due to deeper water, rocky cliffs and less escape cover. Footprints measured in different places showed larger footprint with a maximum length of 10 cm and width of 8 cm corresponds to presence of *Lutrogale perspicillata*.

Spraints were deposited by otters on sandy banks with dense coverage of *Saccharum* and *Phragmites sps.* with an average water depth of 1.5 m . Increasing human disturbances overfishing, cattle grazing, sand and boulder extraction, industrial pollution, inadequate awareness, industrial pollution are the existing threats that need to be addressed by protected area authorities in collaboration with key stakeholders.

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