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CURRENT STATUS OF SUSU (*PLATANISTA GANGETICA GANGETICA* ROXBURGH, 1801) IN RIVER GANDAK, A MAJOR TRIBUTARY OF THE HOLY RIVER GANGA IN BIHAR, INDIA

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INTRODUCTION

The Gangetic Dolphin, *Platanista gangetica gangetica* commonly known as Susu or Soons in local parlance is distributed in Ganga-Bramhaputra- Meghna and Karnaphuli-Sangu river system of India Nepal and Bangladesh. It is found from the foothills of the Himalayas to some of the tidal zone in India, Bangladesh, Nepal and Bhutan. It belongs to Order Cetacea, Sub Order Odontoceti (Toothed whales). The Cetaceans are aquatic mammals and include whales, dolphins and porpoises. The Gangetic Dolphin is the only cetacean available in Ganga and Brahmaputra river systems in India. Recently the river dolphin has been reported from River Sutlej in Punjab in January 2008. (Behera, WWF India, 2008). The cetaceans are having fusiform body, a pair of pectoral flipper and a horizontal compressed tail fluke with or without a notch in middle. They are lung breathers and their nostrils are placed much above the extremity of snout (melon). These animals come above water surface for breathing (Anderson, 1879; Kasuya and Haque, 1972); Mohan *et al.,* 1997; Smith *et al.,* 1998; Sinha *et al.,* 2000 and Alfred *et al.,* 2006; Sinha *et al.,* 2010, Sharma 2010)

Ganges river dolphin is a solitary animal, has a stocky body with long beak (beak in female larger than male) that thickens at the end. The dorsal fin is very small while flippers are large. The skin colour is usually light gray- brown and pale at the belly, often with tinge of pink. The eyes are very small and the forehead known as melon rises steeply. The eyes lack crystalline lens; as a result, the animal is unable to detect light and dark vision. Developed echolocation helps in detection of food and navigation. Occasionally individual swims with one flipper laterally.

The dolphin makes a sound while breathing a reason to be called it soons. Due to solitary nature the animals is sighted frequently alone or in small groups of 2-3 (Jones, 1982; Smith, 1993). Sighting in pairs are generally mother and juvenile/calf and male and female during mating (Kasuya and Haque, 1972; Jones, 1982). During dry seasons i.e. from October to April many dolphins leave tributaries of Ganga and Brahmaputra river systems and congregate in the main channel and return to the tributaries in rainy season-June to September (Reeves and Brownell 1989). But resident dolphin population in major tributaries of Ganga and Brahmaputra river systems do not migrate to the big rivers. Migration is due to dispersal of fishes, which are their main food (Kasuya and Haque, 1972).

Globally, there are three recognized obligate species of river dolphin, which inhabit river and estuaries in Asia and South America, and all are among the most endangered cetaceans on earth. Recently one species, the baiji or Chinese river dolphin, was declared functionally extinct in 2006 (Turvey *et al.,* 2007). The other species are Amazon River dolphin (*Inia gepffrensis*), the Ganges river dolphin (*Platanista gangetica gangetica*) and Indus

River dolphin (*Platanista gangetica minor*). The last one is found in Indus River system of India and Pakistan (Behra *et. al.,* 2008). The Gangetic dolphin was historically distributed throughout the Ganges, Meghana, Bramhaputra and Karnaphulli river system of India and Bangladesh (Ghosh, 1991; Gupta, 1986; Jones, 1882; Reeves and Brownell, 1989; Shreshtha, 1989; Agrawal and Alfred, 1999; Alfred *et. al.,* 2006). But the water development projects like construction of Dams and Barrages threatened the dolphin population in the main channel of the major rivers. Pollution in their habitat, accidental or intentional/direct killing for trade, prey depletion are major threats for the dolphins population (Reeves and Leatherwood, 1995; Alfred *et. al.,* 2006).

SYSTEMATIC ACCOUNTS :

Kingdom	:	**Animalia**
Phylum	:	CHORDATA
Class	:	MAMMALIA
Sub Class	:	EUTHERIA
Order	:	CETACEA
Sub-order	:	ODONTOCETI
Super family	:	PLATANIOSTOIDEA
Family	:	PLATANISTIDAE
Genus	:	***Platanista***
Species	:	***P. gangetica,*** Roxburgh, 1801
Subspecies	:	***P. g. gangetica.***

CONSERVATION STATUS

IUCN (International Union for Conservation of Nature and Natural resources) has declared Gangetic dolphin (Susu) as endangered, while other agencies have also categorized the species as follows:

- Endangered as per IUCN (2003)
- Schedule -I of Indian Wild life (Protection) Act 1972
- Appendix -I of CITES (Perrin and Brownell, 1889)
- Appendix - II of Convention of Migratory Species (CMS)

OBJECTIVE OF THE PRESENT STUDY

Since no documentary evidences were available about the accurate number of river dolphin in river Gandak which originates from Nepal, the main objective of the present study was to assess the current status of the Susu (*Platanista gangetica gangetica*) in the entire stretch of Gandak river from Triveni Barrage at Valmiki Nagar in West Champaran to the mouth of Gandak river meeting Ganga river near Patna in the state of Bihar - a stretch of approximately 320km.

The present study was undertaken by the Gangetic Plains Regional Centre, as a part of the approved annual research plan of work 2008-2010 of the Zoological Survey of India, Ministry of Environment and Forests, Government of India.

Gandak River in India and Kali Gandaki in Nepal

The Gandaki River (also, known as the Kali Gandaki, the Narayani in Nepal and the Gandak in India) is one of the major rivers of Nepal and a left bank tributary of the River Ganga in India. The headwaters of the river are formed at an altitude of 3,900 m (12,795 ft) in the Mustang region of Nepal border; Tibet. The river is notable for the deep gorge through which it flows and also for a large hydroelectric facility in Nepal.

STUDY AREA : RIVER COURSE

The Gandak crosses the outermost foothills of the Himalayas, Sivalik Hills, into the Terai plains of Nepal and from confluence with Trisuli, the river flows southwest and is known as Narayani down to Trivenighat near the India and Nepal boarder. The river later curves back towards the southeast as it enters in India.

Gandak flows southeast across the Gangetic Plains of Bihar state, eventually merging with the Ganga near Patna. The entry point of the river at the Indo-Nepal border is also the confluence of Gandak, known as Triveni, with rivers Pachnad and Sonha also descending into India from Nepal. After the river enters India at Triveni, it travels for a length of 320 km before it joins Ganga river, just downstream of Hajipur at Sonepur (also known as Hariharkshetra), near Mahatma Gandhi Setu at

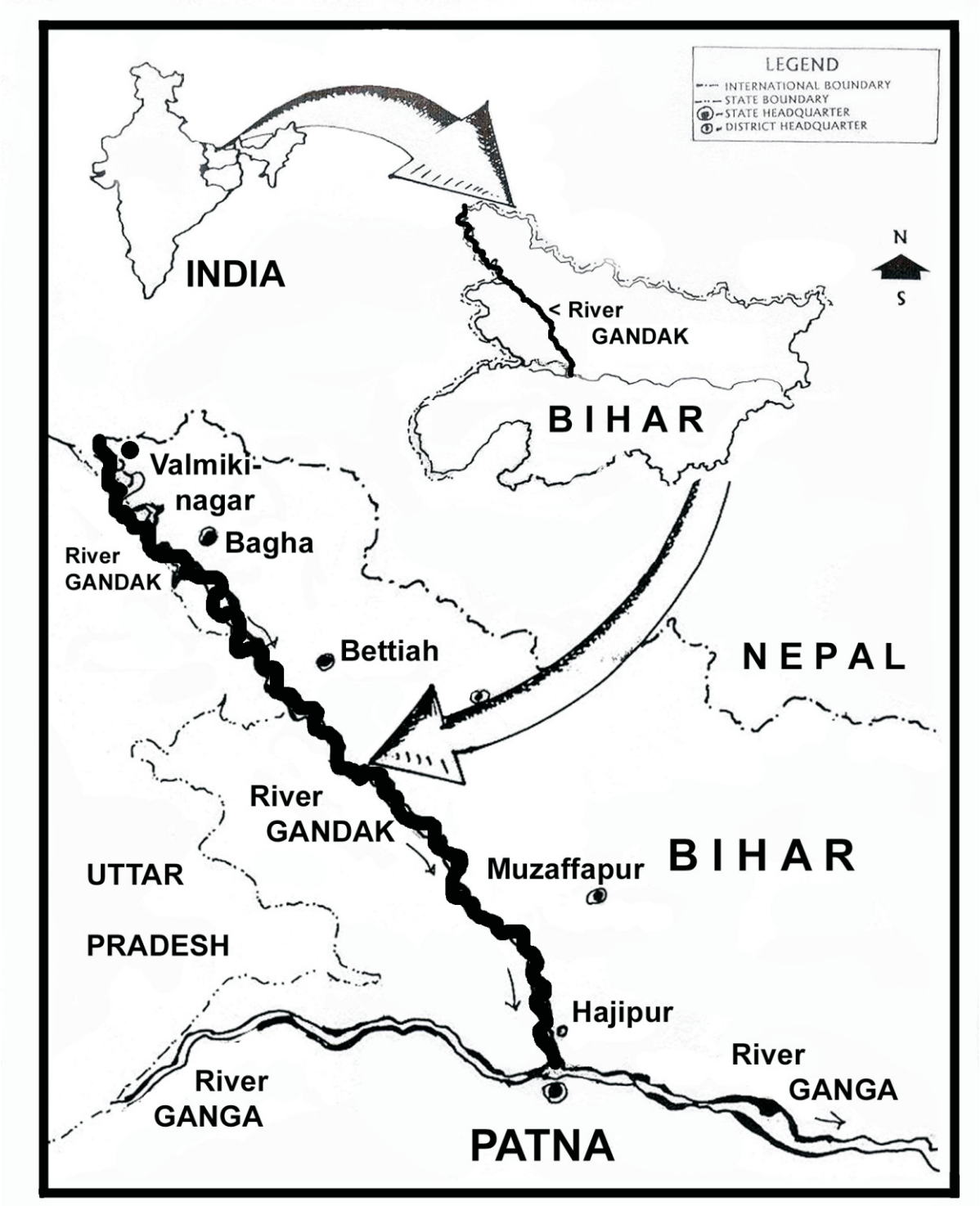

Fig. 1 : Map of River Gandak in Bihar, India, Showing Survey Area

Patna. Before joining river Ganga near Patna, it flows through East and West Champaran, Gopalganj, Bagha, Saran, Muzaffarpur and Vaishali districts of Bihar (Fig.1). The total length of the river is >600 km both in India and Nepal.

The Gandak plains, called the Gandak Megafan comprise Eastern Uttar Pradesh and North Western Bihar and lies in the Middle Gangetic Plains. The total catchments area of the basin up to its outfall into Ganga is 40,553 Sq. Km of which 4,188 Sq. Km lie in Bihar, 895 Sq Km lie in UP while the rest 35,470 Sq. Km lie in Nepal (2nd Bihar Irrigation Commission Report 1994). The river has very steep slope in the mountain but after it debouches into the plains, the slope gradually becomes flatter. Like other rivers of North Bihar, it also brings enormous quantity of sediment load along with its flow during the monsoon period. The silt load so carried gets deposited on its bed as the river flows through plains. This results in aggradations in bet and tendency to spill its banks and in course of the time to shift its course. Any breach in the embankment, therefore, result in catastrophe in the area.

After Anderson (1879) more than 130 years ago not much more has been studied on *Platanista gangetica gangetica* (Susu) by any other scientists in India except by the team of Patna University which carried out studies only in a part of Gandak river.

MATERIAL AND METHODS : SURVEY METHODOLOGY

Survey team consisted of party leader and three officials from ZSI, GPRC, Patna and one researcher from Zoology Department, Patna University. Surveys were conducted by the team using motor launch (navigable in optimum current) following the recommendation of a panel of experts (Perrin and Brownell, 1989). Direct count survey method was used to estimate susu abundance. When susus were sighted, survey team remained in the area for approximately 15-30minutes before recording the actual count. Usually more number of susu is found near confluences of two rivers and downstream of bridge pilings and diaras/sandbars. At such site the boat was anchored at least for one hour observation in order to reduce the chances of counting a single animal more than once or of undercounting when more than one animal were present. In the present study both downstream and upstream of River Gandak from Patna to Balwaghat upstream Bagaha and back were surveyed using the Global Position System (GPS) coordinates for susu sightings.

Distinctive physical characteristics in identification of individual animals were recorded (e.g. scarring, length of rostrum relative to height of melon, and body size). During the continuous survey between Patna to upstream Bagaha near Valmiki National park in West Champaran in Dec. 2008, Apr. 2009 Feb. & Apl. 2010, a total 290 km out of 320 km of the river stretch were surveyed.

Best high and low estimates of the susus populations in the group were recorded. The high and low estimates were used to reflect confidence in the accuracy of best estimate. The low estimate was considered to be an absolute minimum count and the high estimate an absolute maximum count. We used identical best, high and low estimate to indicate a high level of confidence in our best estimate.

Besides the dolphin census the surface water samples, zooplankton and macro-invertebrates fauna as well as sediment samples were also collected for further analysis.

RESULTS AND DISCUSSION

Susu the freshwater dolphin is found up to the Triveni Barrage near India Nepal boarder (persl. commn. : Samir K. Sinha, Asstt. Manager under Wildlife Trust of India, New Delhi working at Valmiki Tiger Reserve). The details of locations, Global positioning system coordinates and number of dolphins and their GPS locations have been recorded and shown in Table 1.

The best congregation of the dolphins was sighted near the counter eddy current where the right/left banks of the river were eroded due to high flood and developed a big poundage area. In

Table-1: Sighting Records of *Platanista gangetica gangetica* (Roxburgh, 1801) In The River Gandak, Bihar From Patna to up Stream Bagaha, West Champaran, During 2008-2010

Sighting Number	Time	Observer	Number of Dolphin			Number in each Group Size			Name of Area	GPS Position
			Best	High	Low	Adult	S.A	Calves		
1st Day										
1.	11:26	P	2	2	2	2	-	-	U/s Ganga confluence	25°38'14''N 85°11'43''E
2.	11:36	P	3	3	3	2	1	-	U/s above location	25°38'42''N 85°11'20''E
3.	11:51	P	3	3	3	1	2	-	Konharaghat	25°41'05''N 85°11'27''E
4.	13:10	P	2	2	2	-	1	1	Hariharkshetra ghat	25°40'38''N 85°11'29''E
5.	13:23	P	1	1	1	-	1	-	U/s Rly bridge	25°41'05''N 85°11'27''E
6.	13:43	P	1	1	1	-	1	-	U/s above location	25°41'35''N 85°11'25''E
7.	14:26	P	2	2	2	1	1	-	U/s above location	25°42'57''N 85°11'15''E
8.	14:32 14:40	P	6	8	6	4	1	1	U/s above location	25°43'19''N 85°11'20''E
9.	14:43	P	2	2	2	1	-	1	U/s above location	25°43'21''N 85°11'18''E
10.	14:57	R	1	1	1	1	-	-	U/s above location	25°43'43''N 85°10'48''E
11.	15:00	P	1	1	1	-	1	-	U/s above location	25°43'34''N 85°10'42''E
12.	15:03	P	4	5	4	2	1	1	U/s above location	25°44'05''N 85°10'40''E
13	15:49	P	1	1	1	1	-	-	U/s above location	25°45'24''N 85°10'20''E
14.	16:08 16:48	P	3	3	3	1	1	1	Barua Ghat, Hajipur	25°46'10''N 85°10'14''E
2nd Day										
15.	08:55	P	2	2	2	1	1	-	U/s above location	25°47'30''N 85°10'08''E
16.	09:17	P	2	2	2	2	-	-	U/s above location	25°48'26''N 85°10'09''E
17.	09:26	P	1	2	1	1	-	-	U/s above location	25°49'36''N 85°10'03''E
18.	09:57	P	2	2	2	1	1	-	U/s above location	25°50'26''N 85°09'29''E
19.	11:09	P	3	3	3	2	1	-	U/s above location	25°52'53''N 85°06'59''E
20.	11:15	P	1	1	1	1	-	-	U/s above location	25°53'08''N 85°06'37''E

Sighting Number	Time	Observer	Number of Dolphin			Number in each Group Size			Name of Area	GPS Position
			Best	High	Low	Adult	S.A	Calves		
21.	12:16	P	4	4	4	2	2	-	U/s above location	25^{0}55'20''N 85^{0}04'51''E
22.	12:25	P	1	1	1	1	-	-	U/s above location	25^{0}55'44''N 85^{0}04'34''E
23.	12:30	P	1	1	1	1	-	-	U/s above location	25^{0}55'52''N 85^{0}04'32''E
24.	12:41 13:41	P	4	5	4	2	1	1	U/s above location	25^{0}56'16''N 85^{0}04'38''E
25.	14:25	R	2	2	2	2	-	-	U/s Rewaghat	25^{0}59'15''N 85^{0}02'31''E
26.	14:24	P	2	2	2	1	1	-	U/s above location	26^{0}00'04''N 85^{0}01'35''E
27.	14:30	P	1	1	1	1	-	-	U/s above location	26^{0}00'14''N 85^{0}01'19''E
28.	15:35	P	1	1	1	-	1	-	U/s above location	26^{0}01'18''N 84^{0}58'10''E
29.	15:47	P	1	1	1	1	-	-	U/s above location	26^{0}01'56''N 84^{0}58'12''E
30.	16:30	P	1	1	1	1	-	-	Fatehabad Ghat	26^{0}04'07''N 84^{0}58'02''E
3rd Day										
31.	07:15	P	2	2	2	1	1	-	U/s Fatehabad	26^{0}04'23''N 84^{0}58'02''E
32.	08:34	P	1	1	1	1	-	-	U/s above location	26^{0}06'10''N 84^{0}57'38''E
33.	08:41 09:13	P	3	4	3	2	-	1	U/s above location	26^{0}06'12''N 84^{0}57'23''E
34.	10:55	P	1	1	1	-	1	-	U/s above location	26^{0}09'55''N 84^{0}53'38''E
35.	11:21	P	1	1	1	1	-	-	U/s above location	26^{0}11'05''N 84^{0}53'59''E
36.	11:30	P	1	1	1	-	1	-	U/s above location	26^{0}11'29''N 84^{0}54'11''E
37.	11:35	P	2	2	2	1	1	-	U/s above location	26^{0}11'39''N 84^{0}54'23''E
38.	11:40	P	1	1	1	1	-	-	U/s above location	26^{0}11'52''N 84^{0}54'38''E
39.	12:39	P	1	1	1	1	-	-	Near Paharpur	26^{0}13'55''N 84^{0}54'36''E
40.	12:45	P	2	2	2	1	-	1	U/s above location	26^{0}13'55''N 84^{0}54'21''E
41.	13:26	P	2	2	2	1	1	-	U/s above location	26^{0}13'54''N 84^{0}52'02''E
42.	13:40	R	1	1	1	1	-	-	U/s above location	26^{0}13'56''N 84^{0}51'09''E

Sighting Number	Time	Observer	Number of Dolphin			Number in each Group Size			Name of Area	GPS Position
			Best	High	Low	Adult	S.A	Calves		
43.	13:45	P	2	2	2	-	1	1	U/s above location	26°14'04''N 84°50'53''E
44.	13:48	P	3	3	3	2	-	1	U/s above location	26°14'09''N 84°50'39''E
45.	13:47	P	2	2	2	1	1	-	U/s above location	26°14'26''N 84°50'21''E
46.	14:25	P	3	3	3	1	1	1	U/s above location	26°15'44''N 84°50'28''E
47.	15:10	P	1	1	1	-	1	-	U/s Sinha ghat	26°17'41''N 84°49'38''E
48.	15:51	P	1	1	1	-	1	-	U/s above location	26°19'04''N 84°48'07''E
49.	15:58	P	3	3	3	-	2	1	U/s above location	26°19'13''N 84°47'16''E
50.	16:07	P	3	3	3	1	1	1	U/s above location	26°19'26''N 84°47'17''E
51.	16:44	R	1	1	1	-	1	-	U/s above location	26°20'53''N 84°45'52''E
52.	16:49	P	3	3	3	2	1	-	U/s above location	26°21'01''N 84°45'35''E
53.	16:52	P	2	2	2	1	1	-	U/s above location	26°21'07'''N 84°45'27'''E
54.	16:59	P	1	1	1	1	-	-	Dumari Bridge	26°21'24'''N 84°45'05''E
4th Day										
55.	08:15	P	1	1	1	1	-	-	U/s Dumri Bridge	26°22'06''N 84°44'29''E
56.	09:49	P	1	1	1	-	1	-	U/s above location	26°23'40''N 84°44'02''E
57.	09:42 09:49	P	2	2	2	-	2	-	U/s above location	26°25'34''N 84°43'05''E
58.	10:00	P	4	4	4	2	2	-	U/s above location	26°25'25''N 84°42'11''E
59.	10:17	P	3	4	3	2	1	-	U/s above location	26°25'25''N 84°41'30''E
60.	10:25	P	3	3	3	2	1	-	U/s above location	26°25'50''N 84°41'25''E
61.	11:33	P	3	3	3	3	-	-	U/s above location	26°28'05''N 84°41'16''E
62.	12:12	P	1	1	1	-	1	-	U/s above location	26°28'20''N 84°40'00''E
63.	12:52	P	1	1	1	-	1	-	U/s above location	26°28'21''N 84°37'23''E
64.	13:24	P	1	1	1	1	-	-	U/s above location	26°29'00''N 84°36'42''E

Sighting Number	Time	Observer	Number of Dolphin			Number in each Group Size			Name of Area	GPS Position
			Best	High	Low	Adult	S.A	Calves		
65.	13:56	P	4	4	3	3	1	-	U/s above location	26°30'40''N 84°32'46''E
66.	14:30	P	1	1	1	1	-	-	U/s above location	26°29'58''N 84°34'48''E
67.	15:30	P	1	1	1	-	1	-	U/s above location	26°30'22''N 84°32'48''E
68.	15:59	P	1	1	1	1	-	-	U/s above location	26°28'21''N 84°37'23''E
69.	16:41	P	1	1	1	-	1	-	U/s above location	26°31'07''N 84°33'21''E
70.	17:15	P	1	2	1	-	1	-	U/s above location	26°30'56''N 84°33'21''E
71.	17:49	P	2	2	2	1	1	-	U/s above location	26°30'34''N 84°31'11''E
72.	18:52	P	1	1	1	1	-	-	Jadavpur Ghat	26°31'13''N 84°30'07''E
5th Day										
73.	08:00	P	1	1	1	-	1	-	U/s above location	26°32'12''N 84°29'25''E
74.	09:03 09:23	P	5	5	4	3	2	-	U/s above location	26°32'22''N 84°28'02''E
75.	10:12	P	1	1	1	1	-	-	U/s above location	26°32'58''N 84°27'09''E
76.	11:40	P	1	1	1	1	-	-	U/s above location	26°34'03''N 84°27'07''E
77.	12:33	P	2	2	2	-	1	1	U/s above location	26°35'13''N 84°27'17''E
78.	13:42	P	1	1	1	1	-	-	U/s above location	26°36'08''N 84°27'17''E
79.	14:59	P	3	3	3	1	1	1	U/s above location	26°37'21''N 84°26'54''E
80.	14:50	P	2	3	2	1	1	-	U/s above location	26°37'53''N 84°25'55''E
81.	15:14	P	2	2	2	1	1	-	U/s above location	26°38'47''N 84°26'34''E
82.	15:50	P	1	1	1	1	-	-	U/s above location	26°39'50''N 84°26'38''E
83.	16:49 17:06	P	3	3	3	1	1	1	U/s above location	26°40'55''N 84°26'15''E
84.	17:40	P	1	1	1	1	-	-	U/s above location	26°41'48''N 84°25'25''E
85.	18:20	P	1	1	1	1	-	-	Sirajpur Ghat	26°42'51''N 84°25'08''E

Sighting Number	Time	Observer	Number of Dolphin			Number in each Group Size			Name of Area	GPS Position
			Best	High	Low	Adult	S.A	Calves		
6th Day										
86.	8:30	P	1	1	1	1	-	-	U/s above location	26°43'35''N 84°25'10''E
87.	9:30	P	2	2	2	1	1	-	U/s above location	26°44'28''N 84°23'25''E
88.	10:12	P	2	2	2	1	1	-	U/s above location	26°45'30''N 84°22'51''E
89.	11:00	P	1	1	1	-	1	-	U/s above location	26°45'54''N 84°21'49''E
90.	11:56	R	1	1	1	1	-	-	U/s above location	26°45'35''N 84°20'45''E
91.	12:30	P	1	2	1	1	-	-	U/s above location	26°46'27''N 84°19'57''E
92.	13:12	P	1	1	1	1	-	-	U/s above location	26°47'20''N 84°19'18''E
93.	14:36	P	1	1	1	-	1	-	U/s above location	26°47'20''N 84°19'18''E
94.	15:14	P	1	1	1	1	-	-	U/s above location	26°48'39''N 84°17'32''E
95.	15:22	P	1	1	1	1	-	-	U/s above location	26°48'58''N 84°16' 41'E
96.	15:27	P	2	2	2	1	1	-	U/s above location	26°48'42''N 84°15' 43'E
97.	15:43	P	2	2	2	1	1	-	U/s above location	26°49'32''N 84°15' 14'E
98.	15:49	P	1	1	1	-	-	1	U/s above location	26°49'45''N 84°14' 02'E
99.	15:55	P	1	1	1	1		-	U/s above location	26°49'43''N 84°14' 02'E
100.	16:01	P	1	1	1	-	1	-	U/s above location	26°51'40''N 84°13' 00E
101.	16:11 16:20	P	5	6	5	3	2	-	U/s above location	26°52'18''N 84°12'13''E
102.	16:25	P	1	1	1	1	-	-	U/s above location	26°53'03''N 84°11'36''E
103.	16:41	P	1	1	1	1	-	-	U/s above location	26°53'46''N 84°10'48''E
104.	17:04	P	1	1	1	1	-	-	U/s above location	26°54'44''N 84°10'49''E
105.	17:21	P	2	2	2	-	2	-	U/s above location	26°55'14''N 84°11'45''E
106.	17:59	P	1	1	1	1	-	-	U/s above location	26°56'02''N 84°12'28''E
107.	18:12 18:32	P	3	3	3	1	1	1	Near Sakma ghat	26°57'03''N 84°11'33''E

Sighting Number	Time	Observer	Number of Dolphin			Number in each Group Size			Name of Area	GPS Position
			Best	High	Low	Adult	S.A	Calves		
7th Day										
108.	06:30	P	1	1	1	1	-	-	U/s above location	26°57'25''N 84°10'27''E
109.	06:36	P	1	1	1	1	-	-	U/s above location	26°57'23''N 84°09'16''E
110.	06:52	R	1	1	1	1	-	-	U/s above location	26°57'52''N 84°08'28''E
111.	07:20	P	2	2	2	1	1	-	U/s above location	26°59'50''N 84°08'44''E
112.	07:41	P	1	1	1	1	-	-	U/s above location	27°00'27''N 84°07'57''E
113.	07:56	P	1	1	1	1	-	-	U/s above location	27°00'49''N 84°06'47''E
114.	08:13	P	1	1	1	1	-	-	U/s above location	27°00'22''N 84°05'56''E
115.	08:38	P	1	1	1	1	-	-	U/s above location	27°01'16''N 84°08'22''E
116.	08:49	P	2	2	2	-	1	1	U/s above location	26°00'19''N 84°04'20''E
117.	09:10	P	2	2	2	1	1	-	U/s above location	27°01'17''N 84°04'06''E
118.	09:35	P	1	1	1	1	-	-	U/s above location	27°02'22''N 84°03'56''E
119.	09:52	P	1	1	1	1	-	-	U/s above location	27°03'29''N 84°04'07''E
120.	10:10	P	1	1	1	1	-	-	U/s above location	27°04'07''N 84°03'28''E
121.	10:15	R	1	1	1	1	-	-	U/s above location	27°04'11''N 84°02'07''E
122.	10:31	P	3	3	3	2	-	1	U/s above location	27°04'49'N 84°00'36''E
123.	10:39	P	1	1	1	-	1	-	U/s above location	27°04'42'N 84°00'29''E
124.	10:50	P	3	3	2	2	1	-	U/s above location	27°05'39''N 84°00'18''E
125.	11:10	P	1	1	1	1	-	-	Near Bagha	27°06'63''N 83°59'56''E
126.	11:52 11:58	P	3	3	3	2	1	-	U/s above location	27°08'27''N 83°59'19''E
127.	12:16	P	6	7	6	3	3	-	U/s above location	27°09'48''N 83°58'80''E
128.	13:00	P	1	1	1	-	1	-	U/s above location	27°11'02''N 83°57'58''E

Sighting Number	Time	Observer	Number of Dolphin			Number in each Group Size			Name of Area	GPS Position
			Best	High	Low	Adult	S.A	Calves		
129.	13:22 13:44	P	3	3	3	1	2	-	U/s above location	27^{0}11'37''N 83^{0}57'04''E
130.	13:49	P	3	3	3	2	1	-	U/s above location	27^{0}12'43''N 83^{0}56'26''E
131.	13:56	P	1	1	1	1	-	-	U/s above location	27^{0}12'59''N 83^{0}55'24''E
132.	14:20	P	1	1	1	-	1	-	U/s above location	27^{0}13'33''N 83^{0}54'32''E
133.	14:43	P	1	1	1	1	-	-	U/s above location	27^{0}14'00''N 83^{0}52'24''E
134.	14:49	P	2	2	2	1	1		U/s above location	27^{0}14'06''N 83^{0}52'21''E
135.	14:59 15:06	P	5	6	5	2	2	1	U/s above location	27^{0}14'11''N 83^{0}51'27''E
136.	15:11	P	1	2	1	1	-	-	U/s above location	27^{0}15'14''N 83^{0}51'02''E
137.	15:19	P	1	2	1	1	-	-	U/s above location	27^{0}15'57''N 83^{0}50'44''E
138.	15:28	P	1	1	1	-	1	-	U/s above location	27^{0}16'55''N 83^{0}50'04''E
139.	15:35	P	3	3	3	1	1	1	U/s above location	27^{0}17'50''N 83^{0}49'47''E
140.	15:29	P	2	2	2	1	1	-	U/s above location	27^{0}18'17''N 83^{0}51'39''E
141.	15:52	R	1	1	1	1	-	-	U/s above location	27^{0}19'49''N 83^{0}50'28''E
142.	15:58	P	2	3	2	1	-	1	U/s above location	27^{0}20'51''N 84^{0}51'21''E
143.	16:12	P	2	2	2	1	1	-	U/s above location	27^{0}20'56''N 84^{0}51'23''E
144.	16:57	P	1	1	1	-	1	-	U/s above location	27^{0}23'42''N 83^{0}51'42''E
145.	17:21	P	1	1	1	1	-	-	U/s above location	27^{0}24'06''N 83^{0}51'13''E
Total no. of Dolphin			**259**	**275**	**256**	**145**	**91**	**23**		

P = "Primary observers" three researchers are sitting in the front of the boat
R = "Rear observer" who is pointing out the left sighting by "P" observer of the dolphin from rear side.
SA = "Sub Adult"
U/S = Upstream
D/S = Down stream

TABLE-2: Summary of river dolphin *Platanista gangetica gangetica* (Roxburgh, 1801) in the River Gandak between Patna and Barwa Wildlife Sanctuary near Bagaha, West Champaran, Bihar during 2008-2010

	Patna to Baruaghat	**Baruaghat to Fatehabad**	**Fatehabad to U/s Dumari Bridge**	**U/s Dumari Bridge to Jadavpurghat**	**Jadavpurghat to Sirajpurghat**	**Sirajpurghat to Sakma ghat**	**Sakma ghat to Barva WLS.**
Total Survey Time (Hrs.)	4.7hrs	7.32hrs	9.1hrs	7.82hrs	5.53hrs	6.98hrs	9.17hrs
Total Survey Distance (Km.)	23.4km	42km	49.1km	43.2km	42km	38.3km	52.0km
Average Survey Speed (Km./hr.)	5.0 km/hr	5.74km/hr	5.40km/hr	5.52km/hr	7.59km/hr	5.49km/hr	5.67km/hr
Number of sighting of Dolphin & groups seen by primary observers	14	16	24	18	13	22	37
Number of sighting of Dolphin & groups seen by the Rear Observer	1	2	2	-	-	1	3
Sum of best high and low estimate of Dolphin group size:							
Best (B).....	32	29	43	32	24	33	66
High (H).....	35	31	44	34	25	35	69
Low (L).....	32	29	43	31	23	33	65
Mean group size based on best estimate:							
Mean.....	1.437	1.047	0.833	1.114	1.214	0.964	1.178
S.D.....	2.286	1.813	1.792	1.778	1.846	1.428	1.737
Range.....	1-6	1-4	1-3	1-4	1-5	1-5	1-6
Percentage error based on groups sightings.....	7.14	12.53	8.33	0.0	0.0	4.54	8.11
Percentage error based on best estimation.....	3.12	6.89	4.76	0.0	0.0	3.03	4.54

Dolphin encounter rate based on best estimate - (dolphin / Km.).....	1.37	0.69	0.86	074	0.57	0.86	1.23
- (Dolphin / hr.).....	6.4	3.97	4.73	4.09	4.34	4.73	7.20
Number of adult, sub adult, calf/ Neonate and unclassified dolphin							
Adult.....	16	20	20	18	13	19	39
Sub adult.....	11	08	16	14	8	12	22
.							
Neonate/Calf.....	05	01	07	0	3	2	5
SD=Standard Deviation							

this area depth was also very high (app. 30-35 feet in post-monsoon season). The second best habitat was observed near the meanders at many sites in the entire stretch of the river. High density of dolphins was also encountered near the confluence where a small water current joining with Gandak River in upper most stretches near Bagaha.

The presence of young and neonate dolphin in the entire stretch of river shows the good recruitment rate in the river.

The density of dolphin was highest (1.37dolphins/km) in between Patna to Baruaghat in Vaishali district may be due many complexities in this stretch. The moderate dolphin density (0.86 dolphins/km) was observed in between Fatehabad to Upstream Dumaribridge in Muzaffarpur District due to many sandbars and good water volume with availability of prey species. Dolphin feeds mostly on smaller fishes like Punctuis spp. and Mustacembalus spp. and these fishes are available in plenty in the entire stretch of the river. Sometimes dolphins were seen to chase the bigger fishes like *Wallago attu* and other carp fishes near the shallow zone of the river. The density of adult dolphin was maximum from Sakmaghat to Barwa wildlife sanctuary near Bagaha.

During the survey between Dumari Bridge on River Gandak (National Highway) and Sattarghat ferry service ghat were recorded. 5 big size turtles (*Aspideretes gangeticus*) swimming in the river current were also recorded. Some turtles were also observed during u/s survey near the river bank and on the small newly immerged diara/ sandbars. Total 7 nos. (5 adults & 2 juvenile) of Gharial (*Gavialis gangeticus*) were also sighted during the survey. The density of dolphins were found to be high in the upper reaches of River Gandak. It may be due to availability of very small fishes for the dolphins and also of and many meanderings, the preferred habitat of the dolphin. No big motorized boats were seen for local ferry service in the entire surveyed stretch.

Total 259 nos. of dolphins as the best count was recorded along the stretch of the river Gandak during the survey period of 10 days. Only one up stream survey data (but encounter of dolphins) as shown in the table : 1. Susus were usually inhabited in region between 5-20 mtrs from the shore. Susus were seen in 1-6 groups with 145 sightings near sandbars/bathing ghats, behind the fishing boats in the fishing habitat and sometimes, following our survey boat in the river. Sometimes susu went up to 2-3 mtrs ranges from the shore, most probably due to availability of the food (prey fishes) near the bank. Only oar ferry crossing were observed at some places near the ghats.

Summary of the dolphin count in different subsection between confluences at Patna to Barwa Wildlife Sanctuary at Bagaha are depicted in Table 2.

Between Patna to Baruaghat in Vaishali district (a segment of 23.4 km river stretch) 32 dolphins were sighted (best estimate 32; group size: 1 to 6; mean Group size 1.437; SD=2.286 and percentage error based on group sighting 7.14, dolphin encounter rate 1.37 dolphin/km and 6.4 dolphin/hr). Total 14 nos. of sightings of dolphin and groups were recorded. From Baruaghat to Fatehabad (a segment of 42km river stretch) 29 dolphins were sighted (best estimate 29; Group size: 1 to 4; mean group size 1.047; SD=1.813 and percentage error based on group sighting 12.53, dolphin encounter rate 0.69 dolphin/km and 3.97dolphin/hr). Total 16 nos. of sightings of dolphin and groups were recorded. From Fatehabad to u/s Dumari bridge (a segment of 49.1km river stretch) 43 dolphins were recorded (best estimate 43; Group size: 1 to 3; mean group size 0.833; SD=1.792 and percentage error based on group sighting 8.33, dolphin encounter rate 0.86 dolphin/km and 4.73 dolphin / hr). Total 24 nos. of sightings of dolphin and groups were recorded. In between u/s Dumari bridge to Jadavpurghat (a segment of 43.2km river stretch) 32 dolphins were sighted (best estimate 32; Group size: 1 to 4; mean group size1.114; SD= 1.778 and percentage error based on group sighting 8.33, dolphin encounter rate 0.74 dolphin/ km and 4.09 dolphin/hr) were studied. Total 18 nos. of sightings of dolphin and groups were recorded.

From Jadavpurghat to Sirajpur ghat (a segment of 42km river stretch) 24 dolphins were observed (best estimate 24; Group size 1 to 5; mean group size 1.214; SD=1.846 and percentage error based on groups sighting 0.0 dolphin encounter rate 0.57 dolphin/km and 4.34 dolphin/hr). Total 13 nos. of sightings of dolphin and groups were recorded. Between Sirajpurghat to Sakmaghat (a segment of 38.3 km river stretch) 33 dolphins were sighted (best estimate 33; Group size min. 1, max. 5, mean group size 0.964, SD=1.428 and percentage error based on groups sighting 4.54, dolphin encounter rate 0.86 dolphin/km and 4.73 dolphin/hr). Total 22 nos. of sightings of dolphin and groups were observed and in the 7th segments from Sakmaghat to Barwa Wildlife Sanctuary (a segment of 52 km river stretch) 66 dolphins were sighted (best estimate 66; Group Size 1 to 6; mean group size 1.178, SD=1.737, percentage error based on groups sighting 8.11, dolphin encounter rate 1.23 dolphin/km and 7.2 dolphin/hr). Total 37 nos. of sightings of dolphin and groups were recorded in this segment.

The Gangetic dolphin is usually associated with meandering of the river channel, confluence of two currents and behind the mid channel island (Hua et al., 1989; Smith, 1993; Smith et al., 1997, 1998). In the present study dolphins were recorded mainly in the main current at the meandering of the river or behind the mid channel island (small emerged diara). Sometimes susus were observed foraging or chasing the prey fish in the very shallow zone, depth appx. 2-3 feets. The observation in Nepal show that they move in and out of the tributaries of the Gandaki, Koshi and Karnali systems during high water season, probably spending low-water season in deep pools of the tributaries. In the main rivers, a decrease in abundance during the summer would confirm a seasonal pattern of migration (Shreshtha, 1989).

Susu population is depleting throughout their former range due to habitat destruction including pollution, commercial exploitation and incidental catch in fishing nets.

Local fishermen of Gandak river informed us about very few accidental catches during fishing in monofilament gill net, they do not confirm the intentional killing.

RECOMMENDATIONS

The monofilament gillnets (Currenty jal) and Mosquito net (Kapda jal) should be strictly banned in the entire stretch of river Gandak. The human pressure and use of chemical fertilizers and pesticides in the flood plains should be reduced. The erosion of the bank of River Gandak should also minimize especially in the dolphin habitat. A continuous mass awareness campaign is needed in the remote area to educate the local fisherman.

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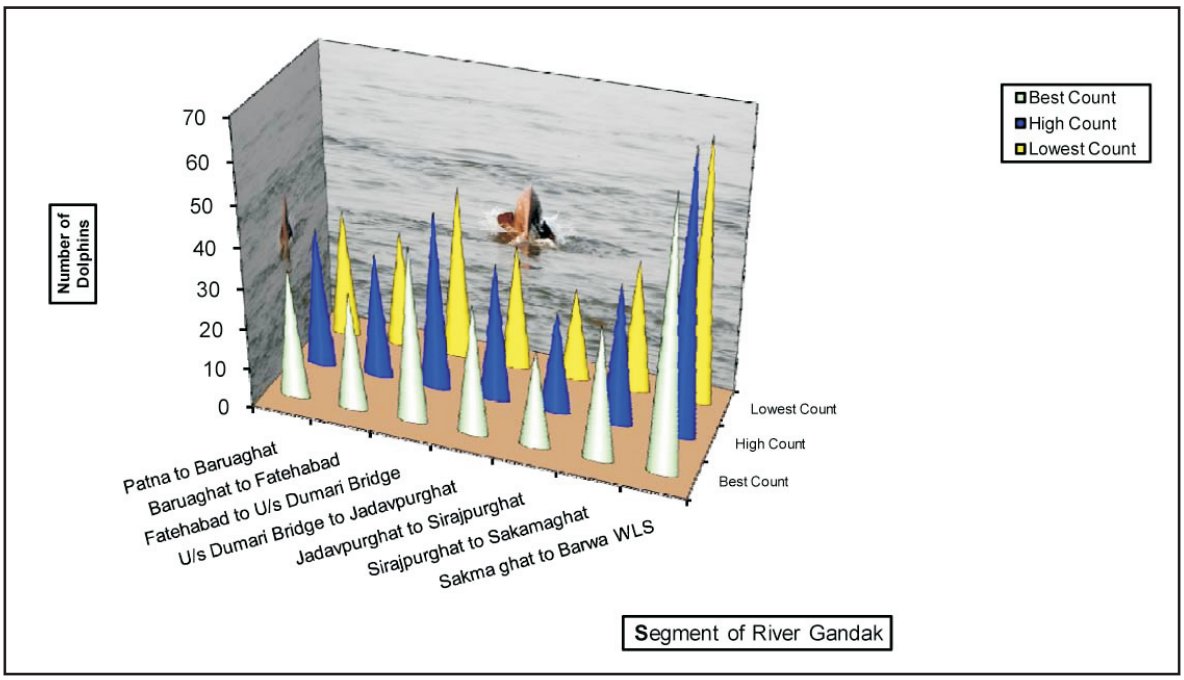


Fig. 2 : Best, Highest and Lowest count of dolphin along River Gandak in Bihar.

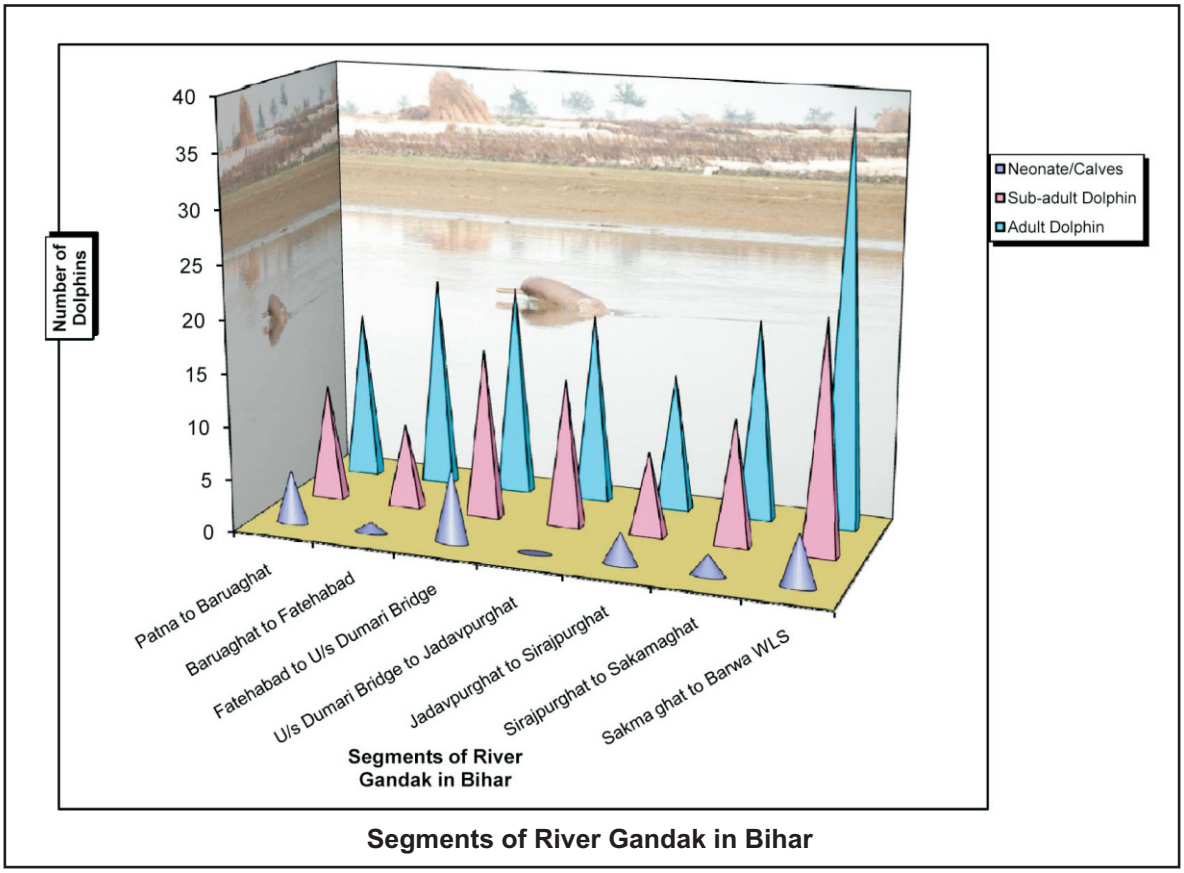


Fig. 3 : Population structure with age classes of dolphin along River Gandak in Bihar.

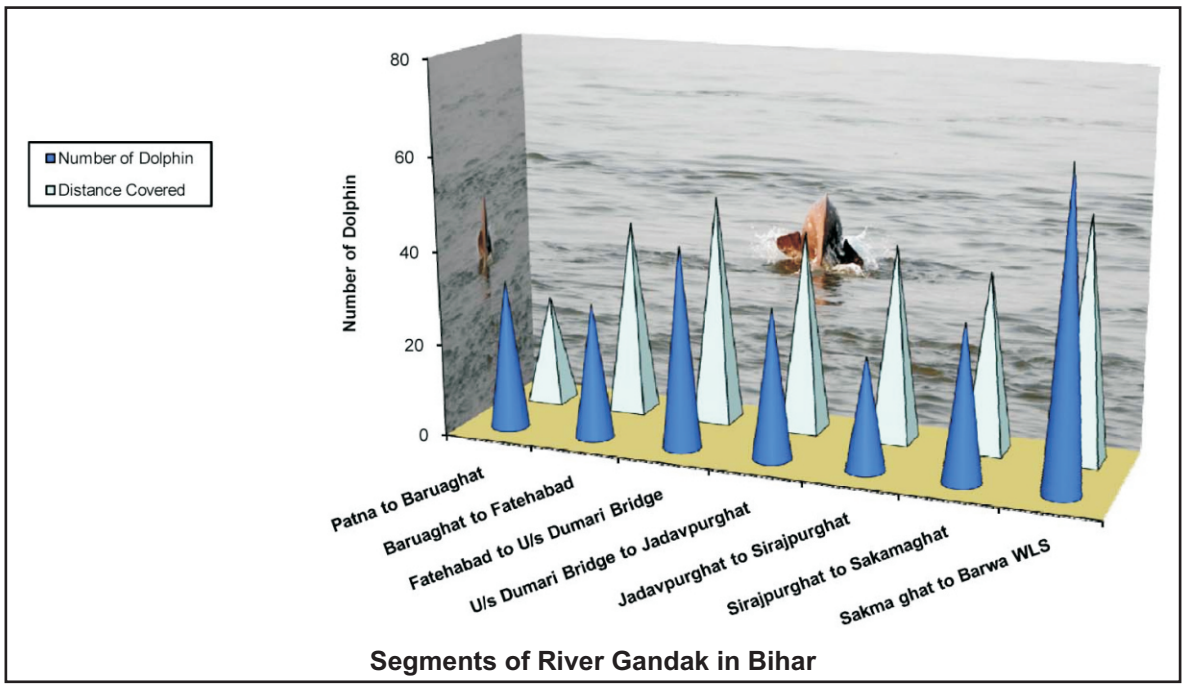


Fig. 4: Graph showing the distribution of dolphin in the different segments of River Gandak in Bihar

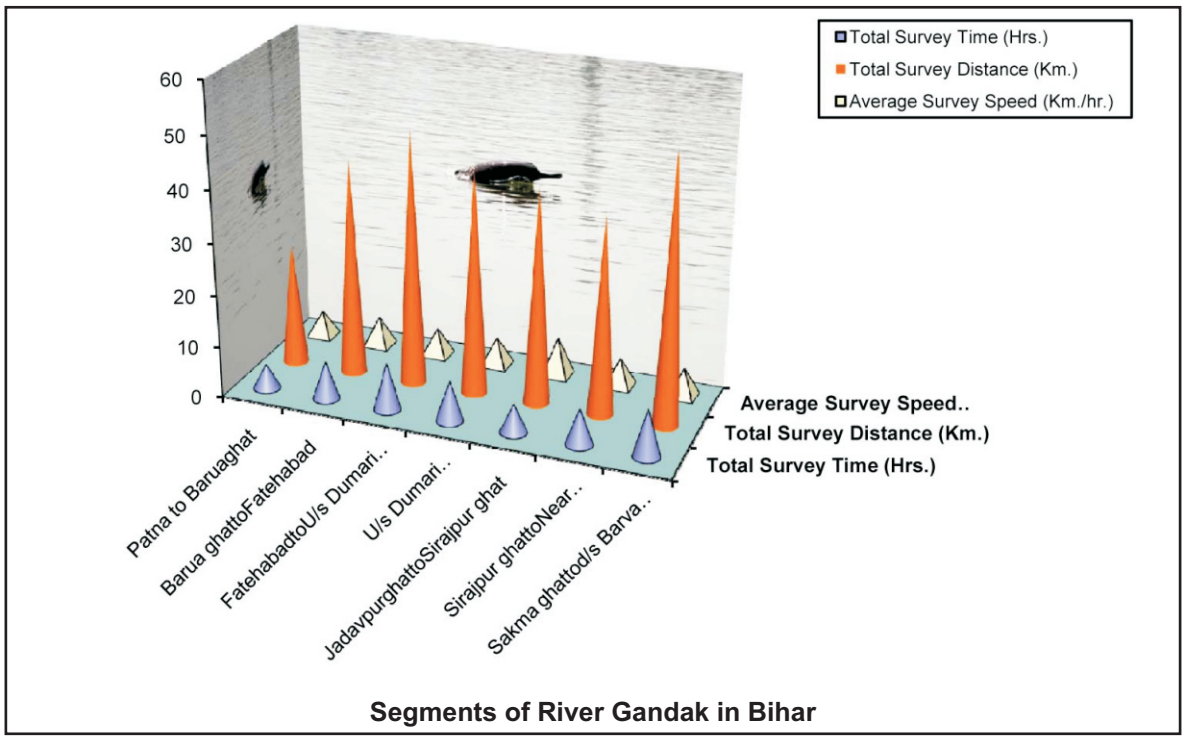


Fig. 5: Survey Time, Survey Distance and Average Survey Speed of the Boat in the River Gandak, Bihar

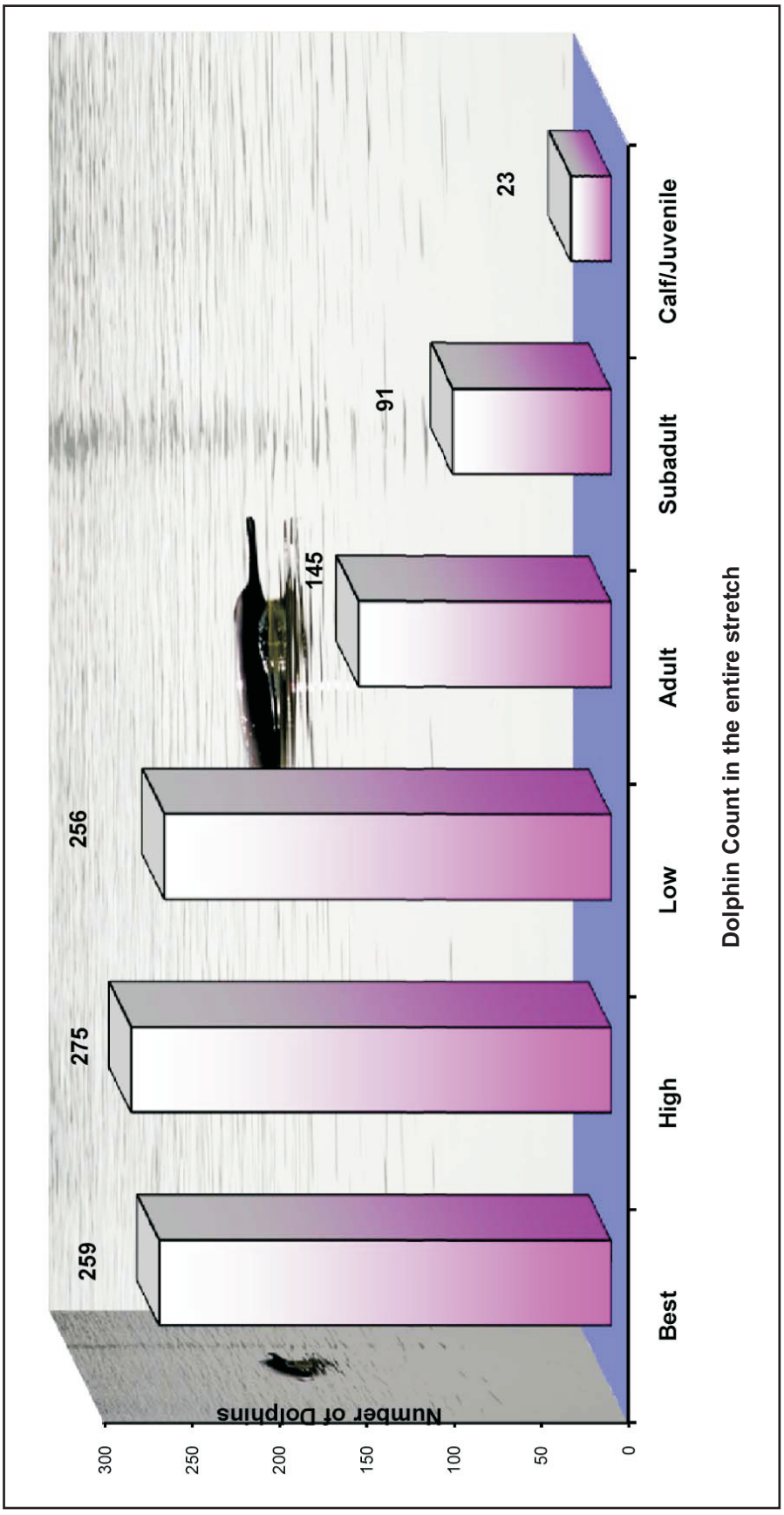


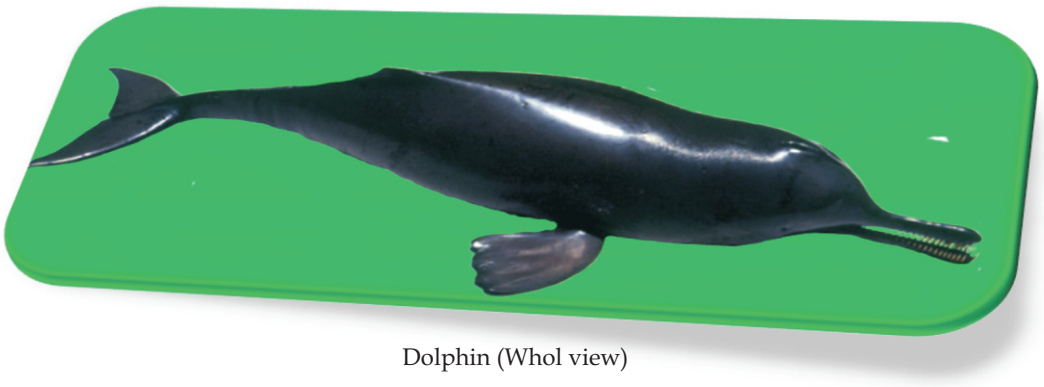
Fig. 6: Dolphin distribution in the entire stretch of River Gandak, Bihar

Gharial *Gavialis gangeticus*
(Gmelin, 1789) eating fish

Perching of Black Kite
Milvus migran, (Boddaert, 1783)

Surfacing of Dolphin in river, Gandak

Turtle (*Aspideretes gangeticus*)
on the bank of river Gandak



Dolphin (Whol view)