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ON THE MORTALITY AND STRANDING OF MARINE MAMMALS AND TURTLES AT GAHIRMATHA, ORISSA FROM 1983 TO 1987*

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ABSTRACT

Observations on the stranded marine turtles and mammals in a stretch of 10 km at Gahirmatha Beach, Orissa during 1983 to 1987 are reported here. The washed ashore marine turtles were due to the result of turtles getting entangled and drowned in fishing operations conducted off Paradip and adjacent area, the carcasses drifting northwards and ashore at Gahirmatha. In 1983 around 7500 olive ridley *Lepidochelys olivacea* were washed ashore and the curved carapace length in cm varied from 51-72 (62.2) and the carapace width in cm varied from 48-63 (57.8). The number of stranded turtles was reduced to 360 in 1987 and this is due to the effective steps taken to enforce the Widlife (Protection) Act by the State Forest Departments. Strandings of Humpback dolphin *Sousa chinensis*, Snubfin dolphin *Orcaella brevirostris* and Finless black propoise *Neophocaena phocoenoides* were also recorded. Mortality of nesting females during *arribada* could have an adverse effect on the breeding population of olive ridley visiting the rookery and consequently on recruitment. A careful study is needed to take preventive and precautionary regulatory measures to be adopted in specific type of fishing operations during the nesting season of olive ridley.

INTRODUCTION

FIVE species of sea turtles are known from the Indian seas and all are at present protected by Schedule I of the Indian Wildlife (Protection) Act, 1972. The Convention of International Trade in Endangered species of Wild Fauna and Flora (CITES) which prohibits trade in turtle products places these species in Appendix I of the convention. The mass emergence or *arribada* of the olive ridley *Lepidochelys olivacea* (Eschscholtz) along the north Orissa Coast, more specifically along the 15 km Gahirmatha Beach has been reported by Bustard (1976), Kar (1980, 1982), Biswas (1982), Kar and Bhaskar (1982), Kar and Dash (1984) and Silas *et al.* (1983, 1984, 1985). The illegal capture and transport of live olive ridley from the nesting beaches of Orissa and West Bengal to Calcutta and other markets have been reported by Bobb (1982) and Ganguly (1980). Incidental catch in fishing gear also accounts for the death of several hundred turtles during their nesting season at Gahirmatha and have been reported by Kar (1980) and Silas *et al.* (1983). Contrary to extensive information available on turtle nesting and conservation, information on the marine mammals along the Indian Coast is restricted to their distribution, strandings and taxonomy. The present paper reports on the mortality and stranding of marine turtles and mammals in a stretch of 10 km at Gahirmatha Beach, in Cuttack District, Orissa during *arribadas* during 1983-1987.

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team to collect data on marine turtles and mammals at Gahirmatha Beach.

Observations

Olive ridley

The Central Marine Fisheries Research Institute's sea turtle research project team visited the Bhitarkanika wildlife sanctuary and specifically Gahirmatha Beach from Habalikhati to Ekkula Nasi to study the nesting beach conditions during January-April every year for a period of five years (1983-1987). During these visits, observations were made on the mass nesting of the olive ridley *L. olivacea*. In addition, to this, data on carapace length and width, plastron length and width and sex of dead olive ridley were collected. For measuring length and width, standard method suggested by Pritchard *et al.* (1983) has been followed. Biological information on the carcasses of mammals washed ashore at Gahirmatha Beach was collected as suggested by James and Soundararajan (1980).

The mortality and stranding of adult *L. olivacea* were caused due to entangling in fishing gears operated from mechanised vessels from Paradip, Dhamra, Talchua and Chandipur fishing harbours and from non-mechanised fishing crafts. In the first week of March 1983, thousands of dead turtles strewn along the stretch of 15 km at Gahirmatha, a true 'grave yard' for turtles, were noticed. The number of dead olive ridley lying on the beach varied from 55 to 150 per hundred metre stretch with an average of about 59 turtles in hundred metre stretch. A rough estimate revealed that 7000 to 7500 olive ridley carcasses along the stretch of 15 km beach were washed ashore. The dead turtles were in different state of decay and their curved carapace length varied from 51-72 cm (62.2 cm) and the curved carapace width varied from 48-63 cm (57.8 cm). In turtles which were freshly washed ashore, deep injuries on head, plastron and carapace were noticed. These injuries were caused by fishermen as the turtle got entangled in their gears. The fishermen in an act to safely recover the net from the entangled turtle, injured the animal.

In 1984, the first mass nesting of olive ridley commenced at Gahirmatha on 25th January and extended upto 6th February. During this 13 days period, about 3 lakhs turtles nested in a stretch of 5 km in the northern sector from Ekkula to Ekkula Nasi. The second *arribada* during 1984 season commenced 60 days after first mass nesting and during the period of 7 days about 2 lakhs turtles emerged for nesting. The number of carcasses of olive ridley washed ashore during 1984 season was 392, of which 24% were identified as males. The sharp decline in the number of carcasses from 7500 in 1983 to 392 in 1984 is due to the stern action taken by the officials of the Forest Department, Government of West Bengal and Orissa in preventing the organised fishing for turtles.

The mass nesting in 1985 was protracted over 16 days from 13-1-1985 to 28-1-1985 with the peak nesting occurring between 16th and 19th January. About 2,87,000 olive ridley nested at Gahirmatha Beach during this period 1985 season, we have observed 694 olive ridley carcasses in different state of decomposition. During 1986, the *arribada* at Gahirmatha occurred from 1st to 10th March and around 48,000 olive ridley emerged for nesting (courtesy : Forest Dept., Govt. of Orissa).

During February 1986, 531 dead turtles were noticed at Gahirmatha (Pl. I A, B). Few of the freshly washed ashore female turtles were cut open and found that the turtles were with fully developed unlaid eggs (Pl. I C, D). During 1987, about 2 lakhs turtles nested from 5th to 14th January in a stretch of 5.7 km in the first mass nesting and again from 6th to 14th March 1987, around 4.02 lakhs olive ridley nested in the second mass nesting in a

stretch of 4.5 km. It was observed about 360 carcasses of olive ridley and numerically this was far lesser than those observed in earlier years.

During 1985-1987, observations were made on the number of dead carcasses of olive ridley by keeping Habalikhati as a base point. The number of dead carcasses in every km in a stretch of 12 km from Habalikhati to Ekkula Nasi were counted and presented in Table 1. During the period, the total number of dead carcasses were maximum near Habalikhati (226). There was a decreasing trend towards northern stretch and at Ekkula Nasi, the number of dead turtles were only 18. The high stranding near Habalikhati is mainly due to intense fishing activity near Paradip which is nearer to Habalikhati.

TABLE 1. *Number of carcasses of olive ridley* L. olivacea *observed at Gahirmatha, Orissa in January-February during* 1985, 1986 *and* 1987

Place	Distance from Habali-khati (Km)	Number of dead Carcasses			Total
		1985	1986	1987	
Habalikhati ..	0—1	102	95	29	226
	1—2	86	53	52	191
	2—3	102	46	37	185
	3—4	106	54	60	220
Ekkula ..	4—5	61	43	27	131
	5—6	44	37	21	102
	6—7	42	51	36	129
	7—8	41	75	7	123
	8—9	48	35	24	107
	9—10	62	42	27	131
	10—11	—	—	22	22
Ekkula-Nasi ..	11—12	—	—	18	18
Total		694	531	360	1585

The percentage frequency of carapace length and width for the olive ridley carcasses observed during 1983-1987 is given in Fig. 1. A higher percentage of olive ridley carcasses were in the size range of 61-65 cm carapace length in 1983 and 1984 and 66-70 cm during 1985-1987. Regarding carapace width, a higher percentage frequency was in the group 56-60 cm in 1983-1984 and 66-70 cm during 1985-87. During 1986 and 1987, measurements were taken separately for female and male and are given in Table 2 and 3. During 1986 the carapace length (SL) of male carcasses (Table 3) varied from 61.5 to 72.0 cm (65.56 cm) and in 1987 it varied from 63.3 to 70.3 cm (66.31 cm). With regard to carapace width (SL) it varied from 54.1 to 62.8 cm (58.52 cm) in 1986 and in 1987 it varied from 54.6 to 59.7 cm (57.41 cm). The variation in the carapace length (SL) of female olive ridley carcasses (Table 2) examined in 1986 were in the size range of 60.7 to 69.5 cm (65.47 cm) and in 1987 it ranged from 62.5 to 70.0 cm (65.52). Regarding

TABLE 2. *Variation in the size (cm) of female olive ridley* L. olivacea *carcasses at Gahirmatha examined during* 1986 *and* 1987 *season*

Year	Parameter	Carapace length (Straight line)	Carapace width (Straight line)	Carapace length (Curved)	Carapace width (Curved)	Plastron length (Straight line)	Plastron width (Straight line)
1986	Range	60.7—69.5	53.8—67.7	64.0—77.0	62.1—72.0	47.0—60.0	45.2—57.8
	Mean	65.47	58.20	67.9	67.0	52.50	50.30
	Carcasses examined	44	44	44	44	32	32
1987	Range	62.5—70.0	53.5—61.5	68.0—75.2	63.1—71.3	47.5—53.5	45.6—57.9
	Mean	65.52	57.15	70.03	66.9	50.31	50.16
	Carcasses examined	50	50	50	50	50	50

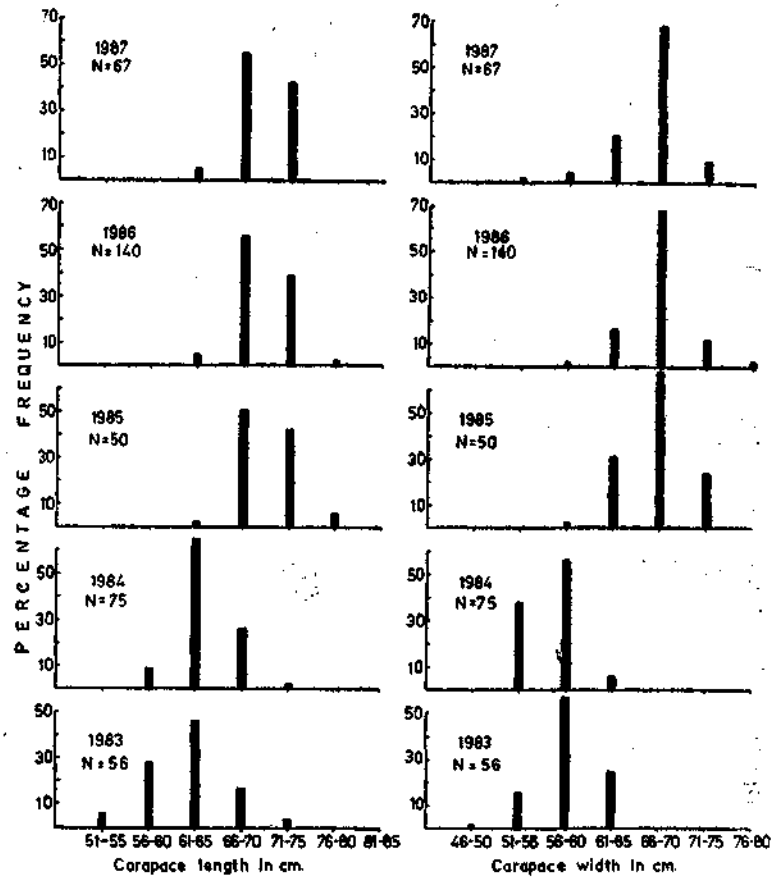

FIG. 1. Percentage frequency of carapace length and width (cm) for adult olive ridley carcasses observed at Gahirmatha, Orissa during 1983-1987.

TABLE 3. *Variation in the size (cm) of male olive ridley* L. olivacea *carcasses at Gahirmatha examined during* 1986 *and* 1987 *season*

Year	Parameter	Carapace length (Straight line)	Carapace width (Straight line)	Carapace length (Curved)	Carapace width (Curved)	Plastron length (Straight line)	Plastron width (Straight line)
1986	Range	61.5—72.0	54.1—62.8	65.0—78.5	64.5—76.0	47.0—53.0	46.1—52.0
	Mean	65.56	58.52	70.04	67.28	49.90	50.00
	Carcasses examined	25	25	25	25	20	20
1987	Range	63.3—70.3	54.6—59.7	68.0—74.0	64.0—73.0	42.5—51.5	47.5—52.5
	Mean	66.31	57.41	70.79	67.70	48.85	50.41
	Carcasses examined	17	17	17	17	17	17

female, carapoe width (SL) it varied from 53.8-67.7 cm (58.20) in 1986 and it varied from 53.5-61.5 (57.15 cm) in 1987.

Marine mammals

Similar to the olive ridley a few marine mammals got entangled in the fishing gears and were hurt by the fishing crafts. The carcasses of these mammals were also washed ashore along with turtles. From 1983 to 1987 a total of 19 dead marine mammals in different states of decay were noticed at Gahirmatha Beach (Table 4). Of the 19 mammals washed ashore, 13 were Humpback dolphin *Sousa chinensis* (Pl. II B) and the carcasses of this species were recorded in all the years except 1987. The details of measurements taken are presented in Tables 5 to 9. During these years, the length from tip of upper jaw to the deepest part of fluke notch of *S. chinensis* ranged from 113-259 cm. In 1986, two carcasses of finless black porpoise *Neophocaena phocoenoides* (Pl. II C) were recorded during February and they were in the size range of 163-180 cm (Table 6). One carcass of Snubfin dolphin *Orcaella brevirostris* (Pl. II D) of the size 201 cm (Table 9) was recorded from Gahirmatha Beach during March 1987. Only on one occasion (16-1-1987) a freshly dead *S. chinensis* (127 cm) was observed (Pl. II A). It was a male specimen and weighed about 30.5 kg. All the possible measurements were taken and are presented in Table 7.

TABLE 4. *Number of marine mammals washed ashore at Gahirmatha, Orissa Coast from 1983 to 1987 during January-March*

Species	1983	1984	1985	1986	1987	Total
Sousa chinensis ..	4	3	2	—	4	13
Orcaella brevirostris ..	—	—	—	—	1	1
Neophocaena phocoenoides	—	—	—	2	2	4
Unidentified (Due to decomposed body parts and without jaws) ..	—	—	—	—	1	1
Total ..	4	3	2	2	8	19

TABLE 5. *Details of carcasses (decomposed) of* S. chinensis *observed at Gahirmatha Beach, Bhitarkanika Wild life Sanctuary, Orissa*

Measurements (cm)		3-3-1983 Specimen			11-2-1984 Specimen				21-3-1985 Specimen	
		No. 1	No. 2	No. 3	No. 4	No. 1	No. 2	No. 3	No. 1	No. 2
Tip of upperjaw to deepest part of fluke notch ..		259.0	243.0	230.0	170.0	220.0	120.0	113.0	162.0	160.0
,, to top of dorsal ..		105.0	76.8	—	80.0	—	—	—	—	—
,, to anterior insertion of flipper (rt) ..		55.0	32.0	—	51.0	54.0	—	—	49.0	42.0
Tooth-count	Rt upper ..	22	—	31	32	32	28	32	30	33
	Rt lower ..	19	—	32	25	32	27	30	32	31
	Lt upper ..	27	—	—	—	—	—	—	—	—
	Lt lower	23	—	—	—	—	—	—	—	—

PLATE I A. Carcasses of olive ridley at Gahirmatha seen during 1986; B. Close up view of a carcass and C-D. Carcass of olive ridley with unlaid eggs.

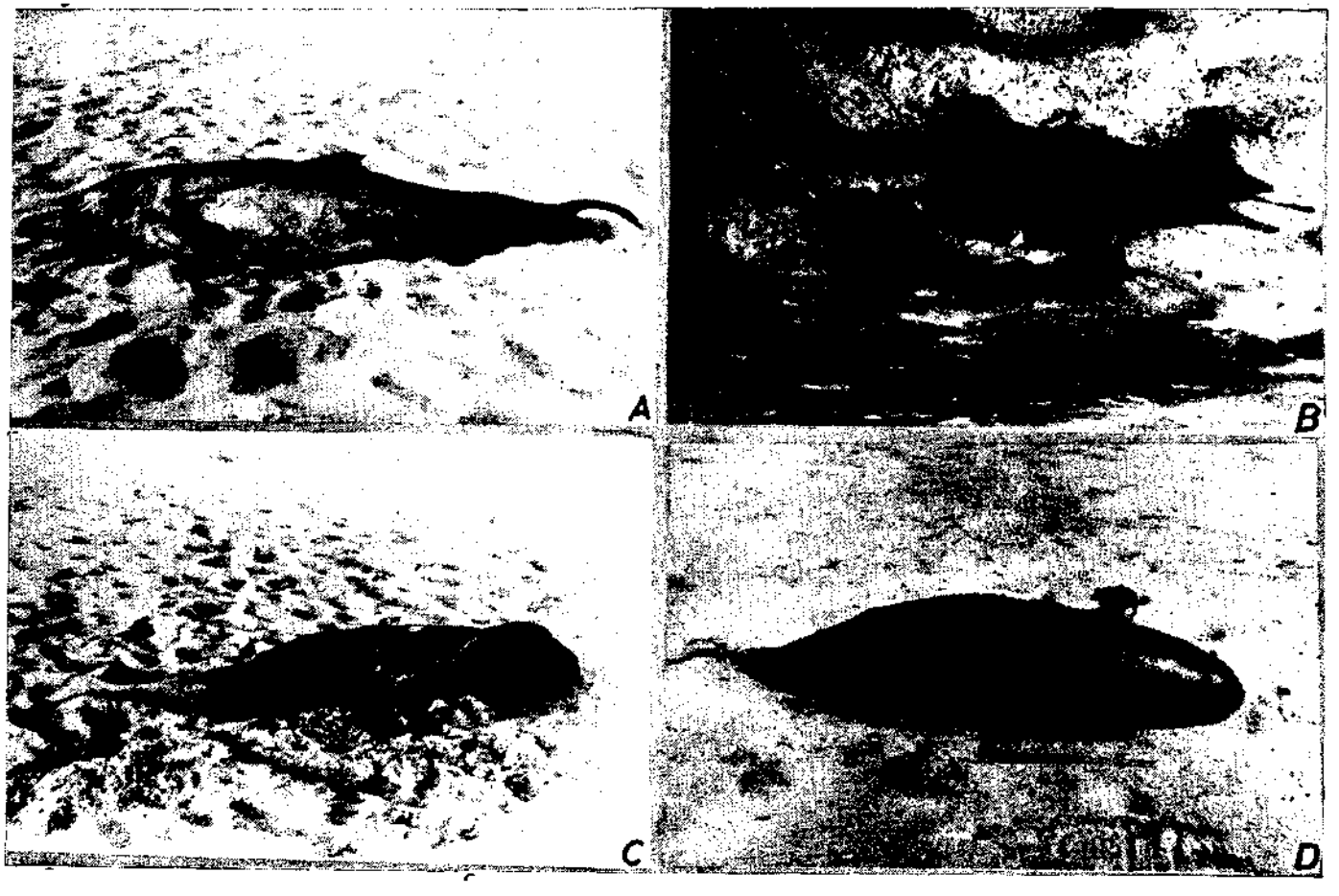

PLATE II A. Freshly washed ashore Humpback dolphin *Sousa chinensis* at Gahirmatha in January 1987 ; B. Carcass of *S. Chinensis* at Gahirmatha in March 1987 ; C. Carcass of Finless black porpoise *Neophocaena phocoenoides* at Gahirmatha in February 1986 and D. Carcass of Snubfin dolphin *Orcaella brevirostris* at Gahirmatha in March 1987.

TABLE 6. *Details of two carcasses of* Neophocaena phocoenoides *obesrved at Gahirmatha Beach, Bhitarkanika Wildlife Santuary, Orissa on* 4-2-1986

Measurements (cm)	No. 1	No. 2
Tip of upper jaw ,, to deepest part of fluke notch ..	180	163
,, to anterior insertion of flipper (rt)	42.5	36
,, to centre of eye ..	9.5	7.0
Flipper length ..	33.0	17+
Tooth count		
Rt upper ..	—	—
Rt lower ..	—	—
Lt upper ..	17	10+
Lt lower ..	15	12+
Condition ..	Decomposed	Decomposed

REMARKS

Large scale mortality of nesting females of *L. olivacea* during *arribada* could have an adverse effect on the breeding population and thereby the total stock. The mortality of olive ridley *L. olivacea* and marine mammals in the incidental catch is caused due to entanglement in the fishing gears. Thanks to the stringent measures taken by the Forest officials of Orissa and West Bengal State Governments, the mortality of olive ridley declined from 7500 in 1983 to 392 in 1984. However mortality has not reduced since 1984

TABLE 7. *Details of freshly stranded male Humpback dolphin* Sousa chinensis (30.5 kg) *observed at Gahirmatha, Orissa on 16th January* 1987

Details	Straightline parallel to the body axis (cm)	Point to point (cm)
Tip of upper jaw to deepest part of fluke notch ..	127	137
,, to centre of anus ..	97	99
,, to centre of genital slit ..	70	78
,, to end of ventral grooves ..	45	46
,, to top of dorsal fin ..	78.5	82
,, to anterior insertion of flipper (rt) ..	38	39
,, to centre of blow hole ..	22.7	25.5
,, to centre of eye (rt) ..	23.7	23.8
,, to angle of gape ..	20.3	24.0
Rostrum (maximum width) ..	5	8
Projection of lower jaw beyond upper ..	1	—
Length of eye (rt) ..	1.6	—
Centre of eye to angle of gape (rt) ..	4.0	—
Centre of eye to angle of gape (left)	4.2	—
Blowhole length ..	1.5	—
Blowhole width ..	2.5	—
Flipper length		
(*a*) tip to anterior insertion (rt) ..	22.0	22.2
(*b*) tip to anterior insertion (lt) ..	22.5	23.0
Dorsal fin height ..	11.5	11.5
Dorsal fin base ..	28.5	28.5
Fluke span ..	32.0	—
Notch of flukes to centre of anus ..	42.0	43.0
Notch of flukes to centre of genital aperture ..	60.0	61.5
Girth at anus ..	—	46.0
Girth at eye ..	—	59.0
Tooth count : Rt upper — 33		
Rt lower — 29		
Lt upper — 33		
Lt lower — 28		
Genital slit length ..	12.5	—
Anal slit length ..	3.5	—

Colour : Dorsal dark grey, ventral greyish white, caudal dark grey and flipper dark grey.
Remarks : Since the specimen was freshly washed ashore, it was cut open and examined. Weight of intestine, lungs, stomach, pancreas, kidney, heart, liver, testis taken.
Parasites : Nil. *Gut* : Empty.

TABLE 8. *Details of four carcasses of marine mammals in different states of decomposition observed at Gahirmatha, Orissa on 16th January 1987*

Measurements (cm)	*S. chinensis*		*N. phocoenoides*	
	No. 1	No. 2	No. 1	No. 2
Tip of upper jaw				
,, to deepest part of fluke notch ..	99.85+	201.0	165.0	160.0
,, to top of dorsal ..	—	105.0	—	—
,, to anterior insertion of flipper (rt)	37.5	—	38.0	37.0
,, to centre of eye ..	24.0	—	18.0	18.0
,, to angle of gape ..	20.0	—	14.3	13.0
Rostrum (max. width) ..	—	—	18.5	7.5
Projection of lower jaw beyond upper ..	—	—	2.5	3.0
Length of eye ..	1.7	—	3.2	3.5
Blowhole length ..	—	—	—	—
Blowhole width ..	—	—	—	—
Flipper length tip to anterior insertion	Damaged	Damaged	—	—
Dorsal fin height ..	—	12.3	—	—
Dorsal fin base ..	—	29.1	—	—
Tooth count Rt upper ..	30	31	17	—
Rt lower ..	30	—	11+	10
Lt upper ..	31	31	17	10+
Lt lower ..	30	—	13+	—

TABLE 9. *Details of three carcasses of marine mammals in different state of decomposition observed at Gahirmatha, Orissa on 7.3.1987 and 8.3.1987*

Measurements (cm)	*S. chinensis*	*O. brevirostris*	Specimen No. 3
Tip of upper jaw			
,, to deepest part of fluke notch ..	188.0	201.0	142.0
,, to top of dorsal ..	—	121.0	—
,, to anterior insertion of flipper (rt)	52.5	36.0	—
,, to centre of eye ..	33.0	11.5	—
,, to angle of gape ..	29.0	9.0	—
Rostrum (max width) ..	—	—	—
Projection of lower jaw beyond upper ..	2.0	—	—
Length of eye ..	2.9	3.0	—
Blowhole length ..	3.5	4.0	—
Blowhole width ..	1.2	1.0	—
Flipper length (tip to anterior insertion) ..	23.0	21.0	—
Dorsal fin height ..	—	6.0	—
Dorsal fin base	—	17.5	—
Fluke span ..	42.0	56.0	—
Notch of fluke to anus (centre) ..	94.0	62.0	—
Girth at anus ..	94.0+	77.0	—
Girth at eye ..	68.0+	64.0	—
Tip of lower jaw to genital opening ..	112.0	109.0	—
Tooth Count Rt upper ..	34	13	—
Rt lower ..	32	13	—
Lt upper ..	33	11	—
Lt lower ..	32	12	—

and hence effective management and conservation policies may be seriously considered to further reduce the mortality of olive ridley as well as marine mammals. The Forest and Fisheries Department, Government of Orissa and West Bengal may enforce restriction in the fishing activity during *arribada* seasons which will prevent large scale killing of the nesting population. Fishermen may also be advised to haul their fishing gears (especially trawl and gill nets) in frequent intervals during the nesting season so that the entangled turtles and marine mammals, if any, may be released to increase the chances of their survival. Another possibility is the introduction of ' turtle excluder net ', which has been developed in the U.S.A. for shrimp trawling ; in this device, the entangled turtles are allowed to escape and the shrimps are retained in the cod end. Attempts can be made off Gahirmatha with similar design trawl nets to ascertain its efficiency in allowing the turtles to escape.

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