

**OBSERVATIONS ON MASS NESTING OF THE OLIVE RIDLEY
LEPIDOCHELYS OLIVACEA AT GAHIRMATHA, ORISSA DURING THE 1987 SEASON ***

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ABSTRACT

Observations made during the 'arribadas' or mass nesting of the Olive ridley *Lepidochelys olivacea* during 1987 at Gahirmatha rookery, Orissa are reported. The first mass nesting occurred in a stretch of 5.7 km from 5th to 14th January and two lakhs turtles nested. During the second mass nesting in a stretch of 4.5 km from 5th to 14th March four lakhs turtles nested. Hatchlings of first mass nesting batch emerged after 60 days of incubation in March 1987 and the percentage of live hatchlings emerged from the natural nests varied from 63.25 to 98.66 (87.72). The mean carapace length in mm from 20 clutches examined varied from 40.2 to 42.8 and carapace width varied from 32.7 to 34.5. The mean weight in gm of the hatchlings varied from 14.75 to 19.10. The emergence of hatchlings of second mass nesting noticed after an interval of 50 days in May 1987 and the mean percentage of live hatchlings emerged varied from 17.95 to 90.38 (54.34). The mean carapace length in mm from 65 clutches examined varied from 36.48 to 42.85 and the carapace width varied from 27.69 to 34.06. The mean weight of hatchlings in gm varied from 13.6 to 18.6 gm. The hatchling success of first and second mass nesting occurred in 1987 at Gahirmatha was compared and the high percentage of spoilt and unfertilized eggs and dead hatchlings was observed in second mass nesting batch.

INTRODUCTION

THE INTERESTING phenomena of 'arribada' or mass emergence of the Olive ridley *Lepidochelys olivacea* along the northeast coast of India, more specifically along the Gahirmatha Beach, Bhitarkanika Wildlife Sanctuary, Orissa have been reported by Bhaskar (1981), Biswas (1982), Bustard (1976), Bustard and Kar (1981), Davis and Bedi (1978), Kar (1982), Kar and Bhaskar (1982), Kar and Dash (1984), Silas *et al.* (1983, 1984, 1985 a, b), Whitaker (1984) and Whitaker and Kar (1984). The present paper deals with the observations made during first and second mass nesting in 1987 which occurred in January and March at Gahirmatha. This study was undertaken to

compare the mass nesting during 1987 with that of the previous years, 1976-1987.

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FIRST MASS NESTING

The first mass nesting in 1987 at Gahirmatha was extended over a period of 10 days from 5-1-'87 to 14-1-'87. On 5th January, about 6,000 turtles emerged for nesting. The nesting intensity increased to about 40,000 on 8th January '87 and decreased thereafter. It is estimated that about 2 lakhs turtles would

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have emerged for nesting. The occurrence of 'arribadas' at Gahirmatha in relation to phases of the moon was earlier reported (Silas *et al.*, 1983). During 1983, 1984 and 1985 the

TABLE 1. Details of estimated number of nesting females during 'arribadas' at Gahirmatha from 1976 to 1987 season

Year	Estimated number of nesting females	Source
1976	1,50,000	Kar and Bhaskar, 1982
1977	1,50,000	"
1978	2,00,000	"
1979	1,30,000	"
1980	2,00,000	Orissa State Forest Department Report
1981	2,00,000	"
1982	176	"
1983	2,00,000	Silas <i>et al.</i> , 1983
1984	5,00,000	Silas <i>et al.</i> , 1985 a
1985	2,87,000	Silas <i>et al.</i> , 1985 b
1986	48,000	Orissa State Forest Department Report
1987	6,02,000	Present paper

first 'arribada' commenced in close correlation with the phase of the moon (one week from full moon). However in 1987, the first 'arribada' commenced one week after new moon. The first mass nesting at Gahirmatha beach occurred in a stretch of 5.7 km from Ekkula to Ekkula Nasi with the peak intensity in the stretch of 2 km south of Ekkula Nasi where the Ranahansua-Patsala River enters the sea. Similar observation of intense first mass nesting near Ekkula Nasi was observed earlier in 1984 (Silas *et al.*, 1984). During 1987 the carapace length (curved) of nesting females varied from 66 to 76 cm (70.8) and carapace length (straight line) varied from 61 to 71 cm (65.9) in the first mass nesting. Regarding carapace width (curved), it ranged from 60.5 to 75.0 cm (68.8) and carapace width (straight line) varied from 5.30 to 65.5 cm (57.6) (Table 4). Clutch size varied from 96

to 144 (119). During 1985 (Silas *et al.*, 1985 b) the clutch size varied from 97-128 (113) in the first mass nesting. The depth of the nest varied from 45-59 cm (49.2) which is comparable to the observations (49.5 cm) made in the first mass nesting season in 1985. The ambient atmospheric temperature at night was 19.0-22.5°C (20.6) and the nest temperature ranged from 24.5 to 26.0°C (25.5).

TABLE 2. Details of nesting females during second 'arribada' at Gahirmatha in 1987 season

Dates	Estimated number of nesting females
6-3-1987	53
7-3-1987	84
8-3-1987	23,450
9-3-1987	44,360
10-3-1987	1,37,735
11-3-1987	1,13,640
12-3-1987	70,480
13-3-1987	12,350
14-3-1987	20
Total 4,02,172	

During January '87, about 360 carcasses of olive ridley were washed ashore at Gahirmatha in different state of decomposition in a stretch of 11.7 km. The mortality of olive ridley was due to entanglement in the fishing gears especially trawl net and gill net. During 1985 and 1986, it was estimated that 694 and 531 carcasses of olive ridley were washed ashore. The decreasing trend in the number of stranded carcasses off Gahirmatha Beach over the 3 year period was due to the effective steps taken by the Orissa and West Bengal State Forest Department in preventing the illegal capture and trade of sea turtles (James *et al.*, 1988).

In the ten clutches examined the diameter of the egg varied from 33.4 to 39.8 mm (36.7) and the weight ranged from 20.4-39.0 gm (31.1) (Table 3). During the observations made

at Gahirmatha in 1985 the mean diameter of the egg was 37.5 mm and mean weight was 31.3 gm which is similar to the present observation.

TABLE 3. Variation in the diameter and weight of eggs of olive ridley from 10 clutches (mean in parenthesis) at Gahirmatha examined in 1987 season (ten eggs were taken at random from each clutch)

First mass nesting January 1987		Second mass nesting March 1987	
Diameter (mm)	Weight (gm)	Diameter (mm)	Weight (gm)
36.5-39.3 (37.7)	33.0-37.0 (33.8)	36.0-39.1 (37.5)	30.0-33.0 (31.0)
33.4-37.8 (35.8)	29.0-31.0 (29.4)	37.1-40.1 (38.7)	31.0-37.0 (34.5)
35.1-36.8 (35.6)	29.0-30.0 (29.4)	36.2-40.9 (38.3)	29.0-40.6 (32.6)
35.3-38.3 (36.8)	30.0-32.0 (33.8)	37.0-38.6 (37.7)	30.0-36.0 (32.9)
37.3-38.5 (38.0)	33.0-35.0 (33.8)	34.8-39.2 (38.4)	32.0-36.0 (33.1)
35.4-36.9 (36.1)	29.0-30.0 (29.9)	35.0-40.0 (37.7)	30.0-42.0 (34.9)
34.4-36.9 (36.0)	27.0-30.0 (27.8)	37.3-40.7 (38.9)	34.0-40.0 (36.8)
36.4-39.8 (38.0)	35.0-39.0 (36.8)	35.6-43.7 (37.9)	30.0-35.0 (32.8)
34.4-37.7 (36.0)	24.0-28.0 (26.2)	35.0-38.6 (36.7)	28.0-32.0 (29.6)
36.7-38.1 (37.4)	27.0-31.0 (29.3)	36.4-42.0 (38.4)	30.0-38.0 (33.9)
N = 100	100	100	100
R = 33.4-39.8	24.0-39.0	34.8-43.7	28.0-42.0
M = 36.7	31.1	38.0	33.2

EMERGENCE OF HATCHLINGS IN MARCH 1987

The hatchlings emerged in March 1987 after an interval of sixty days from mass nesting.

Data on the number of eggs laid, live hatchlings emerged successfully from the pit, those in pipping stage, dead hatchlings in the pit, those dead in pipping stage and spoilt and unfertilized eggs were observed and the details were gathered (Table 6). The percentage of live hatchlings emerged from natural varied from 63.3 to 98.7 with an average of 87.7. The percentage of live hatchlings in pipping stage observed in March 1987 varied from 0.69-39.25 with an average of 11.9%. The percentage of dead hatchlings and dead hatchlings in pipping stage varied from 0.69 to 5.05 (1.9) and 0.66-4.27 (2.0) respectively. With regard to spoilt and unfertilized eggs, it varied from 0.69 to 16.67 (4.9). The present observation of 87.7 per cent hatching success of olive ridley is comparable with the earlier observations made by the CMFRI team at Gahirmatha. During 1984 and 1985, about 74.5 and 89.7% of hatching success were observed. In the turtle hatchery at Kovalam, Madras (Silas and Rajagopalan, 1984), the hatching success was about 66% which is less than the hatching success of 74.5, 89.7 and 87.7% observed in 1984, 1985 and 1987 respectively at Gahirmatha.

The second mass nesting coincided with the emergence of hatchlings of first 'arribada'. The hatchling emergence commenced on 5th March with emergence from 44 nests and increased to 10,000 on 8th March. Due to the coincidence of second mass nesting and emergence of hatchlings heavy destruction of hatchlings and developing embryos were noticed. Predation of hatchlings by sea gulls and crows was also observed (Pl. II C, D). Large number of dead hatchlings were seen along the beach mostly remains of those killed by birds.

SECOND MASS NESTING

The second mass nesting at Gahirmatha commenced after a period of two months from the first mass nesting. The second 'arribada' commenced with 53 turtles emerging on the

night of 6.3. '87 and intensity increased steeply and on the nights of 10th and 11th, around 1.3 and 1.1 lakhs of olive ridley emerged for nesting. The intensity suddenly reduced and on 14th March only 20 turtles emerged for nesting. Unlike the previous years, a very high concentration (Pl. I A-D) of 4,02,172 turtles emerged for nesting for a period of 9 days from 6-3-1987 in the second mass nesting (Table 2). Kar and Dash (1984) observed that the first 'arribada' is very extensive every year when compared to the second one. During March 1984, in the first mass nesting about 3 lakhs in 13 days and in second mass nesting in March '84 about 2 lakhs in 7 days came to the shore for nesting at Gahirmatha

ridley nested and second 'arribada' did not occur in that year. Such an intensive nesting as in 1987 (4 lakhs) during any 'arribada' has not been reported at Gahirmatha. The total nesting females for both the mass nestings in 1987 is estimated to be about 6 lakhs (Table 4). The reason for the low and high intensity is not clearly understood and there is a need to critically study the deviation with precise estimates to be evolved for Gahirmatha Turtle Rookery. The heavy concentration of nesting females posed many problems. There was an overlap of nesting in a stretch of 2 km and hence the emerging hatchlings of first mass nesting was destroyed. Data have been collected on the

TABLE 4. Details of first and second 'arribadas' of 1987 season at Gahirmatha

Parameter	1987	
	First 'Arribada'	Second 'Arribada'
Estimated nesting females (No)	200,000	402,000
Area of nesting (km)	5.7	4.5
Duration of nesting (days)	10 (5.1.1987-14.1.1987)	9 (6.3.1987-14.3.1987)
Size of nesting females :		
(a) Carapace length (cm) Curved	66.0-76.0 (70.8)	67.0-76.0 (71.9)
(b) Carapace width (cm) "	60.5-75.5 (68.8)	64.5-75.5 (70.0)
(c) Carapace length (cm) Straight	61.0-71.0 (65.9)	57.6-73.0 (65.6)
(d) Carapace width (cm) "	53.0-65.5 (57.6)	53.0-64.5 (57.6)
Depth of nest (cm)	45-59 (49.2)	38-52 (47.1)
Nest temperature (°C)	24.5-26.0 (25.5)	29.5-30.2 (30.0)
Ambient atmospheric temperature at night (°C)	19.0-22.5 (20.6)	26.0-27.2 (26.5)
Clutch size (cm dia)	96-144 (119)	69-160 (120)
Distance of pit from highwater mark (m)	6-59 (30.7)	3-27 (12.9)
Incubation period (days)	60	50
Mean percentage of hatching success	87.7	54.4

(Silas *et al.*, 1984, 1985 a). During 1985 the first 'arribada' occurred in January and about 2.8 lakhs nested and in March a mini 'arribada' occurred with emergence of 8,000 nesting females (Silas *et al.*, 1985 b). In 1986, a different pattern was noticed with a delayed occurrence of first 'arribada' in March and during 1st to 10th March about 48,000 olive

measurements of 100 nesting females and the carapace length (curved) and carapace length (straight) varied from 67.0-76.0 cm (71.9) and 57.6-73.0 cm (65.6) respectively (Table 4). These measurements are comparable with the turtles observed during first mass nesting in January 1987. We have no precise information about the re-nesting during second season, but the

similar size frequency of animals was generally observed, pointing to a definite possibility of the females nesting in the first 'arribada' also re-nesting during second 'arribada' season at Gahirmatha. During the observations it was noticed few abnormal olive ridley emerged for nesting (Silas *et al.*, 1984).

Weight of individual egg from 65 clutches were taken during the second mass nesting. The eggs were cleaned and mucus and sand were wiped off before weighing in a balance. The mean weight of egg varied from 28.0-42.0 gm (33.2). The mean diameter of the egg varied from 34.8-43.7 mm (30.0) (Table 3). The diameter and weight of individual egg collected from the second mass nesting batch is comparable to the first mass nesting batch and no significant variability was noticed (Table 3).

size varied from 69-160 (120) which is comparable with the observations made by the authors during first mass nesting, 96-144 (119). In the 1985 season, the average clutch size in the first and second mass nesting was 113 and 136 respectively. In the 1984 season, during first mass nesting the clutch size varied from 70-159 and in second mass nesting it was 74-160 (Silas *et al.*, 1984). The clutch size data collected from Gahirmatha are comparable with those of the earlier observations made by Silas *et al.* (1984) at Kovalam, Tamil Nadu from 23 nests.

Kar and Dash (1984) and Silas *et al.* (1984, 1985 a, b) have reported about the phenomena of beach erosion at Gahirmatha every year. As observed in 1984 and 1985 season, during 1987 season also the erosion of the sea beach

TABLE 5. Variation in the size (mm) and weight (gm) of olive ridley hatchlings at Gahirmatha observed during first and second 'arribada' in the 1987 season (mean in parenthesis)

Period	Carapace length	Carapace width	Plastron length	Plastron width	Weight
1987 First 'Arribada' hatchlings	40.01-42.84 (41.55)	32.70-34.51 (33.0)	31.69-33.99 (32.70)	28.63-30.20 (29.45)	14.75-19.10 (17.35)
1987 Second 'Arribada' hatchlings	36.48-42.85 (40.49)	27.69-34.06 (31.51)	29.59-33.86 (32.18)	25.91-30.14 (28.01)	13.60-18.60 (16.67)

We have collected information on the depth of the nest and it varied from 38.0 to 52.0 cm (47.0) and during January 1987, the average depth was about 49.0 cm. With regard to nest temperature, there was a wide variation between the first and second 'arribada'. The nest temperature during nights in March 1987 showed variation from 29.5 to 30.2°C (30.0), while in January 1987, it varied from 24.5 to 26.0°C (25.5). In view of the higher temperature, the second mass nesting hatchlings emerged and entered into sea (Pl. II A, B) after a period of 50 days while the first mass nesting hatchlings emerged after 60 days of incubation. During the second mass nesting, the clutch

was noticed after the completion of first mass nesting and during the time of second mass nesting resulting in the heavy damage of the eggs laid during 'arribadas' (Pl. III C, D). Due to erosion the distance of the pit in the nesting area from highwater mark in the second mass nesting varied from 3 to 27 m, (12.9) while during first mass nesting the distance varied from 6 to 59 m (30.7).

EMERGENCE OF HATCHLINGS IN APRIL - MAY 1987

The CMFRI sea turtle project team was able to reach Gahirmatha despite rough weather

conditions that prevailed in April-May 1987 and collected data on the conditions prevailed during the second 'arribada' hatchling emergence. For the first time it was possible to collect such information during the second 'arribada'.

Observations were made on the hatching success from nests in the area of 4.5 km of the beach from 26-4-1987 to 1-5-1987. The percentage of live hatchlings emerged varied from 17.95 to 90.38 (54.34) and that of the spoilt and unfertilized eggs varied from 1.51 to 76.47 (23.21). The percentage of dead hatchlings in pipping stage varied from 1.85 to 55.28 (18.0) and the percentage of dead hatchlings varied from 0.67 to 15.86 (3.8). The hatching success of 54.3% in 1987 second 'arribada' was poor when compared to 87.7% observed during first 'arribada'. About

7 to 10 cm depth which also prohibited easy emergence of hatchlings and entry into sea. It was observed in many nests that the hatchlings have made efforts to emerge from more than one outlet due to the compressed sand crest prevailed in the surface. In this process there was a mortality of hatchlings due to exhaustion in making horizontal movement and as a result many hatchlings were found dead either in half emerging condition or just at the exit point.

About 20 hatchlings were randomly collected from individual nests and 65 clutches have been examined (Table 5). The mean carapace length of the 65 clutches ranged from 36.48 to 42.85 mm (40.49) and the carapace width varied from 27.69 to 34.6 mm (31.51). Regarding the plastron length it ranged from 29.59-33.86 mm (32.18) and plastron width

TABLE 6. Comparative account of hatching success during first and second mass nesting (mean values are given in parenthesis)

Year	Live hatchlings emerged	Living hatchlings in pipping stage	Dead hatchlings	Dead hatchlings in pipping stage	Spoilt and unfertilized eggs
First 'Arribada' March 1987	63.25-98.66 (87.7)	0.69-39.25 (11.9)	0.69-5.05 (1.9)	0.66-4.27 (2.0)	0.69-16.67 (4.9)
Second 'Arribada' April/May 1987	17.95-90.38 (54.3)	0.65-12.15 (2.7)	0.67-15.86 (3.8)	1.85-55.28 (18.0)	1.51-76.47 (23.2)

18 and 23% of dead hatchling in pipping stage and spoilt and unfertilized eggs were noticed during May 1987 in second 'arribada', while during first 'arribada' only 2.0 and 4.9% were observed (Table 6). There are two obvious reasons for poor hatchability during second 'arribada'. Firstly, squally winds in the shore area created accretion of excess sand over the nests thereby increasing the depth of the pits which prevented easy emergence of hatchlings from nests. Secondly, intermittent summer rain hardened the surface layer of the sand upto

varied from 25.91-30.14 mm (28.01). Weight was also taken for 65 clutches and it ranged from 13.60 to 18.60 gm (16.67). When compared to hatchlings of first 'arribada' there is a variability noticed in the carapace and plastron width and this might be due to the reason that hatchlings of second 'arribada' were subjected to be in the compressed layer of sand.

The erosion of the beach (Pl. III A, B) especially in the nesting area of second mass

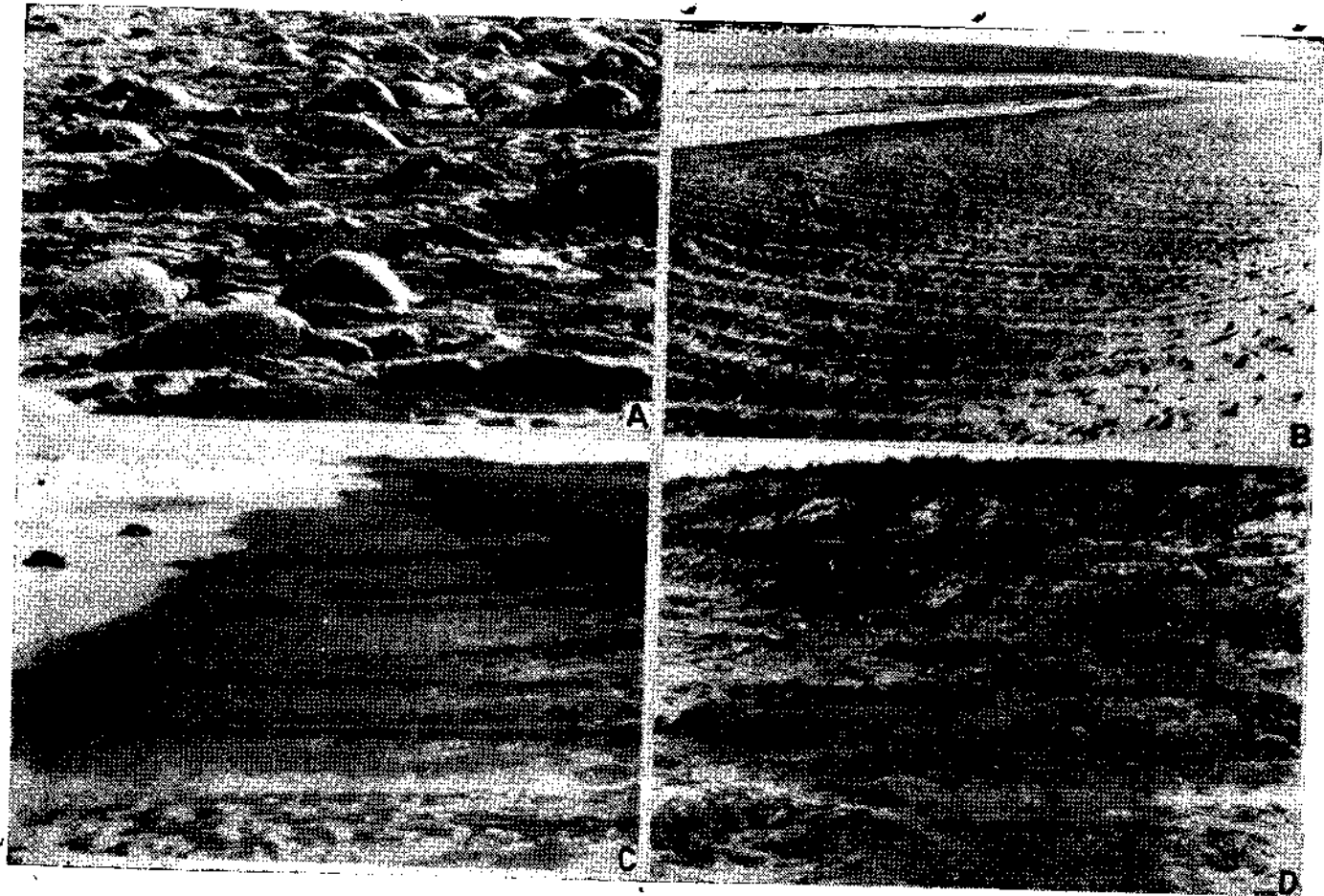


PLATE I A. Olive ridley nesting during 1987 (second 'arribada') at Gahirmatha, B. Tracks of olive ridley during peak 'arribada' in March 1987 at Gahirmatha, C. Olive ridley returning to sea after nesting in the early hours of the day and D. Olive ridley nesting near the sand dune during 'arribada'.

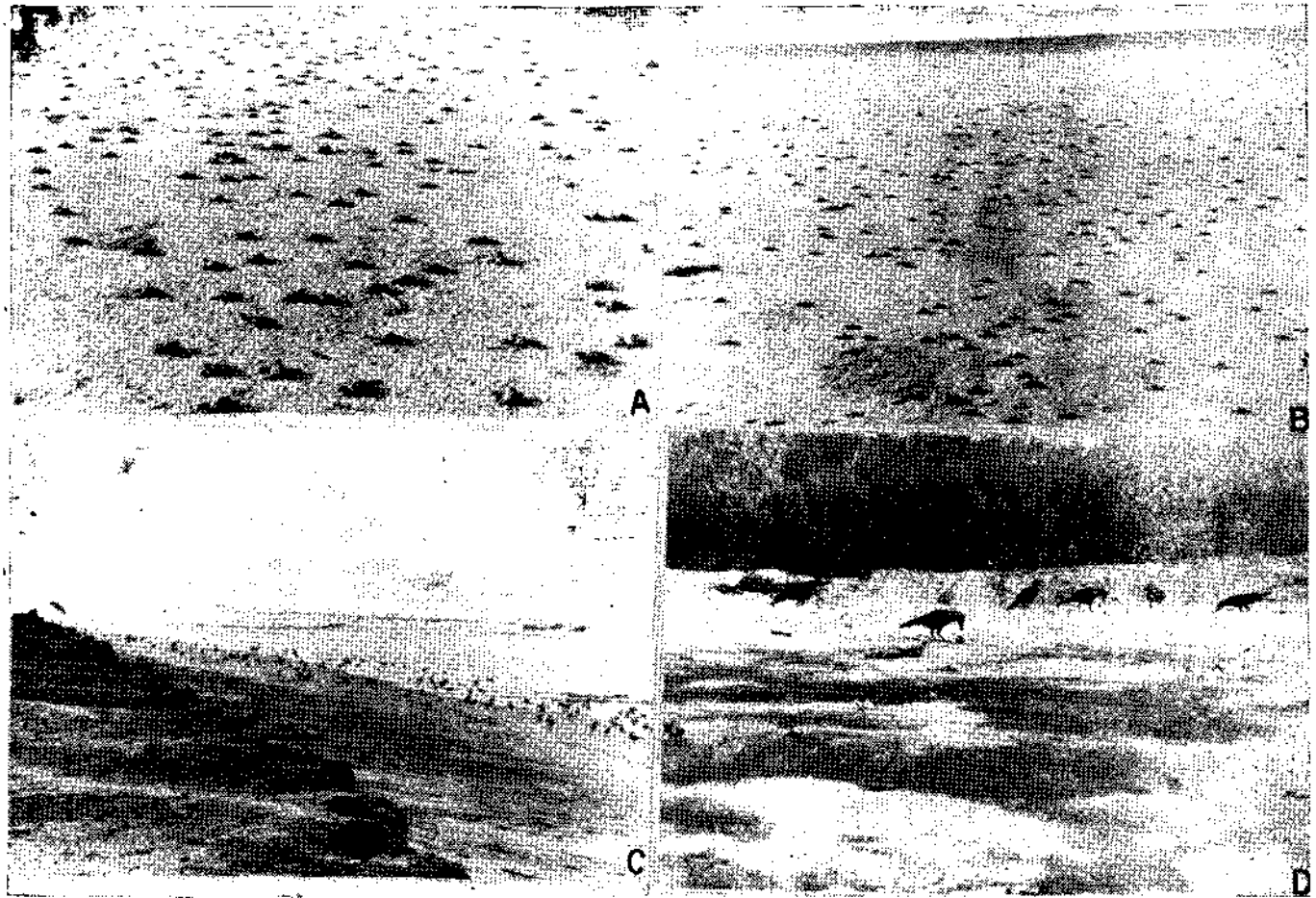


PLATE II A, B. Olive ridley hatchlings entering into sea at Gahirmatha, C. Sea gulls predated on hatchlings during early hours of the day at Gahirmatha and D. Crows predated the hatchlings near the nests.

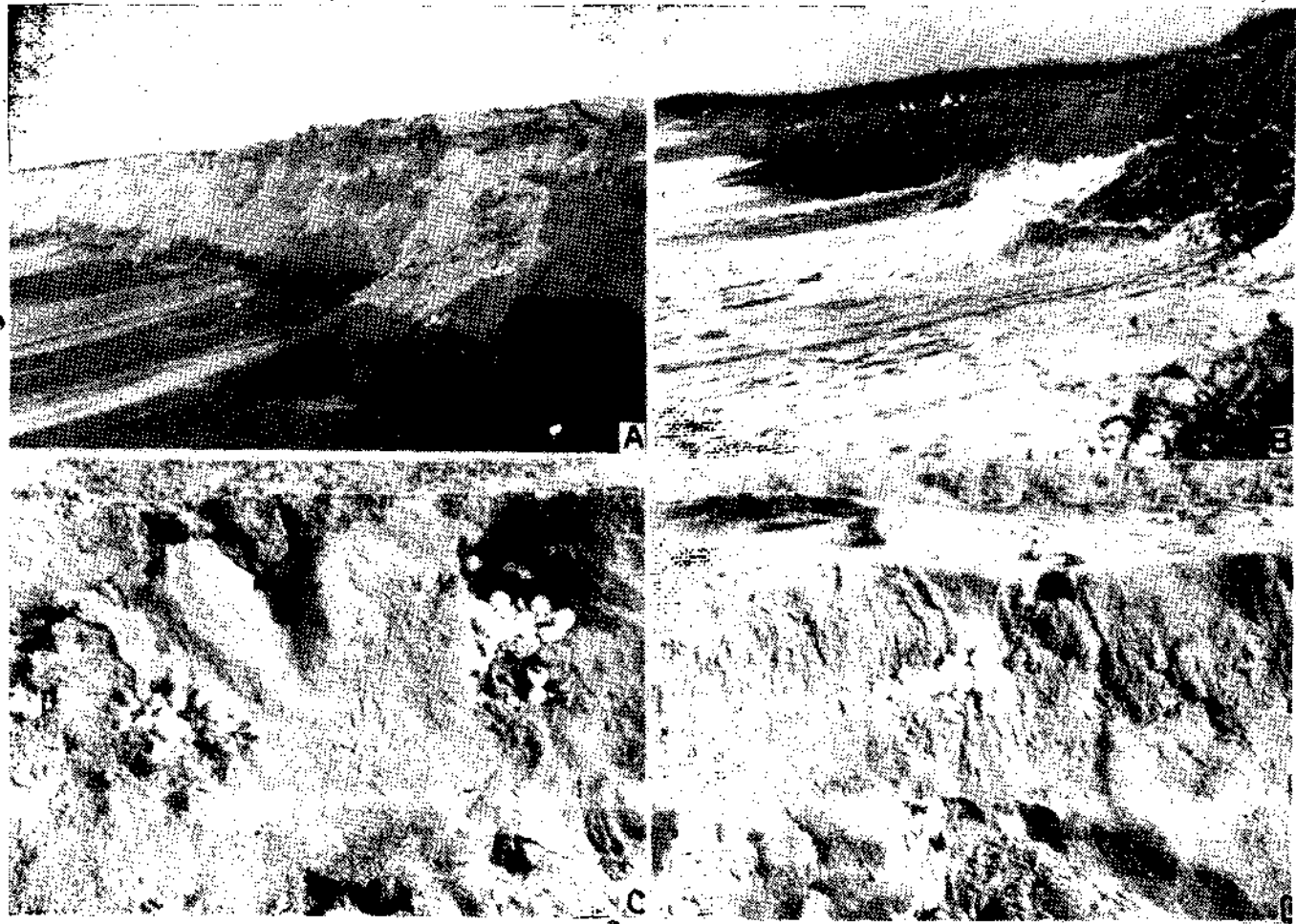


PLATE III A, B. Beach configuration at Gahirmatha during May 1987 resulting in heavy damage of olive ridley nests and C, D, Close up view of exposed nests due to erosion in May 1987 at Gahirmatha.

nesting played a major havoc. There is a marked variation in the width of the beach from what was noticed during the time of second mass nesting which resulted in the exposure of many emerging pits. As soon as the pits were exposed (Pl. III C,D), the eggs were predated by dogs, crows and sea gulls. It was roughly estimated that about 50% of the nests during second mass nesting were damaged by beach erosion in the area of 4 km from Ekkula to Ekkula Nasi.

REMARKS

The turtle nests at Gahirmatha are damaged due to 3 main factors. Heavy predation of

eggs by dogs, jackals, wild boars and other wild animals account for large scale destruction of eggs. Secondly the nests of first 'arribada' are extensively damaged by nesting turtles of second 'arribada'. Thirdly, due to erosion, about 50% of nests were damaged in May 1987. Hence, there is an urgent need to make a systematic study on beach profile condition at Gahirmatha and preliminary attempts on this aspect have already been initiated by CMFRI in May 1987. In view of these conditions, hatchery programmes for collecting the eggs, incubating them and releasing the hatchlings from the same beach will be helpful to conserve the endangered sea turtles at Gahirmatha Beach.

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