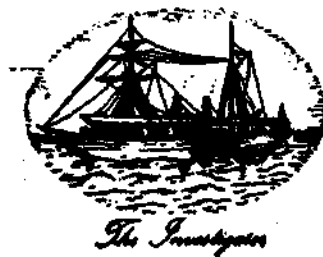


Proceedings of the Symposium on Endangered Marine Animals and Marine Parks

COCHIN, INDIA, 12—16 JANUARY, 1985

Edited by: B. G. SILAS

(Issued in October 1988)



MARINE BIOLOGICAL ASSOCIATION OF INDIA

POST BOX NO. 2673, COCHIN 682 031, INDIA

ON THE SECOND MASS NESTING OF THE OLIVE RIDLEY
LEPIDOCHELYS OLIVACEA AT GAHIRMATHA, ORISSA
DURING 1984

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ABSTRACT

Observations carried out on the second mass nesting of the olive ridley along the Gahirmatha beach towards the end of March 1984 are recorded here. The mass nesting occurred in general along the same stretch where the first mass nesting had earlier taken place from 25th January to 6th February 1984, with a peak activity along about one kilometre of the stretch of the beach. Maximum destruction to earlier nests and emerging hatchlings was noted in this area of overlap. Some observations made during this phase on emerging hatchlings of the first mass nesting are also reported here.

INTRODUCTION

The annual arribada of the olive ridley *Lepidochelys olivacea* (Eschscholtz) along the Orissa Coast has been reported by Biswas (1982), Bustard (1974, 1976), Bustard and Kar (1981), Davis and Bedi (1978), FAO (1975), Kar (1980, 1982), Kar and Bhaskar (1982), Kar and Dash (1984), Kar and Whitaker (1984), Silas *et al.* (1983), Whitaker (1984) and Whitaker and Kar (1984). A detailed account on the first mass nesting of the olive ridley during the 1984 season at Gahirmatha has been reported by Silas *et al.* (1984). We are reporting here a second arribada which took place during the same season at Gahirmatha from 24 March, 1984 to 29 March, 1984, sixty days after the first mass nesting which commenced on 25 January, 1984 and lasted until 6th February, 1984. On 24 March, 1984 about 7,000 turtles emerged for nesting. The intensity increased to about 1,00,000 turtles on 26 March, 1984 and thereafter decreased. The mass nesting lasted for about a week and on 29 March, 1984 hardly about

1,000 turtles nested (Table 1). It is roughly estimated that about 2,00,000 turtles would have emerged for nesting during the second mass nesting. Kar and Dash (1984) observed that the first arribada is very intensive every year when compared to the second one. The first mass nesting of 1984 lasted for about 13 nights during which period about 3,00,000 turtles visited Gahirmatha beach for nesting (Silas *et al.*, 1984).

A significant feature of 1984 mass nesting is the occurrence of such a large number of olive ridley for nesting in the second season. The second mass nesting of 1984 season may be the largest one among the second arribada witnessed in the recent past. The total nesting females for both the mass nestings in 1984 is estimated to be roughly about 5,00,000. However, we have absolutely no information whether the 2,00,000 turtles or a part of this number represent females nesting for the second time during the same season. The modal sizes of the intraovarine developing eggs seen in slaughtered animals indicate distinct modes pointing

TABLE 1. Details of nesting females during second arribada at Gahirmatha in 1984 season¹

Period of nesting	Area-Beach stretch (km)	Estimated number of nesting females	Number of nesting females per 100 metres (Mean in Parenthesis)
24-3-1984 to 25-3-1984 1900 hrs—0600 hrs	.. 2.5	7,000	100—500 (350)
25-3-1984 to 26-3-1984 1800 hrs—0500 hrs	.. 3.0	25,000	300—1200 (800)
26-3-1984 to 26-3-1984 0800 hrs—(Day) 0600 hrs	.. 5.0	45,000	300—1500 (900)
26-3-1984 to 27-3-1984 0700 hrs—0600 hrs	.. 3.5	1,00,000	1000—5000 (3000)
27-3-1984 to 28-3-1984 1900 hrs—0600 hrs	.. 4.0	10,000	70—500 (220)
28-3-1984 to 29-3-1984 1800 hrs—0600 hrs	.. 0.7	2,000	60—600 (300)
29-3-1984 to 30-3-1984 1800 hrs—0600 hrs	.. 1.0	1,000	600 metres-60/100 Metres 200 metres—20/100 Metres 200 metres—10/100 Metres
30-3-1984 to 31-3-1984 1800 hrs—0600 hrs	.. 1.0	25	—

¹Also corroborated with Orissa Forest Department Records.

to a definite possibility of the females nesting in the first arribada also re-nesting atleast once more during the season.

The first mass nesting occurred at Gahirmatha in a 5 km stretch of beach from Ekkula to Ekkula Nasi with the peak intensity in the stretch of 3 km south of Ekkula Nasi. The second mass nesting was also from Ekkula to Ekkula Nasi but the intensity was highest over a stretch of 3 km north of Ekkula which resulted in a heavy overlapping of the nesting area in a stretch of about 1 km. Besides, in the entire stretch of 5 km, large number of nests of the first arribada were destroyed during the second mass nesting. The intensity of damage was high in the area of overlap where a large part of the incubating eggs of first mass nesting which had not hatched out were destroyed. As in the first mass nesting a num-

ber of abnormal females were also encountered (Silas *et al.*, 1984).

We wish to express our sincere thanks to the Conservator of Forests and Wildlife and the Chief Wildlife warden, Government of Orissa and Shri S. K. Misra Deputy Conservator of Forests, Chandbali and his staff for all the help and co-operation extended to us during the period of study.

LENGTH FREQUENCY OF NESTING FEMALES

During the second mass nesting, the carapace length of 85 nesting females measured (curved measurements) from 58 to 74 cm (mean 69 cm). The carapace length of first mass nesting females ranged from 63 to 75 cm with modes at 64 to 65 and 70 to 71 cm (Silas *et al.*, 1984).

CLUTCH SIZE AND WEIGHT OF EGGS

In a few clutches examined the number of eggs was between 74 to 160 which is comparable to the observations (70-159) made during the first mass nesting (Silas *et al.*, 1984). The depth of the nest varied from 45 to 52.5 (48.7) cm which is also comparable to the earlier observations made by Silas *et al.*, (1984) from the Madras Coast.

Weight of individual eggs from three clutches were taken during the second mass nesting. The eggs were wiped off adhering mucus before weighing in a balance. The weight of individual eggs in gm ranged from 26.5 to 32.0 in clutch I, from 22.5 to 30.0 in clutch II and from 27.5 to 33.0 in clutch III. Silas and Rajagopalan (1984) also observed variability in the individual egg weight within a clutch as well as between clutches. In the three clutches observed, eggs were collected as and when the nesting turtle was laying eggs. The eggs were collected in three batches, the first batch contained eggs dropped at the beginning of oviposition, the second batch towards the mid-phase and the third batch those eggs dropped towards the end of oviposition. This was done to study the possible difference in weight of the eggs dropped at different times of oviposition. Little variability was seen in the three batches as earlier observed by Silas and Rajagopalan (1984) along the Madras Coast.

STUDIES ON THE HATCHLINGS OF FIRST MASS NESTING

Hatchling success of eggs laid

The second mass nesting almost coincided with the emergence of hatchlings of the first arribada. The emergence of hatchlings commenced on 22nd March, 1984, about 58 days after the first mass nesting. In the area of mass nesting it was observed that about 6,000 hatchlings emerged from 53 nests located in

a 100 metre stretch on the night of 22nd March, 1984. On the next day about 13,500 hatchlings emerged from 120 nests in a 100 metre stretch. On an average about 113 hatchlings have emerged from each nest. This high intensity of emergence occurred along a distance of about 3.4 km along the shore from 22nd March, 1984 to 24th March, 1984. When the second arribada commenced on 24th March, 1984 there was severe damage to the earlier nests as well as hatchlings emerging thereafter which would have accounted for a loss of roughly about 75% of the remaining egg/ hatchlings. In the urge for nesting the females of the second arribada devastatingly dug up pits in the same stretches of the beach especially in the 'core' area of overlap with the first mass nesting. Silas (1984) has estimated that over 30 millions eggs are annually laid at Gahirmatha with a survival at hatchling stage of only 25% due to heavy predation, re-nesting and resulting damage, unfertilised eggs and arrested development. With this magnitude of damage to the eggs and loss of valuable protein, there are suggestions that part of the eggs should be harvested for human consumption. Mrosovsky and Yntema (1982) have remarked on such utilisation. Pritchard (1978) also has suggested that the logical method of exploiting olive ridley would be to permit egg collection from the first arribada. But we feel that this suggestion should be evaluated in light of information about the temperature regimes at Gahirmatha during the two mass nesting seasons since temperature plays a vital role in deciding sex ratio of hatchlings of successive arribadas. At Gahirmatha some preliminary temperature measurements made in the nests during the first mass nesting (about 25 to 45 metres away from the high water mark) during morning hours (0900 to 1030 hrs.) and during the second mass nesting (about 40 to 50 metres away from the high water mark) in the evening hours (1700 to 1800 hrs.) on April 1984 indicates a rise of mean temperature values from 26.0°C to 34.0°C.

Pivotal temperature where the sex ratio would be 50:50 needs determination. Hatchlings developing at the lower temperature from the eggs laid during the first arribada may mostly be males and those at relatively higher temperature during the second arribada predominantly females. Could this be nature's way of maintaining a balance? Thus any excessive col-

case the number of eggs laid, live hatchlings which emerged, those in the pipping stage, dead hatchlings in the pit, those dead in the pipping stage and spoilt and unfertilised eggs were noted and details are given in Table 2.

The percentage of live hatchlings emerging from natural nest varied from 51.4 to 95.2

TABLE 2. Details of live hatchlings emerged, live hatchlings in pipping stage, dead hatchlings encountered in the pit, dead hatchlings in pipping stage and spoilt and unfertilised eggs observed (percentage in parenthesis) during April 1984 based on the observations made by the authors at Gahirmatha

	Clutch size	Live hatchlings emerged	Live hatchlings in pipping stage	Dead hatchlings in pit	Dead hatchlings in pipping stage	Spoilt and unfertilised eggs	
1-4-1984	..	110	94 (85.45)	4 (3.6)	1 (0.9)	8 (7.8)	3 (2.7)
"	..	99	86 (86.80)	2 (2.6)	—	7 (7.0)	4 (4.0)
"	..	114	81 (71.00)	2 (1.8)	1 (0.8)	27 (23.6)	3 (2.6)
"	..	76	48 (63.10)	5 (6.5)	—	19 (25.0)	4 (5.2)
"	..	149	105 (70.50)	5 (3.4)	34 (22.8)	2 (1.3)	3 (2.0)
"	..	94	84 (89.30)	4 (4.2)	—	4 (4.2)	2 (2.0)
"	..	105	79 (75.20)	2 (1.9)	21 (20.0)	1 (0.9)	2 (1.9)
"	..	133	69 (51.80)	3 (2.3)	2 (1.5)	52 (39.0)	7 (5.2)
"	..	86	59 (68.60)	7 (8.1)	2 (2.3)	9 (10.4)	9 (10.4)
"	..	130	109 (83.80)	2 (1.5)	11 (8.4)	5 (3.8)	3 (2.5)
"	..	133	120 (90.20)	2 (1.5)	2 (1.5)	6 (4.5)	3 (2.2)
"	..	149	128 (85.90)	2 (1.3)	1 (0.6)	16 (10.7)	2 (1.3)
"	..	139	122 (87.70)	7 (5.0)	—	7 (5.0)	3 (2.1)
2-4-1984	..	127	87 (68.50)	2 (1.6)	5 (3.9)	29 (22.8)	4 (3.1)
"	..	101	53 (52.40)	3 (2.9)	3 (2.9)	30 (29.7)	12 (11.8)
"	..	104	99 (95.20)	—	—	3 (2.9)	2 (1.9)
"	..	105	54 (51.40)	3 (2.8)	2 (1.9)	42 (40.0)	4 (3.8)
"	..	147	114 (77.50)	2 (1.4)	2 (1.4)	27 (18.3)	2 (1.3)
"	..	112	73 (65.10)	5 (4.5)	2 (1.7)	30 (26.7)	2 (1.7)
"	..	107	62 (61.30)	1 (0.9)	2 (1.9)	25 (24.7)	11 (10.8)
Total	..	2314	1726 (74.5)%	63 (2.7%)	91 (3.9%)	349 (15.0%)	85 (3.6%)

lection of eggs in an arribada may result in imbalance in the sex ratio which will become evident several years later and could have an adverse effect on the breeding population of occurrence of disproportionately large numbers of males or females.

To study the hatchling success of eggs in the nests 20 clutches were examined. In each

with an average of 74.5%. The percentage of live and dead in the pipping stage varied from 0.6 to 22.8 (mean 3.9) and 0.9 to 39.0 (15.0) respectively. The percentage of dead hatchlings and spoilt and unfertilised eggs varied from 0.9 to 8.1 (2.7) and 1.9 to 11.8 (3.6) respectively. It could be observed that mortality occurred (to the level of 15%) mainly during pipping stage of the hatchlings. Break-

ing the egg shell and merging from the egg is perhaps a crucial stage. In the hatchery system at Kovalam, Tamil Nadu, Silas and Rajagopalan (1984) observed that the hatchling success of olive ridley eggs was about 65.8% which is less than the hatchling success (74.5%) in natural nests observed at Gahirmatha, during the 1984 season.

measurements) of the 10 clutches ranged from 35.7 to 39.7 mm.

The percentage frequency of carapace length, carapace width and weight for 335 hatchlings collected randomly along a stretch of 5 km beach has been studied. A higher percentage of hatchlings was in the size range of carapace

TABLE 3. Variation in the size in mm and weight in gm of olive ridley hatchlings from 10 clutches (mean in parenthesis) at Gahirmatha examined by the authors in 1984 season

Clutch No.		Carapace length	Carapace width	Plastron length	Plastron width	Weight	No. of lateral scutes
1.	.. N = 20	34.4-38.2 (36.7)	30.2-33.6 (31.3)	28.7-31.2 (30.3)	26.0-28.5 (27.3)	14-15 (14.6)	6-7 (6.1)
2.	.. N = 20	38.7-41.2 (39.5)	31.6-36.4 (32.4)	30.1-34.3 (32.2)	27.2-32.5 (29.9)	17-20 (18.9)	5-7 (6.4)
3.	.. N = 20	37.4-41.0 (38.9)	33.1-38.3 (35.0)	33.0-35.3 (33.5)	28.0-31.2 (29.1)	16-18 (16.3)	6-7 (6.4)
4.	.. N = 20	30.5-35.2 (33.5)	29.0-32.7 (30.5)	27.0-29.4 (28.3)	25.4-27.5 (26.6)	9.5-12 (11.3)	6-7 (6.7)
5.	.. N = 20	35.4-38.4 (37.2)	31.3-35.6 (33.9)	28.7-33.0 (31.4)	27.5-31.5 (29.3)	15.5-17 (16.1)	6-7 (6.5)
6.	.. N = 20	36.5-40.0 (38.4)	30.4-38.2 (33.0)	29.0-33.6 (31.5)	26.9-29.9 (28.5)	16-18 (17.3)	6-8 (6.6)
7.	.. N = 18	35.3-38.9 (37.3)	32.0-35.6 (33.5)	30.0-34.3 (32.1)	26.7-30.5 (28.5)	15-17 (15.9)	5-7 (5.9)
8.	.. N = 20	34.7-37.7 (35.9)	31.2-37.4 (33.3)	29.5-32.5 (29.8)	27.4-30.8 (28.9)	15-17 (15.4)	5-6 (5.9)
9.	.. N = 20	34.1-38.9 (35.7)	31.4-35.2 (33.9)	31.2-34.2 (33.3)	27.0-30.4 (29.5)	16-18 (16.9)	6-7 (6.6)
10.	.. N = 20	35.7-38.6 (37.0)	31.0-34.4 (32.6)	30.4-33.1 (31.7)	27.0-29.8 (28.4)	15-17.5 (15.7)	6-7 (6.7)

Variability in hatchlings

Variations were observed in the carapace length and weight of emerging hatchlings in 10 clutches examined. About 20 hatchlings from individual nests were randomly collected and measurements taken as detailed in Table 3. The mean carapace length (Straight line

length 37.1 to 39.0 mm carapace width 31.1 to 34.0 mm and the body weight 15.1 to 17.0 gm. Both in carapace length and weight, these observations are almost similar to the earlier observations made by Silas and Rajagopalan (1984) on the hatchlings collected from the hatchery system of transplanted

clutches. But there was a noticeable difference in the carapace width of natural (Gahirmatha) and hatchery reared (Kovalam, Madras) hatchlings, the modal carapace width being 22.34 mm and 27.28 mm respectively.

Time of emergence and orientation

At Gahirmatha the hatchlings were seen to emerge from the nests from 1700 to 0700 hrs. with the peak activity from 0400 to 0700 hrs. The emerging hatchlings have no difficulty in orienting towards the sea. At Gahirmatha an interesting event was also noticed. Hundreds of hatchlings emerging from the nests near Ekkula Nasi entered the adjacent estuary. We have observed the hatchlings

Movements of hatchling from nest to sea

An attempt was made in quantifying the time taken by the hatchlings to reach the sea from the nests. The distance from the individual nest to the water mark, the number of flipper movements in crossing the dry and wet sand area and the time required for the same were noted. The hatchlings required 10.5 to 32.0 minutes to travel 23.0 to 84.0 metres and reach the wet sand and 2.5 to 18.0 minutes to cross 5.0 to 24.0 metres strip of wet sand (Table 4.). The speed of the hatchling over the dry sand varied from 0.32 to 0.68 metre/minute (0.51) and in the wet sand varied from 0.50 to 0.80 metre/minute (0.66). The hatchlings after undertaking a few movements

TABLE 4. Details of number of 'stages', speed (metre/minute) observed in emerged hatchlings of olive ridley at Gahirmatha in March 1984

Sl. No.	DRY SAND				WET SAND			
	Distance in metres (from nest to high water mark)	Time taken (min.)	Speed (Metre/min.)	Number of 'stages'	Distance in metre (from nest to high water mark)	Time taken (min.)	Speed (Metre/min.)	Number of 'stages'
1.	.. 25	15.0	0.60	75	5.0	2.5	0.50	30
2.	.. 25	16.0	0.64	142	10.0	8.0	0.80	57
3.	.. 22	15.0	0.68	135	8.0	4.6	0.57	22
4.	.. 23	10.5	0.45	103	4.0	3.1	0.77	12
5.	.. —	—	—	—	17.0	10.2	0.60	95
6.	.. —	—	—	—	17.0	13.0	0.76	117
7.	.. 84	32.0	0.38	292	13.5	8.0	0.56	33
8.	.. 38	12.5	0.32	172	24.0	18.0	0.75	109

in the Rana hansa and Patsala rivers on our way from Gahirmatha to Chandabali. Hatchlings were found floating and moving swiftly into the estuary in freshwater about 7 to 10 km away from Gahirmatha beach. Whether this movement upstream is fortuitous or not, and whether the hatchlings return to sea calls for further observations.

stopped for short durations before continuing their crawl. The movements and a subsequent stop over is termed as a 'stage'.

Entry of hatchlings into the sea

Observations were also made on the entry of hatchlings into the sea. Some of the hatchlings entering into the sea during hightide were

washed back again on the beach and reentered with subsequent retreating waves.

On 28th March, 1984 at about 0600 hrs. we observed about 125 hatchlings entering into the sea in a 100 metre area 2 km north of Ekkula. The hectic activity of hatchling movement from shore to sea was noticed near Ekkula Nasi also. In an area of beach about 1.8 to 2 km we observed around 0530 hrs. on 31st March, 1984, 300 hatchlings per metre stretch area entering the sea in one hour. The intensity and concentrations of hatchlings was uniformly dense throughout the length of 2 km beach. In two hours it was roughly estimated that about 1.2 million hatchlings would have entered the sea on that day in this 2 km stretch. Continuous observations are, however, necessary in different stretches of the beach simultaneously to arrive at reliable estimates of the total number of hatchlings entering the sea.

We collected information from the Coast Guard Vessel on the migratory movements of thousands of hatchlings. During the last week of March 1984 the hatchlings which had entered the sea off Gahirmatha were seen off Paradeep and moving towards the south. Besides the hatchlings a large number of adults were also seen moving southward indicating the direction of movement of spent adults after the second mass nesting at Gahirmatha. Silas *et al.*, (1984) reported mass movement of adult turtles during December 1983 towards Gahirmatha. At that time the turtles were reported migrating northward and mass northward movement was seen off Pondicherry, and within three weeks large concentrations of mating pairs were seen off Orissa Coast.

Predation of hatchlings

Since the hatchlings at Gahirmatha emerged and reached the sea also during day time, predation by sea gulls, crows and vultures was

intense during the early morning hours. The hatchling face danger from the time they emerge from the pits, until they reach the sea. The birds turn the hatchlings upside down and peck on the 'umbilicus area' of the plastron making a hole and eat the contents. For every one metre about 10 dead hatchlings with such damage on their plastron were noticed along a stretch of 2 km near Ekkula Nasi in the last week of March 1984.

BEACH EROSION

Kar and Dash (1984) and Silas *et al.* (1984) have reported severe beach erosion in Gahirmatha every year. In 1984 also, beach erosion was noticed near Ekkula immediately after the first nesting was completed. Due to this, large number of eggs were destroyed. Since beach erosion and accretion are regular phenomena every year, the impact of this natural phenomena on the egg loss, success of hatchling and recruitment needs further study at Gahirmatha.

TAGGING OF NESTING FEMALES

During the 1984 season we have tagged about 85 nesting females from the second arribada with monometal tags bearing the numbers 0001 to 0085 and with the inscription reading :

PLEASE RETURN TO
CMFRI, P.B. 1912
COCHIN, INDIA

Tagging was done after the nesting process is completed and on the trailing edge of anterior left flipper. While tagging on 29th March, 1984 we have encountered one nesting female with carapace length 67 cm and width 57 cm bearing the number 12791, tag of Chief Wildlife Warden, Bhubaneswar indicating remigration of the animal for nesting.

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