

SEA TURTLE PROGRAMME

A Report on the
Conservation and Management of
Sea Turtles on the Madras coast

1988 - 89

prepared for the
STUDENT'S SEA TURTLE CONSERVATION NETWORK (SSTCN)

by

Chandy Abraham

submitted to the

Tamil Nadu Forest Department
Government of Tamil Nadu

October 1989

Student's Sea Turtle Conservation Network (SSTCN)
A1/4/4, 3rd Main Road, Besant Nagar,
Madras 600 090. INDIA.

TABLE OF CONTENTS

Acknowledgements.....1

Hatchery and field personnel : 1988-89.....2

Preface.....3

Programme objectives.....4

Area of study.....4

Factors responsible for declining populations.....5

Hatchery management.....7

 site selection

 construction and structure

 methodology

Hatchery record and results.....9

Discussion.....13

Promotional and educational activities.....15

Simplified key to sea turtle species.....17

The Olive Ridley.....18

 systematics

 common & vernacular names

 description

 distribution

 status

 legal overview

 life cycle

Glossary.....22

Bibliography.....23

LISTS

Plates I & II. Sea turtle adult mortality - an indirect result of trawling and Gill net fishing operations. Carcasses are often washed ashore.

Plate III. Collection of eggs.

Plate IV. Normal (x) and abnormal eggs.

Plate V. Public participation on the 'Ridley Trails'.

Plate VI & VII. Nesting Olive Ridley

Figure I. Location map - area of study.

Figure II. Hatchery structure and dimensions.

Figure III. Nesting abundance : 1988-90 season (graph).

Figure IV. Guide to morphological terms.

Table I. SSTCN Hatchery record.

Table II. Olive Ridley : Reproductive Biology Review.

Table III. Natural nest dimensions.

Appendix I. Tide chart : Madras coast.

Appendix II. Letters of permission, Tamil Nadu Forest Department and Union Ministry of Environment and Forests

HATCHERY AND FIELD PERSONNEL

Satish Bhaskar
Field Advisor

Chandy Abraham

Arif Razack

Ramshanker C.

Kartik Shanker

Tara Thiagarajan

Tharani B.

Yohan P. Thiruchelvam

REPORT PREPARED BY

Chandy Abraham

PHOTOGRAPHY

Arif Razack

Kartik Shanker

ILLUSTRATIONS

Smita Sateesh

COMPUTER WORK

Yohan P. Thiruchelvam

Computer facilities extended by the

Madras Consultancy Group

PREFACE

This report presents the results of the SSTCN Sea Turtle Programme on the Madras coast during the 1988-89 season.

Sea turtle conservation work is not new to Madras and began as early as in the 1970's. Hatcheries were maintained by the Madras Snake Park Trust from 1973 to 1976. From 1976 to 1983 the Sea Turtle Recovery programme was operated by the Central Marine Fisheries Research Institute (CMFRI). In 1982 the Tamil Nadu Forest Department launched their " Save the turtle campaign ", with the establishment of five hatcheries, which continued till 1988.

During the 1988 -89 season the SSTCN initiated the Sea Turtle Programme with a hatchery at Neelankarai about 20 kms south of Madras.

It is hoped that such long term perspectives and sustained efforts would serve to enhance and stabilize the population of the Olive Ridley and its nesting habitat on the east coast of India.

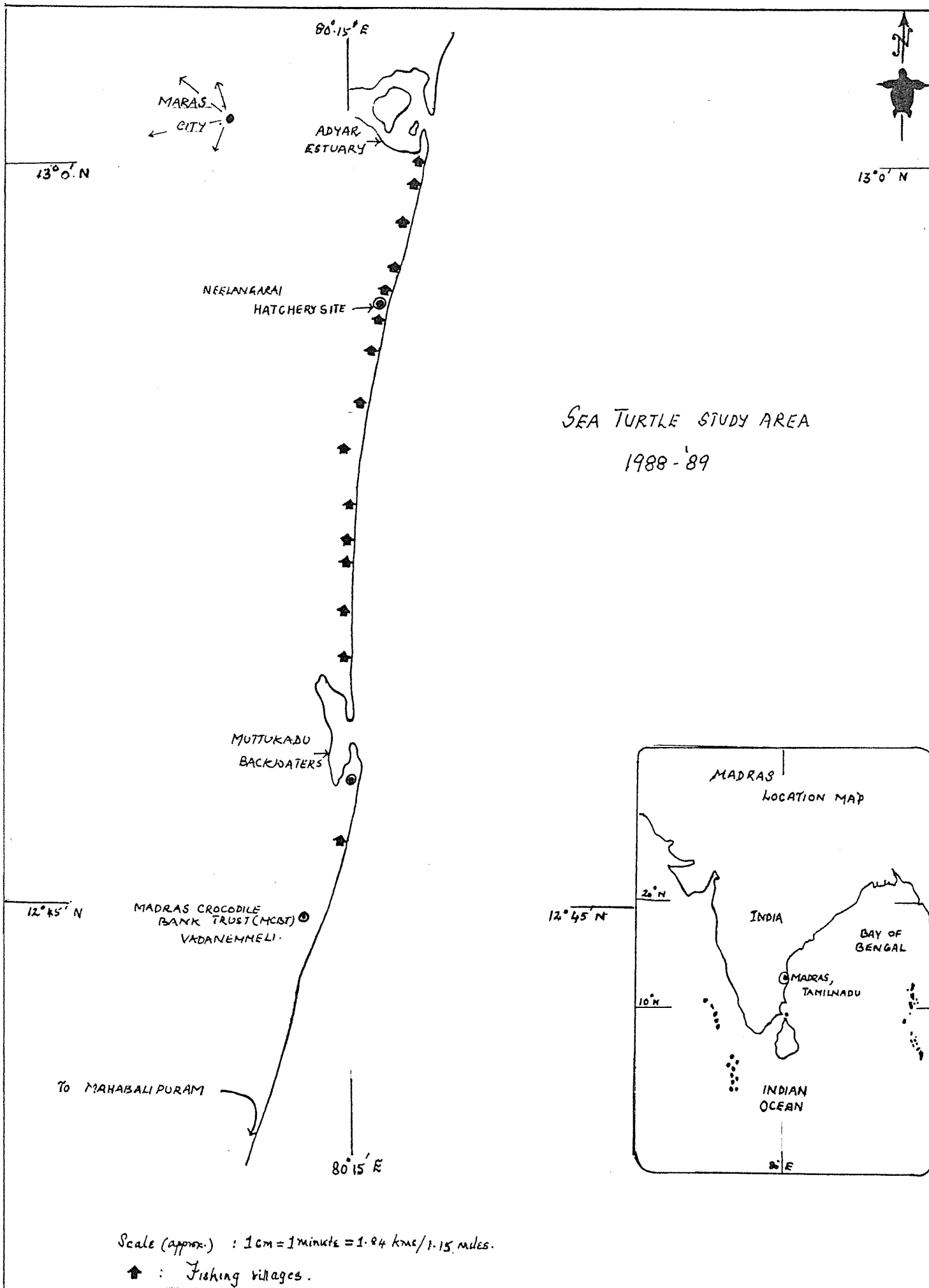


Figure 1. Location map - area of study.

PROGRAMME OBJECTIVES

To ensure the conservation and continued presence of sea turtles on the Madras coast.

To generate scientific information on the biology, management and conservation of the Olive Ridley sea turtle.

To safeguard nesting turtles and beaches against environmentally detrimental factors.

To deter poaching activities by the maintenance of hatcheries for translocation of nests.

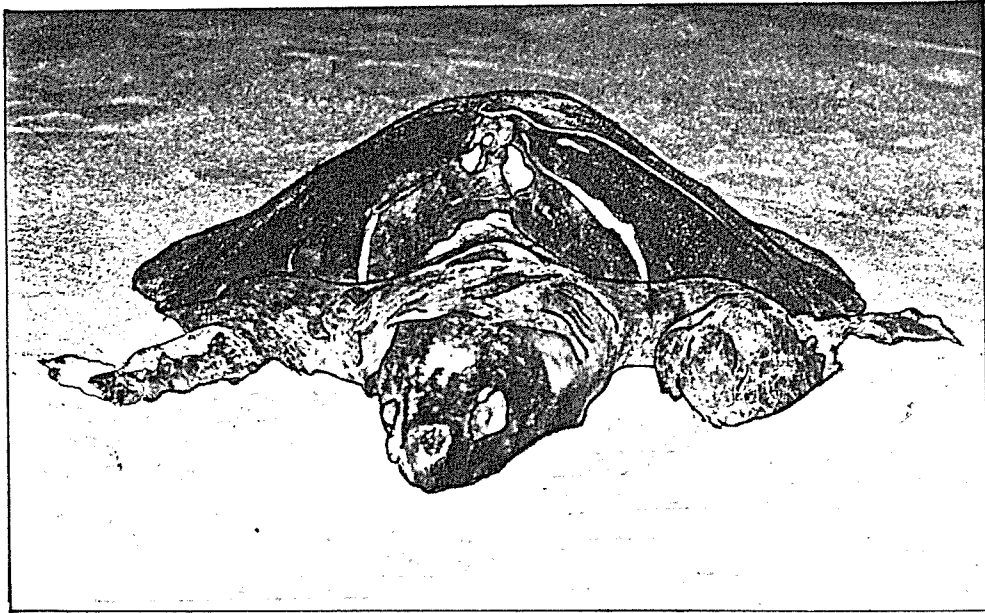
To carry out environment and conservation education programmes among the coastal residents, fisherfolk, student community and the general public.

AREA OF STUDY

The dominant nesting sea turtle species on the east coast of India is the Olive Ridley (Lepidochelys olivacea). Madras, located at approximately 13° N. Latitude and 80° E. Longitude, in the coastal state of Tamil Nadu, is considered a minor nesting ground today.

During the 1988-89 season the area chosen for study and patrolling included a 30 km stretch from the Adyar estuary in the north to the Madras Crocodile Bank in the south.

The beaches are sandy with little or no rocks. Dominant vegetation includes Ipomea, Pandanus and Spinifex. Human burden on the land, approximating a fishing village every 1.3 kms is now increasing with an encroaching urban population. The Olive Ridley nesting season on the Madras coast follows the Northeast monsoon and falls between the winter months of November and March.



Plates I & II. Sea turtle adult mortality - an indirect result of trawling and Gill net fishing operations. Carcasses are often washed ashore.



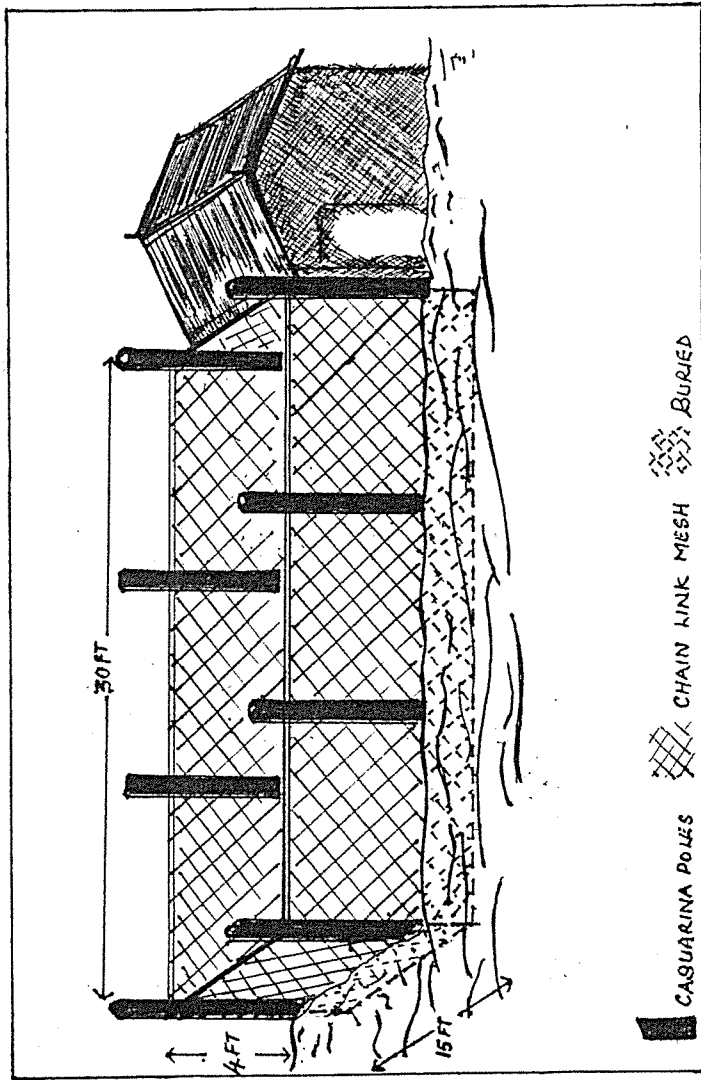


Figure 11. Hatchery structure and dimensions.

HATCHERY MANAGEMENT

Site selection

Selection of hatchery site was influenced by various factors including a centralized location, accessibility and availability of basic amenities. The site finally selected was situated in an area adjacent to the Tamil Nadu Fisheries Department prawn hatchery at Neelankarai, about 20 kms south of Madras city.

The actual placement of the enclosure had to be compromised upon. It was originally intended to construct the enclosure at around the average nesting belt of the Ridley, about 20-25 metres from the waterline. Since such a construction would have interfered with the rights and fishing activities of the local fishermen, the hatchery was constructed at a height of 30-35 metres from the waterline. Other factors which influenced site selection were beach gradient or slope and soil moisture content.

Construction and structure

The hatchery design was essentially very simple. The enclosure had a length of 30 feet (9.09 mts), placed parallel to the sea shore and a width of 15 feet (4.54 mts). Locally available poles (from Casuarina equisetifolia trees) were used as fence posts. Strong galvanized chain link fencing with a mesh diameter of 2 inches (5 cms) was used to complete the enclosure. The base of the fence was buried upto a depth of 1 foot to thwart excavating predators. This reduced the effective height of the enclosure to 4 feet (1.21 mts) which was found to be sufficient. Roofing of any sort was not provided. An equally effective alternative in the form of wicker baskets were used.

An accompanying thatch roofed hut, 10 feet by 10 feet, was erected to house workers and equipment.

Methodology

Collection : The area selected for survey and collection was patrolled on foot every night from December 15th 1988 to February 28th 1989. Nests were located without the use of probes and the eggs collected. Care was taken to ensure that egg handling was kept to a minimum. In addition surgical gloves were used to ensure that sweat or nicotine did not come into contact with the eggs. Necessary data was collected at the nest site, whenever possible.

Transport : The eggs were transported in soft cloth bags to the hatchery. Each clutch was carried separately and subjected to a minimum of stress or jolting during transport. Efforts were made to ensure that nests were relocated within 3-4 hours of nesting.

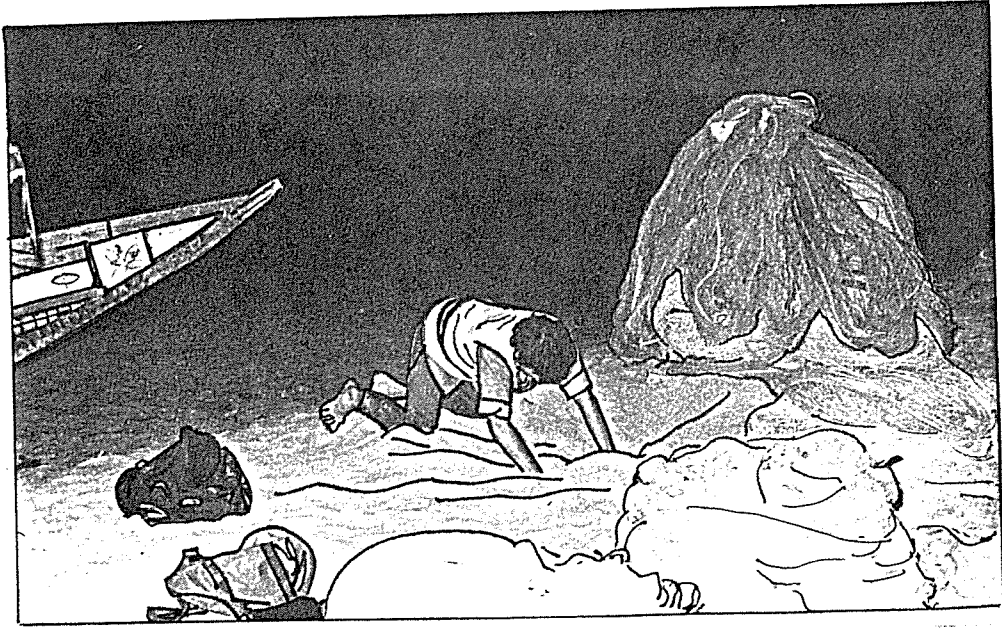


Plate III. Collection of eggs.

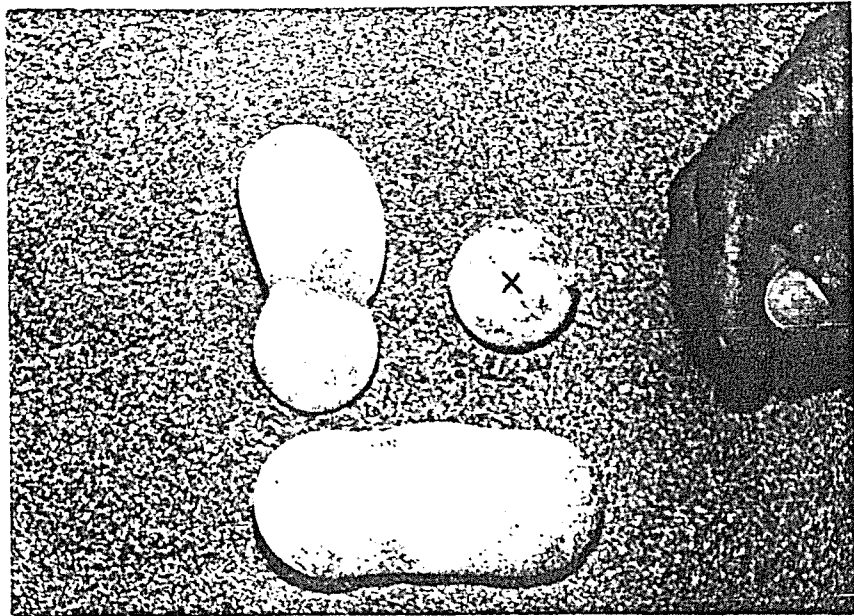


Plate IV. Normal (x) and abnormal eggs.

Relocation : Nest-pits in the hatchery were dug to a standard depth of 18 inches (46 cms). The eggs were relocated with a minimum of handling. Each nest was provided with a tag denoting pit number and number of eggs.

Nests were kept under observation through out the incubation period. After the appearance of a cup shaped depression on the roof of a nest a wicker basket was placed over the nest site.

Release : Emerging hatchlings were collected and released at various points at a distance of 20 feet (6.06 mts) from the waterline.

Excavation : The nests were allowed to remain undisturbed for a period of 24 hours after initial emergence. The nests were then excavated and the remaining hatchlings collected and released. The contents of the nest were examined and the results recorded.

Table 1 : STUDENT'S SEA TURTLE CONSERVATION NETWORK (SSTCN)

HATCHERY RECORD 1988 - 89

Abbreviations :

Coll. date : Date of collection

DIN : Dead in nest

No. of eggs : Number of eggs

UH : Unhatched

DPE : Dead in pipped egg

H : Live hatchlings

| S.No | Coll. date | No. of eggs | DPE | DIN | U | H |
|------|------------|-------------|-----|-----|-----|-----|
| 01 | 12.01.89 | 111 | 2 | 0 | 21 | 88 |
| 02 | 12.01.89 | 112 | 1 | 0 | 0 | 111 |
| 03 | 18.01.89 | 144 | 3 | 4 | 33 | 104 |
| 04 | 20.01.89 | 137 | 28 | 9 | 0 | 100 |
| 05 | 20.01.89 | 139 | 21 | 2 | 4 | 112 |
| 06 | 20.01.89 | 133 | 37 | 4 | 25 | 67 |
| 07 | 20.01.89 | 133 | 50 | 1 | 5 | 77 |
| 08 | 20.01.89 | 130 | 26 | 3 | 10 | 91 |
| 09 | 21.01.89 | 136 | 22 | 1 | 11 | 102 |
| 10 | 21.01.89 | 124 | 30 | 0 | 6 | 88 |
| 11 | 21.01.89 | 147 | 64 | 0 | 2 | 81 |
| 12 | 22.01.89 | 150 | 16 | 0 | 7 | 127 |
| 13 | 22.01.89 | 124 | 16 | 0 | 28 | 80 |
| 14 | 24.01.89 | 111 | 47 | 10 | 7 | 47 |
| 15 | 24.01.89 | 108 | 29 | 2 | 4 | 73 |
| 16 | 25.01.89 | 135 | 50 | 0 | 4 | 81 |
| 17 | 26.01.89 | 115 | 13 | 1 | 2 | 99 |
| 18 | 26.01.89 | 104 | 4 | 3 | 2 | 95 |
| 19 | 26.01.89 | 110 | 1 | 1 | 20 | 88 |
| 20 | 26.01.89 | 148 | 28 | 2 | 14 | 104 |
| 21 | 26.01.89 | 146 | 70 | 0 | 1 | 75 |
| 22 | 26.01.89 | 131 | 30 | 7 | 2 | 92 |
| 23 | 27.01.89 | 110 | 21 | 1 | 7 | 81 |
| 24 | 27.01.89 | 116 | 24 | 0 | 9 | 83 |
| 25 | 27.01.89 | 145 | 27 | 3 | 12 | 103 |
| 26 | 28.01.89 | 113 | 23 | 2 | 9 | 79 |
| 27 | 28.01.89 | 136 | 44 | 1 | 2 | 89 |
| 28 | 29.01.89 | 124 | 16 | 3 | 11 | 94 |
| 29 | 29.01.89 | 142 | 29 | 2 | 18 | 93 |
| 30 | 29.01.89 | 128 | 49 | 1 | 11 | 67 |
| 31 | 29.01.89 | 155 | 3 | 0 | 122 | 30 |
| 32 | 29.01.89 | 113 | 33 | 0 | 5 | 75 |
| 33 | 29.01.89 | 131 | 36 | 2 | 11 | 82 |
| 34 | 29.01.89 | 133 | 16 | 2 | 23 | 92 |
| 35 | 29.01.89 | 138 | 10 | 0 | 41 | 87 |

....continued

| S.No | Coll. date | No. of eggs | DPE | DIN | U | H |
|-------|------------|-------------|------|-----|-----|------|
| 36 | 29.01.89 | 149 | 37 | 2 | 7 | 103 |
| 37 | 29.01.89 | 93 | 6 | 1 | 24 | 62 |
| 38 | 30.01.89 | 115 | 37 | 2 | 1 | 75 |
| 39 | 30.01.89 | 150 | 27 | 2 | 16 | 105 |
| 40 | 30.01.89 | 149 | 0 | 0 | 6 | 143 |
| 41 | 30.01.89 | 128 | 56 | 8 | 9 | 55 |
| 42 | 30.01.89 | 120 | 34 | 0 | 7 | 79 |
| 43 | 30.01.89 | 149 | 55 | 4 | 29 | 61 |
| 44 | 31.01.89 | 99 | 9 | 0 | 6 | 84 |
| 45 | 31.01.89 | 112 | 22 | 1 | 5 | 84 |
| 46 | 31.01.89 | 115 | 30 | 0 | 0 | 85 |
| 47 | 31.01.89 | 121 | 41 | 5 | 2 | 73 |
| 48 | 31.01.89 | 155 | 43 | 3 | 9 | 100 |
| 49 | 01.02.89 | 121 | 10 | 1 | 31 | 79 |
| 50 | 01.02.89 | 145 | 20 | 2 | 15 | 10 |
| 51 | 05.02.89 | 115 | 18 | 7 | 2 | 88 |
| 52 | 05.02.89 | 110 | 21 | 0 | 6 | 83 |
| 53 | 06.02.89 | 88 | 42 | 2 | 9 | 35 |
| 54 | 06.02.89 | 155 | 56 | 0 | 3 | 96 |
| 55 | 06.02.89 | 98 | 7 | 0 | 9 | 82 |
| 56 | 12.02.89 | 103 | 30 | 1 | 5 | 67 |
| 57 | 12.02.89 | 108 | 25 | 0 | 2 | 81 |
| 58 | 13.02.89 | 135 | 22 | 1 | 17 | 95 |
| 59 | 13.02.89 | 116 | 26 | 6 | 19 | 65 |
| 60 | 13.02.89 | 119 | 17 | 2 | 5 | 95 |
| 61 | 13.02.89 | 144 | 32 | 2 | 11 | 99 |
| 62 | 14.02.89 | 106 | 3 | 1 | 23 | 79 |
| 63 | 14.02.89 | 150 | 63 | 2 | 4 | 81 |
| 64 | 16.02.89 | 118 | 20 | 7 | 3 | 88 |
| 65 | 18.02.89 | 143 | 13 | 2 | 7 | 121 |
| 66 | 19.02.89 | 141 | 37 | 1 | 51 | 52 |
| 67 | 19.02.89 | 96 | 44 | 2 | 3 | 47 |
| 68 | 19.02.89 | 147 | 97 | 3 | 9 | 38 |
| TOTAL | | 8625 | 1919 | 137 | 844 | 5725 |

RESULTS

Season : The season commenced on 24th December 1988 and the last nest was recorded on 23rd March 1989.

Collection dates : Nests were collected for relocation from 12th January to 19th February 1989.

Hatching and release dates : 5th March to 13th April 1989.

| Number of nests collected | Total number of eggs | Total number of hatchlings released |
|---------------------------|----------------------|-------------------------------------|
| <u>68</u> | <u>8625</u> | <u>5725</u> |

Average (\bar{x}) clutch size

126.83

Incubation period
(including emergence time)

49-52 days

Hatching success

66.376 %

Dead in Pipped
eggs (DPE)

22.249 %

Dead in
nest (DIN)

1.588 %

Unhatched
(UH)

9.785 %

Total egg fertility

90.213 %

Table II : OLIVE RIDLEY : REPRODUCTIVE BIOLOGY REVIEW

| No | Locality | Season | Peak | Clutch size (\bar{x}) | range | Incubation time (\bar{x}) days | range | Source |
|-----|-------------------------|---------|---------|---------------------------------|--------|--|-------|--------------------------------|
| 1. | Suriname | Apr-Aug | Jun-Jul | 116 | 37-166 | 55 | 46-62 | Schulz, 1975 |
| 2. | Suriname | -- | -- | 116 | -- | -- | -- | Pritchard, 1969b |
| 3. | Mexico | Jul-Dec | Aug-Oct | 100 | -- | -- | 42-50 | Marquez et al 1976 |
| 4. | Costa Rica | Jan-Dec | Aug-Nov | -- | 98-123 | 48.5 | -- | Hughes and Richards, 1974 |
| 5. | Costa Rica | Jan-Dec | Sep-Dec | 105 | 74-126 | -- | -- | Cornelius, 1976 |
| 6. | Austral -lia | -- | -- | 108 | -- | -- | -- | Cogger and Lindner, 1969b |
| 7. | Sri Lanka | Sep-Jan | -- | -- | 90-135 | 50 | -- | Deraniyagala, 1939 |
| 8. | Madras, India | -- | -- | 126 | 79-160 | -- | -- | Silas & Raja- gopalan, 1984 |
| 9. | Madras, India | Oct-Apr | Jan-Feb | -- | -- | -- | 45-58 | Silas, 1984 |
| 10. | East coast, India | Jan-Apr | -- | -- | 43-145 | -- | 51-66 | Biswas, 1982 |

DISCUSSION

Nesting season

Nesting season seems to vary between climatic zones. A comparative sketch of nesting seasons for the Olive Ridley is given in Table I. In the Indian Ocean region, nesting season for the Olive Ridley has been reported as between September and January from Sri Lanka (Deraniyagala, 1939), from the east coast of India between January and April (Biswas, 1982), and on the Madras coast from late October to April (Silas, 1984). In addition Silas refers to distinct peaks in nesting abundance, from mid-January to mid-February.

Nesting during the 1988-89 season began in late December and continued till the end of March. Peak nesting activity was recorded during the last third of January. Subsequent nesting activity declined abruptly. A minor peak was evident again during the second week of February. (Figure III).

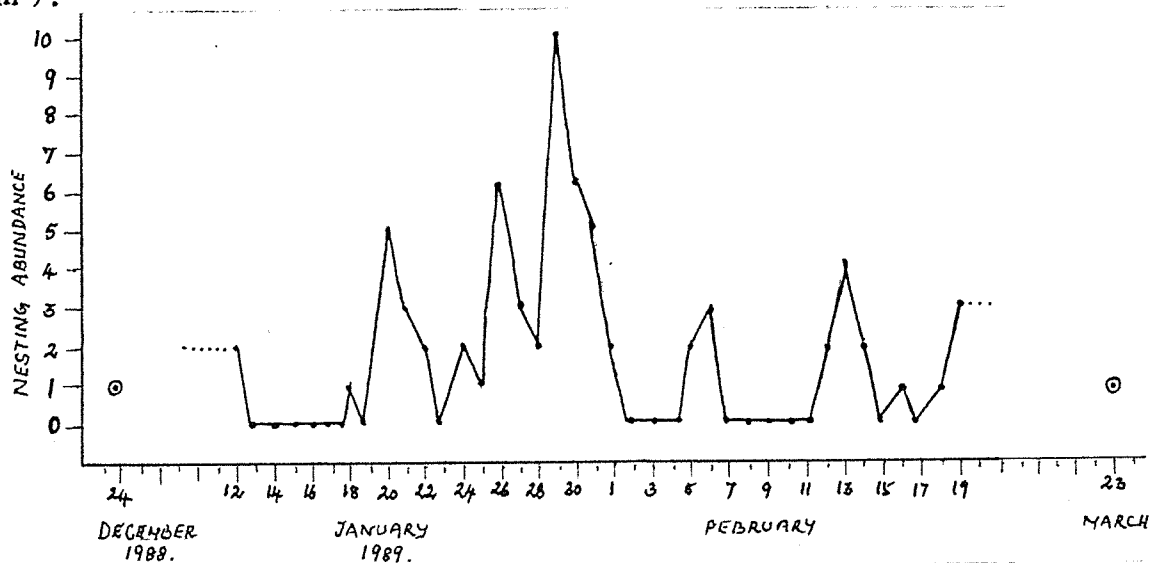


Figure III. Nesting abundance : 1988-90 season

Influence of lunar periodicities

Nesting peaked during the 2nd and 3rd quarters of the moon, immediately preceding and after the full moon.

Nesting time

Emergence of nesting females was observed as early as 8 pm (two hours after sunset) and even until 5 am. Nesting females did not seem affected by the tides, probably because the difference between heights of high and low tides, here on the Madras coast, is comparatively negligible.

Natural nest dimensions have been reported from the Madras coast by Silas (1984). Dimensions from nests collected by the SSTCN during the 1988-89 season on the Madras coast are tabulated below. (Table III).

Table III : NATURAL NEST DIMENSIONS

| No. | Eggs | D.Wl. (mts) | Depth to | | Width of | |
|-----|------|----------------|------------------|-------------------|---------------|------------------|
| | | | 1st egg (cms) | last egg (cms) | neck (cms) | chamber (cms) |
| 1. | 104 | 5.5 | 29 | 45 | 15.5 | 28.5 |
| 2. | 112 | -- | 18 | 38 | 11.5 | 23.0 |
| 3. | 115 | 10.0 | 41 | 53 | -- | 26.5 |
| 4. | 116 | -- | 19 | 38 | 10.5 | 21.5 |
| 5. | 124 | 7.0 | 29 | 45 | 17.0 | 25.5 |
| 6. | 150 | 15.0 | 38 | 56 | 16.5 | 33.0 |

D.Wl. : Distance from waterline.

Eggs

Information regarding clutch size has been reported by a number of authors from different geographic areas. (Table II). From the Madras coast, a mean clutch size of 126 (n = 23) and a range of 79 to 160 have been reported by Silas and Rajagopalan (1984). This year we recorded a mean clutch size of 126.83 (n = 68) with a range of 88 to 155.

A few clutches contained one or two small, undersized and yolkless eggs. A single clutch of 155 eggs contained two abnormalities in the form of multiple fusions. Both these eggs failed to hatch and no discernible embryo could be perceived with the naked eye.

Incubation period

Incubation period, including emergence time, progressively decreased from 52 to 49 days over the course of the season. It is evident that with increasing temperatures (towards summer), incubation periods have decreased.

Hatchery record

Hatching success for the 68 nests collected was 66.376 %. Dead in pipped eggs (DPE), Dead in nest (DIN) and unhatched (UH) were 22.249 %, 1.588 % and 9.785 % respectively. Total egg viability or fertility is therefore calculated to be 90.213 %.

Hatchlings

Three lightly pigmented hatchlings were obtained from the same clutch. These hatchlings took longer to develop than their 'clutch mates' and were discovered when nest contents were being examined following release of most hatchlings. These hatchlings failed to survive.



Plate V. Public participation on the 'Ridley Trails'

PROMOTIONAL AND EDUCATIONAL ACTIVITIES

During the inaugural year of the SSTCN's Sea Turtle Programme both field work and conservation education were given equal importance. Since the primary source of financial support was the large unknown public, funds and publicity proved to be related to a great extent.

SSTCN Badges

Plastic badges depicting a hatchling sea turtle were distributed among those actively involved in the programme.

Stickers

Blue, green and yellow stickers with an emerging hatchling and the legend " Don't let him die ! " served to achieve the dual purpose of raising funds and promoting the organisation and its sea turtle programme.

Posters

Posters inviting people especially students to join the conservation movement were exhibited at various institutions in and around Madras city.

Ridley Trail

Numerous members of the student community and the general public accompanied us on our " Ridley Trail " in search of nesting sea turtles. These trails proved to be ideal opportunities to discuss with the participants topics related to the state of the world's environment, the urgency of the situation and the conservation of our marine ecosystems.

Hatchery visits

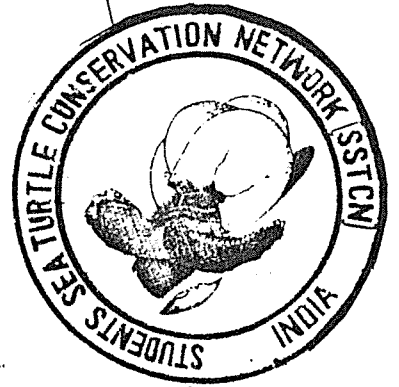
Even after the conclusion of the nesting season and the Ridley Trails people continued to visit the hatchery. A certain amount of controlled public participation was allowed during the release of hatchlings. This served to strengthen their involvement in the conservation movement.

Signature Campaigns

Sponsored signature campaigns were conducted with the help of the students from Sishya and The School-KFI. This campaign in addition to generating the much needed funds also educated people on the predicament faced by the Ridley on our shores.

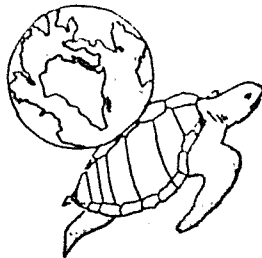
STUDENT'S SEA TURTLE CONSERVATION NETWORK (SSTCN)

A1/4/4, 3rd Main Road, Besant Nagar
Madras - 600 090. Tamil Nadu, INDIA.
Phone : 11-6-01



FRIENDS OF THE RIDLEY

.....
.....
.....



The stability of our planet is being questioned by a growing array of environmental threats. As we continue to ravage the world's natural resources we are destroying the very life-support systems upon which we depend.

Over the past few centuries man has driven many an animal to extinction. The sea turtle population on the Madras coast faces a similar threat. Your support and involvement in our programme to save the Olive Ridley is sincerely appreciated.

"THE RIDLEY TRAIL"

(AN ACTIVITY OF THE STUDENTS SEA TURTLE CONSERVATION NETWORK)

I made it happen

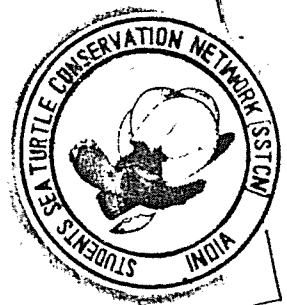
DATE :

NAME :



Don't let him die!

STUDENTS SEA TURTLE CONSERVATION NETWORK (SSTCN) MADRAS - INDIA



HAMADRYAD

JULY 1989

14 No: 1

Scene

On the Turtle Trail

Turtle walks are not all a honeymoon. But they are stimulating experiences for a nature lover. The students who spend the night turtle walking on the beach work, have fun and learn.

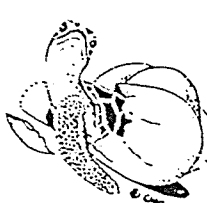
November through February night falls abruptly like a blanket, in the tropics. And Madras sleeps when the city slumbers, a group of students walk its deserted streets waiting for the Oliver Ridleys.

It is a quiet night. The sea rolls soft and ceaselessly on the shore. The sands blanch and glisten in starlight. Not far in the distance, lights flash the garish neon of the harbour. The lighthouse beam over sea and beach. The turtle watchers wait. It is a quiet night. The sea rolls soft and ceaselessly on the shore. The sands blanch and glisten in starlight. Not far in the distance, lights flash the garish neon of the harbour. The lighthouse beam over sea and beach. The turtle watchers wait. It is a quiet night. The sea rolls soft and ceaselessly on the shore. The sands blanch and glisten in starlight. Not far in the distance, lights flash the garish neon of the harbour. The lighthouse beam over sea and beach. The turtle watchers wait.

The turtle watchers wait. It is a quiet night. The sea rolls soft and ceaselessly on the shore. The sands blanch and glisten in starlight. Not far in the distance, lights flash the garish neon of the harbour. The lighthouse beam over sea and beach. The turtle watchers wait. It is a quiet night. The sea rolls soft and ceaselessly on the shore. The sands blanch and glisten in starlight. Not far in the distance, lights flash the garish neon of the harbour. The lighthouse beam over sea and beach. The turtle watchers wait.

"Never in the realm of nature have so many been exterminated by so few in so short a time."

From 'Let them Live' by KAI CURRY LINDAHL



STUDENTS SEA TURTLE CONSERVATION NETWORK (SSTCN) NEWSLETTER (1) JULY 1989

deviously shovels sand with her strong flippers all around, as a decoy. Then she walks back, in a straight but 'downtrack' to the

the bag, the turtle watchers cover the hole and move on.

The turtle watchers look like a select band of beach bums. They wear scruffy shirts and trousers rolled up to the knees. Some have a pair of not too shabby keds slung around their necks. Each carries a well worn cloth bag. Few of them know each other in the gang. Yet under the expanse of the night sky and by the vast stretches of land and sea, a strange companionship is born. Everybody shares a commitment or at least a sympathy for a cause. There is excitement in discovery and a sense of adventure in the anticipation of the unknown.

At the head of the group is a lean, jean and jacket clad figure with a rucksack — Tito Chandy. Between November and March the beach becomes Tito's nocturnal habitat. He knows it like the back of his hand. Almost every night he is on the beach, looking for eggs, beating poachers to them, and watching for turtles. His rucksack has a strange assortment of things. It has a Bible, for Tito to read by starlight when work for the night is over and it is not yet bed time. "Now I can make do with four hours of sleep a night," says Tito. There is a thermometer to measure temperature inside and outside the nest; an inch-tape to take the dimensions of the nest, cloth bags, a stick, a bedsheet, and cigarettes. Tito has the sight of a lynx. Where others see the sand scooped in a million confused footprints, Tito can detect a turtle track. When the smooth track with flipper marks is spied, the corresponding downtrack is traced. At their meeting point the turtle walkers begin scooping the sand, looking for eggs. Sometimes there are no clear uptracks or downtracks. The turtle, befuddled by lights, meanders a bit or decides not

ASIDE

Newsletter

SSTCN's first newsletter was distributed among students, teachers, environmentalists and interested members of the public.

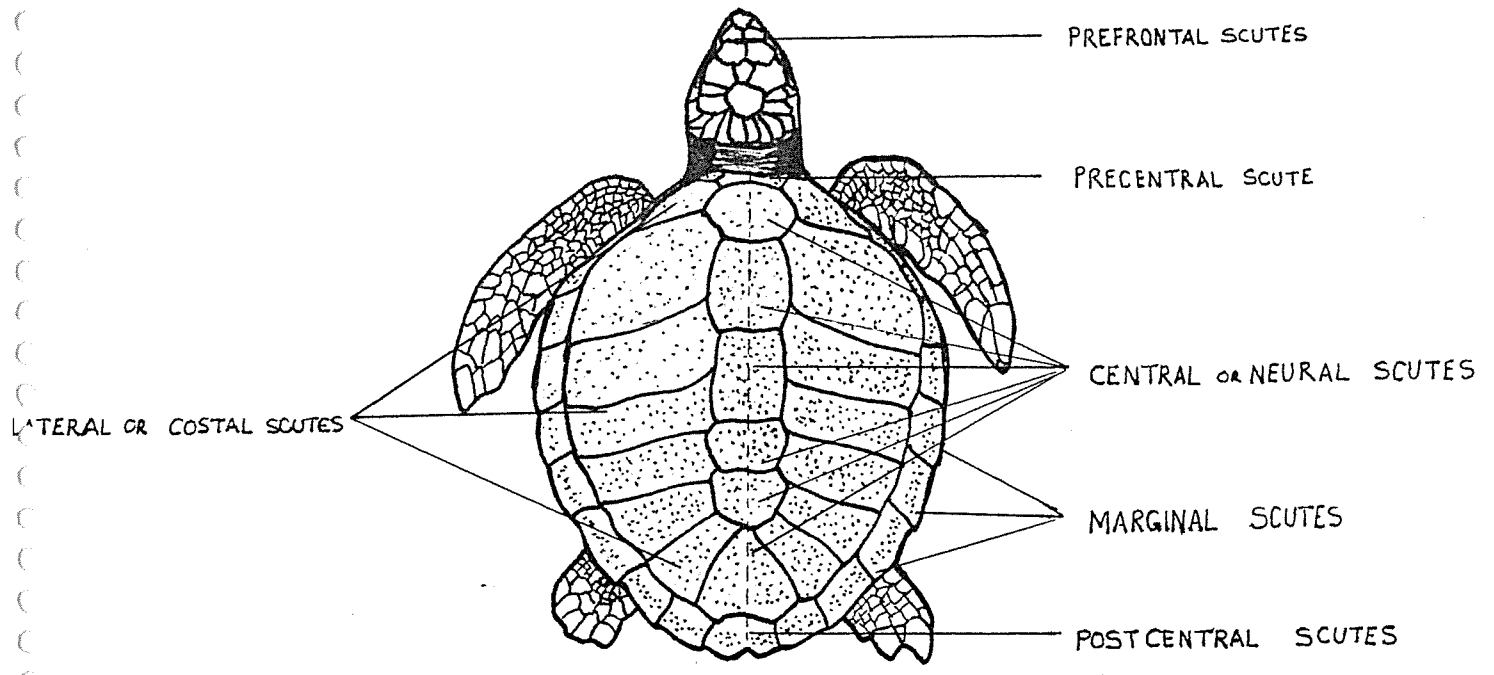
Film

A short (15 minute) documentary film was taken during the latter half of the sea turtle season. The film highlighted the predicament faced by the Ridley, various causative factors and conservation work at the hatchery. The film was subsequently screened for various school and college groups.

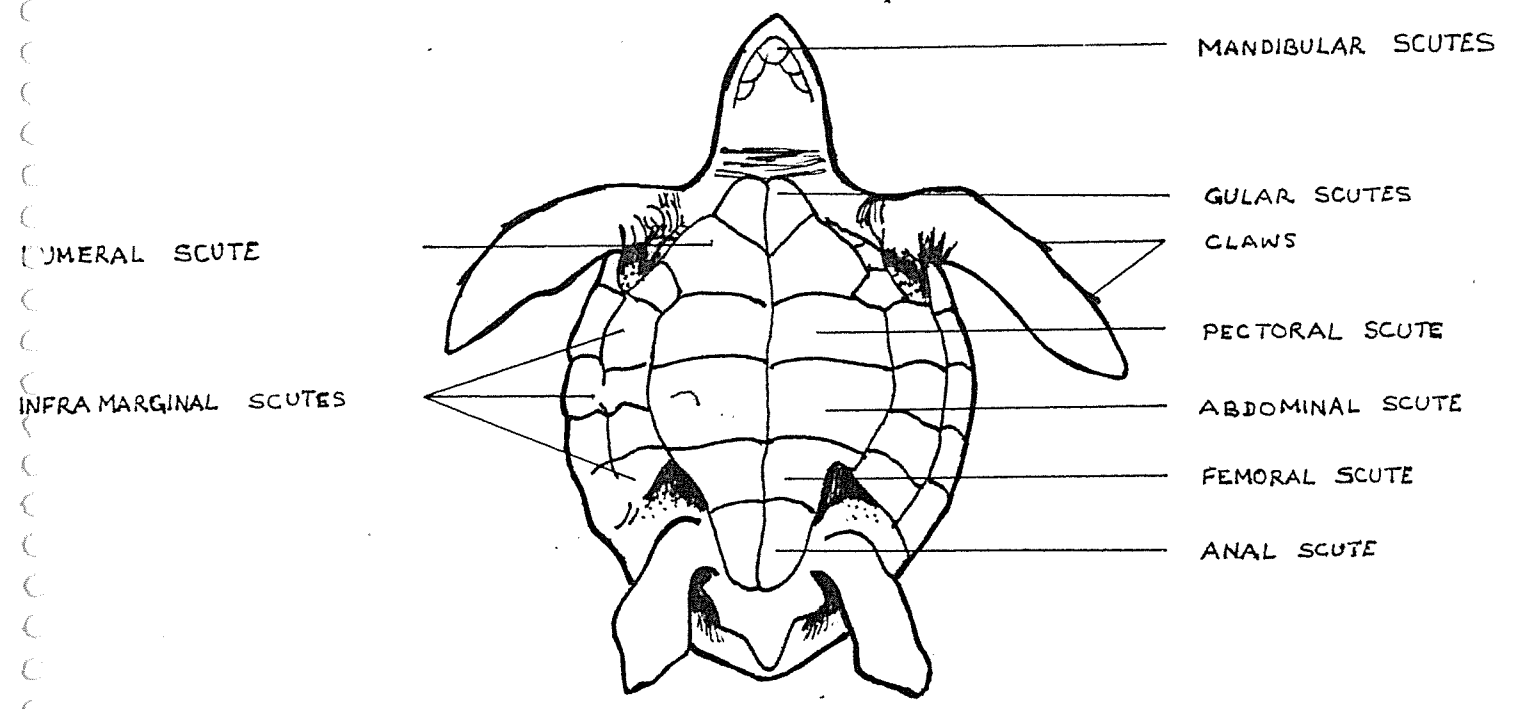
ASIDE, a city magazine featured an article on the SSTCN and its Sea Turtle Programme in its March 1989 issue.

The HAMADRYAD, Journal of the Madras Crocodile Bank Trust, published an account of the Network's activities in its August 1989 issue.

In addition, communication lines were established with other conservation groups, institutions, environmentalists and sympathetic members of the public.



DORSAL VIEW



VENTRAL VIEW

Figure IV. Guide to morphological terms.

Of the 6000 reptilian species surviving today, over 210 belong to the group of tortoises and turtles. Sea turtles comprise of two families namely, Dermochelyidae with a single species, the Leatherback and Cheloniidae with seven species. Five sea turtle species are found to occur in Indian waters. They are the Olive Ridley, Hawksbill, Loggerhead, Green and Leatherback.

SIMPLIFIED KEY TO SEA TURTLE SPECIES OF THE WORLD

1. Leathery shell with seven longitudinal keels:(Leatherback, Dermochelys coriacea.)
 - 1a. Hard shell with horny scutessee 2
 2. One pair of prefrontal scalessee 3
 - 2a. Two pairs of prefrontal scalessee 4
 3. Three scales behind each eye; carapace with upturned margins: (Flatback, Chelonia depressa.)
 - 3a. Four scales behind each eye; carapace heart shaped without upturned sides: (Green, Chelonia mydas ; Black, Chelonia agassizi.)
 4. Four pairs of laterals on each side of the carapace:(Hawksbill, Eretmochelys imbricata.)
 - 4a. More than four pairs of lateral scutessee 5
 5. Reddish brown upper body surface ; plastron with three pairs of enlarged inframarginal scutes: (Loggerhead, Caretta caretta.)
 - 5a. Gray or olive upper body surface; plastron with four pairs of enlarged inframarginals.....see 6
 6. Five pairs of lateral scutes on the carapace: (Kemp's Ridley, Lepidochelys kempfi.)
 - 6a. Six or more pairs (rarely five) of lateral scutes: (Olive Ridley, Lepidochelys olivacea.)

See Figure IV; an illustrated guide to morphological terms. (modified from "Manual of sea turtle research and conservation techniques", Centre for Environmental Education, Washington D.C.)

SYSTEMATICS

Olive Ridley (*Lepidochelys olivacea*, Eschscholtz.)

Phylum : Chordata

Subphylum : Vertebrata

Class : Reptilia

Subclass : Anapsida

Order : Testudines

Suborder : Cryptodira

Superfamily : Chelonioidae

Family : Cheloniidae

Subfamily : Carettini

Genus : *Lepidochelys*

Species : *olivacea*

Lepidochelys olivacea (Eschscholtz)

1829. *Chelonia olivacea*, Eschscholtz, Zool. Atlas pt. 1, p.2, pl.11.
1931. *Caretta caretta olivacea*, Smith, Fauna Bri. Ind., 1 : 71 & 72.
1933. *Lepidochelys olivacea*, Deraniyagala, Ceylon J. Sci. (B) XVII :
62 - 72.
1951. *Lepidochelys olivacea olivacea*, Carr, Handbook of Turtles,
341 - 410.
1976. *Lepidochelys olivacea*, Zwinenberg, Bull. Maryland Herpt. Soc.
12 (3) : 75 - 95.

OLIVE RIDLEY

Common and vernacular names

The Olive Ridley or Pacific Ridley is locally known as 'Gadha kachua' in North India (Hindi), 'Sithamai' in Tamil Nadu (Tamil) and 'Samudram thabelu' in Andhra Pradesh (Telugu).

Description

Smallest among the worlds sea turtles, the Olive Ridley measures upto 27.5 inches (70 cms) over the carapace with weights of upto 45 kgs. In adults the carapace is heart shaped, almost as wide as long. The carapace is hard shelled with non overlapping (juxtaposed) horny scutes.

The numerical arrangement of scutes on the carapace is variable. The Centrals or Vertebrales range from 5 to 9. The Laterals or Costals display a corresponding number of pairs, usually 6 to 8 (rarely 5 to 9). The Precentral or Nuchal is generally in contact with the first costal. The margin formed of 27, rarely 25, Marginal scutes is more or less serrated posteriorly.

Plastral scutes is generally constant. A distinct pore is present on the posterior edge of each of the four inframarginal scutes of the plastron.

Head is medium sized and upto 13 cms wide. Two pairs of prefrontal scales are present. Upper jaw is hooked.

In the adult a single claw is usually present on each anterior flipper which is much stronger and more curved in the male.

The tail of the mature male is much longer than that of the female, extending at least as far as the tips of the posterior stretched flippers. In the female, the tail does not exceed the hind rim of the carapace. The middle of the plastron of the male is more concave.

The olive colour of the adult, without mottling or variegation, gives it it's common name. The plastron is yellow.

In juveniles, the carapace is strongly tricarinate with three distinct keels. Colouration in hatchlings is dark grey to black above and greyish white below.

Distribution

The Olive Ridley is a widely distributed species found to occur almost circum-globally in Pacific, Indian and South Atlantic waters. Large reproductive aggregations called 'Arribadas' occur in limited areas on the Pacific coasts of Mexico and Costa Rica and also in Suriname and India.

In the Indian subcontinent, nesting beaches of the Olive Ridley have been identified in Pakistan, Gujarat, Maharashtra, Goa, Kerala, Lakshwadeep, Gulf of Mannar, South west Sri Lanka, South of Madras, Point Calimere, Orissa and the Andaman and Nicobar Islands.

Status

Though the most abundant of sea turtles, the Olive Ridley is an endangered species today. Populations have declined due to excessive poaching, loss of nesting habitat and directed fishery for meat and skin. The Olive Ridley is included in the International Union for the Conservation of Nature and Natural Resources (IUCN) - Red Data Book.

Legal Overview

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973.

Designed to control international trade in endangered species and their products and parts. Species threatened with extinction are listed in CITES Appendix I and are subject to strict trade regulations. All sea turtles are now included under appendix I.

Indian Wildlife (Protection) Act, 1972.

From September 1977 sea turtles have been placed under Schedule I of the Act. This stipulates that all sea turtles are totally protected.

Life cycles

Marine turtle life cycles include an oceanic and a terrestrial phase. All sea turtles begin life on shore as hatchlings. Growth till maturity continues at sea with adult females coming ashore to nest in turn.

Little is known about courtship and mating which takes place offshore. The possibility that sea turtles are capable of delayed fertilization with the ability to store eggs was questioned and remains a mystery.

Nesting grounds for the Olive Ridley are known from mainland tropical beaches of Pacific, Indian and South Atlantic waters. Large nesting aggregations called 'Arribadas' are found in India, Suriname, Costa Rica and Mexico.

In the Olive Ridley peculiar annual nesting rhythms are noticeable. Within-season internesting intervals are often much larger and more variable than in other sea turtles. This is probably because the timings of nesting seem to be governed by environmental factors such as wind, tide and surf conditions, (Pritchard 1969b ; Schulz 1975). Nesting seasons vary from place to place with distinct peaks in nesting abundance evident.

The Olive Ridley usually nests at night though diurnal nestings are also known.

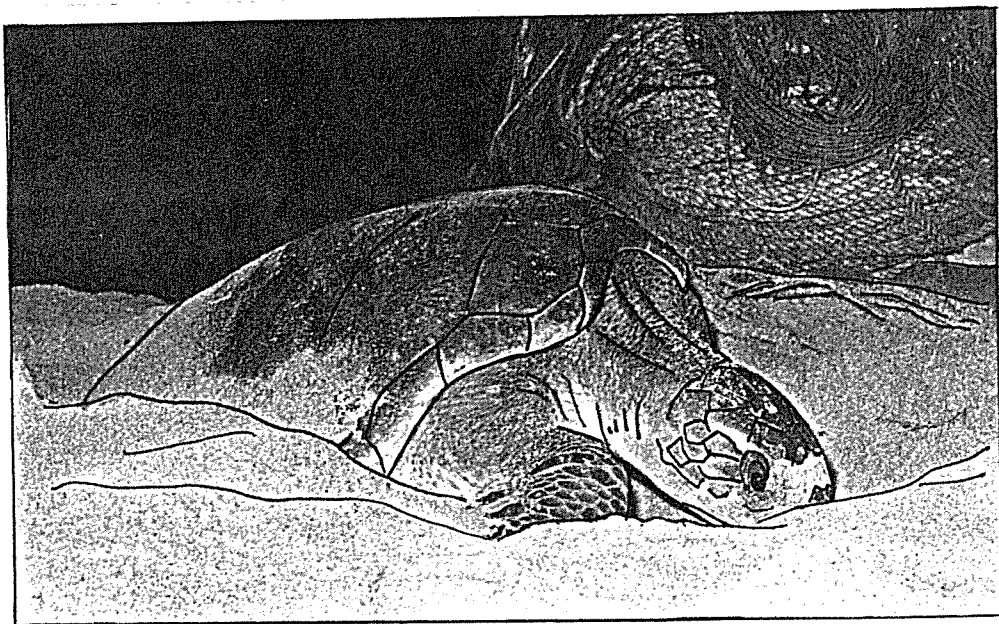
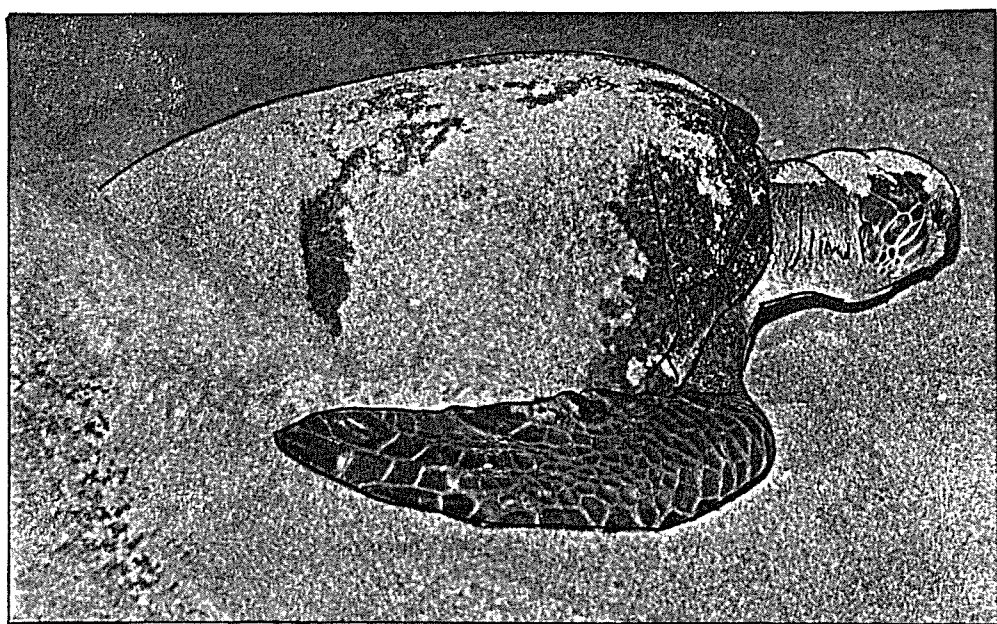


Plate VI & VII. Nesting Olive Ridley



Descriptive accounts of nesting behaviour for the Olive Ridley have been contributed by Pritchard (1969a) and Schulz (1975). Carr and Ogren (1960) quantitatively divided the entire nesting process for sea turtles in general into the following phases :

Stranding, Testing of stranding site and emergence from wave wash.
Selecting of course and crawling from surf to nest site.
Selecting of nest site.
Clearing of nest premises.
Excavating of body-pit. (shallow in the Ridley)
Excavating of nest hole.
Oviposition.
Filling, covering and packing of nest hole.
Filling of body-pit and concealing of site of nesting.
Selecting of course and locomotion back to the sea.
Re-entering of wave wash and traversal of surf.

Only minor variations seem to exist among species.

The eggs are typically 4 cms in diameter. Clutch sizes average 115 eggs. Incubation periods which depend on mean sand temperature, usually average 47 to 52 days.

After breaking free from the egg shell hatchlings remain below the surface for a few days. Emergence above ground is under cover of darkness and cued by the cooler night time temperatures. The extremely active hatchlings head straight for the sea. This 'juvenile frenzy' continues till they reach deep sea.

After a long maturation period they remigrate to the breeding grounds to nest which completes the cycle.

GLOSSARY OF TERMS

- BODY PIT : a depression created by the female turtle during nesting.
- CARAPACE : the dorsal shell of turtles.
- CARUNCLE : the horny tubercle on the snout of a baby turtle used to cut through the eggshell.
- CENTRAL SCUTES : the large scutes extending down the mid-line of the carapace, also called vertebral scutes.
- CRAWL : tracks of the turtle on the beach.
- DIURNAL : referring to day time activity.
- EMERGENCE : a. female - the term for the female turtle leaving the water and coming ashore to nest.
b. hatchling - the hatchlings leaving the nest cavity on their way to the sea.
- ENDANGERED : any taxa likely to become extinct within the foreseeable future if those factors responsible for its status continue operating.
- HATCHERY : a protected enclosure for the incubation of relocated nests.
- INCIDENTAL CATCH : capture of a species while fishing for another species.
- INFRAMARGINAL SCUTES : scutes situated between the marginals and the pectoral, abdominal and femoral scutes of the plastron.
- LATERAL SCUTES : the large scutes running along each side of the carapace between the marginals and centrals Also called the Costals.
- MARGINAL SCUTES : the small scutes around the edge of the carapace.
- PLASTRON : the shell covering the underside of a turtle.
- PRECENTRAL SCUTE : scute immediately preceding the centrals, included in the shell margin. Also called the Nuchal scute.
- PREFRONTAL SCALES : scales covering the area between the nasal opening and the anterior part of the orbit.
- SCUTES : term used for the horny, epidermal scales covering the bony carapace and plastron.
- JUVENILE FRENZY : the heightened period of activity or rapid swimming of hatchlings out to sea following the emergence from the nest.
- THREATENED : taxa likely to become endangered within the foreseeable future. Basically the same as the "vulnerable" category used by the IUCN.

BIBLIOGRAPHY

- Biswas, S. 1982. A Report on the Olive Ridley, Lepidochelys olivacea (Eschscholtz) [Testudines : Cheloniidae] of Bay of Bengal. Rec. zool. Surv. India, 79 : 275 - 302.
- Bjorndal, K.A., Editor. 1982. Biology and Conservation of Sea Turtles. Smithsonian Institute Press, Washington D.C.
- Carr, A.F. 1967. So Excellent a Fish. Nat. Hist. Press, N.Y.
- Chandy, M. 1970. Fishes, India - the land and the people.
- Hirth, H.F. 1980. Some Aspects of the Nesting Behaviour and Reproductive Biology of Sea Turtles. Amer. Zool., 20 : 507 - 523.
- Pritchard, P.; P. Bacon; F. Berry; A. Carr; J. Fletemeyer; R. Gallagher; S. Hopkins; R. Lankford; R. Marquez M.; L. Ogren; W. Pringle Jr.; H. Reichart and Witham. 1983. Manual of sea turtle research and conservation techniques, Second Edition. K.A. Bjorndal and G.H. Balazs, editors. Center for Environmental Education, Washington D.C.
- Ruiz, G. 1988. Olive Ridley Sea Turtle, Lepidochelys olivacea, Conservation and Research in 1987 on the coast of Oaxaca, Mexico.
- Silas, E.G. 1984. Sea Turtles of India - Need for a Crash Programme on Conservation and Effective Management of the Resources. Mar. Fish. Infor. Serv. No. 50.
- Silas, E.G. 1984. Sea Turtle Research and Conservation - some problem areas. Bull. cent. Mar. Fish. Res. Inst., 35 : 1-8.
- Silas, E.G., Editor. 1984. Proceedings of the Workshop on Sea Turtle Conservation. Cent. Mar. Fish. Res. Inst., special publication no 18.
- Smith, M.A. 1931. Fauna of British India, Reptilia and Amphibia. 1 - Loricata, Testudines, London (Tylor & Francis).
- Sternberg, J. 1981. The Worldwide Distribution of Sea Turtle Nesting Beaches. Sea Turtle Rescue Fund, Center for Environmental Education.
- _____ Hamadryad, 4 : No 3. 1979. Madras Snake Park Trust.
- _____ Mar. Fish. Infor. Serv. T & E Ser., No 50 : 1983. Cent. Mar. Fish. Res. Inst.
- _____ Marine Turtle Newsletters.

(WILDLIFE-I)

19-54/86 WL-I

The 22nd December, 1988

Chief wildlife warden,
1710, Tiruchi Road,
Coimbatore-641045.

**SUBJECT: PERMISSION TO RUN TURTLE HATCHARY NEAR
PERIYA NEELANGARI VILLAGE ON THE MAHAPALI-
PURAM ROAD IN TAMILNADU.**

Sir,

The Govt. of India has considered the proposal sent by you for collection of 100 nests of Lepidechelys olivacea and it has been decided to grant permission to Mr. Chandy Abraham to collect 100 nests for hatching purpose. This issue with the approval Joint Secretary(Wildlife).

Yours faithfully,

(S.C. SHARMA)
JOINT DIRECTOR (WL)

Copy to: 1. Chief Wildlife Warden, Tamilnadu for information and necessary action.

2. Mr. Chandy Abraham for information.

(S.C. SHARMA)
JOINT DIRECTOR (WL)

Phone : Office : 24150
Residence : 42118

TAMILNADU FOREST DEPARTMENT.

From
Thiru P. Padmanaban, I.F.S.,
Chief Wildlife Warden,
1710, Tiruchi Road,
Coimbatore - 641 045.

To
The Joint Secretary to Government of India,
Department of Environment
Forests and Wildlife,
Wildlife I Section,
Paryavaran Bhavan,
C.G.O. Complex, New Delhi-3.

C.No. 17668/88D2, Dated 8.12.1988.

Sir,

Sub: Permission to run Turtle Hatchery near
Periya Neelangarai village on the Mahapalipuram
Road in Tamilnadu.

Ref: Dr.P.J.Sanjeeva Raj, CRENIBO letter dt.23.11.

I wish to state that one Mr. Chandy Abraham, student
sea turtle conservation net work, 8, Gurukul Campus, Kellys,
Madras-10 has applied for permission to run Sea Turtle Hatchery
near Periya Neelangarai village on the Mahapalipuram Road
to involve the training of students in conservation education.

For his research purpose, he wants 100 nests after
relocation of the eggs in Hatchery and release of hatchling.
The zoological name of the sea turtle is Lepidochelys olivacea
which comes under the item No. 13 Part II in Schedule I.

For his research purpose he wants five Assistants
for this work. He wants to conduct the research at the Madras
Sea Coast Adjacent to Periyaneelangarai village.

Under Section 12 of the Wildlife (Protection) Act
the prior permission of the Government of India is
necessary for the schedule I animals.

Hence I recommend that the permission may be given
to Mr. Chandy Abraham for three years to run Turtle Hatchery
and to involve the training of students in conservation
education and to collect 100 nests of sea turtle (Lepidochelys
olivacea) for his research purpose. A copy of the letter
is enclosed.

Yours faithfully,


CHIEF WILDLIFE W.

✓ Copy to Mr. Chandy Abraham, C/o. Students Sea Turtle
Conservation net work, 8, Gurukul Campus, Kellys,
Madras-600 010.

MDP/15.12.

M. 15.12.88

MADRAS—INDIA, EAST COAST

Lat. 13° 06' N. Long. 80° 18' E.

TIME ZONE: -0530

TIMES AND HEIGHTS OF HIGH AND LOW WATERS

YEAR 1989

| JANUARY | | | FEBRUARY | | | MARCH | | | APRIL | | | | | | | | | | | | | | |
|---------|-------|------|----------|-------|------|-------|-------|-------|-------|-------|------|------|-------|-------|----|------|------|----|------|-------|----|------|------|
| TIME | Ht. m | | TIME | Ht. m | | TIME | Ht. m | | TIME | Ht. m | | TIME | Ht. m | | | | | | | | | | |
| 1 | 0126 | 0.94 | 16 | 0223 | 0.87 | 1 | 0021 | 0.66 | 16 | 0352 | 0.53 | 1 | 0355 | 0.59 | 16 | 0005 | 0.32 | | | | | | |
| Su | 0827 | 0.45 | | 0911 | 0.33 | | 0704 | 0.20 | Th | 0956 | 0.33 | Sa | 0955 | 0.31 | | 0608 | 0.75 | | | | | | |
| | 1515 | 0.91 | M | 1606 | 0.93 | W | 1412 | 0.70 | .. | 1709 | 0.75 | Su | 1647 | 0.85 | Su | 1150 | 0.39 | | | | | | |
| | 2100 | 0.65 | | 2221 | 0.53 | | 2019 | 0.43 | .. | .. | .. | | 2333 | 0.28 | | 1805 | 0.89 | | | | | | |
| 2 | 0223 | 0.87 | 17 | 0350 | 0.79 | 2 | 0412 | 0.62 | 17 | 0117 | 0.30 | 2 | 0120 | 0.58 | 17 | 0010 | 0.33 | 2 | 0530 | 0.71 | | | |
| M | 0931 | 0.44 | | 1028 | 0.34 | | 1052 | 0.26 | | 0646 | 0.65 | | 0829 | 0.25 | | 0546 | 0.58 | 2 | 1118 | 0.27 | | | |
| | 1630 | 0.93 | Tu | 1729 | 0.95 | Th | 1801 | 0.86 | F | 1238 | 0.21 | Th | 1603 | 0.71 | F | 1129 | 0.30 | Su | 1744 | 0.95 | | | |
| | 2230 | 0.63 | | 2358 | 0.49 | .. | .. | .. | | 1919 | 0.91 | | 2245 | 0.42 | | 1812 | 0.81 | .. | .. | .. | | | |
| 3 | 0345 | 0.82 | 18 | 0527 | 0.76 | 3 | 0029 | 0.40 | 18 | 0152 | 0.23 | 3 | 0349 | 0.53 | 18 | 0056 | 0.26 | 3 | 0019 | 0.17 | 18 | 0104 | 0.22 |
| Tu | 1035 | 0.41 | | 1140 | 0.31 | | 0550 | 0.66 | | 0727 | 0.71 | | 1021 | 0.24 | | 0639 | 0.66 | | 0625 | 0.86 | | | |
| | 1734 | 0.98 | W | 1835 | 1.00 | F | 1157 | 0.19 | Sa | 1317 | 0.15 | F | 1732 | 0.79 | Sa | 1224 | 0.26 | M | 1217 | 0.21 | Tu | 1312 | 0.32 |
| | 2347 | 0.58 | .. | .. | .. | | 1850 | 0.95 | | 1952 | 0.97 | .. | 1853 | 0.86 | | 1831 | 1.04 | | 1831 | 1.04 | Tu | 1912 | 0.95 |
| 4 | 0506 | 0.82 | 19 | 0107 | 0.41 | 4 | 0117 | 0.30 | 19 | 0220 | 0.17 | 4 | 0011 | 0.32 | 19 | 0126 | 0.20 | 4 | 0057 | 0.06 | 19 | 0128 | 0.17 |
| | 1132 | 0.35 | | 0638 | 0.78 | | 0649 | 0.74 | | 0759 | 0.77 | | 0543 | 0.61 | | 0714 | 0.74 | | 0709 | 1.00 | | 0744 | 1.01 |
| W | 1824 | 1.04 | Th | 1236 | 0.26 | Sa | 1249 | 0.12 | Su | 1351 | 0.13 | Sa | 1140 | 0.18 | Su | 1303 | 0.22 | Tu | 1304 | 0.15 | W | 1344 | 0.28 |
| .. | .. | .. | | 1923 | 1.05 | | 1930 | 1.05 | | 2019 | 1.01 | | 1824 | 0.91 | | 1924 | 0.93 | | 1912 | 1.11 | | 1938 | 0.97 |
| 5 | 0042 | 0.51 | 20 | 0155 | 0.34 | 5 | 0155 | 0.20 | 20 | 0244 | 0.13 | 5 | 0056 | 0.20 | 20 | 0149 | 0.15 | 5 | 0134 | -0.03 | 20 | 0151 | 0.14 |
| | 0608 | 0.84 | | 0727 | 0.82 | | 0737 | 0.83 | | 0829 | 0.83 | | 0642 | 0.74 | | 0748 | 1.12 | | 0609 | 1.06 | | | |
| Th | 1219 | 0.28 | F | 1321 | 0.21 | Su | 1334 | 0.06 | M | 1420 | 0.11 | Su | 1235 | 0.11 | M | 1335 | 0.18 | W | 1349 | 0.10 | Th | 1413 | 0.26 |
| | 1906 | 1.10 | | 2002 | 1.10 | | 2006 | 1.14 | | 2044 | 1.03 | | 1906 | 1.02 | | 1951 | 0.96 | | 1951 | 1.15 | | 2005 | 0.97 |
| 6 | 0126 | 0.43 | 21 | 0232 | 0.29 | 6 | 0233 | 0.10 | 21 | 0307 | 0.10 | 6 | 0133 | 0.08 | 21 | 0211 | 0.11 | 6 | 0211 | -0.08 | 21 | 0215 | 0.11 |
| | 0657 | 0.88 | | 0806 | 0.85 | | 0820 | 0.92 | | 0857 | 0.87 | | 0727 | 0.87 | | 0829 | 1.19 | | 0836 | 1.09 | | | |
| F | 1302 | 0.21 | Sa | 1358 | 0.18 | M | 1416 | 0.03 | Tu | 1449 | 0.11 | M | 1321 | 0.05 | Tu | 1405 | 0.16 | Th | 1433 | 0.08 | F | 1443 | 0.24 |
| | 1945 | 1.17 | | 2036 | 1.13 | | 2044 | 1.20 | | 2108 | 1.04 | | 1942 | 1.11 | | 2032 | 1.14 | | 2032 | 1.14 | | 2030 | 0.96 |
| 7 | 0206 | 0.36 | 22 | 0304 | 0.25 | 7 | 0310 | 0.03 | 22 | 0329 | 0.08 | 7 | 0208 | -0.02 | 22 | 0232 | 0.08 | 7 | 0247 | -0.10 | 22 | 0239 | 0.10 |
| | 0742 | 0.93 | | 0840 | 0.87 | | 0903 | 0.99 | | 0925 | 0.91 | | 0808 | 0.98 | | 0836 | 0.95 | | 0908 | 1.21 | | | |
| Sa | 1342 | 0.16 | Su | 1430 | 0.16 | Tu | 1500 | 0.03 | W | 1518 | 0.12 | Tu | 1405 | 0.01 | W | 1433 | 0.15 | F | 1518 | 0.09 | Sa | 1512 | 0.23 |
| | 2022 | 1.23 | | 2107 | 1.14 | | 2121 | 1.22 | | 2132 | 1.02 | | 2019 | 1.16 | | 2037 | 0.99 | | 2112 | 1.09 | | 2057 | 0.94 |
| 8 | 0246 | 0.29 | 23 | 0334 | 0.23 | 8 | 0348 | -0.02 | 23 | 0352 | 0.06 | 8 | 0243 | -0.09 | 23 | 0253 | 0.05 | 8 | 0325 | -0.07 | 23 | 0304 | 0.09 |
| | 0825 | 0.97 | | 0912 | 0.89 | | 0946 | 1.03 | | 0953 | 0.92 | | 0849 | 1.06 | | 0901 | 0.99 | | 0950 | 1.18 | | | |
| Su | 1423 | 0.14 | M | 1503 | 0.17 | W | 1543 | 0.05 | Th | 1549 | 0.13 | W | 1449 | 0.00 | Th | 1503 | 0.14 | Sa | 1603 | 0.12 | Su | 1543 | 0.24 |
| | 2101 | 1.27 | | 2135 | 1.14 | | 2159 | 1.21 | | 2156 | 0.99 | | 2057 | 1.07 | | 2101 | 0.98 | | 2155 | 1.02 | | 2125 | 0.91 |
| 9 | 0327 | 0.24 | 24 | 0400 | 0.21 | 9 | 0426 | -0.03 | 24 | 0416 | 0.06 | 9 | 0318 | -0.13 | 24 | 0315 | 0.04 | 9 | 0406 | 0.00 | 24 | 0334 | 0.10 |
| | 0910 | 1.00 | | 0945 | 0.91 | | 1031 | 1.04 | | 1023 | 0.92 | | 0929 | 1.10 | | 1034 | 1.12 | | 1004 | 1.06 | | | |
| M | 1507 | 0.14 | Tu | 1534 | 0.19 | Th | 1628 | 0.10 | F | 1621 | 0.16 | Th | 1532 | 0.02 | Su | 1651 | 0.18 | M | 1619 | 0.27 | | | |
| | 2139 | 1.30 | | 2202 | 1.12 | | 2238 | 1.15 | | 2221 | 0.95 | | 2135 | 1.14 | | 2240 | 0.92 | | 2157 | 0.87 | | | |
| 10 | 0409 | 0.20 | 25 | 0428 | 0.20 | 10 | 0505 | -0.01 | 25 | 0441 | 0.07 | 10 | 0356 | -0.12 | 25 | 0338 | 0.04 | 10 | 0447 | 0.08 | 25 | 0404 | 0.12 |
| | 0956 | 1.02 | | 1017 | 0.91 | | 1116 | 1.01 | | 1054 | 0.90 | | 1010 | 1.10 | | 1120 | 1.03 | | 1042 | 1.02 | | | |
| Tu | 1550 | 0.18 | W | 1606 | 0.23 | F | 1716 | 0.17 | Sa | 1654 | 0.20 | F | 1616 | 0.06 | Sa | 1602 | 0.16 | Tu | 1658 | 0.30 | | | |
| | 2220 | 1.29 | | 2228 | 1.09 | | 2319 | 1.06 | | 2248 | 0.89 | | 2216 | 1.07 | | 2152 | 0.91 | | 2233 | 0.82 | | | |
| 11 | 0451 | 0.18 | 26 | 0455 | 0.20 | 11 | 0546 | 0.05 | 26 | 0508 | 0.09 | 11 | 0434 | -0.07 | 26 | 0404 | 0.05 | 11 | 0532 | 0.18 | 26 | 0441 | 0.16 |
| | 1045 | 1.03 | | 1052 | 0.91 | | 1205 | 0.96 | | 1127 | 0.86 | | 1054 | 1.05 | | 1206 | 0.96 | | 1126 | 0.99 | | | |
| W | 1638 | 0.24 | Th | 1641 | 0.27 | Sa | 1807 | 0.25 | Su | 1727 | 0.24 | Sa | 1702 | 0.12 | Su | 1633 | 0.19 | Tu | 1842 | 0.33 | W | 1746 | 0.35 |
| | 2302 | 1.25 | | 2255 | 1.04 | .. | .. | .. | | 2315 | 0.82 | | 2257 | 0.96 | | 2219 | 0.85 | | 2316 | 0.77 | | | |
| 12 | 0534 | 0.18 | 27 | 0523 | 0.21 | 12 | 0001 | 0.94 | 27 | 0539 | 0.12 | 12 | 0515 | 0.01 | 27 | 0431 | 0.07 | 12 | 0018 | 0.70 | 27 | 0525 | 0.22 |
| | 1137 | 1.02 | | 1129 | 0.89 | | 0631 | 0.12 | | 1207 | 0.81 | | 1140 | 0.97 | | 0621 | 0.28 | | 1218 | 0.95 | | | |
| Th | 1729 | 0.31 | F | 1718 | 0.32 | Su | 1259 | 0.89 | M | 1807 | 0.30 | Su | 1751 | 0.20 | W | 1319 | 0.86 | Th | 1848 | 0.39 | | | |
| | 2344 | 1.19 | | 2323 | 0.98 | | 1903 | 0.33 | | 2344 | 0.74 | | 2340 | 0.84 | | 2004 | 0.39 | | .. | .. | | | |
| 13 | 0619 | 0.20 | 28 | 0554 | 0.22 | 13 | 0049 | 0.81 | 28 | 0614 | 0.16 | 13 | 0558 | 0.11 | 28 | 0504 | 0.10 | 13 | 0131 | 0.62 | 28 | 0017 | 0.72 |
| | 1232 | 1.00 | | 1208 | 0.87 | | 0721 | 0.20 | | 1256 | 0.75 | | 1232 | 0.87 | | 0727 | 0.36 | | 0622 | 0.30 | | | |
| F | 1824 | 0.39 | Sa | 1757 | 0.37 | M | 1405 | 0.81 | Tu | 1856 | 0.37 | M | 1849 | 0.29 | Tu | 1749 | 0.30 | Th | 1443 | 0.81 | F | 1323 | 0.93 |
| | .. | .. | | 2353 | 0.91 | | 2018 | 0.41 | .. | .. | .. | | .. | .. | | 2322 | 0.73 | | 2009 | 0.40 | | | |
| 14 | 0029 | 1.10 | 29 | 0627 | 0.24 | 14 | 0149 | 0.68 | 29 | 0648 | 0.21 | 14 | 0029 | 0.71 | 29 | 0542 | 0.15 | 14 | 0336 | 0.60 | 29 | 0148 | 0.69 |
| | 0709 | 0.24 | | 1253 | 0.83 | | 0832 | 0.27 | | 0648 | 0.21 | | 1231 | 0.81 | | 0912 | 0.42 | | 0744 | 0.38 | | | |
| Sa | 1333 | 0.97 | Su | 1842 | 0.43 | Tu | 1542 | 0.76 | Tu | 1340 | 0.78 | W | 1843 | 0.36 | F | 1614 | 0.82 | Sa | 1439 | 0.93 | | | |
| | 1927 | 0.47 | .. | .. | .. | | 2220 | 0.44 | | 2008 | 0.37 | | .. | .. | | 2318 | 0.37 | | 2138 | 0.36 | | | |
| 15 | 0120 | 0.98 | 30 | 0024 | 0.83 | 15 | 0341 | 0.59 | 30 | 0135 | 0.59 | 15 | 0135 | 0.59 | 30 | 0005 | 0.66 | 15 | 0515 | 0.66 | 30 | 0342 | 0.75 |
| | 0804 | 0.29 | | 0707 | 0.27 | | 1013 | 0.30 | | 0759 | 0.29 | | 0632 | 0.22 | | 1048 | 0.42 | | 0927 | 0.42 | | | |
| Su | 1443 | 0.94 | M | 1349 | 0.79 | W | 1727 | 0.78 | W | 1521 | 0.72 | Th | 1341 | 0.77 | Sa | 1719 | 0.85 | Su | 1555 | 0.96 | | | |
| | 2044 | 0.52 | | 1940 | 0.48 | .. | .. | .. | | 2228 | 0.39 | | 2011 | 0.41 | | .. | .. | | 2244 | 0.28 | | | |
| | | | 31 | 0104 | 0.74 | | | | | | | 31 | 0126 | 0.59 | | | | | | | | | |
| | | | | 0804 | 0.30 | | | | | | | | 0758 | 0.29 | | | | | | | | | |
| | | | Tu | 1511 | 0.76 | | | | | | | F | 1521 | 0.78 | | | | | | | | | |
| | | | | 2111 | 0.51 | | | | | | | | 2219 | 0.38 | | | | | | | | | |