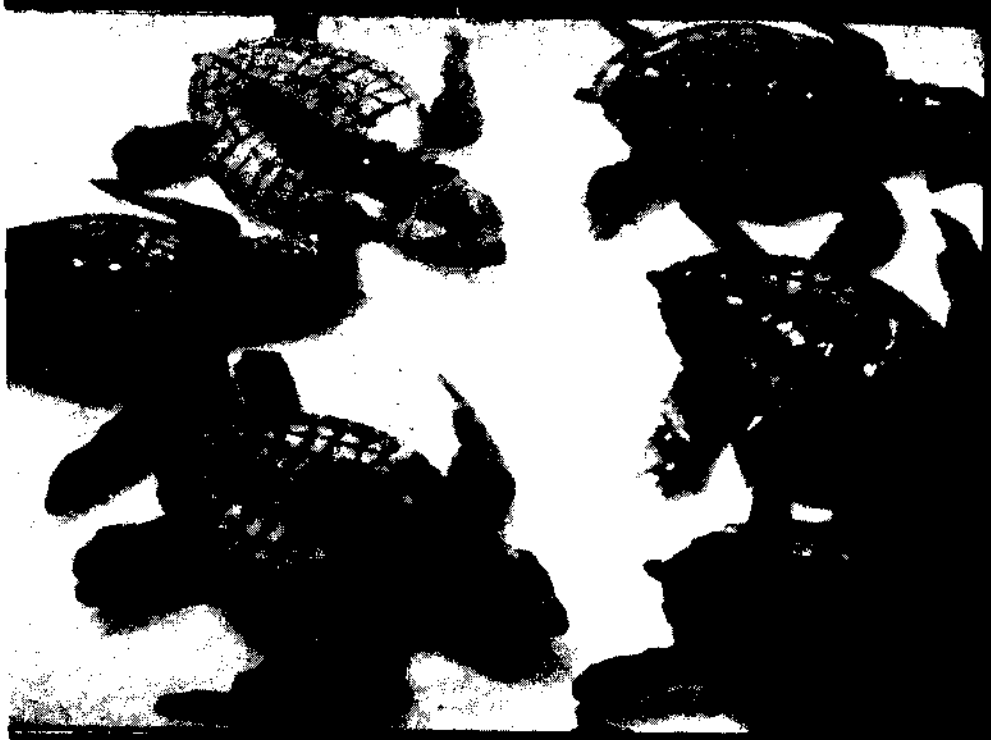
CMFRI SPECIAL PUBLICATION
Number 18

PROCEEDINGS OF THE WORKSHOP ON SEA TURTLE CONSERVATION



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(Continued on back inside)

Cover : Olive ridley hatchlings at CMFRI Farm.

PROCEEDINGS OF THE WORKSHOP ON SEA TURTLE CONSERVATION

27-29, February, 1984, Madras

Organised by

THE CENTRAL MARINE FISHERIES RESEARCH INSTITUTE, COCHIN

in cooperation with

THE DEPARTMENT OF ENVIRONMENT
(GOVERNMENT OF INDIA)
THE MARINE BIOLOGICAL ASSOCIATION OF INDIA
and
THE MADRAS CROCODILE BANK

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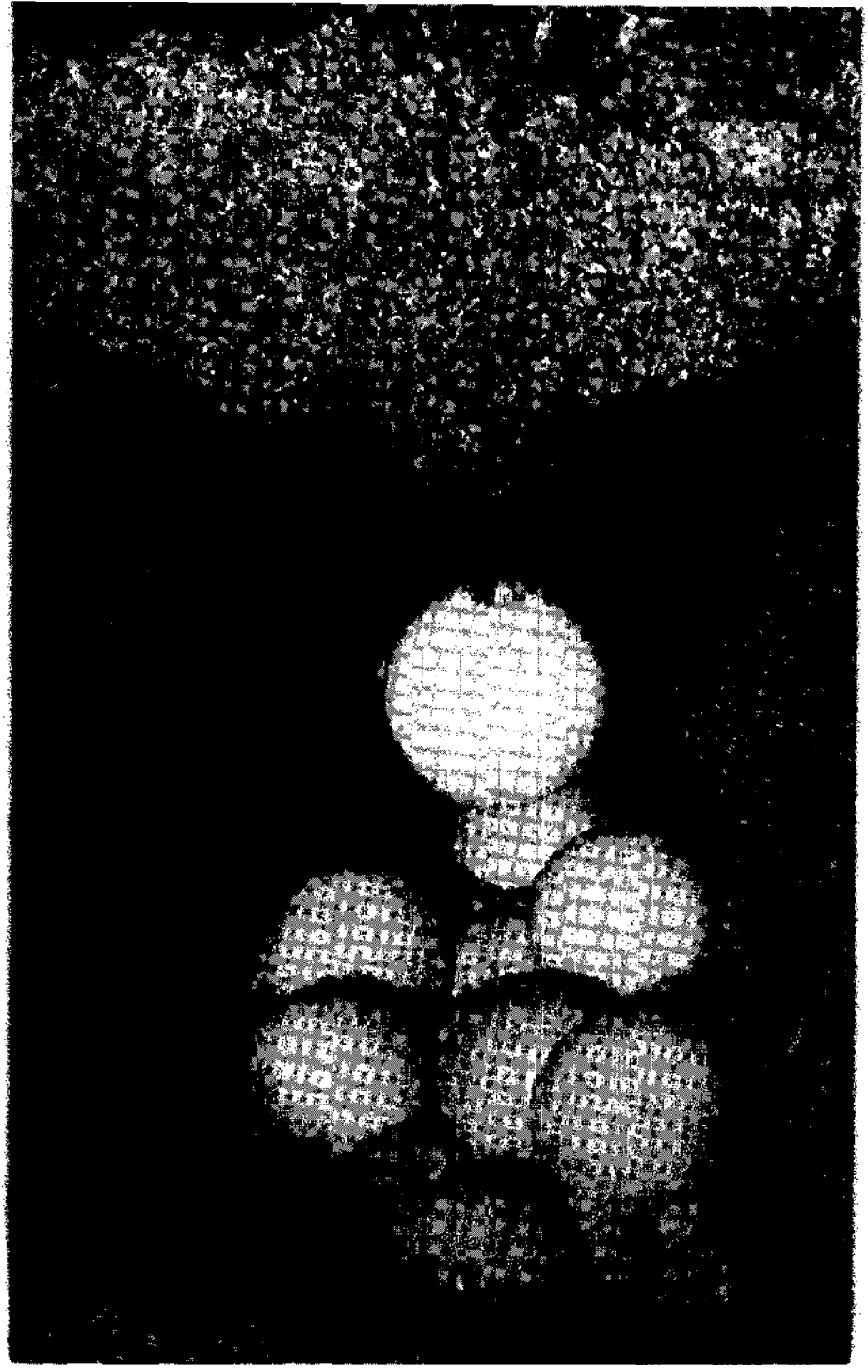


Olive ridley *Lepidochelys olivacea*—oviposition

PREFACE

Sea turtles have attracted considerable attention in recent years on account of their vulnerability despite the fact that all the five species occurring in our seas are protected under the Indian Wildlife (Protection) Act 1972. The mass nesting of the olive ridley *Lepidochelys olivacea* along parts of the Orissa Coast and the illegal capture and sale of this species in the Calcutta markets as well as the heavy accidental catch in fishing operations and consequent mortality and strandings have focussed greater attention on the need for developing proper conservation and management measures for this and other species. Turtle egg predation by man and animals has been rampant in some of the nesting grounds and an effective control is a major unfulfilled task. In addition, there is considerable biodegradation of some of the nesting beaches due to human interference resulting in recent years in the total absence of nesting on such beaches. Very extensive man-made engineering works such as the sea walls along Kerala Coast or protective embankments near Harbours have gone a long way in completely obliterating some of the nesting beaches. To some extent, activities such as beaching of boats, seasonal migrant settlement of fisherfolk on nesting beaches and development of beach resorts have also been significant perturbations.

The sea turtles are vulnerable to predation at all stages of their life cycle whether it be the eggs, hatchlings, sub-adults or adults. Our knowledge of the biology of the sea turtles is very meagre and we have no precise ideas about their life habits, behaviour and their routes of migration to feeding and breeding grounds. While nesting beach surveys and beach walking are of utmost importance in identifying and demarcating nesting beaches, more observations in space and time are needed to give us precise ideas about core areas which need urgent protection by declaring them as sea shore reserves or part of marine parks or sanctuaries. Realising the importance of sea turtles as a resource which needs urgent protection and management, the Department of Environment, Government of India has recently constituted a Sea Turtle Specialist

Group to consider the steps to be taken for the conservation of sea turtles.

In the light of major lacunae in our knowledge, it was felt that the time was appropriate to discuss some of these problems, in depth, at a common forum so that guidelines could be evolved for an action plan with priority areas identified for immediate attention. With this in view, the Central Marine Fisheries Research Institute (Indian Council of Agricultural Research) organised this Workshop on 'Sea Turtle Conservation' at Madras from 27 to 29 February, 1984 with the cooperation of the Department of Environment, Government of India, the Marine Biological Association of India and the Madras Crocodile Bank. The three-day Workshop which was inaugurated by Shri S. A. Subramani, Secretary, Forest and Fisheries Department, Government of Tamil Nadu was attended by 42 participants from the Forest and Wildlife Departments, the Fisheries Departments, Central Government Organisations, Universities and other interested agencies. The programme was discussed under eight Technical Sessions with lead papers on the following themes :

Session I : PROBLEMS OF SEA TURTLE CONSERVATION IN INDIA

Session II : KINDS OF SEA TURTLES IN INDIA, THEIR STATUS AND DISTRIBUTION
MASS NESTING BEACHES OF ORISSA

Session III : VALUE OF SEA TURTLES TO INDIA (FOOD, SUBSISTENCE, CULTURAL, AESTHETIC AND ECOLOGICAL)

Session IV : THE THREATS TO SEA TURTLES IN INDIA

Session V : RECOVERY AND MANAGEMENT PROGRAMMES FOR SEA TURTLES IN INDIA : THEIR VALUE, LOGISTICS AND PROBLEMS

Session VI : CONTEMPORARY PROBLEMS IN SEA TURTLE BIOLOGY AND CONSERVATION—THE URGENT NEED FOR REGIONAL COOPERATION

Session VII : STATE STATUS REPORTS

Session VIII : FUTURE RESEARCH AND CONSERVATION STRATEGIES FOR INDIA—RECOMMENDATIONS

The Workshop aimed at eliciting the maximum possible discussion on the basis of personal experiences as well as seek suggestions from the representatives from the implementing bodies so that feasible recommendations could be made for positive consideration by the Government of India, the concerned State Governments and Organizations for active follow up.

Two important recent publications on sea turtles brought out by the Central Marine Fisheries Research Institute (*Marine Fisheries Information Service*, Technical and Extension Series, **50** : 1-40, 1983, and the *Central Marine Fisheries Research Institute Bulletin*, **35** 1-82, 1984) issued to participants at the Workshop, made available considerable amount of background information on the status of work on sea turtles in India as well as information on the most recent mass nesting of the olive ridley along the Gahirmatha Coast, Orissa in January-February 1984.

The Technical Session on 'Future research and conservation strategies for India—Recommendations' was chaired by me and the panel consisting of the Chairmen of the different technical sessions helped in formulating the draft recommendations. This and the lead papers presented at the various Technical Sessions, the ensuing discussions and the discussions at the final Session helped in the adoption of the recommendations. These have been carefully scrutinised, edited and grouped and are presented here for early action.

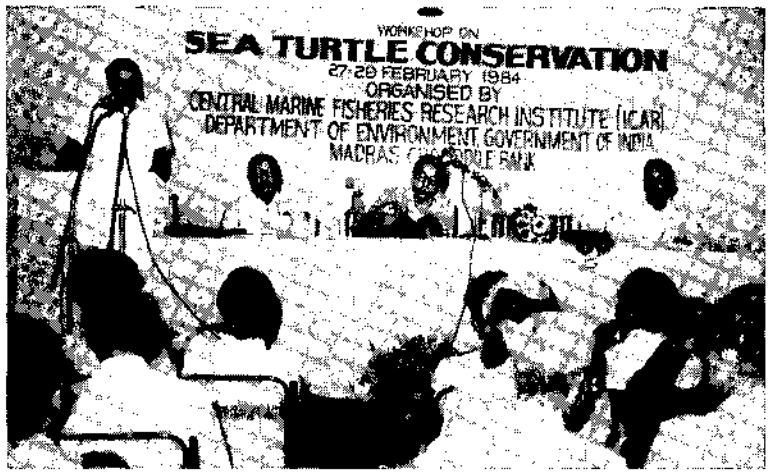
A serious consideration and immediate follow-up action on these recommendations are necessary by all concerned agencies and organisations. There is a greater need today for developing and strengthening effective coordination between the Forest and Fisheries Departments of the various maritime States combined with the full cooperation and goodwill of the Coast Guard and the Indian Navy. There is also an urgent need for interstate co-operation for sharing of data. The Universities and the sources of funding for research programmes *viz.*, the I.C.A.R., Department of Environment and other agencies also need coordination so that funds are not frittered away on identical projects. There is an urgent need for identification of research on various aspects of the different species of sea turtles for which dispensation for collection and examination of sea turtle eggs, hatchlings, young

and adults should be forthcoming from the enforcing authorities. Benign research would form part of the programme of the non-consumptive utilisation of sea turtles. A serious consideration is also necessary as to whether rational utilisation of the olive ridley resource could be undertaken by utilising the doomed eggs or culling a few adults. The Workshop recognised that this aspect needs immediate attention and calls for also investigations on population dynamics and recruitment of olive ridley in this region. Ways and means of minimising accidental or incidental catch by developing modified fishing gear or enforcing fishing regulations in selected areas will be necessary.

I wish to specially place on record my sincere thanks to Shri J. C. Daniel, Shri P. Kannan, Dr. J. Frazier, Shri Romulus Whitaker, Dr. P. J. Sanjeeva Raj and Dr. P. Vedavyasa Rao for the help and cooperation that they extended in the conduct of the Workshop and the finalisation of the recommendations. Thanks are also due to the authorities of the Forest Department, Government of Tamil Nadu, the CMFRI and the Crocodile Bank for making it possible for the participants to visit their facilities at Neelankarai, Muttukadu and Kovalam, and Vadanemmeli respectively. I must also thank my colleagues Shri D. Sadananda Rao, Shri P. T. Meenakshisundaram, Shri M. Rajagopalan, Shri M. Vijayakumaran, Dr. E. Vivekanandan, Dr. D. B. James, Shri K. Rengarajan, Mrs. Rosy Joachim and others at the Central Marine Fisheries Research Institute for their active help and cooperation in the conduct of the Workshop.

E. G. SILAS
Director
Central Marine Fisheries
Research Institute,
Cochin-682 018

26 June 1984



Thiru S. A. Subramani inaugurating the Workshop. Sitting *L.* to *R.* Dr. E. G. Silas, Shri J. C. Daniel and Shri M. Rajagopalan.

Participants in the Inaugural Session.

Thiru S. A. Subramani releasing the CMFRI Bulletin No. 35 on Sea Turtle Research and Conservation. Shri K. Shanmuganathan, Retired Additional Chief Conservator of Forest, Tamil Nadu receiving the same.

Participants returning after seeing one year to four year old olive ridley in captivity for research observations at CMFRI Farm at Muthukad, Chingleput District, Madras.

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Subject : PROBLEMS OF SEA TURTLE CONSERVATION IN INDIA

—Shri J. C. Daniel

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1200-1300 TECHNICAL SESSION—II

Chairman : Shri J. C. Daniel

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—Shri Satish Bhaskar

2. MASS NESTING BEACHES OF ORISSA

—Shri Chandrasekhar Kar

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—Shri M. Rajagopalan

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—Shri Dattatri Shekar

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Chairman : Dr. J. Frazier

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2000-2400 Beach Walk for seeing turtle nesting

29 FEBRUARY 1984

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—Dr. J. Frazier

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2. Status Report of Tamil Nadu on sea turtles
   —K. Shanmuganathan and Joseph Jogindranath
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   —S. L. Chandarji
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Chairman : Dr. E. G. Silas

Subject : FUTURE RESEARCH AND CONSERVATION STRATEGIES FOR INDIA — RECOMMENDATIONS

INAUGURAL SESSION

Welcome Address : DR. E. G. SILAS

Mr. Chairman, distinguished guest Thiru Subramani, Ladies and Gentlemen,

This is the first time we are holding a Workshop in India to discuss matters concerning the conservation and management of our sea turtle resources. There are 5 species of sea turtles in the Indian Seas and all are placed in Schedule I of the Indian Wildlife (Protection) Act 1972 as well as in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Until the recent past, we had been involved with subsistence fishery of sea turtles, particularly in the Gulf of Mannar for the green turtle *Chelonia mydas* and olive ridley *Lepidochelys olivacea*. There was a large scale trade in turtle eggs from the Gahirmatha Coast of Orissa to Calcutta markets for several decades. During the mid-seventies an explosive trade in sea turtles from Orissa to the Calcutta markets suddenly developed and this has been widely reported. Incidental catch of sea turtles in fishing operations such as gill net fishing has also resulted in large-scale mortalities as well as poaching along the Orissa and West Bengal coasts and to a very small extent in other areas. This is also a matter of great concern.

In the seventies there has been a global awareness that the populations of sea turtles due to indiscriminate exploitation have dwindled considerably in many parts of the world. The complicated life history of the sea turtles from the nesting beaches to the feeding grounds which may be several hundreds of kilometres away, and the to and fro long migrations that they undertake have made recruitment studies difficult. There is heavy pressure on the different phases of the life history of the sea turtle starting with human and non-human egg predation, heavy mortality on the beaches and the inshore waters of newly emerged hatchlings,

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The happenings along the Orissa Coast during the mass nesting or 'Arribada' of the olive ridley as well as the pioneering work started at Madras on the hatchery programme of this species by Mr. Romulus Whitaker and his group have helped to focus national attention on sea turtles. The Department of Environment of the Government of India has now constituted a Sea Turtle Specialists Group to look into the problems connected with the conservation of sea turtles. The Central Marine Fisheries Research Institute had started a recovery programme for sea turtles at Kovalam Research Centre of the Institute in 1977-78 and useful information has resulted from the work during the past few years. The Institute has been able to hatch and release over 40,000 hatchlings of the olive ridley in the sea under this programme. Some amount of basic research essential for conservation and management programme has also been carried out and the results of these studies undertaken during the past 5 years are embodied in the Special Bulletin on 'Sea Turtle Research and Conservation' being released at this inaugural function.

In addition to the recovery programme of the olive ridley, the Institute is also carrying out field surveys for demarcating nesting grounds for other species of sea turtles and life history studies. Special mention should be made of the investigations being initiated on turtle poisoning. The flesh of 2 species of sea turtles could become poisonous for human consumption during certain seasons and this has in the recent past resulted in a number of serious incidences of fatality along the South Tamil Nadu and South Kerala Coasts.

We have about 42 participants for this Workshop sponsored by the Forest Department of the various maritime States as well as few selected invitees from the Universities and organisations. We look forward for the 3 day deliberations to help us evolve an action plan and strategy for the future of sea turtles.

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In the hatchery programme between 90,000 and 1,00,000 turtle eggs have been collected and hatching success has been about 70 per cent. I feel that this may be in the right direction. I am hopeful that the programme could be extended to other parts of

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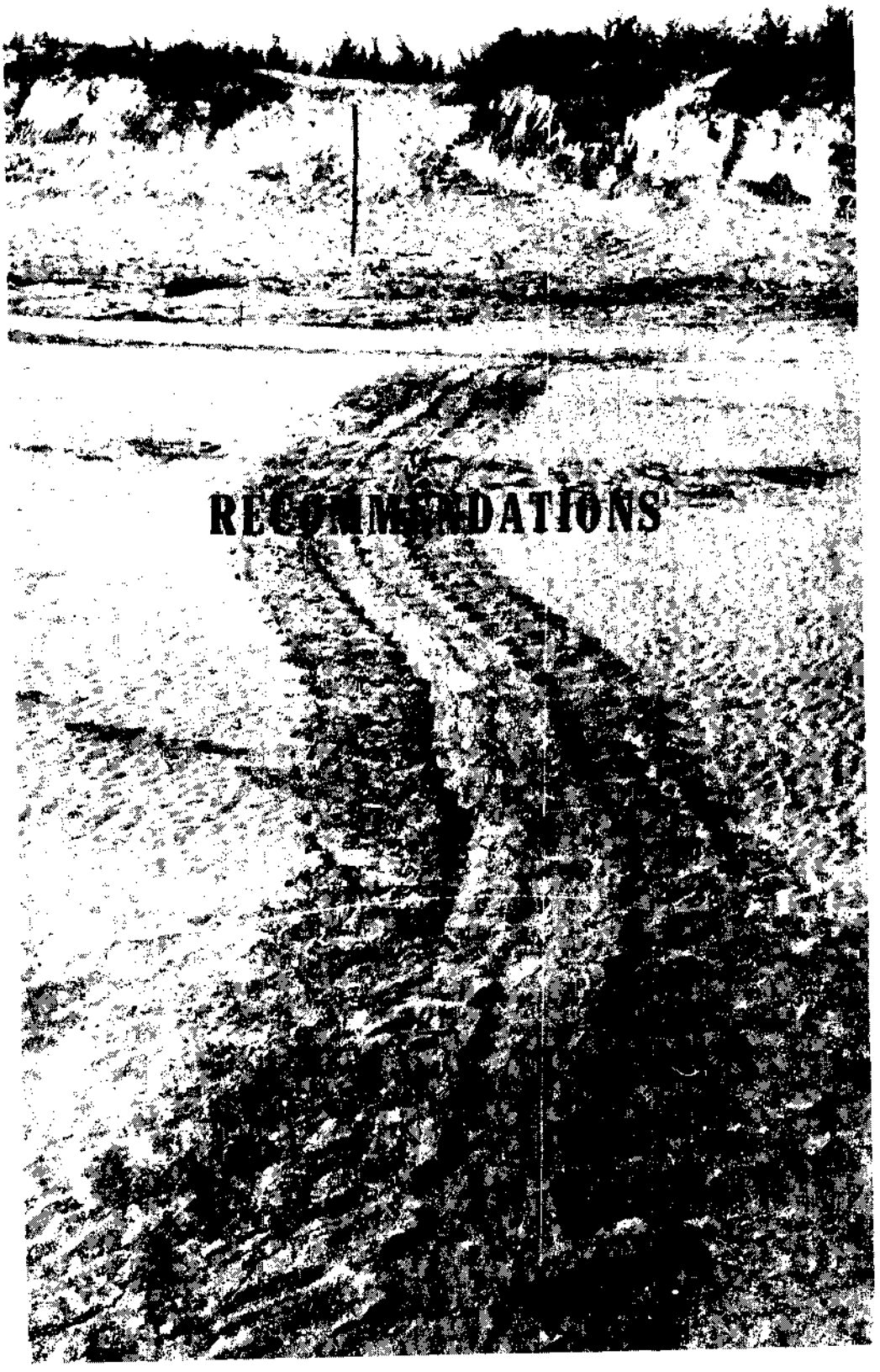

RECOMMENDATIONS

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FUTURE RESEARCH AND CONSERVATION STRATEGIES FOR INDIA

CHAIRMAN: DR. E. G. SILAS

The Chairman had the active co-operation of Shri J. C. Daniel, Shri P. Kannan, Dr. J. Frazier, Shri Romulus Whitaker, Dr. P. J. Sanjeevaraj and Dr. P. V. Rao in the draft formulation of the recommendations which were placed before the final session of the Workshop, discussed in depth and adopted. The recommendations have been edited, grouped and presented in the following pages.

WORKSHOP ON 'SEA TURTLE CONSERVATION' MADRAS 27–29 FEBRUARY 1984

RECOMMENDATIONS

The review and the experience papers presented and the discussions deliberated at the Workshop on 'Sea Turtle Conservation' held at Madras from 27 to 29 February, 1984 identified five major areas for evolving effective strategies for conservation and management of the sea turtle resources of India. These areas are :

HABITAT PRESERVATION of the present critical areas, already identified vulnerable areas, new areas and the national sea shore system ;

SPECIES PRESERVATION through recovery programmes, translocation of nests and setting up of hatcheries ;

LEGISLATION AND ENFORCEMENT of prevalent laws and regulations and future requirements ;

RESEARCH pertaining to biology, ecology, reproductive physiology and endocrinology ; behaviour and

EDUCATION, TRAINING AND EXTENSION especially among public and children on the importance of turtles and need for their conservation, and of the supervisory personnel.

In addition to these, the immediate needs of sea turtle conservation by State Governments were identified on the basis of the lead papers and discussions. The general discussion further highlighted the role of the maritime State Governments and Union Territories, particularly Andhra Pradesh, Gujarat, Andaman-Nicobar Islands and Goa where the turtles are known to visit the

beaches during the nesting period. There is an immediate need of protection of these nesting populations, nesting beaches and the hatchlings in these coastal regions.

Conservation and management of sea turtle resources are complex and require an integrated approach. A pragmatic action-plan, therefore, needs evaluation of life history and behaviour of turtles, their resource characteristics, exploitation, protection measures and their impact on the socio-economic milieu of the society, conservation strategies and clear government policies and programmes. Discussing these and several other related issues, the Workshop resolved the following recommendations.

1. Habitat Preservation

In several ways, the ecological biome of the coast where turtles nest, is closely linked with successful recruitment to the turtle resources. However, increasing human and non-human interference of nesting areas, predation and destruction of turtle eggs and hatchlings, exploitation of eggs and adults for trade and disturbance of the coastal niches due to the beach side developments, are already adversely affecting the population of turtles and their offsprings in the Bhitarkanika, Konarak Coasts of Orissa, Point Calimere region in Tamil Nadu and Bhaidar Island near Okha in the Gujarat Coast. Several vulnerable areas along the south east coast and new areas in the Andaman-Nicobar Islands, Laksha dweep Islands and in Gujarat are identified during the course of the Workshop for consideration of immediate protection measures from the biotic and abiotic hazards.

The coastal zone, besides being a dynamic ecosystem, is an area of diversified activities relating to fisheries, industries, recreation, sport and health resorts. The diversities are often observed to be inter-linked and inter-connected, necessitating an understanding of the role of various critical factors in the management of this zone and its integrated use for the benefit of all. Taking into consideration the various adverse activities in the habitat of the turtle in the coastal zone and the need of developing an integrated system for the development of the area, the Workshop recommended :

1.1. Elevation of the Bhitarkanika Sanctuary in Orissa to the status of a National Park extending the seaward boundaries to include the coastal strip from Shortts Island and Wheeler Island to Hukitola and to protect the entire stretch of beach for mass nesting of the olive ridley.

1.2. Extension of the Konarak Sanctuary on the sea face by 10 km north to include the sand spit at the Devi River mouth which is another mass nesting beach for the olive ridley.

1.3. Evaluation of the Point Calimere Sanctuary for its extension on the seaward side and ways and means of conservation of turtle resource in the region.

1.4. Evaluation of the status of Bhaidar Island near Okha as a nesting site of the green turtle *Chelonia mydas*.

1.5. Establishment of the Gulf of Mannar National Marine Park.

1.6. Protection from human and non-human interferences of the South Bay beach and beaches near Jackson Creek in Little Andaman, South Reef, South Brother, North Brother and Snark Islands in the Andamans ; the beaches stradling the mouth of Dagmar and Alexandria Rivers on the west coast of Great Nicobar ; Suheli, Bangaram, Tinnakara, Parali and Pitti Islands in the Lakshadweep and Piram Island in Bhavanagar District in Gujarat.

1.7. Development of a National sea shore system/an integrated system of coastal zone management including social forestry programme, exclusive reservation of certain segments of beaches for turtle nesting and vegetation development at specified distances of atleast 100 m from the high water mark to allow high beach platform for facilitating nesting of turtles and to act as a screen to shield beaches from artificial light at night which not only keep turtles away from nesting,

but disorient hatchlings resulting in mass slaughter of baby turtles.

Action to be taken by : State Governments and Union Territories (1.1-1.6) and Department of Environment, Government of India and State Governments (1.7).

2. Species Preservation

It is realised that the 'recovery programme' which includes collection and translocation of eggs soon after nesting, incubation of eggs under controlled/protected condition and releasing of young ones, is a definite means of conservation of the turtle resource. Recovery programme through setting up of hatcheries was given considerable emphasis in the Workshop. Noting that there is no definitive guidelines as to the collection of data in the recovery programme and the need for improving the resource through species preservation, the Workshop recommended :

2.1. Standardised technologies be developed and the procedures be reviewed periodically for collection of data relating to turtle nests, nesting season, clutch size, transportation of eggs, transplanting, incubation and emergence of hatchlings and releasing of young turtles.

2.2. Detailed data be collected on recovery/rehabilitation programme on the four most threatened species in the region, viz., the hawksbill, the loggerhead, the green and leathery turtle for different regions of the coast with a view to improve the resource.

2.3. Attractive incentives/reward be provided for the services rendered in egg collection for the recovery programme and species preservation instead of payment on the basis of number of eggs collected, as at present.

Action to be taken by : CMFRI (ICAR), State Governments and Universities (2.1-2.3).

3. Legislations and their enforcement

Realising the various economic benefits of wildlife which includes turtles, its role in maintaining the balance of nature and in literature, art, culture and religion of the country, and at the same time, the undesirable destruction of the resource, legislations such as the Indian Wildlife (Protection) Act 1972 have been enacted and Wildlife Boards have been set up to help wildlife protection in India. India is also a member of the Convention of International Trade in Endangered Species of Fauna and Flora (CITES). The Workshop considered the existing legislations with particular reference to conservation and management of sea turtle resource. It noted the views of the delegates on the legislations to be formulated in future to meet the requirements. In case, Fisheries Act and Regulations are being enacted for different maritime States, the implication of the Indian Wildlife (Protection) Act 1972 and the extent the Fisheries Act can also be jointly effective may be considered and suitably promulgated. A reference was made to the laws, regulations and guidelines on coastal zone management embodied in a recent publication of the National Institute of Oceanography, Goa which stressed the control of pollution arising from the chemical, physical, thermal, sound, light and radioactive sources and those which affect and perturb the coastal zone from sand mining, oil spills and leakages from oil and gas containers and installations, and the establishment of a 500 m buffer zone from the high water mark free of development.

While the legislations for protection of wildlife in India are in force, the Workshop noted the handicaps in effective implementation and their enforcement in consideration of the social, political, cultural and traditional systems in vogue. It further discussed the Article III (5) dealing with ' Introduction from Sea ' of CITES and its relevance in the context of trapping of turtles in high seas and their transportation to Indian Ports. It was observed that the law is not clear whether trapping of sea turtles beyond the territorial waters of India and claiming them as incidental catch is a violation of Indian Wildlife (Protection) Act or not. In this context, the Workshop felt that it would be desirable to formulate appropriate internal legislation to improve CITES in India to protect sea turtles as envisaged in Article III (5) of CITES.

Discussing at length the various aspects of legislations and their enforcement, the Workshop recommended that :

3.1. A critical appraisal of the existing legislations relevant to conservation and management of sea turtle resource is made and interpretation of CITES article III (5) is reviewed for regulating capture of sea turtles from the EEZ of the country or their introduction through the EEZ.

3.2. Effective coordination be developed between the Forest and Wildlife Department with the Fisheries Department of the maritime States.

3.3. The sea patrol is effectively activated and surveillance strengthened for strict enforcement of the Acts and Legislations promulgated by the Centre, Forest and Wildlife Departments of the maritime States and Union Territories.

3.4. Suitable regulations be formulated to arm the Executive Officers with appropriate powers to confiscate powered, non-powered and any other vessels or vehicles used or engaged in poaching, illegal exploitation or transportation of sea turtles. In order to be effective, regulations to facilitate the process of ' Compounding ' Wildlife by officers who have apprehended a case by also delegating to them summary trial powers may be considered.

3.5. Appropriate legislations be formulated to prohibit use of mechanical or manual means, tools or any destructive instruments such as spear guns to kill sea turtles as well as the endangered marine animals from the EEZ of the country.

Action to be taken by : Department of Environment, Government of India, State Governments, Union Territories and Coast Guard (3.1-3.5).

4. Research

Scientific research on various aspects of life and resources of sea turtles in their natural environment is highlighted as an essential prerequisite for evolving viable measures and plans for conservation and management of the resource. The information on the biology, reproduction, ecology and behaviour of sea turtles of India available at present, is scanty. Due to the unique nature of the resource and the difficulties associated in the investigations on such resources and in view of the vital information needed not only on the resource but also on their environment, great emphasis is laid in Co-ordinated Co-operative research programmes. The Workshop identifying the short-term and long-term research needs to obtain reliable data recommended that :

4.1. Directed research be undertaken on growth and age ; reproduction, its process, physiology and endocrinology ; ecology ; food and feeding ; population characteristics and behaviour of sea turtles.

4.2. A planned survey be launched along the Indian Coast to identify nesting beaches, special habitats such as mangroves, coral reefs and marine pastures to facilitate monitoring of core areas of feeding and nesting for further consideration and planning of reserves and sanctuaries.

4.3. Investigations on beach erosion and accretion particularly at the important nesting beaches be intensified.

4.4. The unique phenomenon of congregation of world's largest population of sea turtles at the Gahirmatha and adjacent regions in the northeast coast be immediately studied to understand the biological, ecological and behavioural significance of the phenomenon and the factors contributing to it. Baseline studies of the NW Bay of Bengal are required to better understand the environmental requirements of the world's largest populations of sea turtles that nest at Gahirmatha and to establish standards for environmental monitoring

for early detection of perturbations that may threaten the species.

4.5. Data required to establish turtle hatcheries be collected and such programmes be encouraged with adequate financial support.

4.6. Trials with turtle excluder device in trawl nets be initiated and the gear modified to be available and beneficial of use in Indian waters.

4.7. For future conservation practices it is necessary to explore options of sustained exploitation. Serious consideration may be given to see whether rational sustainable utilization of sea turtle resources could be made in the context of mass nesting activity and the destruction of a sizeable percentage of eggs by nesting turtles as well as non-human predators. The culling of turtles as well as removal of doomed eggs may be given careful objective consideration. Such monitoring and evaluation of the resource is necessary to see whether the olive ridley at some time in the future be shifted from Schedule I to Schedule II of the Indian Wildlife (P) Act if scientific and management data are forthcoming to support the rational utilization of the resource.

4.8. A coordinated and centralised mark-recovery programme to gather information on growth, longevity, migration, mortality and other relevant aspects of life of sea turtles be initiated immediately with the CMFRI as the nodal organization.

4.9. A centralised data bank to facilitate collection, collation and dissemination of information gathered from scientific research, empirical knowledge of fishermen and other sources be established at the National Marine Living Resources Data Centre (NMLRDC) at the Central Marine Fisheries Research Institute with active cooperation and close linkage with Wildlife

Department, National Informatic Centre and other agencies engaged in the R & D programme of turtle resources.

4.10. Since the research and development programmes on turtle resource involve different organizations such as Department of Environment, Forest Departments, Fisheries Departments, Wildlife Departments, Research Institutes, voluntary organizations and realising the great importance of coordinated and cooperative programmes to obtain quicker information and results, such coordinated inter-institutional programmes be planned and taken up. To guide, advise, direct such programmes a Research Committee for Sea Turtles in India with appropriate terms of reference be constituted and established by the Department of Environment, Government of India.

4.11. Similarly, a Coordination Committee be established for the maritime States of the east coast (West Bengal, Orissa, Andhra Pradesh, Tamil Nadu and Pondicherry) to facilitate formulation of coordinated action plan and its implementation for the conservation and management of sea turtle resources particularly the olive ridley turtle.

4.12. To facilitate exchange of information and discussions among the various individuals/organisations to tackle problems of conservation and management of sea turtle resources and related issues and to ensure coordinated programmes, periodical workshops, seminars and symposia be organised. This should also stimulate international regional cooperation in sharing information and facility.

Action to be taken by : Department of Environment, Government of India, CMFRI (ICAR), Universities, State Governments and Non-governmental organizations (4.1-4.12).

5. Education, Training and Extension

Education, Training and Extension play a significant role in the formulation and effective implementation of policies for the rational conservation and management of turtle resources. The public, the children, the tourists and the novice have to be educated with the principles and conception of nature, values of the living resources particularly the endangered and vulnerable species and their non-consumptive utilization for the benefit of the present and future generations. The introduction of conservation measures such as banning of capture of turtles, the eggs and destruction of their nests and pollution of the environment in which they live fail to meet the objectives and become contraversies because of ignorance of the public towards these issues and the nature of the resource. The need for creating enhanced interest in the natural resources and moulding public policy is becoming greater day by day. Acknowledging the vital importance of this aspect, the workshop, recommended that :

5.1. Concerted efforts be made on mass education of the public, fishermen and school children through information media such as doordarshan, radio, press, mobile film shows on the conservation and management of turtle resources, their economic benefits and their environment and legal aspects of sea turtle exploitation and strengthening school syllabus to include more on conservation.

5.2. Organised training courses be offered to field officers and extension officers who are involved with sea turtle conservation programmes.

5.3. Extension programmes relating to turtle conservation be strengthened and intensified to propagate the values of conservation of turtle resources for the benefit of mankind.

5.4. The fund of historical information available with the coastal fishermen and villagers on sea turtles be collected so that information is not lost for ever.

A central organisation such as CMFRI could take the lead in this matter and coordinate with the Anthropological Society of India and other relevant institutions.

Action to be taken by : Government of maritime States and Union Territories ; CMFRI, ICAR, Bombay Natural History Society, World Wildlife—India, Ministry of Information and Broadcasting, Government of India (5.1-5.4).

6. Immediate needs of sea turtle conservation by State Governments

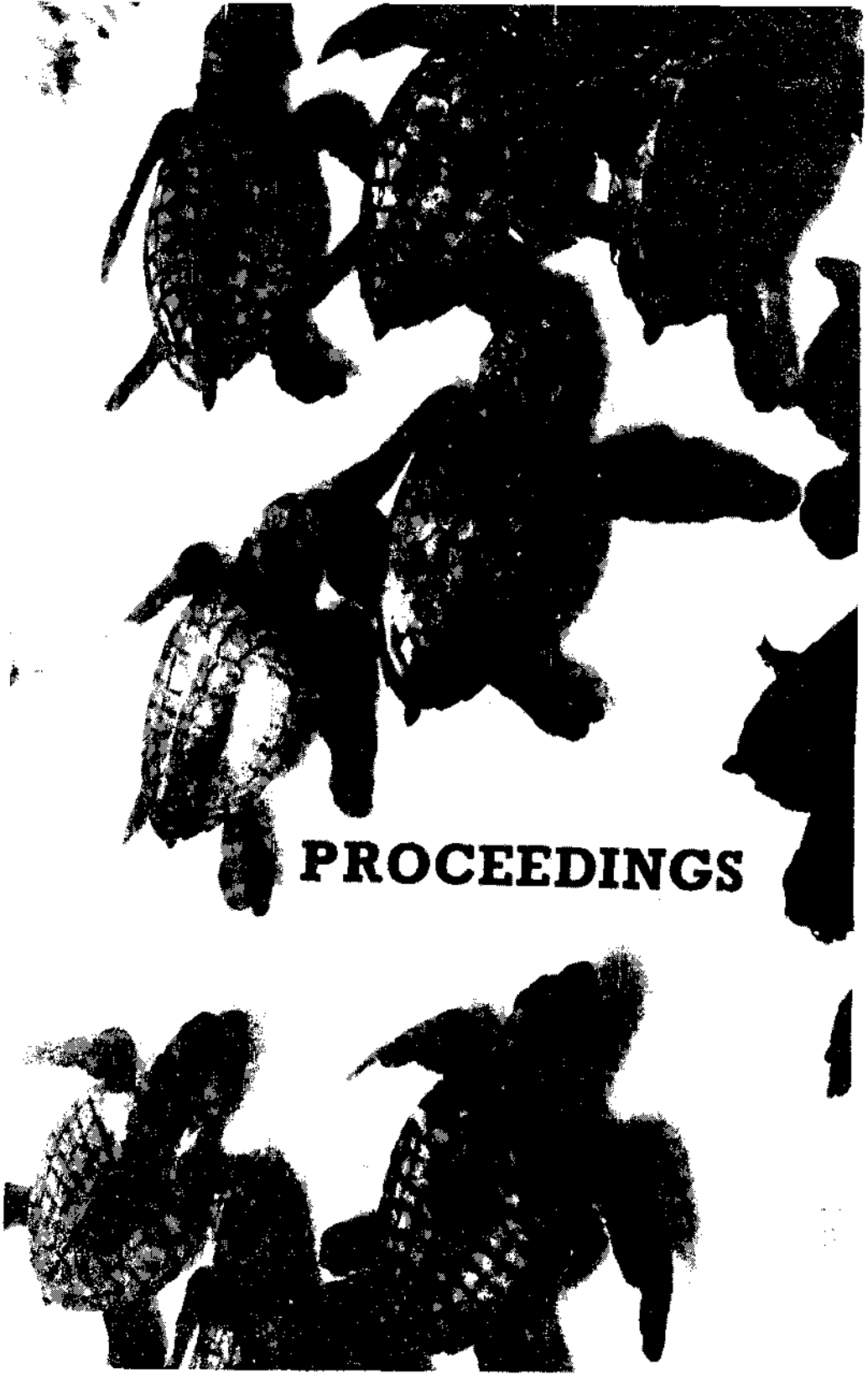
The Workshop during the course of its deliberation identified the following areas which calls for special attention and efforts by the concerned state governments to protect the nesting sites where the hawksbill, green turtle and leatherback are known to nest. It recommended that :

6.1. The nesting sites in the Kwangtung, North Reef Island, Latouche, North Cinque, South Cinque, Twin Islands and Interview Island (northern end) of the Andaman Nicobar Islands be given adequate protection during the nesting season of turtles.

6.2. The beaches south of Dwaraka from where sand is mined for cement and the southern coasts of Diu Island in Gujarat Coast where sand is removed for construction be identified as critical areas requiring habitat preservation for turtle nesting.

6.3. The tourism authorities of Goa be enlightened on nesting habits of sea turtles and the recreational values of the resource and be urged not to undertake any construction in the 100 m zone from the high water level, if necessary with proper regulation, to protect the nesting turtle population and the hatchlings.

6.4. Special surveys for turtle nesting grounds be undertaken in the Godavari-Krishna delta areas in Andhra Pradesh.



PROCEEDINGS

PROBLEMS OF SEA TURTLE CONSERVATION IN INDIA

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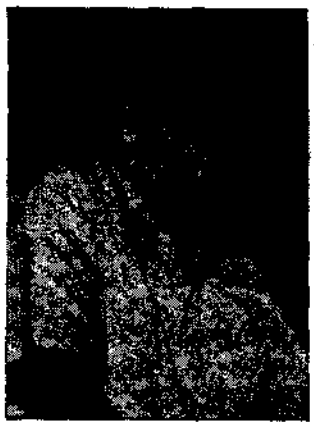
INTRODUCTION

In the brief remarks I made at the Inauguration of this Workshop I drew attention to some of the subjects which require our consideration. Basically the function of this Workshop will be to examine the state of the art. We shall not be presenting papers but discussing problems that face field officers in organising the conservation of marine turtles. To identify problems and their remedies, it is necessary to examine the limitations of our knowledge of the Sea Turtles, the species that occur and their ecology, primarily their breeding ecology. You will notice from the programme that has been drawn up for the Workshop, that different aspects of turtle ecology will be considered in some detail by the Workshop. It may be useful to consider briefly some of the basic aspects. I would appreciate if you could note points as I go along so that we can have a useful discussion.



PROBLEMS OF SEA TURTLE CONSERVATION

The first question that one seeks an answer is where and when do turtles nest in India? The first part of the question where do marine turtles nest in India is currently under investigation. One

must here draw attention to the commendable work done on this aspect by Satish Bhaskar who has been surveying the beaches along the Indian coast and whose report should provide us a large amount of original data.

The second part of the question is when do they nest ? Fragmentary data is available on this aspect which, considering the vast coastline and the marginal interest in turtle biology, is to be expected. Co-ordinated procedures for the collection of data on nesting locations, time of breeding and density of nesting and the establishment of a data bank for this information is an aspect we should discuss and determine at this Workshop.

The second question that one should consider is the species that nest along our Indian coasts and here we should include also the species that are not strictly marine. I am drawing attention to the estuarine *Batagur basta* and *Pelochelys bibroni* both need urgent attention. It is now well established that the commonest, and most widespread and therefore presently the most exploited in spite of existing laws, is the Ridley Turtle (*Lepidochelys olivacea*). While conservation measures prepared for this species may be adequate for the other less common species, they are rare enough and exclusive in selection of nesting sites, particularly the leathery turtle, to deserve special attention for conservation.

The third question that requires our attention is the legal basis for turtle conservation. The only umbrella legislation now available is the Indian Wildlife (Protection) Act 1972. The species of marine turtle that occur along the Indian Coasts are included in Schedule I of the Act which covers completely protected species, whose destruction or capture draws severe penalty. Unfortunately the enforcing authority which is the forest department in most cases has their main focus of interest miles away from where turtles occur so that enforcement suffers. An additional factor for the failure of the act to be effective is that the people who are concerned with turtle exploitation, mainly the fisherfolk in the coastal villages are unaware of the existence of such a legislation. It is true that both the points I have made receive more attention now and it would be worthwhile having a discussion on the legal aspects of conservation.

The fourth question that we could consider is closely related to the third question, that is, why are turtles captured and the eggs taken and what are the methods used in the commercial utilisation of the groups traditionally.

Turtle flesh and the more easily procurable turtle eggs have been a protein source. The eggs particularly have been used in the past without apparently serious effect on the population. Destruction of adults, which are in the case of turtles, the breeding population, is probably the more damaging to the species. The legal status is that the species cannot be utilised. This is acceptable presently when we do not have adequate information on the populations of the species, the annual turnover, and how best this can be increased. However, once we have reasonably precise data it may be necessary to consider the grade of protection that each species may require and whether a blanket ban is necessary and more pragmatically, whether it is possible to enforce such a ban. It is certainly necessary for large scale commercial exploitation but should the odd specimen that is killed or the odd clutch of eggs that is excavated receive equally exemplary punishment is a point to be considered. To have an opinion on these points we must have information on the utilisation of turtles as a renewable natural resource. A beginning has been made by the Central Marine Fisheries Research Institute who have already conducted a time frame survey over a period of 2 months in 2300 coastal villages from Kutch to Calcutta gathering information on fishing gear, vessels used and turtle in incidental catches. The survey also covered 1800 fish landing sites, we should consider how best the resources of the CMFRI can be used to monitor turtle catches deliberate or accidental along the entire marine littoral of the country. We should also give some thought to the possible methods of assuring that trawlers have escape hatches built into their nets.

The fifth question that we should give attention to is the protected hatching programmes. The rational behind these operations are (*a*) to provide protection so that the maximum number of clutches hatch and (*b*) that the maximum number of hatchlings have a chance of survival. It is well known that the period when a turtle is most vulnerable is when the young are concentrated and

therefore easily accessible to their predators. This is when these hatch and make their way to the sea. Predators occur both on land and in water. How best can the survival percentage be increased? Again is it necessary? If so can we determine the reasons why it is necessary to interfere in the natural weeding out which has been going on for millions of years as a built-in hazard in the life of the turtle. This leads us to the next question, research in turtle biology which would attempt to provide the answers.

Research should cover the whole panorama of turtle biology. There are a large number of questions for which we have to find answers. Some of them as they occur to me now are for instance what are the factors that underlie the selection of a nesting beach, is it the approach from the sea ? the texture of the sand ? the remoteness of the beach ? the vegetation on and behind the beach or the lack of it ? is selection visual or tactile or has selection been programmed into the animal and is an instinctive behaviour and therefore the animal does not show choice but will try and nest irrespective of existing conditions and the population disappears as conditions on the nesting beach deteriorate. Another aspect would be hatching success and the factors that influence them basically heat and humidity. The fact that temperature can drastically affect population structure is now well established and temperature manipulation is a matter that needs very serious consideration in protected nesting programmes. Another research programme that needs immediate attention if we are to collect worthwhile data is individual identification, that is, the tagging of turtles. This has to be organised on a large scale and on precisely determined methods. This requires fairly detailed discussion.

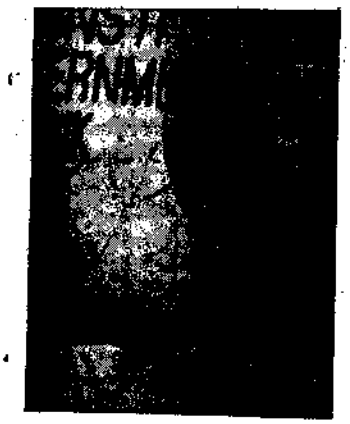
Finally some rather interrelated factors namely who is to do the research ? who is to do the management ? how should we interlink research and management, how best can we establish liason between the researcher and the manager. We should also discuss methods of establishing interdepartmental, interstate and international linkages in turtle research and management problems concerned with conservation.

A vital need is education not only for drawing attention to the turtle and the need for its conservation but also as a communication link between the various groups involved in the life of the turtle. Education is perhaps the most urgent need.

I have, I am afraid rather sketchily drawn attention to the problems of turtle conservation in India. But I hope that what I have said will form an useful base for discussions.

DISCUSSION

P. KANNAN : In addition to the Wildlife (Protection) Act 1972, CITES deals exclusively with internal trade, but there is one provision in the Convention which infringes on illegal killing of turtles claimed to have been trapped in the high seas and landed in an Indian Port. This is the provision relating to 'introduction from sea'. When a protected species *eg.* turtle, is landed in an Indian Port and declared to the concerned Forest Officer or Police Officer within the prescribed time limit, the fisherman would have fulfilled his obligation by the Wildlife Act. The provision of the Wildlife Act pertaining to illegal killing of the turtle or interstate movement of a species listed in Schedule I of the Act cannot be applied to such a case. There is need for including a provision in the internal legislation to correspond with CITES. The drafting of such a provision to strengthen the Act is underway.



I. RAJENDRAN : Along Tamil Nadu Coastline turtles are caught inadvertently. More extension work to enlighten the fishermen is necessary.

W. P. DURAIRAJ : The Tamil Nadu Forest Department should strengthen the personnel to patrol more areas during the nesting season of sea turtles.

K. SHANMUGANATHAN : During the 1983 season in Tamil Nadu only 150 km area was covered. More staff is needed for extending the coverage to other areas. The Fisheries Department personnel can also be empowered to enforce the regulation under the Indian Wildlife (Protection) Act. While enforcement of the Act throughout Tamil Nadu may take sometime, due to religious bias among some sections, there is no fishing for turtle. The Forest Department have to pay to local people Rs. 10 per 100 eggs brought to the hatchery.

J. JOHINDRANATH : During the nesting season of the olive ridley along the Madras Coast, the Forest Officers are keeping a close watch on the markets where eggs are illegally sold. So also, a watch is kept on the hotels which may resort to the purchase of the eggs. Stricter enforcement of the Act is needed.

K. R. RAMANATHAN : In Tanjore District the Forest Department is buying the eggs at the rate of 20 paise per egg for the hatchery. With the help of the Fisheries Department mass education and an extension programme among the coastal people, which is much needed could be taken up.

J. FRAZIER : We must treat hatchery projects as well as other form of human manipulation as experiments. When we become involved in purchasing eggs for hatcheries, there is a danger of things getting out of hand. If we stimulate whole-time poachers to bring eggs to a hatchery by bidding the market value, there is a danger that the competition for eggs will drive the price up and the hatchery will become involved in a price hike with the market. Also, we create a paradox by telling them that the eggs are totally protected and not to be transferred and then telling them that we want to bring all the eggs and will pay more than the black market price.

C. KONDAS : In natural nests we have no idea about the sex ratio in the hatchlings, nor the extent to which transfer of eggs will affect the sex in hatchlings. What will be the fate of eggs transferred after considerable delay or purchased from the market and used in the hatchery?

J. FRAZIER : As regards sexing, the use of radio-immunoassay to detect relative androgen levels has been done on young turtles, but not on hatchlings. Four years is the minimum age that can be assayed accurately. The technique is expensive requiring very special equipments and have been tried in many places with considerable efforts. But the results are still not conclusive. We must be careful that even with the best intentions, our actions do not cause more harm than good. For example, holding hatchlings for a period of more than 12 hours may result in a release of animals too weak to feed for themselves.

E. G. SILAS : Sea turtle hatcheries in India have been established where there has been heavy predation of eggs by human and non-human predators. Translocation of clutches to the new nests should be done within a few hours after laying. Collection of eggs through local help and on payment very often results in mixing of clutches and too much of disturbance of eggs which may result in low hatchability.

R. WHITAKER : In about 10 to 15 days of incubation the sex is determined based on temperature. Higher temperature is said to lead to females and lower temperature to males.

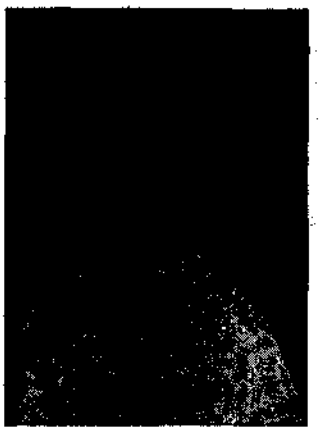
J. FRAZIER : A minimum of 6 animals is necessary to make the earliest determination of sex through examining the androgen levels.

J. C. DANIEL : How do we enhance and build up the species?

J. FRAZIER : The type of management involves the establishment of protected areas or sea shore sanctuaries of nesting beaches. In establishing sea shore sanctuaries such as in Sunderbans, Kodikkarai and in the Gulf of Mannar, the resource for local people has to be looked into. Their co-operation is essential for giving protection.

C. KONDAS : The Wildlife Act empowers declaring the area from the point of protection within the reserves. Declaring as a reserve, an area, subject to all provisions can be considered. Here, a sea shore strip will be more effective.

S. K. MISRA : I must mention about the nesting habitat of olive ridley in Bitarkanika Sanctuary in Orissa. Already drilling for oil in the Mahanadhi bed about 70 km southeast of Gahirmatha has been attempted. So far, they could not detect oil. In case oil is found, the chances of oil pollution affecting Gahirmatha is great. We have to protect Gahirmatha so that the nesting beach is not lost for ever. Still poaching is going on in Wheeler and Shortts Islands. The Forest Departments is not having the vessels to control and monitor the area. The mass nesting of Olive ridely also coincides with peak fishing activities. From Paradeep Harbour larger trawlers belonging to different organisations including Chilka Development Corporation are operating. Some control or regulation through the Forest Department to declare an area of 48 km stretch from Wheeler and Shortts Island southwards between October and April upto the completion of the second mass nesting is needed. The mangrove forest in the area should also be given protection.



W. P. DURAIRAJ : As regards protecting any nesting beach, the need is also educating the fisherman through an extensive extension programme.

T. S. N. MOORTHY : Although we generally state that 5 species of sea turtles occur in Indian waters, only 2 *viz.* the olive ridley and the green turtle commonly nest on our beaches. As yet there are no published records of the estimated population of the loggerhead, hawksbill and the leatherback, there were some reports about trade on a small-scale of the hawksbill along the Visakhapatnam Coast. This incidentally also indicates the probable occurrence of the hawksbill in waters off Visakhapatnam, Andhra Pradesh.

K. SHANMUGANATHAN : From my knowledge of the Sunderbans, I learnt that fairly large numbers of the estuarine crocodile and the monitor lizard have a deterrent effect on sea turtle movements and the hatching of the eggs.

In concluding the Discussion, the Chairman Shri C. KONDAS remarked that :

(i) From the point of conservation, to create an awareness among the public a very extensive programme is necessary.

(ii) A very comprehensive programme of research on various aspects of the biology and the behaviour of sea turtle is needed so that, we can take up constructive steps in the protection and conservation of the resource.

(iii) Monographs on sea turtle research and other specific projects may be planned identifying areas of lacunae which need priority attention.

(iv) There is considerable variation in coastal ecological conditions and the need is for understanding local factors which will help in the conservation programme.

TECHNICAL SESSION II

KINDS OF SEA TURTLES IN INDIA : THEIR STATUS AND DISTRIBUTION

CHAIRMAN : SHRI J. C. DANIEL

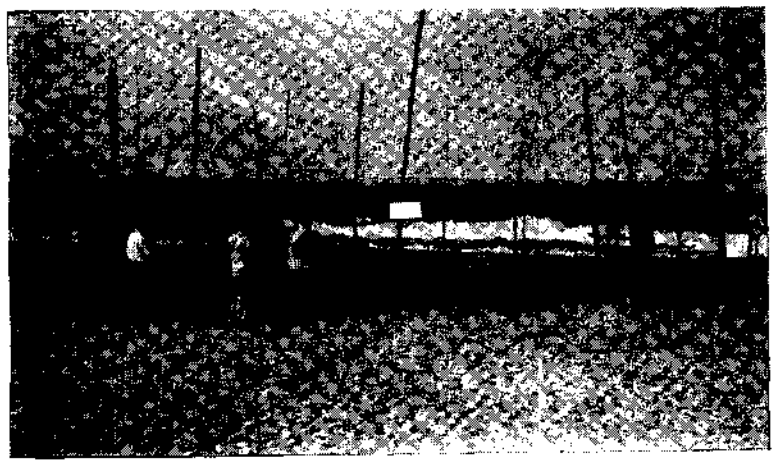
— THE DISTRIBUTION AND STATUS OF SEA TURTLES IN INDIA

SATISH BHASKAR

— MASS NESTING BEACHES OF THE OLIVE RIDLEY *LEPIDOCHELYS OLIVACEA* (ESCHSCHOLTZ, 1829) IN ORISSA AND THE BEHAVIOUR DURING AN ARRIBADA

C. S. KAR AND M. C. DASH

— Discussion



THE DISTRIBUTION AND STATUS OF SEA TURTLES IN INDIA

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INTRODUCTION

Of 7 or 8 species belonging to five genera and 2 families of sea turtles living today, five species, representing each of the five genera are known from the Indian Seas.

Family	Genus	Sp. known from India	Absent or unrecorded from India
Chelonidae	*Chelonia*	*mydas*	*depressa, agassizi*
	Eretmochelys	*imbricata*	
	Lepidochelys	*olivacea*	*kempi*
	Caretta	*caretta*	
Dermochelidae	*Dermochelys*	*coriacea*	

Sea turtles commute between nesting and feeding areas which may lie adjacent to each other or be separated by distances of over a thousand miles.

Species	Feeding area in Indian waters	Nesting in India
C. mydas	Present	occurs
E. imbricata	Present	occurs
L. olivacea	Unknown	occurs
C. caretta	Present	unknown
D. coriacea	Unknown	occurs

GUJARAT

Lepidochelys olivacea nest on both the western and eastern coasts of India, in Lakshadweep and in the Andaman and Nicbobar Islands. The most important nesting beaches for the species exist in the state of Orissa, where one of the world's biggest aggregations of turtles nest yearly at Gahirmatha and neighbouring beaches. The best nesting locations on the west coast of India exist in Gujarat, where the olive ridley nests everywhere on the available sandy beaches but the most favoured beach is a 2.5 km beach on uninhabited Bhaidar Island in the Gulf of Kutch, where on a peak night 70 ridleys nested. The green turtle (*Chelonia mydas*) is found to nest commonly in Kutch District and on the western and southern shores of the Saurashtra Peninsula.

Gujarat is thinly populated and its beaches are at present less prone to human disturbance though, at places interference is maximal with industrial growth and fishing activity.

On Saurashtra's northern shore, mangrove swamps that fringe much of the coast leave little nesting habitat suitable for olive ridley and practically none for green turtle which require nesting beaches where the sand above high tide level is deeper and covers more expanse. However, seagrass beds and coral reefs in this area especially in the vicinity of Karumbhar island—provide food for a considerable population of green turtle whose numbers and nesting migration routes have yet to be ascertained. There is a strong possibility that some of the green turtle that feed in the Gulf of Kutch migrate to the nesting beaches at Sandspit and Hawkes Bay near Karachi, Pakistan.

Eretmochelys imbricata, has not yet been reported to occur along Gujarat coast although fishermens' reports suggest that it does occur in far lesser numbers than the green turtle and the olive ridley. The loggerhead (*Caretta caretta*) is not known from the area and the leatherback (*Dermochelys coriacea*) is encountered but rarely by fishermen at sea.

Reasonably fresh olive ridley nests were recognizable with certainty only if they had been destroyed by animal predators,

the visible evidence in such cases mainly a conical pit in the sand with the eggshells strewn about. An unknown, perhaps considerable proportion of ridley nests would therefore have gone unnoticed. Human-predated ridley nests could sometimes have been confused with 'crabbing' excavations on the beach sand, made by poor fisherfolk, and with shallow burrows made by jackals on the lee side of clumps of tall grasses on the beach. 'Crabbing' excavations were, however, usually shallower and lower down the beach than turtle nests.

It was possible to make a reasonably accurate count of the total number of green turtle nests made since the beginning of the nesting season. Occasional sites where liquor had been illicitly distilled could have been mistaken for old nesting pits made by green turtles, though the former excavations tended to be larger and closer to a rectangle in shape.

Green turtles were sighted close inshore throughout the survey period, August-October usually off rocky cliffs, on the coastal stretch between Mangrol and Okha and near the times of high tide. Similar sightings of green turtles were recorded in the area in June during a 1977 survey by the Madras Snake Park Trust. A maximum of about five turtles could be seen intermittently from favourable vantage points as they came up for air.

A total of 1243 Olive ridley nests and 866 green turtle nests were located on the Saurashtra Peninsula (excluding islands). On an average, nesting was denser on the peninsula's western coast roughly between Okha to Veraval, than on the southern coast (Veraval to Gogha). The nesting densities on roughly 200 km of the west coast were 3.95 nests/km for ridleys and 3.88 nests/km for green turtles, as compared to 3.31 nests/km for ridleys and 0.36 nests/km. for green turtles on the 250 km southern coast of the peninsula. There were several stretches where the density of nesting was much higher than the averages given above ; to consider the best example, there were 29 old nests made by olive ridley and 39 green turtle nests on a 2 km stretch immediately south of the Indian Navy's Defence Security Corps establishment at Okha when surveyed on 19th October 1981.

All the figures relating to nesting densities and numbers given above are lower than the true figures for an entire nesting season, because,

(*a*) The survey covered the period August-October whereas, the nesting season for the olive ridley starts in June and ends about early November, and that for the green turtle spans at least July to January.

(*b*) Many olive ridley nests would have gone unnoticed for reasons stated earlier.

The 110 km stretch between Veraval and Porbandar, when surveyed in December 1980 yielded 504 green turtle nests, for a density of 4.58 nests/km as compared to 4.20 nests/km for the same stretch when surveyed in October 1981.

Uninhabited Bhaidar island and little-disturbed Piram island are also important olive ridley nesting areas. Bhaidar has a 2 km long sandy beach of which a half kilometre stretch on its northeastern end is favoured by nesting ridleys. The numbers that nested during the period 11-15 August 1981 were :

11 August 1981—76

12 August 1981—26

13 August 1981— 9

14 August 1981— (3 Ridleys came ashore but did not nest)

15 August 1981— 0

Ridleys can nest at Bhaidar only near the time of high tide owing to the large tidal range there. Nesting may tend to be more frequent at spring rather than neap tides, but the prevalence of strong winds appears to be a much stronger influence favourable to nesting. Fishermen who occasionally visit the island report that there are nights when over 100 turtles nest there. Mammal and reptilian predators do not exist on Bhaidar, though a species of wild cat, probably *Felis chaus* exists there. However, a considerable proportion of the clutches laid are inundated and destroyed by high spring tides. Accidental intra-specific nest destruction is common. Green turtles frequently enter and leave

a creek on the island during flood and ebb tides respectively, and are caught and usually released by fishermen operating nets, but do not appear to nest at Bhaidar. They require a longer time to complete the nesting process than ridleys, a propensity that could leave them stranded by the tide. The carcasses of five olive ridleys were found in a swamp that backs the nesting beach, evidently a result of fatal misorientation landwards.

The nesting beach at Piram island is hardly about 300 metres in length and only 11 nests made by olive ridleys were identified during a 4 day stay from 28-31 August, 1981 ; the island, however, assumes importance because (*a*) daytime nesting by olive ridleys, a rare phenomenon elsewhere in India, is common place there ; (*b*) the island has a human population of about 18 of whom only four eat turtle eggs, making protection of the turtles nesting there easier ; (*c*) it provides a natural laboratory to monitor the nesting numbers over the course of a year in order to determine more precise limits and peaks of the nesting season, and to determine re-nesting (within-season) intervals, remigration (between-season) intervals and other valuable data.

Nesting at daytime occurs only on those days when the time of high tide falls around late evening or early morning—the unusually large tidal range (maximum, over 10 metres) which exposes a large area around Piram island at low tide forces ridleys to nest around the time of high tide—an occurrence which is the rule at Bhaidar island also. Dogs and jackals being absent, two species of monitor lizards (*Varanus flavescens* and *V. bengalensis*) are the main animal predators on sea turtle eggs at Piram.

No sandy beach exists on the Saurashtra Coast to the north of Gogha, which is the eastern limit of ridley nesting on the peninsula. In Saurashtra, green turtles do not nest further east than Chanch island where a single old nest was located. The coast near the village of Cangnath 17 km west of Diu island is the easternmost area where green turtles nest in numbers, in Saurashtra.

Green turtles and olive ridleys also nest in the district of Kutch. Twenty-eight animal-predated ridley nests and 7 nests of green turtles were found on a 30 km stretch immediately to the east of Jakhau Port. Nesting is reportedly more frequent on the coast

east of this stretch, upto the town of Mandovi. Seventeen ridley nests were located on the four km stretch west of Mandovi. Most ridley nests in Kutch get obliterated by wind-blown sand in a few days, often sooner. This could partly account for the fact that only one old nest was identified on Navinar island, whereas, the Lighthouse staff stationed there estimate that six or seven ridleys may nest nightly on the kilometre-long beach in August, the peak season.

Eastwards from Navinar, the nesting density tapers off until a point where the last traceable ridley nest was located 15 km west of Tuna Port. No suitable sandy habitat in Kutch exists to the east of this point.

The eastern bank of the wide Kori creek and the mangrove-rich coast extending southeast from it upto Jakhau port have yet to be investigated as to sea turtle nesting.

Sea turtle eggs are removed in varying degrees at different localities by humans for consumption and for sale. Thus on the southern coast of Saurashtra, every nest found is searched and the eggs removed. They may be sold at the rate of 2 or 3 to the rupee, usually privately and not in fish markets. Human predation on eggs is less common on the peninsula's western coasts, one indication being the greater proportion of animal-predated nests on this coast. Though most Hindus consider turtles as sacred, individuals of at least two communities—the Waghiris and the Kolis—walk the beaches in the early morning on hunts for turtle eggs. In Kutch, the Lodhis are the main turtle-egg consumers. Turtles are rarely sought (for their meat) while nesting, and many fishermen state that they release those caught in their nets at sea. However, there is a small though apparently growing market for turtle meat at some places. Sea turtles caught accidentally in trawl nets are brought to the fish market at Mithapur where they are butchered and sold. It is reported that 10 to 15 turtles may be sold daily soon after the southeast monsoon ends in September. Turtle meat, fat and eggs are believed by some coastal inhabitants to help in the cure of lung diseases.

Dogs, jackals, monitor lizards, crabs and crows and perhaps wild pigs and hyaenas number among the creatures that prey on

sea turtle eggs or hatchlings. The nests of green turtles escape predation by animals more frequently than ridley nests do, without doubt because their nest excavation are deeper and more extensive.

The rapidly growing fleets of mechanised fishing boats in Saurashtra and Kutch, and the increasing number of outboard engines that are being fitted on to traditional fishing sail boats will require more effective conservation action in future, to restrict accidental catch and drowning of sea turtles in nets. Much nesting habitat is being destroyed for construction purposes and for the manufacture of cement. For the latter purpose, a 12 km stretch of sandy beach extending southwards from 2 km south of Dwarka upto Gorinja has been physically trolleyed away in its entirety (a railway track has been laid specifically for this). Large quantities of sand have been removed from many other beaches in Saurashtra and Kutch. At Jafarabad, a breakwater that all but encloses a beach once favoured by nesting turtles has been constructed. These developments necessitate quick action in setting aside as sanctuaries the productive nesting beaches presently known to exist.

India's second Marine National Park includes most of the favoured turtle-grass habitats in the Gulf of Kutch and the important ridley nesting island of Bhaidar.

Maharashtra

Green turtles and olive ridleys occur in Maharashtra waters. Stray nesting instances have been recorded, but surveys have apparently not been conducted.

Goa

Thirty-five per cent (about 65 km) of Goa's 160 km coastline is sandy beach inherently suitable for sea turtles to nest on, the remaining coast being mostly rocky. Six major rivers including the Zuari and the Mandovi flow into the Arabian sea. Elsewhere in the world, leatherbacks often favour beaches near river-mouths.

in order to nest on. It appears very likely that Goa's beaches once hosted large nesting populations of this species prior to man's intervention.

Salm identified the olive ridley as being the commonest sea turtle on this part of India's west coast, found a ridley nest in February at Calangute and repeated the rarity of the occurrence and nesting of the leatherback turtle in the area. He also quoted Goa fishermen as stating that instances of nesting (presumably by olive ridleys) had declined in recent years.

A live but weak ridley, an adult female, was found on shore 2 km north of Mandrem on 21 July 1981 at 1 p.m. An infected, ring-shaped injury present around its right foreflipper may have been caused either by entanglement in a net at sea or by a tether tied by a prankster who may have encountered the turtle as it nested. Many goose-barnacles (*Lepas* sp.) and a 3 mm thick layer of algae were present on most of its carapace.

The freshly—stripped carapace of an olive ridley lay in the fish market at Panaji (Panjim). The meat had been sold at the rate of Rs. 30 per kg the highest price I know of for turtle meat in India. This turtle, like one at Mandrem had algae and *Lepas* growing on its shell. The possibility that some Ridleys 'reside' in the waters around neighbouring islands (e.g. St. George's island, 4 km from Vasco-da-Gama) requires investigation.

The July 14th issue of the daily 'Navprabha' refers to a 200-250 kg turtle having a shell 4 ft long and 3 ft broad which was caught by a fisherman at Ribandar (7 km upriver from the mouth of the Mandovi), and sold for Rs. 200. The description fits a very large green turtle (*Chelonia mydas*).

A fisherman named Pedro states that 30 to 40 sea turtles, most or all caught in nets at sea had been consumed by humans at Shirdon this year. Like most coastal folk in Goa, Pedro relishes turtle meat and eggs; he states that the main nesting season in Goa is September-October. Turtle meat is usually sold by the handful, Rs. 5 a portion.

Sea turtle bones were found near Harmal (Arambol) but no evidence of nesting was found on the 50 km of beaches surveyed.

jackals were heard calling at night. They probably destroy fewer turtle nests than do dogs and man.

Most of Goa's sandy beaches have become tourist attractions ; the resultant disturbance, especially in the post-monsoon period which is believed to be the main nesting season, coupled with the heavy demand for turtle eggs and meat leaves scant hope for the survival of sea turtles in Goa in the absence of conservation measures.

KARNATAKA

Long stretches of sandy beaches exist in Karnataka and nesting has been reported by the CMFRI at Karwar. I have no first-hand data from this state, however.

KERALA

Four species—the olive ridley, the green turtle, the hawksbill and the leatherback—of the five found in India are known from Kerala waters. However, all except the olive ridley are now rare or uncommon. The virtual absence of leatherback (*Dermochelys coriacea*) in Kerala is directly traceable to man (see Smith, 1931) *i.e.*, to the indiscriminate killing of nesting females and to the collection of their eggs. That the common species found today (the olive ridley) suffers exploitation was confirmed in 1979 by Dr. Lal Mohan of the Central Marine Fisheries Research Institute (CMFRI) and by L. Namassivayam of the Kerala Natural History Society (pers. comm.). Local but substantial commerce in sea turtle eggs and meat was recorded, despite wide-spread knowledge among coastal inhabitants of the legally protected status of sea turtles. At Calicut, the CMFRI began protecting a few clutches of eggs from human and canine predation by the use of wire enclosures around natural nests. The Institute also undertook a leaflet campaign advising local people against exploiting sea turtles. Recently the CMFRI has advocated the establishment of a sea turtle reserve to include the stretch Cannanore to Ponnani.

Sea turtle nesting beaches in Kerala have been (a) 'fenced off' by granite blocks and embankments as protection against sea erosion, thereby excluding sea turtles from nesting on about 200 km

of Kerala's 590 km coast (b) rendered unproductive by human disturbance of nesting habitat and predation on eggs and adult turtles, a consequence of human overpopulation (c) physically trucked off for the extraction of titanium *e.g.*, at Chavara 15 km north of Quilon by the Indian Rare Earths (IRE).

Despite this, nesting by the olive ridley occurs, mainly during the period August to November. A nest made on 24-25 May could not be confirmed as to species (Ridley or Hawksbill). Leatherbacks nest on rare occasions in Kerala. Nesting by the green turtle and the hawksbill in Kerala remains unconfirmed.

Large concentrations of sea turtles (perhaps ridleys) are reportedly seen at sea by fishermen during the monsoon months. Sea turtles are killed while nesting and netted at sea, for their meat. Their eggs are sold or locally consumed nearly everywhere they are found in Kerala (rate Rs. 15-20 per hundred). Village dogs excavate and eat the few clutches that escape the attention of humans. Sea turtle oil is used as a cure for asthma. Seven ridley carcasses found on Kerala beaches in April-May 1981 may have belonged to turtles drowned accidentally in trawl nets and to those attacked by sharks or injured against reefs or seawalls. Heavier mortality may occur during the nesting season when turtles congregate offshore to breed. The waters around Sacrifice Rock reportedly harbour a year-round population of sea turtles.

Tamil Nadu

The state is unique in India in possessing five species of sea turtles ; three species—the olive ridley, the hawksbill and the leatherback—nest here (the last very rarely).

The coral and seagrass areas in the Gulf of Mannar and Palk Bay provide rich feeding habitats for turtles.

Four to five thousand turtles were being caught annually in the late nineteen sixtees in southern Tamil Nadu, three quarters being green turtles ; olive ridleys and loggerheads together formed one fifth of the total (Jones and Fernando, 1968). The projected formation of India's first Marine National Park, the hatchery

programmes operated by the CMFRI, the Forest Department and the Madras Snake Park and the nesting areas/islands located in the state will be described by CMFRI officials during this workshop.

Andhra Pradesh

Forty-five km in Southern Orissa, 209 km in the extreme north of Andhra Pradesh and the 16 km stretch between Kakinada and Uppada—a total of 270 km was surveyed between 18 January —26 February 1982, a year when the 'arribada' at Orissa was exceptionally late and scanty—only less than 1000 turtles nested at Gahirmatha.

Olive ridleys nested wherever suitable sandy beach existed, but no 'arribada-like' proportions were found. A total of 444 ridley nests were counted on the 270 km stretch surveyed (average nesting density 1.64 nests per km). Only four nests had not been predated upon by canines or humans—these nests were all very fresh, made on the nights before I reached their sites and in one case, while I walked a beach at 2 pm (this is apparently a rare instance of an olive ridley having nested on a sunny afternoon). The total number of nests counted is undoubtedly low because (a) the survey did not span the entire ridley season (December-March) (b) many nests and tracks could have bean obliterated by the elements and by the activities of fishermen on the beach. The possibility of nesting by other species on unsurveyed areas such as the Krishna and Godavari deltas (including the Coringa wildlife sanctuary) remains. The find of a hawksbill hatchling north of Visakhapatnam in a shore seine net raises the possibility that this species also nests in Andhra Pradesh. A single instance of attempted nesting by *Dermochelys* has been reported (Dutt, 1979).

Despite protective legislation, sea turtle eggs are collected and eaten all along the Andhra coast and were sold in the Visakhapatnam fish market until a few years ago. Andhra fishermen annually establish temporary fishing camps on the southern parts of the Orissa coast, at least as far north as the mouth of the Rushikulya river ; as the main fishing season largely coincides with the turtle nesting season, many turtle nests are collected by them in each winter. No evidence of an 'arribada'—the mass-nesting over

time and space characteristic of the ridleys—was present in southern Orissa upto 21 January 1982, the date this coast was surveyed.

Adult ridleys netted by Andhra fishermen were being transported by rail and lorry to markets in West Bengal from points at least as far south as Waltair a few years ago, before the transport of turtles by rail was prohibited. Large numbers of sea turtles caught along Andhra coast were supplied to a big refugee camp near Raipur (in the interior state of Madhya Pradesh) for consumption by displaced persons from Bangladesh. Turtle meat is, however, not eaten by most inhabitants of Andhra Pradesh.

Besides accidental catch or drowning in trawl nets, nesting habitat destruction *i.e.* beach-side development and beach sand removal by the IRE (Indian Rare Earths) and removal for construction purposes may be listed among the recent factors working against sea turtles in Andhra Pradesh.

The Andaman Islands

Four species occur and nest in the Andamans, the green turtle, the hawksbill, the leatherback and the olive ridley. Important nesting beaches exist for each of these except the last.

A total of over 360 hawksbill nests were found on 12 uninhabited islands during a 2 month survey covering the period 16 November 1983 to 18 January 1984. Two islands—South Reef Island and North Brother Island—accounted for at least 158 nests. The breakup was :

Island	*Minimum No. of hawksbill nests*
Snark	27
Kwangtung	27
Latouche	12
Interview	17
North Reef	19
South Reef	80
North Cinque	18
South Cinque	20
North Brother	78
South Brother	37
West Twin	12
East Twin	13

The highest concentrations of nests occurred on islands where water monitor lizards (*Varanus salvator*) were absent *e.g.*, South Reef and Snark islands and where human disturbance was minimal. The hawksbill's peak nesting period in the Andamans is believed to be April-January, with some nesting taking place round the year. The tabulated figures therefore do not give the total number of nests per season at any island.

Approximately 194 green turtle nests were found on 4 islands :

Snark Is.	12
Interview Is.	105
S. Reef Is.	40
S. Brother Is.	37

The green turtle nests were all old, strong evidence that as in Lakshadweep, the peak nesting period for this species is the south-west monsoon, June-September ; sporadic year-round nesting may also occur. Uninhabited South Sentinel island is known to be favoured by nesting green turtles.

In addition to the previously-known leatherback nesting beaches at West Bay and South Bay in Little Andaman, 20 Leatherback nests were found on two hitherto undocumented beaches on Little Andaman—a 4 km stretch north of the mouth of Jackson creek (16 nests) and a 1½ km stretch further north (4 nests). The 7 km beach at West Bay, one of the three most productive leatherback beaches surviving in India (the other 2 are on Great Nicobar island) had 80 visible leatherback nests when visited on each of 2 occasions, in January 1979 and February 1981. The smaller beach at South Bay has 10 nests on both occasions ; these figures, added on to 4 stray leatherback nests present on the island's north-eastern side during the 1979 survey give a composite total of 114 nests for the whole island. The eastern part of the island is inhabited. With the recent proliferation of small mechanised boats in the Andamans, most of the once-remote islands are now within easy reach of poachers and unlicensed shell-divers posing a serious threat to the continued existence of the turtles and their habitats. Feeding habitats for turtles occur in many areas in the Andamans. Two Marine Biosphere Reserves have been set up by the Administration.

The Nicobar Islands

Four species of turtles—the green, the hawksbill, the leatherback and the olive ridley—occur and nest in the Nicobars. While feeding and nesting habitats are widespread, the turtle population is limited to some extent by the average Nicobarese keenness in hunting and fishing.

Great Nicobar Island is the most important nesting island. The two beaches at the mouth of the Dagmar and Alexandria River on the island's west coast each showed about 80 leatherback nests during a survey in April 1979. However, when they were visited in February 1981, the numbers were 55 nests near the Alexandria and 8 near the Dagmar. The fall in numbers could be explained by the second survey having been conducted earlier in the nesting season than the first—however, predation by Nicobarese on the eggs is substantial, of the 63 leatherback nests 10 had been marked with upright stakes indicating human predation. Olive ridley nests numbered 137 (this may have included a few hawksbill nests) of these, 33 were near the Alexandria and 104 near the Dagmar.

The olive ridley nests, predictably, suffer heavier human predation on account of the relative ease with which a probe stick will locate the eggs—98 of the 137 nests had been marked with upright stakes. Monitor lizards prey on the eggs. The sea between Great Nicobar and Kandul island appears to be a favoured inter-nesting habitat for olive ridleys—four were seen at sea in the span of 1½ hours.

Hawksbills nest at Pygmalion Point, the southernmost point of India.

Islands of lesser but still appreciable importance as regards nesting are Katchal, Trinkat and Teressa Islands. It is reported that uninhabited Meroe island is favoured by nesting green turtles.

Lakshadweep

Four species occur and nest in Lakshadweep—the green turtle, the hawksbill, the olive ridley and the leatherback ; the last is very rare.

Green turtles nest primarily during the months of the south-west monsoon, June-September, though nesting may occur at other times too. Nesting islands for this species are Suheli Valiyakara, Tinnakara, Bangaram, Suheli Cheriyakara and Parali, all of which are uninhabited during the monsoon nesting season. On Suheli Valiyakara, the most important nesting island over 200 nesting craters by green turtles had been counted in October 1977; the total number of green turtle nests made during the southwest monsoon period (May-October) in 1982 was between 119 and 135; this involved between 22 and 27 turtles. The 1977 survey found 45, 15, 8, 10 and 13 green turtle body pits respectively on Tinnakara, Bangaram, Pitti, Parali II and Suheli Cheriyakara island. A few hawksbills and olive ridleys also nest on the inhabited islands of Androth, Kadmat and Agathi. Minicoy appears to possess a feeding population of green turtles, though nesting by this species also occurs there. In earlier years, hawksbill scutes were being exported to Mangalore, but the degree of trade in this is presently unknown. The fat of all turtles is used to water proof the joints of the mechanised boats belonging to the islanders. Behavioural and other studies of green turtles in their feeding habitat can be profitably undertaken at Minicoy on account of the turtles relative insensitivity to human disturbance, probably a result of centuries-old abstinence from turtle hunting by the Minicoyans.

MASS NESTING BEACHES OF THE OLIVE RIDLEY *LEPIDO CHELYS OLIVACEA* (ESCHSCHOLTZ, 1829) IN ORISSA AND THE BEHAVIOUR DURING AN ARRIBADA

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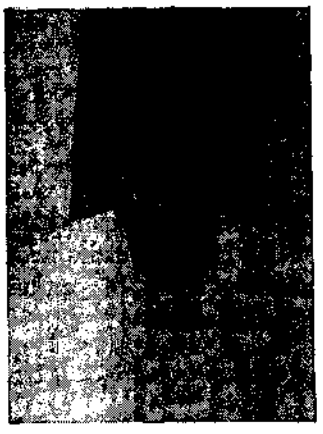
INTRODUCTION

Among sea turtles only the members of the genus *Lepidochelys* (i.e., the olive ridley *Lepidochelys olivacea* (Eschscholtz, 1829) and the Kemp's ridley *Lepidochelys kempi* (Garman, 1880) form reproductive aggregations, known variously as 'morrimas', 'arribazones', 'flotas', and 'arribadas'. Popularly the massed nesting is known as 'arribada' (a spanish term meaning 'arrival'). However, no one has yet described the term quantitatively. For convenience, in this paper we define the terms 'mini arribada' for a nesting aggregation involving 100 to 1000 nesters in a particular night on a stretch of less than 10 kilometers of beach and 'arribada' involving more than 1000 turtles.



Nesting aggregations were first discovered for the Kemp's ridley sea turtle by Hildebrand (1963). At Gahirmatha on the coast of Orissa, such aggregations of the olive ridley have been recorded by Daniel and Hussain (unpublished); Biswas (1982), Bustard (1974, 1976), Bustard and Kar (1981), FAO (1975), Kar

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(1980, 1982), Kar *et al.* (in prepn.), Kar and Bhaskar (1982), Silas *et al.* (1984) and Whitaker (1984).

Although the factors which synchronise such aggregation still remain unclear, most authors attribute a survival value to this trait as a means to swamp predation with a very temporary over abundance of food (Hildebrand, 1963 ; Carr, 1967 ; Zwinenberg, 1976 ; Pritchard, 1979 ; Marquez and van Dissel 1982). Pritchard and Marquez (1973) mentioned that 'survival value of the trait may be that local predator populations are bewildered by the sudden huge abundance of potential prey—the adult turtles, their eggs, or, two months later, the hatchlings—and although they may consume all they can, the manifestation is over so rapidly that many of the turtles will still survive, and excessively high predator population levels will be inhibited simply because they cannot be sustained by one or two big meals a year.'

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Descriptions of the rookery near the Devi River mouth

Recently a rookery was discovered near the Devi River at the extreme southern part of Cuttack District, Orissa between Nadiakhia muhana and Akasia muhana (lat. 19°58' N 20° 01' N and long. 86°4'-86°45' E) (Kar, 1982). It lies between the main (southern) mouth of the River Devi which is at least 10 m deep and the secondary northern mouth which is never more than 1 m.

deep at low tide. The rookery extends for about 4 km in length and is about 100 km south of the Gahirmatha rookery (see below). The beach is wide, flat (small sand dunes of about 1-2 metre high are present on the northern side) and without any forests except recently planted casuarina. The mangroves, which were once abundant all along the coastal belt of Cuttack District, Orissa, have now totally disappeared from this region due to human encroachment and felling for firewood and other household purposes. The secondary branch of the river runs north parallel to the coast along its entire length before meeting the sea, thus forming a barrier island. The colour and texture of sand and beach topography resembles to some extent that of the Gahirmatha beach. About 100,000 female ridleys were estimated to have laid eggs during 1981 at the Devi rookery (Kar, 1982). It is not clear whether such large numbers are maintained each year or whether arribadas occur at the same time at both the rookeries. Tagging and monitoring are urgently required to confirm these and other facts.

GAHIRMATHA ROOKERY AND MASS NESTING BEHAVIOUR OF THE OLIVE RIDLEY

Gahirmatha beach is a 35 km long stretch in Cuttack District, Orissa forming the seaward boundary of the Bhitarkanika Wildlife Sanctuary (Kar, 1982). Mass nesting by the olive ridley takes place along 10 km of coastline from Habalikhati (the location of the main research centre) northwards upto Ekakulanasi. The beach runs in a north-east to south-west direction. It is remote from human habitation and is geographically separated from the mainland by mangrove creeks. At Habalikhati the beach is backed by sand dunes reaching heights of about 30 m. They extend about 2 km to the north-east upto ' Akhifuta Jora'. This section of the coastline has been planted with casuarina and is backed by dense mangrove forests. Creeks having blind ends but reaching nearly to the sea from the southern and northern limits of this stretch. Prior to 1981 the southern creek approached the sea in the form of a U-shaped loop near Habalikhati and then extended southwards to Satabhaya village, running almost parallel to the coast. In the cyclone of 10 December, 1981 the, beach was broken through

at Habalikhati connecting the creek with the sea. A few months later wind action redeposited the beach closing the seaward mouth and forming the blind end near Habalikhati which is presently approachable by boats only during high tides. North-east of 'Akhifuta Jora.' a section of about 2 km of coastline is almost devoid of high sand dunes and backed by dense mangrove forest. North-east of this another 3 km stretch has sand dunes approximately one to two metres high and a thin line of mangrove is present on the estuary side. The dunes are covered with beach vegetation viz., *Ipomea pescaprae*, *Spinifex* and other grasses. Between the mangroves and the nesting beach, plantations have recently been started by the Coastal Shelter Belt Afforestation Circle of Orissa Forest Department as an anti-cyclone measure. The remaining 3 km section with small scattered dunes (about 0.5 m high) occur progressively to the mouth of the Maipura River Nesting by olive ridley is exceptionally concentrated in this section which has no forest cover and is backed by open shallow waters without mangroves. The background of this section is the Maipura estuary extending from 'Kakranassi muhana' or 'Ekakulassasi muhana' right upto the Shortt's and Wheeler Islands (Palmyras Point).

At Gahirmatha rookery the nesting beach is very wide, flat and consists of sand which may contain some rare earths such as titanium. The colour varies from brownish white to blackish white or is completely black. The texture of sand varies from medium to fine hard packed particles. Often half of the beach near the high water mark looks brownish white and the remaining half removed from the high water mark looks black in colour. The nest site selection may be related to the texture and quality of the beach sand which in turn are related to digging a successful nest cavity, and thereafter conditions of temperature, moisture and aeration necessary throughout the incubation period for the developing embryos.

The average width of the main nesting beach remains almost constant during an arribada although it undergoes cyclical seasonal erosion throughout its entire length. In winter months the width of the rookery is maximum (50 to 60 metres) after the onset of the south-west monsoon in March-April erosion begins. During the

rainy season (June to September) the average width of the nesting beach is at its minimum. (5 to 10 metres). Hence, the arribada coincides with the period when the width of the rookery is at its maximum.

After the first mass nesting the subsequent arribadas may take place on the same or different parts of the beach. Perhaps this nesting site preference has adaptive significance as the numerous terrestrial beach predators will need to travel long distances to locate nests. Earlier workers have recorded nesting and have also remarked on the possibility of this sort of nest site preference by ridleys on other beaches (Pritchard and Marquez, 1973 and Loveridge, 1946).

The second mass nesting at Gahirmatha sometimes occur coinciding or prior to the hatching of eggs deposited during the first arribada. If the incubation period which is temperature dependant, varying from 45 to 70 days is more than the time interval between two consecutive arribadas, and if both the arribadas take place over the same stretch of coastline, clutches deposited during the previous arribada will be destroyed.

The shift of the arribada and the use of different parts of the beach in later mass nestings, therefore, appears to be a strategy of the olive ridley to avert the possibility of premature accidental excavation of developing embryos by subsequent nesters and thus to increase the overall hatching and emergence success of the hatchlings.

At Gahirmatha, the beach slope is gentle during the first arribada (late December to February). After conclusion of the first arribada erosion begins on the Ekakula-Ekakulanasi stretch preventing the later nesters to negotiate the beach in many places. Possibly the ridleys are capable of viewing the beach topography while swimming. Prior to commencement of an arribada masses of ridleys have always been observed swimming parallel to the coast just beyond the 3rd breaker line in the shallow coastal waters off Gahirmatha. They intermittently raise their heads out of water as if carefully scanning the beach. Nesting usually does not occur in eroded areas having vertical walls, whereas adjacent stretches having gentle slopes will host large numbers of nesters, thus support-

ing the above contention. The orientation capacity of ridleys appears to be greater (more accurate) in the water than on land.

Nesting of olive ridleys at Gahirmatha occur throughout the year with a variation on the number of solitary nesting ridleys from one, to one hundred or two hundred. Arribada usually occur two times in a nesting season during the period late December to April. The first arribada commences during late December to mid February while the 2nd arribada may commence between mid-February and April. The first arribada is usually very big when compared to the second arribada or subsequent mini arribadas during the months of April and May. The occurrence of arribada is known to be highly correlated with the phases of the moon (Marquez *et al.*, 1976) and usually takes place 2 or 3 days before or after the moon enters its last quarter (Marquez and Van Dissel, 1982). Observations made during the past seven years at Gahirmatha rookery strongly suggests that the arribadas usually take place coinciding with or one or two days after the neap tidal days along with increasing tide. Another interesting observation made at Gahirmatha is that immediately following an arribada the number of nesters abruptly decline and for about a week practically no turtles emerge to lay their eggs.

Big arribadas may continue after dawn into the morning hours upto 8.00 or 9.00 am, although the number of nesters emerging rapidly decreases. Diurnal emergences are more common when the sky is overcast and cloudy. During the 1982-83 nesting season after formation of the arribada, mass nesting continued for 3 days and nights, without any interruption although the number of nesting ridleys was comparatively less during the mid-day.

Large number of eggs are burried under the sand and after the peak hatching period a substantial proportion remains as unfertilised, unhatched or rotten eggs. It is possible that the presence of decaying remains of unhatched or rotten eggs and dead hatchlings which remain burried underneath the sand has an adverse effect on hatching success in the following nesting season. However, at Gahirmatha the erosion and subsequent deposition of sand helps in washing the beach and freeing it from various bacteria, fungi, organic detritus etc, and keeps the beach ready for the next seasons' arribada.

At Gahirmatha the arribada usually begins in the northern most section. In subsequent nights, as space or available nesting area become a limiting factor, the waves of nesting females spread south-west from 2 to 6 km of the beach (north-east—south-west). Within 2 to 3 days the arribada reaches its peak. Thereafter the concentrated nesting contracts slowly back to the northern end.

Some authors (*e.g.* Pritchard and Marquez, 1973) have reported that nesting emergences of ridley turtles, whether sporadic or aggregated, tend to correlate with a strong on shore wind. At Gahirmatha such a correlation could only be found with turtles nesting sporadically or when groups of a few hundred individuals nested on a particular night. No such correlation could be found during arribadas. However, it is interesting to note the mass nesting at the Gahirmatha coast usually takes place coinciding with, or immediately following, late seasonal rains associated with strong or moderate winds. In the subsequent nights, wind action appears to have no role after formation of any arribada. The above may have some bearing on the formation and triggering of an arribada.

How the ridleys maintain their aggregation during their migratory movements between their feeding and nesting grounds is a matter for speculation. They must have some means of finding each other. There are several possibilities. They may use visual means ; pheromonal secretions or they may be sensitive to mechanically produced vibrations resulting from surface swimming. The olive ridleys and the Kemp's ridleys are the only turtle species known to form arribadas and they are also the only turtle species that possess a complete and well developed series of secretory pores along the inframarginal scales of the plastron.

Remigration and Inter-Nesting Intervals

Tagging sea turtles commenced at Gahirmatha coast for the first time during 1978 (Kar 1982). So far a total of 15,000 turtles have been tagged at Gahirmatha using standard monel metal cow ear tags size : 49 from National Band & Tag Company, U.S.A., supplied by courtesy of FAO/UNDP. Tag return data strongly

suggests that a considerable proportion of Gahirmatha ridleys return to nest annually. Bustard and Kar (1981) have reported a 24% tag recovery during the 1979 nesting season. Tag recoveries also indicate that some turtles nest twice in a season at Gahirmatha. Tag return data will be discussed in detail in a later paper.

Formation of Arribada and Mass Migration

How the initial aggregation is formed in the olive ridley population coming for mass nesting is unknown. It is almost certain that olive ridleys migrate enmass and not solitarily from their feeding grounds to the mass nesting place. A number of small or large groups may migrate together upto the breeding ground until they congregate in very large numbers in the immediate vicinity of the mass nesting ground. Whitaker (1984) has reported that prior to the ridley mass nesting season in Orissa congregations of ridley turtles have been sighted by Sri Lankan fishermen, moving from north of Jaffna into the Bay of Bengal. Oliver (1946) and Deraniyagala (1952) have reported large concentrations of olive ridley in the coastal waters of Sri Lanka migrating northwards in the months of September and November respectively *i.e.*, prior to the peak nesting season on India's east coast. A large concentration of ridleys in December, 1978 in the above area apparently migrating northwards was reported by T.F.H. Hoffmann, Ex-President of the Nature and Wildlife Protection Society of Sri Lanka in his letter to R. Whitaker, with a request to protect the known nesting grounds of these turtles on India's mainland (Kar and Bhaskar, 1982). The first arribada took place at Gahirmatha rookery two months later.

Very recently, towards the end of November 1983 the Indian Coast Guard cabled the Chief Secretary of the Government of Orissa conveying the news about the mass migration of northward moving sea turtles in the coastal waters off Tamil Nadu 7 miles east of Pondicherry. Only a week later mating concentrations of sea turtles were sighted off Gahirmatha (Silas *et al.*, 1984). Mass nesting commenced on 25th January 1984. Zwinenberg (1976) reported the maximum speed of travel for a tagged ridley to be 83 km per day the turtle had been recovered within 23 days from a point off Geara (Brazil) 1900 km away from the place

originally tagged. Attributing a speed of travel of 83 km per day, the Gahirmatha turtles could have taken about 14 days to cover a straight line distance from Pondicherry to Gahirmatha coast (1165 km approximately) or about 16.3 days (1353 km. approximately) if they had hugged the coast line. Since the turtles were sighted only 7 miles east off Pondicherry it is probable that they had migrated along the coast rather than across the open sea.

The presence of about 600 carcasses of dead ridleys including both males and females on the Gahirmatha coast and about 500 carcasses at Hukitola island as a result of incidental catch during September 1983 to January 1984 confirms the presence of copulating pairs already during the above period. Therefore, it is possible that the Indian Coast Guard observed the tail end of a migratory concentration of ridleys off Pondicherry by which time the leading groups might have progressed further north. A proportion of them may even have reached the offshore waters off Gahirmatha by that time. It may be possible that the path chosen by the leading groups is subsequently followed by other groups. Physically handicapped and mutilated or deformed individuals may reach the nesting grounds later towards the end of an arribada (Silas *et al.*, 1984). Here, the pheromonal secretions may also be playing a role in the migration process. Silas *et al.*, (1984) have mentioned that between 20th and 22nd January, 1984 a tagged ridley was caught in a shoreseine net at Peddamylavamilanka (south), about 24 km south of Narasapur. The tag (number 14398)—had been applied in 1983 at Gahirmatha. The above evidence combined with earlier records of sightings of northward mass migration of ridleys off Sri Lanka waters indicates that the ridleys probably cover the entire length of the east coast of India to reach the mass nesting beaches along the Orissa coast with stray numbers nesting on the Tamil Nadu, Kerala and the Andhra Pradesh coasts during the long migration. Other populations possibly migrate from other areas such as Sunderbans, the Indonesian Archipelago and East Asia. However, such assumptions must remain for the present—at the level of speculation until more detailed research work is done by use of remote sensing techniques, radio telemetry, tagging ridley turtles and detailed observations are made in the open sea along the migratory routes (Silas, 1984).

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DISCUSSION

J. C. DANIEL : Plantations on or near beaches is a problem in other States also.

R. WHITAKER : Another cyclone may completely obliterate the Gahirmatha Beach. As such, plantations may be necessary as anticyclone work.

C. S. KAR : I have noticed nesting turtles shift to areas where plantations are not there.

J. FRAZIER : No proper study of this situation has been done so far. There are some cases in Mexico, but not in Costa Rica. We must think of a compromise solution—instead of plantations, recuperating mangrove may be taken up.

S. K. MISHRA : The Wildlife Authorities in Orissa are aware of the situation of beach plantation of casuarina affecting the nesting turtles. They have now recommended the stoppage of casuarina plantation along Gahirmatha Coast.

J. FRAZIER : Mixed planting programme of Casuarina plantation and mangrove development should be taken up.

K. SHANMUGANATHAN : Mangrove plantation may not help very much as an anticyclone measure since the cyclone winds are to be confronted at the highest level which is done by casuarina plantations.

E. G. SILAS : Grave danger to Gahirmatha Beach is from sea erosion. There are good indications of erosion along the southern stretch. Immediate interdisciplinary studies are necessary to find out the causative factors. Sand mining and Paradeep Port developments will also have to be looked into for understanding the problems of erosion and accretion along that coast. The area is also cyclone prone and direct hits may also cause heavy damage, but this is unpredictable.

SHIAM SUNDER : Nesting turtles along the Madras Coast are affected by the powerful lights from the beach resorts along the Madras—Mahabalipuram coastal stretch. A factory near Nelankarai is also letting out industrial waste directly into the sea which may also affect nesting. Some regulatory measures on switching off lights on nesting beaches and preventing pollution should be taken.

M. VIJAYAKUMARAN : The high sand-dunes on either side of the road from Madras to Mahabalipuram are being levelled or dug out for construction of farms and buildings. Will this not be dangerous in future?

S. KONDAS : Already the beach has been eroded due to these activities. There is a ban on construction of any building within 500 m of the high water mark. However, this is not strictly adhered to.

P. J. SANJEEVARAJ : What is the role of mangrove in the turtle food chain?

C. S. KAR : Decaying mangrove leaves may be eaten by turtle hatchlings.

M. VIJAYAKUMARAN : Olive ridley hatchlings do not consume any food upto 5 or 6 days after emergence. Their primary instinct is to reach the open sea habitat as soon as possible. As such mangroves may not have a direct role in the food chain of turtles.

T. SUBRAMONIAM : Do the salt gland in turtle produce any pheromones which help in mating migrations as in the case of sea snakes in polar regions?

C. S. KAR : I have no information.

J. C. DANIEL : How do you identify the tracks of different species?

S. BHASKAR : Tracks made by the nesting leatherback and the green turtles are distinctive for two reasons. These species as also the loggerhead which is apparently unknown from Indian waters drag themselves above the nesting beach using all four flippers in unison, an action which leaves a symmetrical set of tracks. Hawksbill and olive ridley move diagonal

limbs alone in unison thereby leaving staggered flipper per-imprints on either side of the midline of the track ; leatherbacks are among the broadest of any animal in the world and are therefore easily recognizable. Nesting green turtle tracks did not as a rule overlap in width with those of olive ridleys and hawksbills, the latter are usually smaller and never with those of leatherbacks which are larger. It appears to be difficult to distinguish ridley from hawksbill tracks for their widths overlap. It is possible that the hawksbill is a weaker swimmer than the ridley, this may result in the stride lengths of hawksbills on land being the smaller of the two, though this requires further investigation.

S. K. MISRA : Is there any correlation between the nesting beaches of marine turtles and mangrove area ?

S. BHASKAR : In Andamans even though vast stretches of sandy beach are available behind the mangrove vegetation I have not come across even a single nesting in that area. There is no correlation existing based on my surveys.

V. J. RAJAN : How about the existence of fishing villages along the stretch of our main coast line ?

S. BHASKAR : Always there will be fishing villages at least within a distance of 5 kms.

M. VIJAYAKUMARAN : Nesting of olive ridley is noticed off Okha in Gujarat in the month of June to November. In Tamil Nadu the nesting period is from December to March. Is there any relationship between the rainfall and the egg laying ?

S. BHASKAR : I have no definite idea about this problem.

K. SHANMUGANATHAN : Normally the egg laying starts after the monsoon period in Tamil Nadu. But unusually heavy rain occurred in the months of February along the Madras Coast. Whether the eggs collected and kept in the hatchery will be affected due to this has to be looked into.

M. VIJAYAKUMARAN : Most of the turtle eggs have the ability of absorbing water from the surrounding. The surrounding moisture condition may help in the normal development of the embryo.

TECHNICAL SESSION III

VALUE OF SEA TURTLES TO INDIA (FOOD, SUBSISTENCE, CULTURAL, AESTHETIC AND ECOLOGICAL)

CHAIRMAN : DR. P. J. SANJEEVARAJ

— VALUE OF SEA TURTLES TO INDIA

SHRI M. RAJAGOPALAN

— Discussion

VALUE OF SEA TURTLES TO INDIA

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INTRODUCTION

Five species of sea turtles are known to inhabit Indian Coastal waters and Bay Islands. In the order of abundance they are the olive ridley *Lepidochelys olivacea*, the green turtle *Chelonia mydas*, the hawksbill *Eretmochelys imbricata*, the loggerhead *Caretta caretta* and the leatherback *Dermochelys coriacea*. The green turtle is considered the most valuable of all living marine reptiles since its flesh is a delicacy and the main source of the famous turtle soup on account of which the turtle itself is called by Germans as 'Supenchild Krote' (Soup turtle). In addition to its flesh, the eggs of green turtle are also consumed. Green turtles are sought for their oil which is used in the manufacture of cosmetics and the skin to be made into leather. Until recently baby turtles were killed, cured, stuffed and sold as ornaments. The blood of this turtle is in demand in Tuticorin, Tamil Nadu where it is believed by the locals to be an elixir. The hawksbill turtle, is famous for its dermal plates which are used for tortorise shell. The carapace of the adult is strikingly amber with streaks and markings of reddish brown, blackish brown and yellow. The shell of the hawksbill consists of scutes that overlaps at first but become juxtaposed in large animals. The shell is most valuable before juxtaposition

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occurs. Shields are removed from the shell by immersing the freshly killed turtle in boiling water. Heat and pressure are applied to flatten the plates before working into jewellery and other objects. It is known one hawksbill can yield a maximum of 3.6 kg of shell but normally it is about 0.68 to 0.91 kg of shell. Eggs of loggerhead are much relished than the flesh. The shell of the adults are used in the preparation of ornaments. Olive ridley eggs are considered a delicacy and flesh is also consumed. Flesh of the leatherback is not relished but the eggs are considered a delicacy when fresh. The oil extracted from the leatherback is used in maintenance of boats and canoes.

Value of Turtle in the Past

Turtle fishery in Tamil Nadu

Turtle fishing was practised for ages in the Gulf of Mannar and Palk Bay mainly by non-Hindu fishermen. In the sixties it was estimated that on an average about 3000 to 4000 turtles were landed every year between Pamban and Cape Comorin. In the Palk Bay, the fishery was of a much lower level and about 1000 turtles were landed annually between Rameswaram and Mimisal. The main fishing centres in the Gulf of Mannar were Pamban, Kilakarai, Tuticorin, Ovari, Kuttankuli, Periathalai and Cape Comorin while along the Palk Bay the centres were Rameswaram, Tondi, Tirupallakudi, Devipatnam and Pamban. The green turtle constituted about three fourth of the total catch. Olive ridley and loggerhead formed about 20% of the catch. The catch was mainly sent to Tuticorin from different places of capture. The assembling centres for turtles in the Gulf of Mannar were Rameswaram, Kilakarai and Tuticorin and on the Palk Bay Coast Tondi and Pamban. At these places special pens were constructed in the sea close to shore for keeping the turtles alive.

Turtles were caught by special type of wall nets and nets were made of fibres of *Acacia planifrons* or of cotton yarn. Two types of nets known as 'Pachuvalai' and 'Kattuvalai' were used requiring between 5 to 8 men each for operation. The 'Pachuvalai' was usually cast at night at the entrance of two parallel coral reefs and hauled after a lapse of 12 to 18 hours.

' Kattuvalai ' used to be longer and devoid of any anchor and buoy. Fishing with this net was also conducted between two coral reefs but in much shallower water and six fishermen usually operate the net. They beat the surface of the water or the sides of the canoe to drive turtles into the net. The net was usually laid on full moon nights and fishing was generally conducted for two hours.

In Orissa

Eventhough no organised fishery for turtles existed along Orissa and West Bengal Coast, trade in turtle eggs and turtle flesh occurred every year during the ' arribada ' in Bhitarkaniaka area. From the time when Kanika was a Zamindari holding, people were paying ' Andakara ' (revenue for the eggs) and were collecting boat loads of eggs from this area. The Forest Department of Orissa has also issued licenses for collection of eggs at the rate of Rs. 15 per boat load of eggs (roughly between 35,000 to 1,00,000 eggs). Eggs were sold in all the river side villages where they were consumed mainly by the economically poorer communities of Orissa. Large scale transport of eggs during the season to the Calcutta markets also took place. Locally people used to preserve the turtle eggs in large quantities by drying them in the sun for future use. The estimated legal take in the 1973 season was 15 lakh eggs but the actual illegal take was probably much more.

Status of export of turtles and turtle products

Prior to the sixties, there was a regular trade in turtles between India and Sri Lanka. Live turtles were transported in sailing boats from Pamban, Tamil Nadu to Jaffna, Sri Lanka. Due to restrictions imposed by the Sri Lanka Government, the trade was stopped in 1965.

Chelonian products have been exported under the category as turtle meat, turtle shell, turtles, tortoise shell, living tortoise, tortoise belly and as tortoise skin. Between 1963 and 1974, 102022 kg of sea turtle products valued $ 1,00,800 were exported from India. The price of 1 kg of tortoise shell increased from Re. 1 in 1967 to Rs. 20 in 1969 and to Rs. 185 in 1975.

Between 1971 to 1976, 120 kg of turtle shell worth of Rs. 2,916 were exported to France and United Kingdom. The tortoise

shell weighing 8215 kg valued at Rs. 2,97,892 were exported to Australia, France, Hong Kong, Italy, Japan, Netherlands, Singapore, Spain and Federal Republic of Germany between 1971 and 1977. The turtle hoofs of 757 kg worth of Rs. 20,402 was exported to Japan, Singapore and U.K. between 1975 and 1980 Living tortoise was exported between 1971 and 1975 to the tune of about Rs. 25,350 to France, Italy, Japan, Netherlands, Switzerland, U.S.A., U.K. and West Germany. Between 1974 and 1976, 106 kg of turtles were exported to Nepal and West Germany worth Rs. 4,577. Turtle flesh as calipash, the light greenish fat-like meat found as irregular patches inside the carapace immediately below the scutes and calipee the light yellowish meat found in patches attached to the plastron are exported. 125 kg of tortoise belly was exported to Singapore during 1971—1972 worth Rs. 4,160.

Present Status

At present all the five species of sea turtles occurring in Indian seas are protected as they are placed in Schedule I of the Indian Wildlife (Protection) Act 1972 as per Amendments made to the Schedules in September 1977. India abides by the Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES) which prohibits trade in turtle products.

The explosive trade which sprung up for the olive ridley, in the late seventies and early eighties despite the Indian Wildlife (Protection) Act, created considerable concern at the national level. During the 1981-82 season it was estimated that 15 fishing units, each unit comprising of a motor launch with six country boats were deployed from Digha, West Bengal. Each unit captured about 6000 turtles during the season from November to January off Orissa Coast. During the 1982-83 season the scale of poaching was reduced to a great exent. It was estimated that from mid December to end of February 1983 about 10000 live olive ridley turtles were clandestinely landed at Bhanshalghat, West Bengal and thence transported to Calcutta and Tata Nagar markets. In the 1982-83 season there was a reduction in the catch by almost 90% over the previous season. The directed fishery for olive ridley was not carried out during the 1983-84 season. The

incidental catch from gill nets were hidden and transported in wooden boxes and bamboo baskets and sold in Calcutta markets. In December 1983 about 360 olive ridley turtles were sold in Calcutta markets.

The 1982-83 season saw a significantly large number of dead olive ridley washed ashore along the Gahirmatha coast. This was the result of incidental catch from fishing gears operated from mechanised and non-mechanised fishing boats. It was estimated that about 7000 to 7500 dead turtles were washed ashore along a stretch of 15 km at Gahirmatha. The incidental catch was drastically reduced in 1983-84 season to about 400 turtles stranded over a stretch of 15 km along Gahirmatha Coast chiefly due to voluntary refrainment of fishing. A seasonal restriction in the fishing activity using certain types of fishing gears such as wide meshed gill nets would be imperative. Clearly demarcated inshore area should afford protection to turtles from fishing activity during the mating season. A turtle excluder net for shrimp trawling has been developed in the U.S.A. and trials with similar designed trawl nets should be undertaken to see its efficacy in allowing turtles to escape while fishing selectively for shrimps from mechanised boats in our coastal waters.

In Bay Islands

In the Andaman Islands all species except the leatherback was hunted for meat. In the Nicobar group cooked turtle meat is still consumed regularly, but sometimes taken raw when it is minced and mixed with coconut. The green turtle and hawksbill are the species usually eaten. The green turtle meat was brought to Port Blair market and sold at Rs. 3 to Rs. 5 per kg as late as seventies.

In the Lakshadweep the turtle meat is rarely eaten by the islanders, but a handful have acquired the habit from turtle eating mainlanders. In some areas turtle meat was ueed as shark bait. Turtle fat was used to waterproof the boats in Amindivi and other islands. There was no systematic effort made to dig out eggs for consumption.

Recovery Programme

The recovery programme for the olive ridley has been taken up by the Central Marine Fisheries Research Institute, the Forest

Department, Govt. of Tamil Nadu and other agencies in Tamil Nadu. In this programme turtle eggs are collected soon after nesting and incubated in the properly maintained hatcheries and young ones are released back at the same beach on hatching. The recovery programme was initiated in Tamil Nadu as the human and non-human egg predation was very high and nesting is sparce. The Tamil Nadu Forest Department has taken up the programme in all the districts bordering the east coast of the State.

Future prospects

Serious consideration has to be given for stepping up the recovery programme to sea-ranching programmes. There will be a possibility of culling of turtles as well as doomed eggs from Gahirmatha, Orissa. We have to monitor and evaluate the marine turtle resources to take any decision on this. There is also need to look into the non-consumptive utilisation of sea turtles in activities such as education, recreation and tourism.

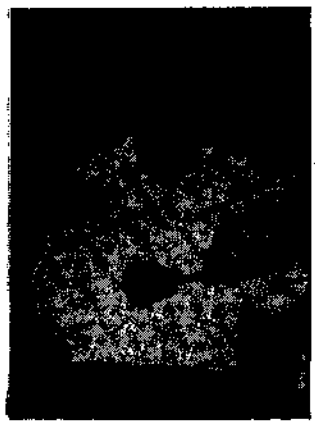
Cultural and aesthetic values

The turtle is venerated as according to Hindu belief, it is the second incarnation of Lord Vishnu. During the churning of the ocean of milk for getting nectar by Gods and Demons using Mount Manthara as churner and Serpent Vasuki as cord, the Mount Manthara started to sink, but was supported by Lord Vishnu in the form of a turtle. Due to this belief Hindu fishermen in Tamil Nadu consider the sea turtle as God and as such when a turtle is caught in their fishing net it is released into the sea. Fishermen generally do not eat, collect or sell turtle eggs. Whenever the nesting females crawl close to or inside fishermen's huts, they perform religious rituals. There is another legend about a turtle called 'sea goddess' which lays two large eggs which a human can never see.

In the Lakshadweep, the hawksbill shells were used for ornamental purposes. An entire shell is cleaned and coated with French polish and displayed in living room walls. The laminae on a hawksbill shell are made pliable by heat and moulded around the shafts of walking sticks. Knife handles are also adorned by hawksbill laminae.

In the Nicobars, shells of turtles are found on trees near Nicobares homes. This is apparently done after a turtle has been speared by a novice for the first time and ensures good lunch in future hunts. Turtle shells are used as feeding troughs for chicken and as containers for transporting coconut. Turtle carapace are frequently seen hanging on the walls of huts of Onge tribals. The horny laminae on the shells of hawksbill are moulded by the Nicobares into a variety of trinkets, finger and ear rings, bangles, combs and belts. Pieces of silver are imbedded into tortoise shell finger rings.

DISCUSSION



P. J. SANJEEVARAJ : Has any work been done to study migration of sea turtles by using remote sensing technique? Would telemetry be useful in such studies?

E. G. SILAS : Central Marine Fisheries Research Institute is carrying out remote sensing and satellite imagery studies along the west coast, but I don't think this will help in pinpointing turtles, unless they are in large aggregation. Aerial surveys could certainly help. In the United States, a number of experiments using telemetry have been carried out to study inshore and offshore migration of turtles. Documented information on this is available. Large scale tagging over a number of years may also help in understanding the migratory habits and breeding behaviour such as renesting of sea turtles. Using monel metal tags supplied by FAO, Mr. Chandrasekar Kar has already tagged about 15,000 olive ridley at Gahirmatha and recoveries have started coming in. One thousand similar monel metal tags from Central Marine Fisheries Research Institute have been handed over to Shri Kar for continuing the programme. Internal tags have been developed recently in the United States and these require X-ray equipment for detection and may not be practicable in India.

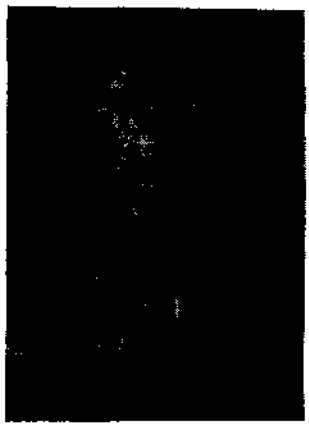
J. C. DANIEL : Can anyone do the tagging? How can monitoring be strengthened ?

E. G. SILAS : The external tags as used now can be done with little practice. If not properly done, the tag losses may be great and the results could become negative. The Central Marine Fisheries Research Institute has over 45 field and research centres along the coast and the monitoring of the tag recoveries of tagged turtles in the drowning incidental catch or from the nesting beaches can be monitored to some extent. This will certainly supplement observations by individuals and other organisations. There will be need for developing a co-ordinated approach on this.

J. C. DANIEL : Tagging should be done by one Central Agency like the Central Marine Fisheries Research Institute.

E. G. SILAS : I welcome the suggestion. With our infrastructure at the Institute, we will be able to positively help in this programme as well as in monitoring tag recoveries or ' tag reading ' of remigrants.

T. S. N. MURTHY : I would like to mention that there is a Vishnu temple in Srikkakulam District, Andhra Pradesh, where Vishnu is seated on a turtle. There are religious sentiments regarding the turtles in some coastal areas and fishermen do not fish turtles or eat turtle meat or egg.



P. J. SANJEEVARAJ : It is surprising why such sentiments are not attached to fish which is also an avatar of Vishnu.

K. SHANMUGANATHAN : An administrator would ask in what way would turtle conservation help other than protecting an endangered species. It is difficult to try and convince the authorities the actual value of turtle conservation. There is need for bringing out pamphlets and information in regional languages to help create greater awareness.

E. G. SILAS : At Gahirmatha during mass nesting of the olive ridley there is heavy destruction of nests of previously laid eggs by subsequent influxes of nesting females. This is more so as nesting is restricted to a short stretch of the beach as had taken place in January-February 1984. This is also

followed by heavy predation by non-human predators. The time has come when we may have to consider whether a part of the eggs could be utilised for human consumption or some of the animals could be culled. How do we go ahead with this?

K. SHANMUGANATHAN: How long should we protect turtles? Why not start mariculture of turtles?

J. FRAZIER: The exploitation of turtles during 'Arribada' must be carefully studied taking into consideration two previous instances. Nesting population in 4 mass nesting places have been destroyed in Mexico where exploitation of turtles from nesting beaches for reptile skin was started in 1960. In about 10-15 years 3 or 4 major populations have been destroyed and it no longer is a resource in the country. Similarly in Costa Rica there are 3 mass nesting areas and recently some of the students are appealing for the rational exploitation of the turtle eggs for preserving the species. The problem is aggravated by the poor hatching success of the eggs.

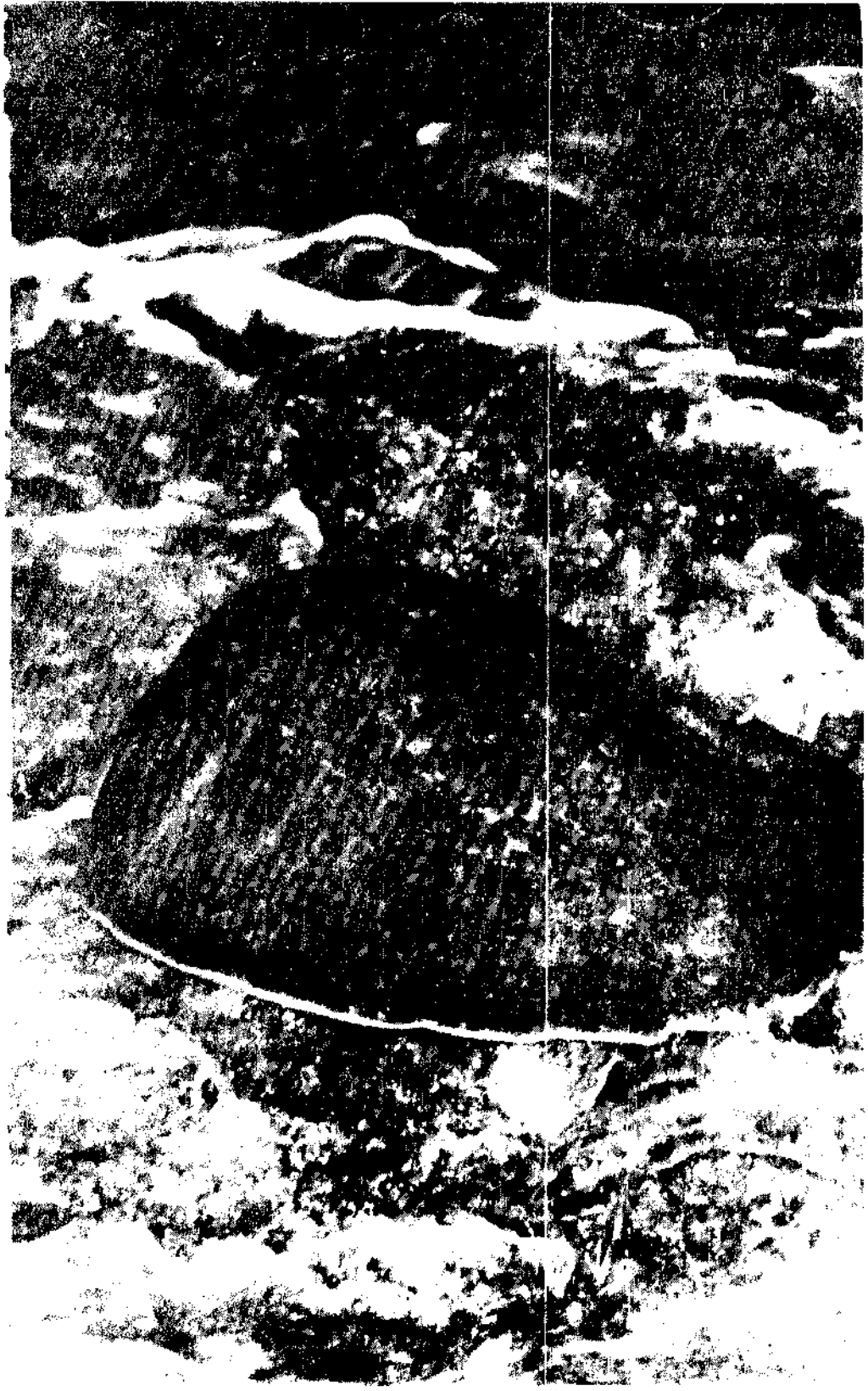
T. SUBRAMONIAM: What is the hatching mechanism in turtles and are turtle eggs cleidoic or non-cleidoic?

R. WHITAKER: The hatching is by breaking the shell by the beak and claws.

M. VIJAYAKUMARAN: Based on water absorption, protein and fat metabolism and nitrogen excretion, we have now classified sea turtle eggs as non-cleidoic. I would refer you to a paper in CMFRI Bulletin No. 35 on this subject.

J. AZARIAH: How do turtle hatchlings orient themselves to the sea?

J. FRAZIER: The seaward orientation of hatchlings has been studied in detail. It is due to phototaxis.



TECHNICAL SESSION IV

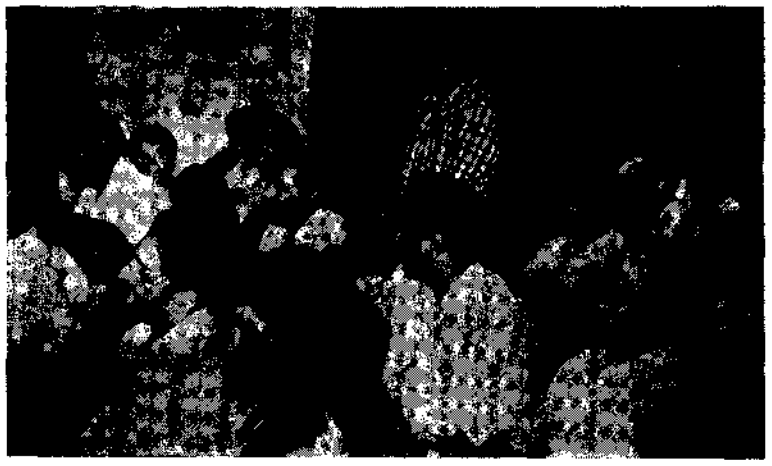
THE THREATS TO SEA TURTLES IN INDIA

CHAIRMAN : SHRI ROMULUS WHITAKER

— THREATS TO SEA TURTLES IN INDIA — EXPLOITATION AND HABITAT PERTURBATIONS

SHRI SHEKAR DATTATRI

— Discussion



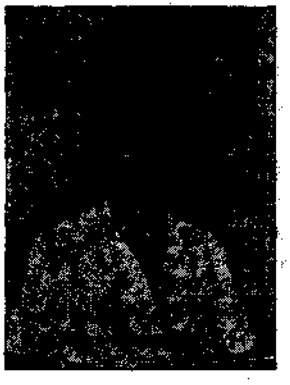
THREATS TO SEA TURTLES IN INDIA — EXPLOITATION AND HABITAT PERTURBATIONS

SHEKAR DATTATRI

Madras Snake Park Trust, Madras-600 022

INTRODUCTION

Contemporary sea turtle conservation programmes in India are limited to-in most cases atleast—the establishment of egg hatcheries. While these may be of great conservation value if scientifically managed, they will scarcely suffice if sea turtles are to be effectively conserved in the long run. And if we are to achieve our goal of long term conservation it is imperative that we develop a broad based strategy with habitat conservation as one of the top priority measures. Towards achieving this end, let us begin by enumerating and examining the various threats that confront our sea turtles today.



Even without supportive quantitative data we can assert empirically that sea turtle populations have declined drastically during the last few decades directly or indirectly as a result of human activities. Only the olive ridley (*Lepidochelys olivacea*), among India's five species of sea turtles can be considered still abundant. The loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*) and green (*Chelonia mydas*) are rare, in that order of importance and have all but succumbed completely to heavy hunting pressure/habitat destruction. Nesting populations of these latter four species are extremely small, fragmented or altogether non existent on the Indian mainland

and sizeable nesting populations (Speaking relatively) are at the present day restricted to remote/uninhabited islands in the Andaman and Nicobar and Lakshadweep groups.

I am greatly indebted to Satish Bhaskar whose help was invaluable in the preparation of this paper. The Madras Snake Park Trust provided facilities as always, for which I am thankful. Dr. Jack Frazier and Ms. Susana Salas commented on some parts of the manuscript and offered useful suggestions. I thank them for their time.

Threats

Exploitation

Man has been exploiting sea turtles for several millenia, for eggs, meat, tortoiseshell, flipper hide, oil, fat or blood. He still does and will probably continue to do so as long as is possible. And there's no reason why he should not provided the resource remains plentiful and is judiciously utilised. This, unfortunately, is not the case today (Table I). Hunting for subsistence (as defined by Frazier, 1981), that relatively innocuous form of exploitation has been largely replaced by commercial exploitation which demands the slaughtering of thousands of sea turtles, indiscriminately and year round and where retailers and middlemen stand to earn huge profits. The turtle markets of West Bengal perhaps illustrate this most clearly.

Elsewhere, egg poachers remove virtually every clutch of eggs laid for consumption and sale. The demand for turtle flesh and eggs is attributable to their relative low cost. In most parts of the country turtle meat sells at between Rs. 5 and 10/Kg as compared to Rs. 16-19/Kg of mutton. Turtle eggs at 5-10 paise each are 12-6 times cheaper than chicken eggs. Consequently thousands of turtles and tens of thousands of eggs are lost every year placing heavy strain on our already decimated turtle populations. Unless the turtle markets (which, of course, are absolutely illegal) are speedily put out of action, India's sea turtles may soon be eaten out of existence ; they already have been in many places.

Habitat perturbations

This term encompasses a variety of factors which adversely affect sea turtle habitats, often rendering them entirely unfit for

TABLE — 1. Exploitation

THREAT	SPECIES MOST AFFECTED: OLIVE RIDLEY	GREEN	HAWKS BILL	LEATHER BACK	PLACE (S)	REMARKS
Catching technique 1. Trawling	1	2	3	4	Orissa, West Bengal, Andhra Tamil Nadu, Orissa, A & N Islands	Deliberate catch Accidental catch
2 Set net fishing	1	2	3	4	1 Andamans, Tamil Nadu; 2 Andamans, Tamil Nadu; 3. Andamans, Tamil Nadu,	Slight Heavy Heavy
3. Spearing	1	2	3	4	1 Nicobars; 2. A & N Islands, Lakshadweep; 3. " " 4 A & N Islands;	Slight Heavy " Slight
Motive for exploitation 1. Meat	1	2	3	4	1. West Bengal; 2. S. T. Nadu, A & N Islands; Lakshadweep, 3 As in 2	Heavy Heavy Slight
2 Oil (Boat sealant)	1	2	3	4	1 Lakshadweep, T. Nadu, 2. Lakshadweep, T Nadu; 3 Same as 2 4 T. Nadu, Lakshadweep;	Slight Heavy, Slight Slight
3. Flipper leather	1	2	3	4	1 & 2 Saurashtra;	Slight (for footwear)
4. Tortoise shell	1	2	3	4	A & N Islands, S T. Nadu;	Slight
5. Eggs*	1	2	3	4	1. Mainland, Lakshadweep, A & N Islands; 2. Saurashtra & Nicobars; Andamans & Lakshadweep; 3 A & N Islands, Lakshadweep, 4. Nicobars, Andamans,	Heavy. Gujarat — Bullock feed Slight Nicobars — Pig feed Heavy Andamans — for dogs Slight (in addition to human consumption) Heavy Slight Heavy, Slight
6 For blood and fat	1	2	3	4	1 Tamil Nadu; 2 T Nadu, Andamans; 3 T Nadu,	Slight Slight Slight

HEAVY SLIGHT *SOLD EVERYWHERE EXCEPT NICOBARS

nesting or feeding as the case may be. The rapid 'development' of beaches—previously inaccessible or untouched—for housing, resorts or other constructions is perhaps one of the most serious threats today and coupled with other forms of disturbance or habitat modifications such as erosion preventive embankments, jetties etc., sand mining and lights on the beaches, to name a few-has rapidly and seriously reduced the length of available suitable nesting habitat. Recently Satish Bhaskar, after a survey of the Kerala coast, reported that 200 km of that State's 590 Km coast has been 'fenced off' by granite blocks and embankments meant for protection against erosion, thereby excluding nesting sea turtles from the area. Scores of other examples can be cited all over coastal India (Table 2). The changes are not necessarily always as obvious or drastic and they don't necessarily have to be. Who would have known for instance that the beaching of boats on the Tangaserri beach would wipe out the nesting leatherback population from that area? (Smith, 1931). This should teach us that even seemingly trivial modifications of the habitat could have severely detrimental-indeed, disastrous-consequences and that even 'minor' development on beaches should be carefully assessed before they are actually carried out.

SUMMARY

1. Large numbers of breeding adults are caught annually and carted off to the markets for slaughter and several thousands more-hatchlings, juveniles and breeding adults—are killed accidentally by drowning in trawl and gill nets.

Result : Rapid depletion of numbers.

2. Simultaneously (in many areas), virtually every clutch of eggs laid—particularly on the mainland—is collected by humans or destroyed by domestic animals such as dogs and pigs.

Result : Recruitment is greatly reduced.

3. Increasing amounts of nesting habitat are being rendered unfit for this purpose as a result of human settlements, other constructions, erosion preventive embankments, other physical barriers and lights on beaches, to name a few uses.

TABLE 2. *Habitat Perturbations*

Nature of Threat	Place	Species Occuring in the Area (and likely to be affected) and Remarks
General		
Human settlements	Indian mainland and some islands in the Andaman and Nicobar and Lakshadweep groups	Depending on their distribution all species will be affected.
Beach resorts		
Other construction on shore (jetties etc.)		
Erosion preventive embankments		
Lights on beach		
Fishing activities		
Beached boats		
Specific		
Fencing of beaches (to protect a few saplings in plantations from being inadvertently uprooted by nesting turtles)	Lakshadweep	Green, Hawksbill, Ridley and Leather-back.

Sand mining for cement	Saurashtra South Tamilnadu	Green and Ridley Green, Hawksbill and Ridley.
Sand mining for construction purposes	Most states on the mainland and the A & N Islands	Depending on their distribution all species will be affected.
Sand mining of black sand beaches for Titanium ore and I.R.E. (Indian Rare Earths)	Kerala, Tamil Nadu and Andhra Pradesh	Mainly Ridley.

Potential

Rapid colonisation of coastal areas and beaches for human settlements or resorts, of areas hitherto inaccessible or untouched.	Indian mainland and many islands in the Andaman and Nicobar and Lakshadweep groups	All species will be affected depending on their distribution
Proliferation of mechanised fishing boats increasing the operational range and efficiency of turtle hunters and making beaches and feeding grounds once remote easily accessible.	,, ,,	,, ,,
Marine pollution	,, ,,	,, ,,
Coral mining	Gulfs of Mannar and Kutch and around the Islands.	Hawksbill and possibly loggerhead.

Result : Progressively fewer turtles will be able to nest successfully outside protected areas.

Admittedly, the outlook does appear pessimistic. But let us not forget that there is still a fair amount of good coastal habitat left in the country which is even now regularly used by nesting turtles. The identification and assessment of all such areas should be given priority attention now in order that we may safeguard our sea turtle resources for the future.

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Discussion

R. WHITAKER : There is destruction of coral due to trawl operations in the Gulf of Mannar area, which results in habitat destruction of sea turtles. Some urgent action should be taken towards habitat protection in this area.

J. AZARIAH : MMDA (Madras Metropolitan Development Authority) has to be made aware of habitat protection while giving sanctions for beach resorts and other constructions near the beach. Public also should be made aware of this fact. NCERT should be contacted to include a lesson on sea turtle conservation in the school syllabus.

V. J. RAJAN : There is need to educate the school children and this should have priority.

K. SHANMUGANATHAN : In order to protect the beach we must recommend for an Act of Parliament to check building construction near the beach.

A. N. KARVE : Already there is an existing law which prohibits building construction within 500 metres from high water mark.

K. SHANMUGANATHAN : In Lakshadweep Islands, coconut palms are being planted all over the beach thereby restricting the nesting beaches. Also the fencing of the beach by defence department also has affected the nesting beach.

A. N. KARVE : In Lakshadweep the fencing is only in the western side to protect the beach which is being washed away. There is no fencing on the eastern side which is the nesting beach for turtles. Hence there is no change for nesting habitat in Lakshadweep due to fencing.

There is high level pollution in the turtle nesting beaches of Madras Coast from Ennore to Pondicherry. In Madras city the rivers Coovum and Adyar empty polluted water into the sea. The Madras Corporation should be asked to filter the water before releasing into the sea.

G. GURUMANI : Is there any data on population decline ? If not how do you say that a species is really endangered or not. How many endangered species are there. Are we protecting one of the abundant species ?

K. SHANMUGANATHAN: Circumstantial evidences indicate that sea turtle populations have declined. About 50 years ago there was a good population of sea turtles in the Gulf of Mannar. The intensity appears really low today. Same is the case of the leatherback turtle. A nesting beach existed for the leatherback turtle in Kerala, but at present we are not able to find even a single nest of the leatherback along the Kerala Coast.

S. BHASKAR : The number of nests in the Krusadai Island, Gulf of Mannar has considerably reduced now.

E. G. SILAS : There is no quantified data on the turtle populations in our seas. Some quantified data on the stranded turtles due to poaching and incidental fishing activities is all that is available.

A. N. KARVE : Matting pairs of olive ridley off Orissa Coast aggregate appearing like small islands and the matting pairs also produce noise.

PANNERSELVAM : Hatchlings can be punched in the marginal scutes and released to find out whether they are coming back to the same beach.

E. G. SILAS : Importance should be given to non-consumptive utilisation of sea turtles so that the relationship between man and turtle could change from killing them to utilise them for educational, recreational and tourism and research purposes. Some sort of tourist attraction like whale watching can be planned. There is immediate need to study the problem of turtle poisoning. The effects of poison is known only after 24 hours of consumption. More information on the food of sea turtle is needed.

K. SHANMUGANATHAN : The predation by birds, crabs, etc. on the hatchlings can be avoided by releasing them into the sea by taking them in the boat.

World Wildlife volunteer : Industrial waste in the nesting beaches of Madras, especially in Neelankarai, 15 km south of Madras, from the cement pipe factory may affect the nesting beach. Neelankarai beach is well known for the nesting of olive ridley in the season from December to March. Some action has to be taken to prevent the pollution problem.

S. K. MISRA : Caustic Soda factory in Ganjam District, Orissa is releasing industrial wastes into the river which may affect the nesting beaches. This matter has been reported to Shri Digvijaya Singh, Minister of State Department of Environment.

K. SHANMUGANATHAN : Due to predation the survival of hatchling in the mass nesting beach must be extremely low. It is likely that one in thousand may reach the stage of maturity. The number of turtles coming to mass nesting area may be monitored systematically.


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TECHNICAL SESSION V

RECOVERY AND MANAGEMENT PROGRAMMES FOR SEA TURTLES IN INDIA : THEIR VALUE, LOGISTICS AND PROBLEMS

CHAIRMAN : DR. J. FRAZIER

— RECOVERY AND MANAGEMENT PROGRAMMES FOR SEA TURTLES IN INDIA : THEIR VALUE, LOGISTICS AND PROBLEMS

SHRI ROMULUS WHITAKER

— Discussion

RECOVERY AND MANAGEMENT PROGRAMMES FOR SEA TURTLES IN INDIA: THEIR VALUE, LOGISTICS AND PROBLEMS

ROMULUS WHITAKER

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INTRODUCTION

There is a tendency to look at sea turtle species as a single unit, but it is important to realise that the five species found in Indian waters all have unique aspects of their biology, status and conservation requirements. The hawksbill and green turtles are only abundant in the Bay Islands and Lakshadweep, while the leatherback and loggerhead are definitely scarce in our area. But the ridley populations that nest on our coast are, at least in Orissa among the most dense in the world. Accordingly, our approach to sea turtle conservation should begin with a more complete assessment of the biology and requirements of such species.

Sea turtle enthusiasts in the rich countries have developed a powerful lobby for total protection of sea turtle and largely ignore or denigrate the need to fulfil the management aspects of sound conservation programmes for the developing countries. This approach may look good for sea turtles now but it is short-sighted and harmful in the long run. To be brief, a balanced, open-minded, middle-of-the-road approach is definitely the right one for India.

HABITAT PROTECTION

Nesting Beaches

Surveys carried out by Kar and Bhaskar (1981) and others on the rest of the coast and islands have now pinpointed most of the main sea turtle nesting beaches. A few such as Point Calimere in Tamil Nadu, Gahirmatha in Orissa, Pirotan Island in Gujarat, Labyrinth Islands in the Andamans and in the Sunderbans of West Bengal lie within sanctuaries where protection should be guaranteed. The total extent of these protected beaches is less than 150 linear kilometeres which is not much out of thousands of kilometres of coastline, while some of this region's most important nesting beaches (Little Andaman for leatherbacks, South Reef Island for greens and hawksbills, and several islands in Lakshadweep for hawksbills and greens) remain unprotected. A system of National Seashore Reserves is one way to consolidate protection and management for critical coastal habits.

Once the main nesting areas have been determined, protection can be planned in the manner most applicable to the particular beach. A few examples of problems and action taken will be illustrative.

(i) *Gahirmatha, Orissa*: (a) Sea turtle beaches included within Bhitarkanika Sanctuary (b) Protection of adjacent mangrove forests to deter erosion and maintain an intact estuarine ecosystem. Here it should be noted that another branch of the Orissa Forest Department entrusted with planting casuarina as a cyclone barrier has been slightly over-zealous and has started planting on the edge of the main turtle nesting grounds which could further limit the already cramped rookery.

(ii) *Pirotan Island, Gujarat:* Removal of sand for construction halted in this area after creation of the Marine National Park.

(iii) *Suheli, Lakshadweep*: Proposed construction of a lighthouse could adversely affect green turtle nesting there.

(iv) *Madras-Mahabalipuram beach:* Development of housing and beach resorts along the coast may deal the death blow to the

already heavily pressured ridley population here : Control on beach development, use of bright lights at night, pollution and other aspects must be considered in protecting nesting beaches near and in urban areas.

Feeding Grounds

Green turtles and hawksbills in particular are dependent on sea grasses and coral reefs in sheltered water. One of the two of these situations occurring on the mainland is protected (Marine National Park, Gulf of Kutch in Gujarat) ; but perhaps the most important areas, the Gulf of Mannar islands have yet to be protected. In both Lakshadweep and the Bay Islands, factors such as coral mining, deforestation and resultant siltation are destroying the delicate reefs. Other pressures on marine life in the islands point to the need for establishing adequate protected areas there and baseline studies to provide the rationale and guidelines for sustained conservation. Fishing techniques, particularly bottom trawling, should be assessed for permanent damage to turtle feeding areas. Among the earliest forms of animal and plant life to be affected by pollution of coastal waters are molluscs, algae and sponges. It is likely that already many habitats where these important turtle foods live have been rendered uninhabitable by oilspills, toxic chemical waste and raw sewage. All this points to the need for actual implementation of the currently evolving regulations on pollution control.

Species Protection

Patrolling by Land and Sea

Already Forest Department personnel in Tamil Nadu and Orissa have found it part of their duty to patrol beaches to deter turtle-egg poachers. Needless to say, to patrol the vast stretches of Indian beaches where only widely spread, sporadic nesting occurs today, would be impossible and must be limited to areas of concentrated nesting. Enlisting public help from interested towns people and fishermen (many of whom revere the turtle as holy) can be a valuable asset in controlling poaching on beaches. On turtle beaches in Mexico, armed soliders are posted as guards

(but this gives rise to complications). In the last two seasons, the participation of the Indian Coast Guard and Navy with patrol boats, plane and helicopter dramatized two important points (*a*) that such inter-departmental cooperation is essential to effectively protect sea turtles and (*b*) that if the protection of the sea turtle is to be the job of the State Forest Department they must get the necessary patrol boats and train personnel for the job and get out on the sea.

Market and Movement Control

While it may be difficult to effectively patrol the beaches and high seas, it is often much easier to stop commercial trade in turtles and eggs by market raids, check posts and intelligence contacts through the railways, trucking agencies and fishermen. The few taken for local consumption add up to almost nothing compared to the market sales, the largest one being in Calcutta which despite laws and raids continues. Others, such as the Tuticorin market, have gone underground, turtles being clandestinely sold on the beaches in early morning hours.

Incidental Take

Effective implementation of a 3 km inshore ban on mechanised trawlers helps local catamaram and countryboat fishermen as well as sea turtles and may be the single most important action to prevent the massive annual incidental take (over 3,000 of the Gahirmatha Coast last year). Unfortunately the problem is ' political ' and the only solution is meticulous patrolling and enforcement by Navy, Coast Guard and Customs. The turtle excluder device developed to reduce the incidental capture of turtles in the U.S. should be introduced for trials here and the results publicised. The FAO, Bay of Bengal Project would perhaps be interested in doing the initial experiments.

Public Education

The plight of the sea turtles is that we know so little about them yet they are heavily exploited, eggs and adults, throughout most of the world. Children and adult humans who live along the coast (many in fishing villages) can be taught by radio, TV, pamphlets, and posters about how and why sea turtles should be protec-

ted. Poachers always find it difficult to operate where there is a positive public attitude toward wildlife.

Education must extend to the level of the factory and trawler owners who pollute habitat or incidental catch of turtles. India has seen several recent examples of how valuable, effective public opinion can be to species protection.

Non-consumptive utilization of turtles such as tourism (to see them laying eggs) and research can help create more public esteem for sea turtles which have a natural appeal ahead of the other, more toothy or venomous reptiles such as crocodilians and snakes.

Project Tiger being the best example. A good film can easily be made on sea turtles of India and would be a valuable step in heightening public awareness.

MANIPULATION

I. Recovery

Erasing Tracks : Before some measure of protection came to Madras beaches we used to race ahead of the egg poachers and rub out turtle tracks, make false tracks and generally disrupt their work. It was certainly an effective and simple technique to deter human predation and probably helped prevent dogs and jackals from finding nests.

Transplanting Nests : A slightly more elaborate but still simple and effective method of protecting nests from all predators is the careful digging up and transplanting of the nest to a suitable nest hole dug nearby.

Hatchery and Release : One of the most popular conservation techniques is the collection or purchase of eggs for hatching and release. Some of the constraints include :

(i) the chances of mishandling eggs and delays in getting them to the hatchery.

(ii) siteing and maintaining hatchery so that losses due to heat, dessication, inundation and predation are minimized.

(iii) temperature related sex determination presents the danger of producing unnaturally biased sex ratios

(iv) holding the hatchlings for longer than 12 hours after hatching will mean releasing tired hatchlings which may not survive.

In general, following the exact specifications established by the nesting female turtle is our best guide for hatchery site selection, hole size, temperature and humidity of the sand. No amount of lecturing or field manual drawings can substitute for actual observation of a turtle making her nest and laying her eggs. Although it is conjectured by turtle researchers in other countries involved with hatchery projects for over two decades that these measures are valuable exercises that help sea turtle populations, there is as yet little supporting data but considering the 90% egg loss we used to report on the Tamil Nadu Coast the present release of 10's of thousands of hatchlings each season must certainly be helping the recruitment rate.

Translocation of nests to other beaches or even entirely new areas where nesting habitat exists but numbers of turtles are low or absent may be an applicable strategy in some circumstances. Constraints to be considered include costs and the lack of evidence of success in trials in other countries.

Headstarting by Rearing : An elaboration of the hatchery system is captive rearing for a year or more to relase ' headstarted ' juveniles well past the stage of maximum mortality. This is an expensive and technologically much more complex procedure involving dietary, husbandry and veterinary problems. It is being used mainly to assist the recovery of truly endangered species or populations of sea turtles, in particular the Kemp's or Atlantic ridley. Despite many such programmes this technique is still unproven and must be treated as an experiment.

II. Management

Culling ' Surplus ' Adults for Market : As attractive as such a ' simple ' method of managing the turtle resource seems, the proposal breaks down because of our inadequate knowledge of the status and biology of the reptiles in question. I was recently

privileged to stand on Gahirmatha Beach in Orissa and watch thousands of ridleys climb ashore in their annual nesting ' arribada ' (as it is called in Latin America). And we saw only the females. The Coast Guard sent reports of seeing ' islands ' and ' flotillas ' of turtles heading north to Orissa during November and December—perhaps a total of 5 lakhs or more ! The Educated estimates of ridley turtles captured for market uptill 1982 range from 30,000—90,000. Perhaps someday Calcuttans will enjoy their sea turtle meat again, but first we must study the basic dynamics of this ridley population.

Collection of Doomed Eggs for Market : With the exception of beaches in the Bay Islands and Lakshadweep which are only just being studied, the only beach where nesting density is high enough to talk about a commercial offtake is Gahirmatha. Over 40 million eggs are laid there each season, of which possibly 50% are destroyed by successive waves of nesters coming up onto the same stretch of beach. While we may be reluctant to depart from the trend of total protection it is essential to put wildlife conservation in the correct perspective and look forward to a time when turtles are conserved for careful, sustained usage. No one can help but see the tremendous egg loss which takes place during the annual arribada. While birds in the sanctuary and scavengers such as wild pigs, jackals and hyena benefit from this it appears very likely that some part of this protein source could be used once again for human consumption. Data collection in this direction, if not already being done, will be a very valuable step forward in modern management.

Ranching for Market : Ranching is the commercial rearing of turtles from wild collected eggs or young preferably doomed eggs. It may be an expensive operation which competes with local people for locally caught protein to feed the turtles which is a major constraint. Other arguments againt this form of mariculture are : the creation and encouragement of a market for sea turtle products that cannot be filled by the ranches inability to control the market. However, in the specific case of Orissa (from where Calcuttans were consuming perhaps 2 lakhs kg of sea turtles each year) there may be a good argument for a ranching scheme. The basic equation is how much it will cost to raise a ridley to a marketable size (say 15 kg in 3-4 years), and whether at this growing cost

it can be profitably marketed. The answer mostly depends on a very cheap and very abundant protein source to feed the turtles which does not compete with the local human protein needs. From what we know about the ranching of other reptiles which produce more valuable products (crocodile skin) it seems that profitable turtle ranching may not be economically feasible for a local market.

Captive Breeding : So far captive breeding of 2nd generation captive stock has been achieved only at the Cayman Islands Turtle Farm after years of investment and trials. In India the need for captive breeding as a recovery measure has not been demonstrated. The development of the technology would be valuable if it can be done cheaply (in a natural harbour for example), but at this stage the limited resources available for sea turtle conservation in India should be channelled under a single coordinated plan for the entire country. In general, research must support and monitor any of the options pursued ; studies directly relevant to sea turtle conservation can be encouraged through the appropriate academic and technical agencies. Once we know more about the status and biology of these animals which touch our shores for only a few hours each year, we will be able to decide which of our many conservation and management options are the right decisions.

Reference

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Discussion

P. Kannan : Could you tell us the kind of problems the Orissa Forest Department officials are facing in preventing poaching of turtles.

S. K. Misra : Problems faced by the officials are in handling the cases. Persons who are poaching the turtles in the high seas have to be brought 80 km away through the rivers and creeks. The personnel are released on bail and the vessels are also released on bail. Many of the persons have not appeared in the case also. Further, the problem is the persons involved in poaching are the fishermen from West Bengal and not from Orissa and this becomes an interstate problem. They are the migratory fishermen and it is difficult for the West Bengal Department of Police also to trace the persons involved who are released on bail.

A. N. KARVE : There is a lot of delay in finalising the cases by the courts. The cases booked in the 1982-83 season have not been decided so far.

E. G. SILAS : The problem is complex due to migrant fishermen from West Bengal who are involved with the poaching. In January 1984, Forest officials of West Bengal at Contai obstructed one truck carrying sea turtles at Bajkul checkpost and produced the same before the Judicial Magistrate of Contai. The merchants defended that the turtles captured are not covered by the Indian Wildlife (Protection) Act. The Additional Divisional Forest Officer, Midnapur was brought to identify the turtles and then the turtle were released into the sea at Junput. Even the earlier cases pending in the Court at Contai have not yet been decided. There is an urgent need to develop and strengthen the co-ordination and co-operation between the Forest and Fisheries Departments within the States as well as interstate between West Bengal and Orissa. At present the Fisheries Department officials are not at all involved.

K. SHANMUGANATHAN : Some sort of compounding — on the spot fine — powers can be delegated to the wild life officers.

R. WHITAKER : Compounding will not solve the problem. The vehicle or trawler involved has to also be confiscated.

A. N. KARVE : The Central Government or Coast Guard is not at all in the picture. The coastal waters are regulated by the state government legislations. The Coast Guard cannot book cases against the Indian fishing vessels which are coming under the fishing industry. They can prevent the foreign fishing vessels and book cases against them.

P. KANNAN : Without amending the Act, how about appointing honorary wildlife wardens to look into the problem of poaching?

S. K. MISRA : Already the Chief Wildlife Warden, Orissa has the powers to appoint honorary wildlife wardens.

K. SHANMUGANATHAN : In Tamil Nadu also the Chief Wildlife Warden and The Additional Chief Conservator of Forests have the powers to appoint honorary wildlife wardens.

J. FRAZIER : There is immediate need to preserve the mangrove areas, at Gahirmatha. In this connection the study made by the WWF can be looked into.

E. G. SILAS : The problem is very crucial at Gahirmatha. There are stumps and remains of mangrove in the intertidal region in the southern sector of the Gahirmatha Beach close to Habalikhati. The vast pile up of sand among mangrove vegetation resulting from the 1976 and 1981 cyclones which had affected the area is still evident with a broad fringe of withered mangrove over a few kilometres stretch.

TECHNICAL SESSION VI

CONTEMPORARY PROBLEMS IN SEA TURTLE BIOLOGY AND CONSERVATION — THE URGENT NEED FOR REGIONAL CO-OPERATION

CHAIRMAN : SHRI P. KANNAN

— CONTEMPORARY PROBLEMS IN SEA TURTLE BIOLOGY AND CONSERVATION

DR. J. FRAZIER

— Discussion

CONTEMPORARY PROBLEMS IN SEA TURTLE BIOLOGY AND CONSERVATION

J. FRAZIER

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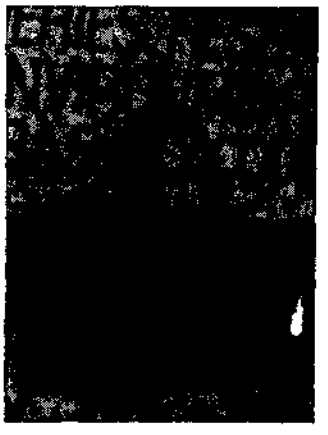
INTRODUCTION

I must clarify from the beginning that I have neither the intention nor the time to give a detailed listing of biological and conservation problems, rather, my purpose is to give some insight of the variety and magnitude of these issues. Two philosophical points are intimately related to the overall topic: First during the course of the last few weeks some dear and respected friends have been introducing me as a 'Sea Turtle Expert'. While I have been actively involved in sea turtle research and conservation in a score of countries, in all oceans, over the past 15 years, I am not a *sea turtle expert* — nor have I ever met one. Yes, I have more experience with this subject than most people, but my knowledge is inadequate to enable me either to consistently make accurate predications about sea turtle biology or to effectively manage stocks of sea turtles. I hope to convince you that it will be a long time before a 'sea turtle expert' walks this planet.



Second, we often fool ourselves into believing that the information relevant to a topic is finite. It is increasingly common for some biologists and administrators to treat biological knowledge as a tangible object subject to property laws and sovereignty. In fact, there are no bounds to biological knowledge — discovering

one small fact results in the realization that another dozen questions need to be answered. Indeed, living systems are so dynamic and mutable that there some times does not even seem to be stability in biological knowledge.

Now, if the major benefit of learning about biology is to understand and help manage the living systems of which we are a part and so inextricably dependent, we should strive to make as much biological knowledge available as soon as we can. Two key actions that are required for this end are communication and cooperation. This Workshop is an illustrious example of just these principles, but unfortunately there are many examples in conservation activities where non-cooperation seems to be the dominant factor. This Workshop is an omen that common sense will prevail in dealing with sea turtles here in India.

I am indebted to several colleagues — original members of the Sea Turtle Specialist Group — and organizations for the opportunity to participate in the Workshop ; particularly Dr. E. G. Silas and Shri J. C. Daniel for their expert organisational abilities and Shri R. Whitaker for constant encouragement and support. Invaluable facilities and logistic support were provided by the Madras Crocodile Bank and Madras Snake Park. Mrs. Brenda Bhaskar has miraculously transformed quickly scribbled manuscript into readable English.

Contemporary Biological Problems

The contemporary biological problems that I have selected as examples were chosen to illustrate not only the variety of subjects about which we know too little or nothing, but also the fact that many very basic points have yet to be understood. Developing whole fields of knowledge is dependent on understanding these basic points. We can start with the kinds of sea turtles. It is hard to imagine a group of animals that is more distinctive, more easy to recognize. Yet, despite the fact that there are only a few kinds of sea turtles — no one knows exactly how many there are. Seven is the number usually stated to exist, but there might be only 6 or perhaps as many as 8. Without knowing with certainty how to distinguish one kind from another; the information we

gather is liable to mix different species, and hence, it will be of little use. Luckily for our purposes, there do not seem to be ' Problem populations ' in this region.

The largest of all the sea turtles and all turtles, is the leathery *Dermochelys coriacea* (L.). Besides its size there are several features that make this animal distinctive, including seven longitudinal ridges on the top shell or ' carapace ' and an absence of horny scales. Numerous published accounts — by experienced people (*e.g.* Pritchard, 1980) — claim that this turtle has no external keratinous structures. This is mis-information and typifies many of the contemporary biological problems : Although the beak is very reduced, there is a small horny sheath, and hatchling leathery turtles are covered with scales for the first few days of life. This is important because it is critical evidence for a particular evolutionary history-leathery turtles have not omitted the production of external keratin, merely reduced it or gone a step beyond by discarding it.

The beak has deep notches and cusps, completely unique to this turtle. Yet, the function of these is unknown. One would assume the structure to be related to feeding, and although there are detailed analyses of stomach contents of leathery turtles (Brongersma, 1969), there are no detailed osbservations of leathery turtles feeding in the wild (Frazier *et al.*, in press).

At the other end of this turtle are other unique features — the caudal projection and a thick membrane that unites the hind legs and tail. Probably these are locomotory adaptations, one reducing drag and the other providing an unusually large surface for propulsion and/or steering. But, we do not know the answers because no one has recorded the details of how this animal swims in the wild. We lack basic, but careful, observations of feeding and locomotion.

The smallest of the sea turtles, smaller than some of the freshwater turtles in India, is the ridley *Lepidochelys olivacea* (Eschscholtz) which also has several unique features. Flipping it over one finds 4 large scales at the sides of the belly shell, or ' plastron '. These are the ' inframarginals ', and each of them has a conspicuous pore. All sea turtles in the family Cheloniidae have pores, a fact which is not widely known, but only ridleys have obvious

pores in the inframarginals. In the other species the pores are in the axillary and inguinal scales and they are most visible in small turtles. Is it significant that small individuals of the large species and all individuals of the smallest species have obvious pores? The associated ducts and fatty tissue are sometimes called 'Scent glands' (Smith, 1931) and they may release an offensive chemical to make small turtles less attractive to predators, or they may function in chemical communication. But, we have no direct evidence of their use or purpose.

Despite our ignorance about the function of these pores, they are invaluable for differentiating the ridley from the loggerhead *Caretta caretta* (L.). These two species were confused years ago, for both have relatively large heads and more scales on the carapace than other turtles in this family. The loggerhead can be used to illustrate other kinds of problems; consider the distribution of this turtle: In the East Pacific, although other species are abundant, the loggerhead is rare; from Alaska to Chile no one has ever found one nesting (Frazier and Salas, in press). In the Indian Ocean this turtle is also relatively uncommon. Only areas where nesting regularly occurs is in the southwest (South Africa, Mozambique and Madagascar) and on Masirah Island, Oman. Other species of turtle are widely dispersed throughout the same region. Curiously the Masirah population is the biggest in the world (Frazier, in press). Too little is known about the habitat requirements of this (or any other) turtle to be able to fully explain or understand its geographic distribution.

In the Mediterranean, where the loggerhead is the most abundant sea turtle, it is common to find turtles whose shells are covered with live animals and plants. In fact, the sea turtle is often an island ecosystem. Oysters 12 cm across have been found on these turtles. The occurrence of these epizoa give valuable clues as to the microhabitats where the turtles live, but this information is only now beginning to be collected and analyzed (Frazier *et al.*, in prep.).

The hawksbill turtle is characterised by its thick overlapping scales, the source of 'tortoise-shell'. Yet, no one seems to have pondered the reason for the usually thick shell on the hawksbill.

Is it to protect a turtle which is relatively lethargic and subject to infestations by sessile invertebrates from the ravages of burrowing barnacles ? Too little is known of the turtle and its parasites.

In the western Indian Ocean the hawksbill has the unusual habit of nesting during the day time, but it is unclear why (Frazier, 1984). Indeed, the reason for the more usual nocturnal nesting is not fully understood.

Best known of the sea turtles is the green turtle *Chelonia mydas* (L.). Yet, despite its common name, little attention has been given to the colouration of this turtle. There are marked ontogenetic changes : hatchlings are dark blue/black above ; at six months they have more chestnut-brown, and by one year they are mainly chestnut brown in a pattern of rays ; immatures of several years of age develop the characteristic greenish ground colour found in adults. In addition to age-dependent changes there are sexual differences : females have concentrations of pigment in all scales with most dark pigment in rays ; males often do not have concentrations of pigment and usually have dark pigment in spots. Not only have these obvious features been poorly studied, but there is no good explanation for the colouration (Frazier, 1971).

By pooling information from all species and filling the many remaining gaps by inference and imagination, it is possible to construct a generalized life table. This can be simplistically partitioned into 10 phases : (1) terrestrial nest, (2) sea going hatchling (3) pelagic hatchling in wind rows, (4) pelagic juvenile in open ocean, (5) immature in protected waters, (6) immatures and adults restricted to neritic habitat, (7) reproductively active adults migrating from feeding to breeding grounds, (8) mating offshore of nesting beaches, (9) females leaving the sea to nest on terrestrial beaches and (10) return migration to feeding ground. In fact, very little of this life cycle has been adequately studied, except the nesting phase.

Going briefly through the generalized life cycle innumerable large gaps in our knowledge become obvious. Starting where the most information is available, with the female coming ashore to begin the nesting process, we are ignorant as to which behavioral

and physiological cues guide the animal. Somehow a gravid female locates a nesting beach, but not any beach—she will commonly home in on a certain sector of one particular beach (Carr and Carr, 1972). How this is accomplished is unknown.

She climbs the beach, and well above the high water mark locates a nest site. Possibly she is guided by olfactory cues in the sand. Once she has selected the site a series of highly stereotyped behaviours takes over (Carr, 1982). By making swimming movements in the sand, a pit is excavated and the turtle slowly advances into this. The effort and size of the pit varies between species (Hendrickson, 1982), so somehow each species has a similar — yet different — set of requirements in construction of the body pit. At the termination of the body pit, the turtle begins scooping out an egg chamber with alternate movements of the hind flippers. This is done behind its back and the stereotyped nature of the behaviour is evident when watching a turtle that has lost one hind flipper ; it moves the stump in alternation with the good flipper as if both were functioning. Somehow it determines when the egg chamber is of the right size and then immediately begins to lay eggs. Nearly 200 eggs may be laid in about half an hour. Then she kneads sand over the eggs and resumes swimming movements and covers and camouflages the nest. Again, the factors which guide the turtle in this activity are not known, but different species cover for different periods of time. Occasionally a female will go through the entire nesting process, but not lay any egg (Cornelius, pers. comm. ; Whitaker, pers. comm.). If we understood more about physiology and behaviour, these naturally occurring aberations would be invaluable in understanding the norm, but at present we can only call them ' freaks '.

At the end of the nesting the female returns directly to the sea. This behaviour has been well studied and the sea-finding ability of the female, as well as the hatchling, depends on an orientation toward the brightest part of the horizon (Mrosovsky, 1978).

Once back in the sea the female may stay around the nesting area to lay another nest after about two weeks time. Curiously, she does not seem to copulate more than once in a season (Wood and Wood, 1980), so it seems that sperm are stored for as many as

consecutive nestings during a single season. Yet, no morphological structures have been found in the female turtle that would suggest an ability to store enough viable sperm for fertilizing hundreds of eggs over a period of several months (Owens, 1980). Another related problem is the way in which ovulation and vitelization occur. It seems that 100 to 200 follicles are ovulated, surrounded with albumen and a calcarious shell all in a period of 48 hours or less. This fact is all the more curious when considering that the oviduct is essentially a thin, straight tube (Owens, 1980).

The eggs left in the beach receive no care from the female ; unlike crocodiles and some snakes, lizards, amphibians, no turtles care for their eggs. In fact, a nesting turtle may dig up the eggs of a nest laid earlier. She may even dig up her own previous nest. The eggs which remain undisturbed incubate by the temperature of the sand which is dependent mainly on the amount of solar radiation that strikes the nest site. This temperature in turn determines the length of incubation : The warmer the eggs the faster they develop. Incubation temperature also determines the way the embryos develop : the number and shape of scales and the sex of the turtle are temperature-dependent. At cool temperatures males are produced ; at warm temperatures, females (Mrosovsky and Yntema, 1982). We mammals think of this as very odd, but in fact extra-genetic sex determination is the rule in some ' lower animals ' and some animals even have sex reversal where they reproduce as females and later as males. We should not let our own egocentrism lull us into determining what are the norms of nature !

The turtles finally hatch, dig out of the nest and run down to the sea oriented by a positive phototaxis (Mrosovsky, 1978). Both on land and in near shore waters hatchling turtles are subject to tremendous numbers of predators. There are few direct measurements of mortality, but there are a variety of ' estimates ' which differ tremendously from one to the other (Stancyk, 1982). At this point in the life cycle, the sea going phase, empirical information becomes very scarce. There are observations of newly emerged turtles swimming directly and purposefully out to sea and several people have seen them in lines of floating vegetation (Carr, 1982). We don't know what they eat, how they live or even how long they

live on the open sea, but at some point juvenile turtles appear back in coastal waters. It now seems that many very important nursery areas are in protected bays and estuaries. The immature turtles evidently give up their pelagic habits and take up a neritic existence, and each species developes its own specific characteristics — particularly feeding habits and habital preferences. After an unknown period of years, possibly 10 to 30, the animals mature and finally become reproductively active. But no details of any of these phases are known in wild populations.

We do know that reproducing animals will suddenly appear at nesting beaches during the breeding season. Females tagged on the nesting beaches are recaptured from long distances — thousands of kilometres—away, so we infer from this that migrations are made from feeding grounds to breeding grounds and back again to feeding grounds. However, the information is not totally conclusive and some people argue that the average female does not survive to make a return migration (Hughes, 1982). A tremendous effort has gone into investigating the means by which turtles find their way to nesting beaches, but this continues to be a mystery. Inspite of our own ignorance, the turtles normally manage quite well to go through their life cycle and reproduce their numbers.

No matter how incompletely we understand it, several very important points are relevant from the turtles' life history. It is incredibly complicated and extends over tremendous spans of time as well as space. A single individual, in the course of its life, will begin life in a terrestrial environment then live in, and depend on, pelagic, neritic and semi-estuarine environments. During this period the individual will disperse over thousands of km of ocean and when it matures it will make equally large movements from feeding to breeding grounds. This has tremendous implications on management and conservation practices, a subject to which we will return.

There are a number of technical problems in studying and managing sea turtles and these must be solved before further advances are made on many fronts. Individuals have been marked with a variety of tags, mainly metal or plastic, but little attention

has been paid to the success of the technique. In some projects half the tags are lost within the first few weeks, so any ecological or behavioural interpretations based on tag recovery are suspect (Mrosovsky, 1983).

Even more problematic is a technique for marking hatchlings. It is difficult to mark an animal that is only 5 cm long, but if it increases its body length by more than a factor of 25 it will be impossible to use conventional marking procedures. The most promise for hatchling tagging is by using skin grafts, a technique developed by Hendrickson and Hendrickson (1984).

Determination of an animal's sex is also problematic, except in adults and subadults. At present the only way to determine the sex of an immature is by examining the histology of the gonads or by radioimmunoassays (Owens, 1982). Determination of a turtle's age is also problematic, there is no technique that gives a precise estimate (Frazier, 1982).

If one had to represent the entirety of marine turtle biological knowledge graphically it would look like a spiders' web or a sponge — more holes than matrix. The significance of this in conservation practice is that we usually have to operate in ignorance. A wildlife or fisheries manager is in many respects a special case of a store keeper. His overall goal is work at a profit and have a constant stock in his store. He will need to know supply rates, consumption rates, shelf life, cost of supply, taxes on various transactions and a great many other things before he can plan his business logically. In economy this may be difficult — in ecology it is impossible. We cannot supply precise information to one of these critical questions.

Take the very obvious questions : where are turtles and how many are there? During the last decade some of the largest populations of 5 species of sea turtles have been 'discovered'. This includes the enormous population at Gahirmatha. Over the last decade Satish Bhaskar and Chandra Shekar Kar have been investigating turtles in India, virtually walking every inch of coast, but despite their boundless energy and dedication, we have only begun to know about where the turtles are in India. As to how many — the estimates can only be very rough at best. And then,

we are only able to guess at the number of females that nest in a year ; we are so ignorant about natural sex ratios, generation time, recruitment rates and other critical factors in a basic life table, that we are only able to make the wildest guesses about the number of immatures, subadults and adult males.

Nesting seasons are not fully worked out. For example we are only now beginning to appreciate the intricacies of the ridley season on the east coast of India and it seems that it begins several months earlier in the south.

Nesting is the most conspicuous phase in the turtle's life history, so most of what we know is about nesting. Our knowledge of feeding grounds is very limited. Certainly the marine pastures and coral reefs in Lakshadweep, Gulf of Mannar and Andamans and Nicobars are of major importance to feeding green and hawksbill turtles. Next to nothing is known about the feeding habitats of the other turtles here.

And what about the dispersions and migrations ? from where are the turtles coming when they arrive at the nesting beaches ? and where do they go when they leave ?

We could go on asking these basic, but unanswered, questions, but now you will appreciate that our ignorance is profound and that this is the general situation with sea turtles in the world today.

None the less and thanks to the dedication of some of our colleagues, we know almost a dozen critical areas for sea turtles in India and the main breeding seasons are known for most.

Apart from lack of knowledge, another major problem in conservation is establishment of sanctuaries, parks, reserves and other protected areas. It has been established that there are critical habitats for marine turtles, as well as other endangered animals and plants on uninhabited islands in Lakshadweep and Andaman and Nicobars. A similar situation exists for the Gulf of Mannar and despite years of work by state and central governments, as well as international agencies, these critical areas have still not been protected. Each day their position in resource management is further compromised and devalued.

In addition to habitat preservation there is a need for direct species protection. Nesting females and their eggs are most easily captured, but they are the most important part of the population, for its reproduction and maintenance. Hence, special protection is required on nesting beaches. Where human activities are intense, the coastal zone may be polluted or otherwise modified with constructions so as to render it unsuitable to nesting turtles. Where human densities and pressures are high there may be severe predation on nests.

Protection in these areas runs into direct conflict with other human interests ranging from large capital investments to traditional subsistance level utilization. This problem is well illustrated here in Tamil Nadu, where in the past virtually all nests have been dug up for eggs. Now an ever more active hatchery programme by the Forest Department is collecting eggs in 3 districts. This has involved an annual expenditure of over 3 lakhs of rupees and employed nearly 150 people. Another alternative, involving beach patrols and maintaining nests in their natural sites is unworkable at present.

Hatchery programmes are not without their own special problems. Any form of human manipulation always runs a risk of unwanted effects. For example, handling turtle eggs risks fatally damaging egg membranes. Hatcheries can be located in areas subject to inundation and complete destruction of all eggs. They can also be located where sand and incubation conditions are inadequate, yielding low hatching success. Unsuitable incubation temperatures from inappropriate hatchery sites, unsuitable nest construction or placement can result in highly skewed sex ratios. Unsuitable handling of hatchlings can decrease the chances of their surviving the first weeks of life at sea and the development of appropriate behavioural responses.

There are many examples, all round the world, where dedicated and well intentioned programmes have done more harm than good. This may not be the case here, but I want to make it clear that simply intending to do good is not always sufficient and we must objectively analyse the effect of our actions-despite our intent.

Also seemingly unrelated actions can have tremendous effects. The incidental capture of turtles in trawls is one example. The

annual drownings of turtles in the US are in the tens of thousands. Last year thousands of turtles were drowned in Orissa. In most instances the trawlermen would much rather not catch the turtles, for they crush the catch. But despite the true desires of the trawlermen, their actions pose a serious threat to turtles. These problems must be identified and resolved. In this instance the Turtle Excluder Device, developed by the U.S. National Marine Fisheries Service ; may prove useful to both trawler operators and turtle conservationists.

In this last point is a central concept for successful long term conservation — resolving problems with as little conflict as possible. The most direct way to eliminate the problem of accidental catch by trawlers is by excluding their fishing activities from the core areas used by turtles. However, if a compromise can be struck by requiring gear or operational modifications then both parties will come out ahead.

Perhaps the most sensitive issue with sea turtles is how to treat them. In most places of the world they represent traditional sources of valuable and inexpensive proteins. In addition to the ecological and aesthetic benefits they provide — they are truely a food resource for many of the coastal peoples of the world (Frazier 1980). Prohibiting their utilization as a traditional food source often complicates the problem of resource management. The desires and needs for the resource do not diminish so the exploitation becomes clandestine and furtive, which sets up a situation of conflict and makes it nearly impossible to monitor the real situation.

In addition, political pressures ferment in these conditions to the point where they precipitate an abrupt change in policy which often undoes all the good that has been done over many years. What is at the base of this problem is the concept of ' conservation '. If only a few benefit it will be regarded by the majority as an elitist activity. Regardless of whether one advocates right wing or left wing governments, it is clear that where such situations of conflict exist there will be a great element of instability. This is inconsistent with a central premise in conservation — the *sustained* rational utilization of a resource.

I am not advocating a chain of turtle slaughter houses up and down the coast of India. We have seen what happens when these

animals are overexploited ; there are plenty of examples around the world, including in the Indian Ocean (Frazier, 1980). It is only sensible that we be very concerned and very protective of these animals that have been so badly depleted throughout their range. In our present state of ignorance it would be insane to pretend that we can rationally manage wild stocks of turtles. But our immediate requirements need not restrict our long term goals. I am convinced that for the security and permanency of effective biological conservation we must direct efforts at developing programmes for sustainable rational yields for the benefit of local peoples.

The final point which is absolutely critical to marine turtle conservation is Co-operation and in many respects this deserves a session to itself. We are dealing with animals that have no respect for the political boundaries we draw on maps ; they freely cross between districts, states and countries. Like migratory birds or the great whales, sea turtles are truely international animals. No one person or political entity owns them. They are a common heritage of all humanity. Our success or failure in conserving sea turtles will be a pointed indication of our own futures (Frazier, 1983).

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DISCUSSION

T. SUBRAMONIAM : In the case of invertebrates such as millepedes, they have defence mechanism using phenolic compound showing antipredatory activities. In the case of turtles, the secretions from the marginal pores may have some role to play as a defensive mechanism.

E. PRABHAKARAN : In the case of cockroach also they have the capacity of secreting antipyridic action as defence mechanism.

J. FRAZIER : There is need to make lot of studies on the adaptations.

J. JOHINDRANATH : In the case of turtles, they shed tears at the time of egg laying process. Is there any significance in it ?

J. FRAZIER : The excess of salt is being excreted through the lacrymal gland. The secretion is useful in excreting excess of salt but also useful in clearing their eyes when sand particles are adhering in the eye. Continuous wiping of eyes can be observed at the time of nesting in the sandy beach.

J. JOHINDRANATH : How about the turtles coming from deeper areas to surface for breathing ?

J. FRAZIER : Sea turtles are not generally seen in the deeper waters. They may go to a depth of 30 metres or so.

V. J. RAJAN : How long can sea turtles remain under the sea without coming to the surface ?

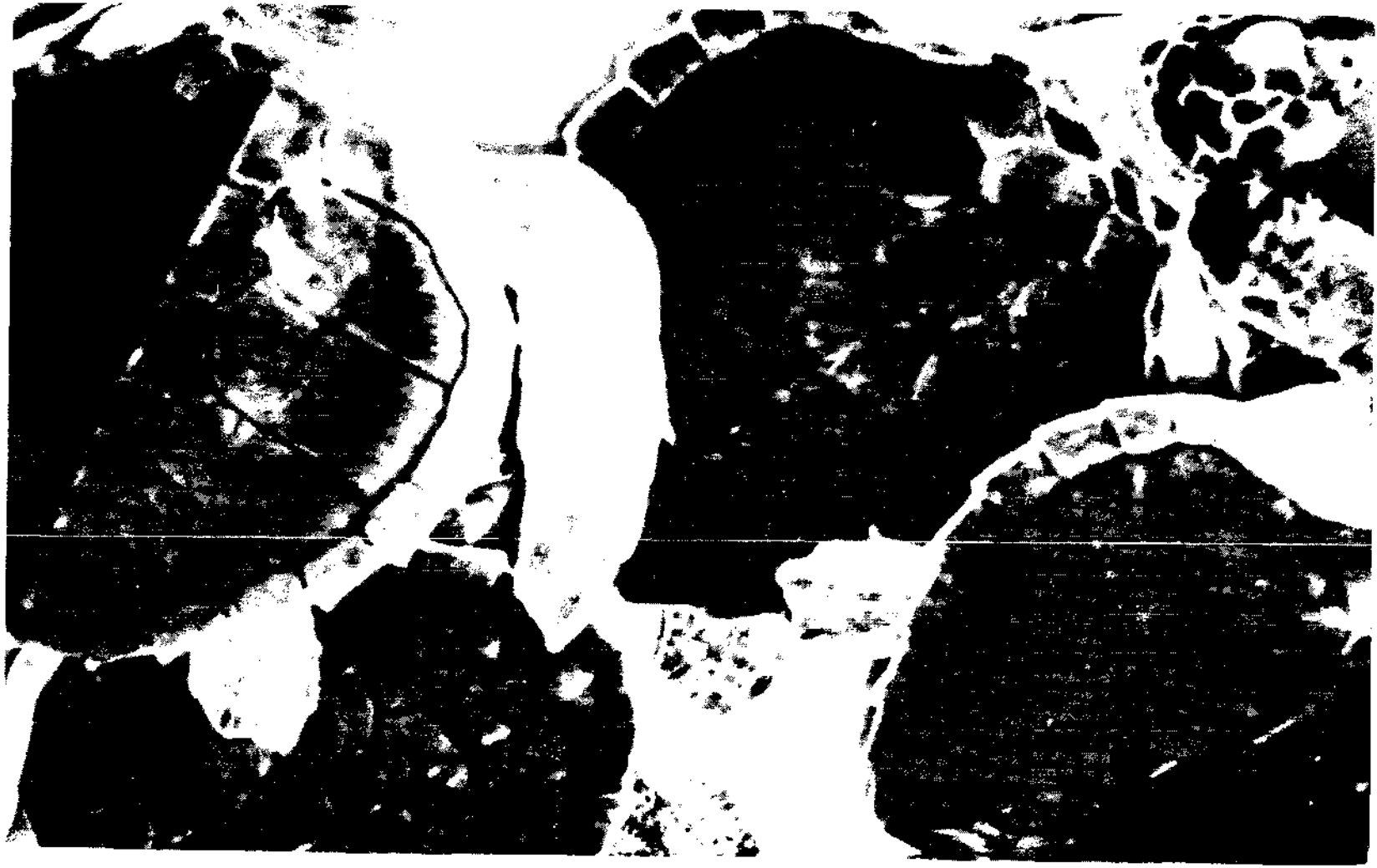
J. FRAZIER : They have the capacity of remaining under the water even for months together when they hibernate. In the swimming condition they may be able to remain under the water for few minutes.

P. J. SANJEEVARAJ : How about the differentiation of hatchlings in early stages or during the development using sex chromosomes ?

J. FRAZIER : There is no heterozygous sex chromosomes in the case of turtles. So it will not be possible to differentiate using the sex chromosomes. Already methods have been developed using radioimmunological technique.

K. SHANMUGANATHAN : How far does temperature affect the sex of hatchlings ?

J. FRAZIER : It is a very critical area and already so much has been studied on the effect of incubation temperature of the eggs on sexual differentiation. Even a change of 1 to 2°C can make a considerable difference to the sex ratio of the hatchlings.



TECHNICAL SESSION VII

STATE STATUS REPORTS

CHAIRMAN : SHRI K. SHANMUGANATHAN

— CONSERVATION AND STATUS OF SEA TURTLES IN ORISSA

C. S. KAR AND M. C. DASH

— STATUS REPORT OF TAMIL NADU ON SEA TURTLES

K. SHANMUGANATHAN AND JOSEPH JOGINDRANATH

— STATUS OF SEA TURTLE CONSERVATION IN KARNATAKA STATE

S. L. CHANDARJI

— DISTRIBUTION OF NESTING SITES OF SEA TURTLES IN MAHARASHTRA

KAFEEL A. SHAIKH

— Discussion

CONSERVATION AND STATUS OF SEA TURTLES IN ORISSA

C. S. KAR AND M. C. DASH

INTRODUCTION

Conservation of wildlife is achieved through the following main approaches. First, by protecting the endangered species by law from being disturbed, killed or otherwise exploited and by its proper implementation nationally and internationally. Secondly by setting aside core areas of each habitat as Nature Reserves, Sanctuaries, National Marine Parks and Biosphere Reserves, etc., where wildlife can continue to exist in a purely natural state. Thirdly by educating the lay man who interact with wildlife about the need for both conservation and research, as without their involvement and co-operation wildlife conservation would be impractical. Finally, by undertaking indepth scientific research to understand the behaviour and basic biological needs of the species in order to formulate future management programmes based on sound footings.

In the international context there exists a very strong protective policy for sea turtles. All species found in India have been included in Appendix-I of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). India ratified CITES in 1975 and it came into force in October 1976. The species have been included in the IUCN Red Data Book as 'Endangered' which means that the 'taxa is in danger of extinction and whose survival is unlikely if the casual factors continue operating'.

In India all the five known species of sea turtles are now fully protected from hunting, killing and other forms of exploitation under the Indian Wildlife (Protection) Act, 1972 by an amendment of the schedules in September 1977.

In the above amendment excluding the flatback sea turtle *Chelonia depressa*, six species were included in the list of Schedule-I

animals along with the locally unreported Kemp's ridley *Lepidochelys kempii*. Changes were made in the revised list of Schedules (Government of India letter No. 1-28 78-FRY(WL) dated 12th September 1980 effective from 2nd October 1980). *Lepidochelys kempii* was then removed from the list as it is not known to occur in Indian waters.

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Establishment of National Parks and Sanctuaries and Extension of the limits of existing Sanctuaries

The limits of the Bhitarkanika Wildlife Sanctuary in Orissa, gazetted vide Government of Orissa, FFAH Department Notification No. 4F (W)-34/75 6958 dated 22nd April 1975 may be extended northwards to include Wheeler and Shortt's Islands, inadvertently omitted from the original gazettement ; and southwards to include Hukitola Island near False Point terminating near the port of Paradip to include the long narrow sand spit much used by nesting ridleys as suggested by Kar and Bhaskar (1982).

The status of Bhitarkanika Wildlife Sanctuary may also be upgraded to the level of a National Marine Park or Biosphere Reserve for protecting sea turtles, estuarine crocodile and the last remaining mangrove ecosystem in the State of Orissa. The mangrove are unique but dwindling fast due to human encroachment.

Another marine reserve or sanctuary (Kujang-Astarang Wildlife Sanctuary) may be constituted at the southern extreme end of Cuttack District of Orissa covering the newly discovered mass nesting ground of ridley turtles near the Devi River mouth (Kar, 1982). From north to south this should include the coastal belt of Kujang Range of Cuttack District and the coast line of Puri District upto Astarang. A number of river mouths and sand spits occur in the above places, which are nesting areas of ridley sea turtles.

While establishing the above Marine National Park, Biosphere Reserve, Marine Reserve etc., adjacent nearshore waters and a buffer zone further offshore are required to be included in order to protect marine turtles while they are breeding and migrating in the vicinity.

In the plan to protect sea turtles and other wildlife of Orissa State, the Forest Department of the Government of Orissa has taken initiatives for establishing two additional sanctuaries (as detailed below) along the Orissa Coast. These sanctuaries originally intended for black buck and birds incidentally possess sea turtle nesting beaches. Proposals relating to the approximately 12 sq. km Konark-Balukhand Sanctuary in Puri District were sent by the Forest Department to the Government of Orissa in July 1980.

The limits of the proposed Konark-Balukhand Sanctuary presently include approximately 40 km of the coast line in Puri District terminating at the north end near Keluni Muhana. This may be extended 8 km further north to include about 48 km of the coastline within the sanctuary limits to protect important sea turtle nesting grounds, on the northern side of the river mouth near Keluni Muhana.

The proposed Chilka Wildlife Sanctuary with an area of approximately 900 sq. km includes parts of the Puri and Ganjam Districts of Orissa and contains the largest brackish water lake in the country. The proposal of the Orissa Forest Department in May 1979 was specifically for protecting the various species of migratory birds. The sanctuary's eastern boundary bordering the Bay of Bengal has long coastal stretches favoured by nesting olive ridleys and

possibly other sea turtle species. The area of this sanctuary should therefore, include a buffer zone further offshore, extending out to the edge of the continental shelf. In addition to the above major nature reserves it is necessary to preserve small areas of significance, such as nesting beaches and breeding grounds of marine turtles, after detailed surveys locate and identify such key areas.

In the neighbouring States of Orissa *i.e.*, West Bengal and Andhra Pradesh, there are possibilities of locating mass nesting ground of sea turtles particularly in the sandy beaches and islands of Sunderbans (W.B.); and the Godavari and Krishna deltas of Andhra Pradesh (Kar, 1983). Both of these areas have mangrove forests and a number of sand spits at river mouths which may constitute nesting habitats for ridleys.

Gahirmatha : The Present Situation, Poaching and the Trade in Sea Turtles

Olive ridley visits Gahirmatha Coast in Bhittarkanika Wildlife Sanctuary, Orissa annually for mass mating offshore during November and December and mass nesting on the beach in January-March (to a lesser extent during April-May). Thousands of sea turtles are seen floating on the surface in the sea during the breeding period. Poachers, mainly from West Bengal operating with powered vessels, trawlers and country boats, find it easy to catch these turtles in the absence of any effective agency to enforce the protective legislation on the high seas. The catch is unloaded at Digha and other adjacent places of the West Bengal Coast and transported to the Calcutta market by land routes for disposal despite the existence of check posts. Therefore, additional check posts should be established near the border areas of Orissa—West Bengal and within the states for better control and check on movement of sea-turtles and their products. Necessary instructions should be issued to the staff posted in these check posts to exercise strict control and to book cases against the transport of sea turtles, their meat and other products by road inside West Bengal.

Role of Orissa Forest Department, Indian Navy and the Indian Coast Guard Service

Joint patrolling by Forest, Police, Navy and Coast Guard officials actively protected the olive ridley off Gahirmatha coast and in the Bay of Bengal during 1981-82, 1983 and 1983-84 nesting seasons. The services of the Coast Guard ships were utilised in making anti-poaching sorties in the Bay of Bengal in the above years. With timely help from Coast Guard and police personnel, and the Coast Guard patrolling vessel *Rajhans* on 6th and 7th February 1983 the Forest Department Personnel of Orissa successfully patrolled the coastal waters between Paradip and the Dhamra mouth. For the first time 61 poachers were arrested at sea and their vessels compounded. A total of 9 cases have been instituted against the offenders in which 3 motor launches and 10 country boats were also seized. The arrested persons were all from West Bengal. They were produced before the Judicial Magistrate at Kendrapara (Orissa), but the above cases are still pending in the court. The timely action taken by the alert Forest Department of Orissa needs appreciation.

Sea worthy motor launches and speed boats should be acquired by the Orissa State Forest Department (the main executing agency) to monitor the waters off Gahirmatha Beach and to control the incidental killing of adults at sea, which at present is rampant.

To render necessary help and assistance to the Forest Department personnel of Orissa in the aforesaid sea patrol, it is necessary that help of the Coast Guard also be inducted during the mating and nesting seasons of the olive ridley (September to March). After March, the sea usually becomes rough preventing the poachers from operating and so routine patrol in the sea may not be necessary thereafter.

Some poaching occured in the months October to December (Mating period) and immediately thereafter, in past years. During February 1983 two patrol vessels and a naval helicopter patrolled the area and a shore liason office was positioned at the Gahirmatha 'rookery' for contact and assistance. During the 1983-84 nesting season the Gahirmatha Coast was also regularly patrolled by

helicopter and small low flying planes of the Indian Coast Guard Service. It is understood that the patrolling activities and the sea turtle protection operations will be streamlined and made more systematic in future by the Indian Navy and the Indian Coast Guard. It is hoped that with this type of protection mating will continue undisturbed and more females will be able to reach the coast unmolested.

As in 1982-83 the presence of Indian naval ships in coastal waters off Orissa, should also be sought for in order to discourage trawlers of all nations from illegally exploiting turtle reources in our Exclusive Economic Zone (EEZ).

Annually about 50,000 turtles were exported from the Gahirmatha area alone between the 1970's and the 1981-82 season. During the 1982-83 nesting season alert action and vigilance by forest officials of the Governments of Orissa and West Bengal reduced poaching of sea turtles considerably. Inspite of this an estimated 10,000 live turtles were clandestinely landed between mid-December, 1982 to the end of February, 1983 at Bhanshalghat from where they were transported to Calcutta and Tatanagar for marketing (Silas *et al.* 1983). Moll, Vijaya and Bhaskar in their survey report relating to West Bengal during February 1983 have also reported that ' in West Bengal the trade in olive ridley sea turtle was continuing more under cover but seemed to be flourishing as well as ever ' (Moll, 1983).

During the 1983-84 nesting season sea turtles were transported to Calcutta's Howrah market from Digha and the adjoining places, the number for the season is estimated at a few thousand (Silas *et al.*, 1984). The datewise observations by Shri P. C. Roy Choudhury, Deputy Director, Wildlife Preservation, Eastern Region, Calcutta and the Inspector of Police have been given below.

Date of inspection	*No. of turtles brought for sale*
5.12.1983	15 to 20 Nos.
6.12.1983	22 Nos.
7.12.1983	7 Nos.
8.12.1983	16 Nos.
9.12.1983	36 Nos. Lorry No. WBQ 6528

10.12.1983	58 Nos. Lorry No. WBQ 6512
11.12.1983	87 Nos. Lorry No' WBQ 3512
13.12.1983	64 Nos. (Out of this 26 were brought by rail)
14.12.1983	33 Nos.
16.12.1983	15 turtles + 25 tied bamboo boxes each containing 2 to 3 turtles.

Mr. P. C. Roy Choudhury (Pers. comm.) has reported that these observations were made in the morning hours between 7.00 A.M. and 10.00 A.M. and probably greater number of turtles were transported daily to Calcutta and despatched to different selling markets before inspection by officers. Further, a truck containing 74 olive ridley was seized at Rajkul checkpost by the West Bengal Forest Dept. on 30th Jan. 1984. All these turtles were from Orissa (Silas *et al.* 1984). Therefore, the law protecting turtles needs to be rigidly enforced in the State of West Bengal and in Calcutta in particular, the main market for turtle meat and other sea turtle products.

A systematic inventory of turtle conservation laws is needed to determine where gaps in coverage exist and what the priorities of actions should be.

For example mechanised boats, trawlers and country boats and other accessory equipment used for offshore poaching of sea turtles and trucks, lorries, rickshaws, etc., similarily used on land should be confiscated by the Forest Department personnel as is being presently done under the recent amendment of Forest rules by the Government of Orissa for forest offences.

The railway authorities (Commercial Superintendent, S.E. Railway, Khuruda Road Division and Kharagpur Division) were moved from time to time by the Forest Department of Orissa since 1975 to stop the booking of sea turtles from all coastal rail heads in Orissa and West Bengal. This was largely implemented, but turtles were still being booked to Howrah from a few stations during all the seasons upto the current (1983-84) nesting season (Silas *et al.*, 1984). Immediate action is therefore, needed to stop this.

In addition trained Forest Department Staff and Railway officials should also be on the look out for the false documentation and declaration of sea turtles and their products as fishery products.

Incidental Catch: Need For Fishing Regulations

A new major threat observed during the 1982-83 nesting season is that unlike previous years large numbers of mechanised fishing and country boats were operating off the Gahirmatha Coast just in front of the mass nesting ground — from bases such as Paradip Port and Dharma fishing harbour situated on eitherside of the Gahirmatha rookery. In the same season, 3,000 breeding size turtles were found dead in a roughly 10 km stretch of our study area alone and the area looked like a graveyard during the nesting season (Silas *et al.* 1983). The same or slightly smaller concentration of the dead turtles was also found along roughly an additional 60 km of the coast northwards. During the 1983-84 nesting season about 600 turtle carcasses were found washed ashore in the Gahirmatha study area and another 500 carcasses in Hukitola Island. These are exclusively the result of incidental catch in fishing nets.

Therefore, in order to stop incidental catch in offshore areas all coastal states should be prepared to establish restricted fishing zones in areas of high turtle concentration (as has been done by Mexico, near Rancho Nueuvo and by the United States, near Cape Canaveral).

For Orissa a minimum of 10 km wide strip of coastal water extending from Palmyras Point near Wheeler Island to False Point near Hukitola Island *i.e.*, from latitude 20°47'N to 20°16'N should be declared off limits to all fishing activities during the month September through March-April.

The Honourable Chief Minister of Orissa Shri J. B. Patnaik and Srimati J. Patnaik, M.P. have verbally agreed to the above proposals during their recent visits to Gahirmatha on 31st December, 1983, and 29th-30th January, 1984, to witness the mating and mass nesting of sea turtles.

Market Surveys

Market surveys are essential for gathering information about sea turtle products, trade routes, etc., as well as local consumption of these products to provide a firm base for future action. Market surveys would help to identify the ultimate outlets for the products. A suitable strategy to discourage consumption will be evolved after more reliable data is available.

Threats to Sea Turtle Habitats and Their Protection

Beach Erosion

Approximately 20 km of the Gahirmatha Coast north of Chinchiri Muhana are being eroded by the sea. Apart from seasonal fluctuations (erosion and deposition) annual erosion at the rate of at least 5 metre per year has been recorded over the last 5 years. Two forest blocks along this coast have been washed away and dead remnants of mangroves are visible at low tide along many stretches (Silas *et al.*, 1983). It is possible that the cause for this erosion is the regular removal of sand from the upcurrent breakwaters at Paradip Port and the consequent depletion of sand carried by littoral drift. This sand is mined partly for land development inland and the balance being dumped in the deep waters offshore. Shri S. N. Bhanjh Deo, Member, State Flood Control Board draws attention to this possibility in his report 'Flood control and allied problems of Orissa rivers (Page 22)' published by the Government of Orissa. The matter urgently requires a multidisciplinary approach and studies to ascertain the causative factors of erosion. It is hoped that the concerned engineers take up a study to determine the exact causes and recommend palliative measures.

Plantations along the Beach

Efforts to create coastal shelter belts by raising plantations and construction of palisades in islands and coastal areas important to nesting turtles should be carefully examined. Extensive plantation activities and construction of palisades, etc., may be threatening important nesting beaches and simultaneously introducing new

predators as occurs at Gahirmatha. This may have an adverse effect on the nesting habitat and on the turtles themselves. Therefore such plantation programmes should be stopped completely along at least 10 km of concentrated nesting beach at Gahirmatha, along 5 km at the northern extremity of Hukitola Island, along 4 km immediately north of the Devi River mouth and along favoured stretches as yet undiscovered.

Further, since most mass nesting of olive ridley sea turtles throughout their circumglobal range takes place on sandspits at river mouths, no plantation should be attempted at existing sandpits near river mouths and islands. On other sandy beaches a 50 metre wide stretch of beach inland of the spring high tide line (highest tide mark of the year) requires to be left untouched and free from all sorts of plantation and other developmental activities. Gradually developing sandspits and sandy islands should also be carefully examined before manipulating the habitat.

Further, no manipulation of sea turtle habitats (nesting beaches as well as foraging grounds which includes the feeding ground and migratory routes *i.e.*, marine and estuarine habitat of sea turtles) for food, water, shelter, mineral requirements, tourism, oil drilling installations should be done. Turtle habitats should be completely protected from pollution and the detrimental effects of all possible external influencing factors.

Protection to Mangrove Forests

Conservation problems such as encroachment, felling of mangrove trees along the coastal belt and illegal fishing in estuaries, rivers and creeks, are being encountered inspite of protection (in Bhittarkanika) and may apply to all such habitats. A stringent action plan and its implementation is needed to stop this.

Since mass nesting habitats of olive ridley all over the world are very closely linked to the presence of mangrove habitats in the vicinity, all such habitats in India which by themselves are now endangered, should be listed in an inventory. This initial step will pave the way to protect the mangroves and their associated sea turtle habitats in India.

Protection to Feeding Grounds

Complete protection should be afforded to cora lreefs and coral islands. These areas should be declared as marine reserves being important feeding and nesting grounds for some species of marine turtles.

Non-Human Threats to Sea Turtle Eggs, Hatchlings and their Protection

Predation

Mammals are the major predators on ridley nests at Gahirmatha rookery. During sporadic nesting which occurs throughout the year, single nests are almost always destroyed by one of the following : wild pigs, feral dogs, jungle cat, hyaena, etc. This normally occurs within twenty four hours of completion of nesting unless they are transferred to a protected hatchery. Nest predation is most heavy between Habalikhati and Ekakula since the nesting beach is immediately backed by dense casuarina and mangrove forests. Predation is relatively less on the stretch of beach between Ekakula and Ekakulanasi area. Birds are the secondary predators of ridley eggs. Although they have not been observed to dig into the nests they consume the exposed eggs by both mammalian predators and nesting female turtles from the previous night.

Protection measures presently undertaken by the Orissa Forest Department at Gahirmatha include :

(i) During arribadas translocation of nests laid below the high water mark which are liable to be destroyed by inundation during the subsequent high tides to a centralised hatchery.

(ii) After peak nesting season transfer of nests laid by the sporadic nesters to the hatchery.

(iii) Throughout the peak nesting season (December-May) assiduously patrolling the beach by employing more number of watchers to protect the nests from various beach predators and poachers.

(iv) During the peak hatching period by regularly patrolling the beach upto 10.00 A.M. in the morning the forest department personnel collect hatchlings which fail to reach the surf before dawn. Such action helps to protect the hatchlings from the dangers which they may face while crawling along the hot beach sand as well as from the avian predators.

A few more suggested measures to prevent the nest destruction by beach predators include :

(i) fencing the stretches of concentrated nesting beach where predation is heavy.

(ii) Spreading plastic or nylon nets over the beach immediately following an arribada.

(iii) Spreading electric wires along the forest edge.

(iv) Extensive patrolling of the beach to scare away the predators and

(v) Killing or preventing the feral dogs from entering into the rookery.

Conservation Education

A recommendation should be made to the postal department to produce postage stamps and postcards, inland letters, envelops etc., relating to the plight of sea turtles and the value of this wildlife heritage. Such stamps have been produced by many countries to increase conservation awareness.

Turtle meat is eaten virtually by no Oriyan. On the other hand turtle meat and eggs are favourite food item and are much relished in West Bengal. Therefore, an extensive publicity extension programme should be conducted (as has been done by the CMFRI on an experimental basis) during the forthcoming breeding season, which commences in mid-October. Efforts need to be concentrated mainly in the problem areas *i.e.*, in all coastal villages and towns of West Bengal including Calcutta, the main market for the meat, eggs and other sea turtle products in India. This will greatly help in reducing the heavy offshore poaching of ridley in Orissa.

The presence of volunteers and staff in the above places will also help to collect and transmit forest intelligence and other information on poaching or movement of sea turtles and its nest, eggs etc. to the West Bengal Forest Department for necessary action at their end.

Turtles and their value as a national heritage should be highlighted in various local, regional languages particularly for children in the form of posters, informative pamphlets and school textbooks.

Conservation organisations such as BNHS, WWF (India) the Department of Environment and the ICAR should provide leaflets on the sea turtle conservation programmes for general distribution.

Travelling natural history museum exhibits on sea turtle ecology and conservtion should be launched.

Sea turtle hatcheries which are being established in different states should always give priority in employment and training to local people as is being done at Gahirmatha turtle research centre.

Distribution of coloured photographs illustrating different species of sea turtles along with questionnaires in regional languages would help to train local people in identification of different sea turtle species. It will aid in gathering information about local turtle populations.

Publicity and conservation education through the media of radio and TV, etc. would have a useful effect in creating public awareness for sea turtle conservation.

In order to increase the conservation awareness amongst the people, the Orissa Forest Department has already taken the initiative for producing a documentary film on sea turtle 'arribadas' at Gahirmatha having deposited necessary funds for the purpose. The film to be produced by the I & P.R. Department of Government of Orissa is in process. This documentary film when completed will be a unique wildlife film and therefore, the I & P. R. Department should give first priority in producing this film during the forthcoming nesting season of the species.

Research Priorities

A few lines of research work important to sea turtle conservation which have been identified during the course of the research works in Orissa are described below.

The long term tagging programme initiated for the first time in India at the Gahirmatha rookery by Orissa Forest Department with assistance from GOI/FAO/UNDP as part of the crocodile conservation programme in India, should continue so as to achieve and maintain a total saturation tagging programme for the ridley sea turtle population as quickly as possible. Therefore the FAO/UNDP may be requested by the Government of India to continue providing necessary tags, other equipment and also to provide financial and pragmatic support to this global conservation programme.

A programme for aging hatchlings and head started ridleys should be initiated and maintained for a few years at Gahirmatha to determine wild growth rate, age at maturity and homing instinct of nesting females to their natal beaches.

Ecological and behavioural studies of turtles on their foraging grounds and at points along the migratory routes should be initiated.

Experiments designed to investigate the ' lost year ' mystery of sea turtles by radio tracking and telemetry are required.

Experiments be designed to know where and how far olive ridley turtles go between peak mating and the first and second mass nesting periods on the Gahirmatha Coast, Orissa. Remote Sensing and Telemetry studies would be most helpful for this.

The Department of Environment and the National Wildlife Institute of the Government of India should get involved through association with the wildlife wings of the State Forest Departments to take up the above work urgently on a high priority basis with technical and pragmatic support from national organisation such as the Central Marine Fisheries Research Institute and International organisations such as FAO/UNDP in view of long term national interests and in order to support research work more meaningfully.

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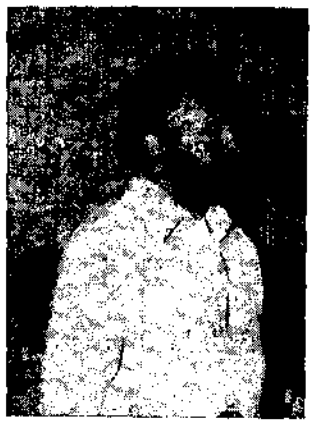
STATUS REPORT OF TAMIL NADU ON SEA TURTLES

K. SHANMUGANATHAN AND JOSEPH JOGINDRANATH
Forest Department, Madras-600 020

To save the marine turtles from extinction, the Tamil Nadu Forest Department had undertaken the task of providing safe conditions. The turtle conservation work was taken up by the department on a large scale. During 1982-83 season turtle walks were conducted and the eggs collected by the Department and transported to temporary hatcheries where they were put in the same way as found in nature. Thus, the loss of eggs due to predation was avoided. The hatchlings when they came out were



totally protected from any predator and taken safely into the sea and released. Thus, all possible predation on the egg and hatchling stages were totally controlled. In the 1982-83 season, hatcheries were established over the coastline of 150 km and in places such as Madras, Kodikkarai and at Tiruchendur and about 94,000 eggs were collected for the programme. Out of these nearly 77,000 hatchlings were released into the sea by the Forest Department in 1982-83 season.

The hatchery programme was continued in the 1983-84 season also and the details of work carried out will be furnished in due course.

STATUS OF SEA TURTLE CONSERVATION IN KARNATAKA STATE

S. L. CHANDARJI

Assistant Conservator of Forests, Karwar, Karnataka

The Karnataka State has a coastline on western side having Arabian Sea to a length of about 207 km. As per the recent Wildlife (Protection) Act, action is being taken to conserve and protect sea turtles along our coast. The available information shows that sea turtles are found along the coastal sea and come out at number of places for nesting. It is learnt that eggs of turtles are collected by poorer class of people and consumed as food. But the selling of turtles and eggs in large scale in bazars is not reported. We have fairly good response by recent publicity on conservation and protection of turtles. We will chalk out a programme and plan to conserve the turtle in Karnataka after consulting higher authorities by making use of the valuable suggestions of the Workshop.

DISTRIBUTION OF NESTING SITES OF SEA TURTLES IN MAHARASHTRA

KAFEEL A. SHAIKH

Deputy Conservator of Forests, Wildlife, Thane, Bombay, Maharashtra

It is now recognised all over the world that most species of sea turtles are commercially over exploited and are in urgent need of complete protection for survival, especially as the females come on the seashore for egg laying. The eggs also fall prey to human and other predators. The International Union for Conser-

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vation of Nature has listed all the sea turtles as threatened, endangered or rare in its Red Data Book. Two species *i.e.*, green turtle (*Chelonia mydas*) and olive ridley (*Lepidochelys olivacea*) are known to nest along the coast of Maharashtra.

According to the publication ' Worldwide distribution of sea-turtles nesting beaches ', by sea turtle Rescue Fund Centre for Environmental Education, the minor nesting places of green turtle in Maharashtra are Bombay (Bombay Chaupati) and Dhahanu and no major nesting places are reported, whereas the minor nesting places of olive ridley are Alibag and Ratnagiri and major nesting areas are Bombay and Dahanu.

According to Kar and Bhasker (1982 ; K. Bjorndal, (Ed.) Biology and Conservation of Sea turtles) : ' The green turtle and olive ridley are known to nest here but concentrations appear to be low. Recent nesting by ridley have been recorded at Gorai, Khim, Manowrie and at Versova. Nesting by green turtle occurs at Backbay (Mhasowade in Salm, 1976) and by unrecorded species at fort (Mhasowade in Salm, 1976) and at busy Chowpatty beach, but detailed surveys have yet to be undertaken. Nesting turtles and eggs are often taken by humans. Nesting by a green turtle occurred at Salseltee Island (Mawson 1921) '.

A reconnaisance survey of western coast of Thane Circle was carried out by the Deputy Conservator of Forests and Wildlife, Thane during March 1983 to ascertain traditional nesting sites and gather information on intensity of nesting. The relevant information of nesting was obtained by contacting old fishermen, specimen collectors of Fisheries Department and other experienced persons including forest staff by visiting actual sites. Some of the important local persons who could furnish the information are listed in Annexure I. The survey revealed that there are as many as 30-35 minor nesting sites presumably of both green and olive ridley turtles, which is an important discovery. It is significant to note that the literature does not indicate nesting sites in Murud and Srivardhan Taluks of Raigad District of Maharashtra where promising and relatively undisturbed sites exists.

The egg laying season was reported to be August to October. However, one nest was actually seen at Velas in Srivardhan Taluk

of Raigad District during March, 1983. The peak nesting season appears to be August-October. Thus there is a strong possibility that both the species of sea turtles nest on western coast and surely the nesting by green turtle which is a rare species if confirmed will be of great value for future work. There appears to be no major nesting sites of olive ridley turtle in Thane Circle and nesting intensity appear to be low varying from 10 to 50. The nesting sites does not fall under the jurisdiction of Forest Department.

The survey revealed the following information :

(*a*) There was no evidence reported of turtle nesting sites in Roha, Rajpuri, Telwad, Korlai, Salav, Mhasla, Srivardhan, Borli, Danchetan, Dighi, Surve, Adgaon, bharal Khor, Shekhadi, Jeeno bander area.

(*b*) The nesting sites of green turtles were established in following places :

District Raigad — Roha Forest Division

(*i*) *Murud* (*Murud Tahsil, Murud Range*) : Nesting sites during the egg laying season *i.e.*, from August, September, October are approximately 25. Though there is considerable disturbance at the site due to nearness of Murud town still nesting takes place every year, between Rajpuri bridge to Police station (about 3 km).

(*ii*) *Nandgaon* (*Murud Tahsil*) : At Nandgaon Beach the nesting sites are 30-35, over the length of about 3 km.

(*iii*) *Kashid* (*Murud Tahsil*) : There is a fine beach which extends to about 5 kms, but the nesting site is located behind the primary school on sea shore and extends to about 2-3 km. Presently, the Port Trust Department is building a masonary bund all along the habitation. This activity may disturb the egg laying site. The Kashid is one of the most prominent sites. There appears to be about 50 nests during the season.

(*iv*) *Velas* (*Srivardhan Range*) : The site extends from Adgaon to Velas about 2 km in length. Nesting sites 40-50. This is one of the prominent sites.

(*v*) *Devaagar* (*Srivardhan Range*) : The site extends from Velas to Devaagar to Bharodkol about 5 km. Number of nesting sites 30-40,

(*vi*) *Kandivali* (*Srivardhan Range*) : This is the least disturbed site which extends to about 3 km from Kondivali Aravi to Walwati. Number of nests 50-60.

(*vii*) *Walwato* (*Srivardhan Range*) : Beach extending from Hareshwar to Kuroli about 1-2 km. Number of nests 10-15.

In Alibag Forest Division of Raigad District following nesting sites were reported (*i*) Avas (*ii*) Akshi (*iii*) Revdanda (*iv*) Nagaon (*v*) Khim. Besides Mandava (Taluk Alibag) and Karanjar (Taluk Urab) were reported as probable places.

The locations of nesting sites at Bombay and Bombay suburbs were as under :

(i) Girgaon, Chowpti and the point of Road diversion to Malabar hill and Babulnath Mandir, which is away from human disturbances.

(ii) Governor's Gate.

(iii) Shivaji Park to Mahim,

(iv) Juhu to Varsova (Ruia Baug, Ruia House and towards end of Varsova Beach),

(v) Mud Island,

(vi) Gorai Island and

(vii) Marve.

However, there are considerable biotic and other disturbances on these sites near Bombay.

In the southern portion of the western coast Ratnagiri Kolshi (Taluk Dapoli) and Anjarl (Taluk Anjarala) were reported as nesting sites.

In the northern portion of the western coast coming under Dahanu Forest Division of Thana District following nesting places were reported.

(i) Dahanu (Dahanu Range), (ii) Aagar (Dahanu Range), (iii) Palghar (Palghar Range) (iv) Satpati (Palghar Range). Besides other possible places in Chikhala, Bordi, Zai, Chinchani in Dahanu Taluks and in Thane Forest Division of Thane District (v) Arnala (Mandvi Range) (vi) Nandagon (Gokhiware Range) and Bassein to Nallospora region (Tal, Bassein).

Causes of nest disturbance : The main cause of disturbances to the nesting sites is human. The fisherman normally do not indulge in egg collection, but the children and unemployed specially Agari Tribals residing near sea shore rob the eggs.

Normally the eggs are collected by Agris (Maratha profession, cultivator), Pagis (Cultivator), Mali (Horticulturist), Bhandari (Tadi collector), Gaoli (Cultivator, milk vendors). In egg laying season, the collectors some time sleep on the beaches and keep watch on egg laying activity to locate the nesting sites. Usually the turtles come by midnight depending on high tide time. At times, the collectors with the help of stick feel the hollow site and thus locate the nest. The jackal, foxes and at time hyaena also locate the sites and consume the eggs. Since these predators normally hunt along sea shore to obtain seafood and also there is more scope for scavenging activities in the villages located along the sea shore, hence predator menace is considerable. All sites where fishes are kept for drying purpose are frequented by these predators, specially jackals.

Consumption of eggs : The eggs are eaten by some people in Bombay. The yellow of egg is only eaten. The white of egg is first removed by puncturing the egg shell and draining white of the egg and collecting the yolk separately. The white of the egg is mixed with water and given to the bullocks as a decoction for vitality. The omlette is made from yellow of the egg and also a local cake by mixing coconut milk, jaggery or sugar. The eggs are eaten as it is believed that they are very nutritious and provide strength. They are also first pricked, salt applied and then boiled and eaten. The white of the egg is not eaten as it has undesirable smell.

The collectors after distributing the eggs to friends sell the rest of the eggs which may fetch about Rs. 1 to Rs. 2.50 each. There is no regular market. At times eggs are sold at Chira Bazar, Dhobi Talao, Bandra and Andheri markets.

Poaching of sea turtles : There are no reports of poaching of sea turtle on the west coast of Thane Circle. The turtles are considered sacred in Maharashtra and because of this religious feeling the species might have been saved from ruthless exploitation.

However, it is observed that at places all along the coast wherever the sea turtles come for laying their eggs are robbed by the local people.

Thus it will be seen that there is need to undertake a detailed survey and to adopt specific measures to protect these nest sites and to monitor those sites at least in a general manner for nesting success and study of population dynamics and other aspects of sea turtle biology, the knowledge of which is vital for conservation of sea turtles. Presently the nesting sites are kept under surveilance by the Forest Department and Fishermen Co-operative Societies have been apprised about the strict legal protection accorded to sea turtles and need for preservation of nesting areas.

ANNEXURE I

Name	Village	Taluka	Dist.
Shri Ramesh Anant Kini	Juhu	Juhu	Bombay
Shri Dhondu Shankar Mengekar	Ruiya House	Bombay	Bombay
Shri Madhaikar	Murud	Murud	Raigad
Shri Dharma Gopal Baridre	Vedur	-do-	Raigad
Shri Raghu Katkari	Kashid	Murud	Raigad
Shri Vithoba Mahadeo Bhagat	Murud	-do-	-do-
Shri Laxman Shravan Waghmare	Kashid (Chikani)	-do-	-do-
Shri Sadanand Barakye Dhamal	Murud	-do-	-do-
Shri Laxman Malekar	Murud	-do-	-do-
Shri Dhamal Karunkar	RFO, Murud	-do-	-do-
Shri Sadhu Shivaram Waghmare	Murud (Dongari)	-do-	-do-
Shri Damodar Raghunath Madhekar	Nandgaon	-do-	-do-
Shri Daliatrey Dhondu Mahadik	Parshi (Mahasala)	Mahasala	-do-
Shri K. S. Shilkar, Sarapanch	Velas	-do-	-do-
Shri D. G. Naik	RFO, Shrivardhan	Roha Division	
Shri Mahadeo Bhiku Mundekar	Velas	Mahasala	Raigad
Shri Balirao Ganpat Pedanekar	Shrivardhan	-do-	-do-
Shri Sakharam Ganpat Rawat	-do-	Shrivardhan	-do-
Shri Madhukar Dattarey Thakur	Navedkhor	Alibag	-do-
Shri Shantaram Golap	-do-	-do-	-do-
Shri Shankar Dharma Change	-do-	-do-	-do-

DISCUSSION

I. RAJENDRAN : At present the State Fisheries Department in Tamil Nadu is not involved in the Sea Turtle conservation programme. Conservation programme is purely coming under the purview of the Forest Department. The Fisheries Department is more involved with the setting up of the Marine National Park in the Gulf of Mannar.

K. SHANMUGANATHAN : As far as Tamil Nadu is concerned, both Forest and Fisheries Departments are under the control of the same Secretary. So, the co-operation between these two Departments can be planned well.

E. G. SILAS : Does the Tamil Nadu Fisheries Department possess an effective extension wing ?

I. RAJENDRAN : The Fisheries Department has an extension wing and has mobile vans also. If proper films on turtle conservation are provided the Department is prepared to screen them in the coastal fishing villages to educate them.

WORKSHOP ON SEA TURTLE CONSERVATION

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* Out of Print.

Back Cover : Olive ridley hatchlings heading for sea.