

# MARINE TURTLES

Proceedings of the 2nd Working Meeting of Marine Turtle Specialists.

Organized by the Survival Service Commission, IUCN,

8—10 March 1971, at Morges, Switzerland

Published with the financial assistance of UNESCO



International Union  
for Conservation of Nature and Natural Resources

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CANCION DE TERESITA

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Soy buscada,  
Deseada, soy amada,  
Aunque tengo mil arrugas  
Como todas las tortugas  
Soy buscada,  
Deseada, soy amada,  
Aunque tengo un carapacho  
Que no rompe ni el mas macho.

Soy buscada,  
Deseada, soy amada,  
Pero no rae gusta nada,  
Pues rae quieren para sopa,  
Para adornos en la ropa,  
Para bolsos, cinturones,  
Y también para jabones.

Soy buscada,  
Deseada, soy amada,  
Y por culpa de ese amor  
Yo de mal voy en peor;  
Cada dia somos menos,  
En los mares ya no abundo,  
Algun dia no quedaran  
Mas tortugas en el mundo.

SONG OF TERESITA

---

I am sought after,  
I am desired and loved -  
Although I have a thousand wrinkles  
Like all turtles.  
I am sought after,  
Desired, loved -  
Although I have a shell  
Which even the strongest cannot break.

I am sought after,  
I am desired and loved -  
But I get no pleasure from it,  
Since they want me for soup,  
For adornment of their clothes,  
For purses, belts,  
And even for soap.

I am sought after,  
I am desired and loved -  
And because of that love  
I go from bad to worse;  
Each day we are fewer,  
No longer abound in the seas;  
One day no more turtles  
Will be left in the world.

The International Union for Conservation of Nature and Natural Resources (IUCN) was founded in 1948, and has its headquarters in Morges, Switzerland; it is an independent international body whose membership comprises states, irrespective of their political and social systems, government departments and private institutions as well as international organizations. It represents those who are concerned at man's modification of the natural environment through the rapidity of urban and industrial development and the excessive exploitation of the earth's natural resources, upon which rest the foundations of his survival. IUCN's main purpose is to promote or support action which will ensure the perpetuation of wild nature and natural resources on a world-wide basis, not only for their intrinsic cultural or scientific values but also for the long-term economic and social welfare of mankind.

This objective can be achieved through active conservation programmes for the wise use of natural resources in areas where the flora and fauna are of particular importance and where the landscape is especially beautiful or striking, or of historical, cultural or scientific significance. IUCN believes that its aims can be achieved most effectively by international effort in cooperation with other international agencies such as UNESCO and FAO.

The World Wildlife Fund (WWF) is an international charitable foundation for saving the world's wildlife and wild places. It was established in 1961 under Swiss law, with headquarters at present in the vicinity of and eventually to be shared jointly with those of IUCN. Its aim is to support the conservation of nature in all its forms (landscape, soil, water, flora and fauna) by raising funds and allocating them to projects, by publicity and by education of the general public and young people in particular. For all these activities it takes scientific and technical advice from IUCN.

Although WWF may occasionally conduct its own field operations, it tries as much as possible to work through competent specialists or local organizations.

Among WWF projects financial support for IUCN and for the International Council for Bird Preservation (ICBP) have highest priority, in order to enable these bodies to build up the vital scientific and technical basis for world conservation and specific projects. Other projects cover a very wide range from education, ecological studies and surveys, to the establishment and management of areas as national parks and reserves and emergency programmes for the safeguarding of animal and plant species threatened with extinction.

WWF fund-raising and publicity activities are mainly carried out by National Appeals in a number of countries, and its international governing body is made up of prominent personalities in many fields.

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OPENING ADDRESS

by

Gerardo Budowski  
Director-General, IUCN

It gives me great pleasure to welcome you on behalf of IUCN to this Second Working Meeting of the Marine Turtle Specialist Group. Having gone through some of the papers, in anticipation of this meeting, one cannot escape the conclusion that here is a subject in which the opportunities are outstanding.

In fact, it has many of the necessary ingredients for successful development, always provided that the information available can be geared towards effective action programmes. Turtles are particularly fascinating creatures with so many unique or still unknown features in their life history. One cannot help feeling that any efforts made towards their conservation should be able to catch the imagination of mankind. They have certainly caught mine and I still vividly remember the emotion produced when I saw the first movie picture showing the strenuous labour of egg laying of a marine turtle.

Moreover, there are the intriguing aspects of turtle rearing of which we know so little. Then there are several fascinating features in sea turtle biology such as the mysterious "lost year", the mystery that surrounds the return of the female turtles to their natal beach to nest and so on; I do not need to elaborate - after all you are the experts, not me. But coming back to the egg laying it has been argued that the proper care and patrolling of these special nesting beaches can easily make all the difference between recuperation of numbers and further depletion. And here, of course, we can and should be able to modify existing destructive practices. One should also mention, in this connection, the attraction of commercial hatcheries and rearing - and, provided that it does not infringe upon the egg supplies of beaches where turtles come naturally, this should be considered as an attraction and certainly not as a negative point. If properly channelled and controlled, such commercial enterprises ought to make it possible to relieve at least part of the pressure of destructive exploitation on those natural environments not particularly well conditioned for high productivity. They could also provide important assets for scientific research, or serve a useful purpose educationally or in the development of the tourist potential.

Of course many of these possibilities have also their negative side. The fact that there is a commercial market may increase the pressure on natural supplies and not relieve it. The fact that egg-hatching takes place in very localized areas and that some of these areas are presently vulnerable,



particularly to human depredation, is particularly dangerous. Hearing turtles alien to the general area implies the hazard of accidental escapes. But then, every factor can have a positive and a negative side, and if we are meeting here today it is because we felt that with the knowledge already accumulated and by pointing out the main areas where more and urgent research is needed, we can promote the necessary changes. At least, we should try to do our best and I will not hide my optimism, because I think mankind is moving at a very fast speed towards the recognition that he must live in balance with his environment. Therefore I have good hopes that recommendations for turtle conservation will fall on much more receptive ears than ever before.

Nevertheless in an era of widespread deterioration, anyone who is as hopeful as I am myself owes an explanation. I am aware that we have witnessed over recent years a further degradation of turtle habitats, more pressure, more difficulties in the control of poachers, and that you will certainly point out during the course of the discussions many more dangers that loom over marine turtles. On a much broader scale, we have also witnessed further deterioration in what we have lately called "the health of the biosphere". But there are also many encouraging signs and I can best see the marine turtle problem in the context of world-wide problems affecting conservation of species and habitats. Suddenly, conservation and environmental concern are "in" or, as the French would say, "à la mode", and there is no doubt that they are here to stay.

In IUCN we are getting a direct feeling of this trend from many different sources, some of which we had never suspected before. Perhaps the most significant change has been the attitude displayed by the machinery of the United Nations and its different agencies. Being legally bound to execute the wishes of member countries, it can hardly be expected that the UN will move in the forefront of ecological thinking and indicate new trends and new paths as to what action to take. Besides, we all know that the traditional tendency is for governmental delegates to consider first the interest of countries which they represent rather than to look at problems that require global approaches and global solutions, such as the biosphere and its functioning, its health, as we like to call it. National interests prevail over global interests, yet it is precisely in the United Nations system that some of the greatest changes are presently taking place. A few weeks ago I attended the meeting of FAO's Ad Hoc Committee on Forestry in Rome, where representatives from 60 countries were requested to indicate their wishes as to the direction in which they wanted FAO's Forestry Department to move. FAO had prepared a series of lengthy documents showing its new incursion into the environmental field from the forestry standpoint, including many conservative aspects. The delegates seemed to love it and made no reservations as to how strongly they wanted FAO to reinforce this new tendency. In fact, they asked for much stronger action. Significantly a few voices of dissent were heard, mostly from elderly people who resented the fact that traditional forestry and particularly commercial timber operations were being de-emphasised in favour of environmental considerations. Not surprisingly, it became equally clear that among FAO forestry experts, there was also this

difference of opinion as to where FAO should move. Although I am not too familiar whether these changes are also going on in other Departments of FAO, I hasten to acknowledge that from the Fisheries Resources Division of FAO, we have been enjoying a long lasting cooperative relationship and I hope we will receive some hints from Dr. Sahrhage as to some of the new developments that are taking place in his division. We hope - and I say this unabashedly - that we can all capitalise on these for our turtle programme.

Three weeks ago the Preparatory Committee meetings of the 1972 United Nations Conference on The Human Environment took place in Geneva, and again conservation of nature and natural resources was at the root of many discussions. IUCN was represented in the working groups that were formed in order to decide on the different types of activities to be carried out for the 1972 Conference; and again it was quite clear that a considerable input was expected from our organization. I hasten to say, that I have somewhat mixed feelings about this since we can hardly cope with the additional work load that is increasingly demanded from us on world conservation matters.

UNESCO's programme of Man and the Biosphere, with its considerable conservation ingredient, has finally taken shape. The important role that IUCN has played in making this programme possible and its future role in implementing it appear now much clearer and quite favourable. I could also mention the changing attitudes of several other intergovernmental organizations towards dealing more intensively with conservation matters. In some cases, we may trace the influence of IUCN in bringing about some of these changes, but in others - I am almost pleased to say - we had no major input and the developments have been a natural reaction against environmental degradation. These tendencies show up in multiple, manifestations throughout the world, many of which affect IUCN in some way or another; for instance there is the closer, friendlier and much more productive cooperation between the World Wildlife Fund and IUCN; there is the increased demand for IUCN to inject conservation into a multitude of meetings to which, unfortunately, we can only respond to a minimal degree; and there are many other new activities which I shall not enumerate here.

I have mentioned these developments because they directly or indirectly affect marine turtle programmes, either because of the new or increasing interest of different organizations throughout the world in conservation or because they make it possible for IUCN to move in this field with better cooperation and financial backing. To meet this challenge, however, IUCN has had to undergo a very significant change. This process is presently in full swing. Some of you have known our organization for years and while it was always staffed by a small group of extremely dedicated conservationists, it was so poorly financed that it could hardly pretend to do the job for which it had been created. In fact, it is amazing to see how many publications were produced and how much good will generated with so little financial support. We have now 19 professional members on

our staff, 16 of whom are located at Morges; and the number of field projects is now around 70, a good amount of them operational. Every one of the 6 IUCN Commissions (except one - Environmental Policy, Law and Administration - pending the arrival of its officer in June 1971) is now staffed with an Executive Officer who is servicing the Commission and its different specialist groups and coordinating these activities with those of other Commissions or other type of scientific activities not directly connected with the Commissions. IUCN's "new look" as we like to call it also includes a section on Research and Planning under the direction of Dr. Raymond Dasmann, our Senior Ecologist, assisted by Dr. Colin Holloway and Dr. Patrick de Rham, among others.

The world interest in conservation which has been generated is presently "exploding" and naturally there are different appreciations as to what action should be given the top priority by IUCN. We are aware of this but we are at the same time pledged to base our actions on the best possible appraisal as to where the priorities lie. And those priorities will always depend first and foremost on the best possible scientific understanding of a world situation. Naturally economic and even political considerations also influence our decisions; and naturally, too, our principal deterrent to getting more action under way is shortage of funds for financing the execution of our programme, made up of the 70 projects referred to above, some of which are very relevant to marine turtle. For example, among them are several projects for monitoring of species populations and biotic communities throughout the world as a contribution towards a general appraisal of changes taking place in the biosphere. This includes, of course, our current appraisals of vanishing species and the continuous up-dating of the Red Data Book. It will also include work on depleting species. The fact that marine turtles lend themselves well to such monitoring may generate a series of useful correlations, involving other biological variables. A somewhat similar project involves a continuing review of the health of the oceans, and we are particularly eager to capitalize on the advice of our new Marine Habitats Committee, created three months ago.

We are also entering, or rather expanding, into the field of marine parks and here, too, we expect to receive some useful input from your group. Studies of coastal and estuarine areas will be given much impetus through another series of projects.

Finally, and from a completely different angle, we are working on a series of ecological guidelines that should be the basis of solutions to problems involved in economic development. Not only should this make possible a holistic long-term approach to land and sea-use planning, but eventually we expect to generate much greater awareness amongst countries of the possibilities open to them of requesting assistance from intergovernmental agencies. Ultimately, we hope that money from the U.N. Development Programme can be channelled towards programmes that include marine turtles within their scope.

I have purposely mentioned to you some of our current thinking and our desire to ride the present wave of environmental concern. I insist that this is quite relevant to marine turtles - may I say "ecologically linked" - and it was equally my purpose to inform you how IUCN operates in order that you should be able to give us the most effective advice for linking your field of competence to our own activities - and, what is perhaps more important, for leading our thinking into operational programmes or action programmes, as we like to call them. We sincerely feel that IUCN is in a particularly favourable position to make everyone understand that marine turtles have a very important role to play in the complex environmental balance and that any money invested to capitalize on present knowledge, to promote action or to gather more research data as a basis for action, will indeed be very well invested and should produce multiple benefits. As an (international non-governmental organization, we can loudly proclaim what failure to take action implies and we should, of course, explain frankly how the benefits could produce a series of advantages for mankind. Not only should we emphasize the economic aspects, which are self-evident, but we can also expatiate upon the scientific, educational, aesthetic and cultural advantages that a sound programme of marine turtle conservation, including wise utilization, can yield, as part of a coordinated effort, towards a more balanced relation between man and his environment. With the help of our sister organization, the World Wildlife Fund, we believe we can get the message across.

I therefore hope very much and do not mind repeating that, when we depart from here, you will have provided new and effective advice and additional arguments for a series of action-oriented projects which should make a decisive and lasting impact on marine turtle conservation.

SUMMARY OF THE MEETING

---

1. INTRODUCTION

Dr. Gerardo Budowski welcomed participants to the meeting on behalf of IUCN; his address forms the introduction to these Proceedings. Members regretted the death since the last meeting in March 1969 of one of their number, Dr. E. Balasingham from West Malaysia.

Professor Archie Carr having resigned the Chair in favour of a non-delegate, Dr. Budowski was elected Chairman of the meeting. Dr. Colin Holloway was elected as vice-chairman, to act as Chairman in Dr. Budowski's unavoidable absence later in the meeting. Dr. Robert Bustard suggested that the task of minuting the meeting be shared by the IUCN Secretariat and the Scientific Co-ordinator to the Group. Dr. Peter Pritchard and Miss Moira Warland therefore acted as joint rapporteurs.

The work and achievements of the Marine Turtle Group in 1969 and 1970 were reviewed by Dr. Pritchard in his paper on his functions as Scientific Co-ordinator to the Group (Paper 1).

2. SUMMARY OF NATIONAL AND REGIONAL SITUATION REPORTS

Reports given by Group members and other authors underlined changes in the marine turtle research and conservation situation since the previous meeting.

Queensland, Australia

Many turtle resource surveys have been undertaken with the help of grants from the World Wildlife Fund (U.S. National Appeal) and substantial rookeries have been found and research farms established. Dr. Bustard's report is contained in Paper 2. Although no exploitation of turtles occurs in Queensland, a certain number of green turtles are taken from Western Australia. Two crayfishing boats operate in these waters taking turtles in the cray off-season and turtles taken find their way to U.S. and Japanese markets. Mr. John Lusty pointed out that some Australian meat also goes to West Germany.

Costa Rica

Professor Carr summarized his report contained in Paper 3. He referred to the tripartite agreement between Costa Rica, Nicaragua and Panama which has remained unsigned by Nicaragua and has been consistently flouted by Nicaraguans (two hundred turtles per day were said to be taken). Efforts should be made to ensure that the two laws outlined in the agreement be

Observed by all three countries. It was agreed that F.A.O., who had sponsored the relevant conference in tially, should ask to be informed of their success in implementing the agreement. Professor Carr also mentioned the increasing exploitation of the olive ridley on the Pacific coast of Costa Rica, Guatemala, Honduras, Mexico, Nicaragua and Panama. Professor Carr emphasized the need for an exploitation-limiting agreement between the countries concerned, on the lines of the existing tuna fishing agreement.

#### Galapagos and French Guiana

The reports for the Galapagos Islands (Paper 4) and for French Guiana (Paper 5) were presented by Dr. Pritchard. In both these areas, existing conservation measures were considered adequate, but it was decided that the importance of the leatherback nesting beach in French Guiana, and the need for constant monitoring of the situation should be stressed to the authorities concerned. Discussion centred around the taxonomic status of the green turtle on the Galapagos. Professor John Hendrickson moved the congratulations of the Group to Dr. Pritchard for his outstanding research work on the Galapagos turtles.

#### Mexico

The report for Mexico is contained in Paper 6. Mexican turtles continue to be exploited at a heavy rate, but a great deal of important and valuable research and management is being undertaken by Mexican biologists and certain beaches continue to be patrolled. The translation of an article published in the journal Técnica Fesquera in December 1970, drawing attention to certain aspects of Mexican marine turtle conservation, was tabled at the meeting and has been included as Taper 7.

#### Sabah

The Group noted from the report from Sabah presented by Mr. George de Silva, Paper 8, the considerable progress that had been made since the last meeting in the enforcement of existing legislation in Sandakan in hatchery and tagging programmes, in the launching of an education programme and in the declaration of three key islands as Game Sanctuaries for turtles. The purchase of these islands was still being negotiated with the Government with funds raised as a result of a television programme in the United States.

Of concern, was the practice of fish dynamiting near turtle islands and the lack of law enforcement in other areas. Particularly serious was the, heavy turtle exploitation by the Japanese in the Sulu, and South China Seas, and by Filipino fishermen in the Celebes Sea.

#### South Pacific Islands

Dr. Harold Hirth's report on the turtles of the South Pacific Islands is contained in Paper 9. Recommendations arising from his four-month survey, carried out as a consultant to the FAO/UNDP Project for the South Pacific Islands Fisheries Development, were as follows:

- (a) Only juvenile and sub-adult (carapace length less than 35" measured along shell itself) green turtles should be taken in the Kingdom of Tonga and the Fiji Islands. The turtle population then should be continually monitored to determine if these models of exploitation could be adapted to other areas.
- (b) All rookeries should be totally protected.
- (c) A thorough ecological study of the hawksbill should be undertaken.
- (d) Rose Atoll, American Samoa, should be given protective status.
- (e) No restocking programmes should be undertaken in the South Pacific until the success of the Caribbean venture is proven.

There was some discussion of Dr. Hirth's proposal to set a maximum size limit (35" carapace) on turtles caught in this area; Dr. Bustard explained how he had come to make this recommendation originally to the Government of Fiji. It was concluded that size limits had to be tailored to fit the particular exploitation pattern in the area.

#### South-east Africa and Madagascar

Further surveys had been undertaken in south-east Africa, Mozambique, Madagascar, Europa Island and the Mascarenes and some totally unexploited rookeries were discovered, providing valuable opportunities for baseline research into natural populations. Mr. George Hughes's report is contained in Paper 10.

In the ensuing discussion on sex ratios in turtle populations, Mr. Hughes mentioned that the ratio of male to female green turtles in the completely unexploited Europa population was approximately 1 to 3 or 4. Professor Carr pointed out that apparent sex ratios near breeding grounds changed with the season, there being 2 or 3 males per female in Costa Rica in early August, about 1 to 1 in mid-August and no males left in late August. Dr. Bustard added that in Australia there may be only four months of mating activity on a nesting ground where turtles nested eleven months out of the year.

#### Surinam

Dr. Joop Schulz report on the turtles of Surinam (Paper 11) was presented in Dr. Schulz's absence by Dr. Pritchard. Discussion emphasized Dr. Schulz' discovery that nests which had been located by probing thereby breaking one or two eggs, gave seriously reduced hatching percentages when transplanted to a hatchery, even when the broken eggs were discarded. Professor Hendrickson and Mr. Mark Fisher gave instances from their experience showing the necessity for freedom from extraneous bacteria for successful hatching of eggs.

Reports were also presented from Colombia, Trinidad and Tobago and Indonesia. These are contained in Papers 12, 13 and 14.

The interest of the Group also focused on important nesting islands such as Aldabra, Astove and Aves; Specific Group members were given responsibility for monitoring the turtle conservation situation on these islands. Further information was to be sought on turtles in Brazil, Cuba, Java, Pakistan, Peru, the Seychelles and Turkey.

3. THE TURTLE INDUSTRY

A valuable feature of this second meeting was the attendance of a director of the world's first turtle farm, Mariculture Limited of Grand Cayman Island in the British West Indies, and the head of Europe's leading turtle soup firm. Their contributions are given in Papers 15 and 16.

Mariculture is pioneering commercial farming of sea turtles, a process which, it is hoped, eventually will reduce the pressure on dwindling natural sources. The venture began in 1968 and some 44,000 green turtles are at present being raised. The trade in turtle products, in addition to meat and eggs, includes calipee (the cartilaginous material taken from among the bones of the belly shell) for soup, hides for turtle leather, shells for "tortoise-shell", oil for cosmetics, and even stuffed yearling turtles for souvenirs. Sea turtles and their eggs have always been an important local source of protein in the tropical areas where they nest, but this non-commercial use is considered less of a threat to the various species.

Certain dangers of wide-scale turtle farming were discussed by the Group; among these was the bad example of foreign industrialists having access to eggs on protected beaches, and the possibility of hybrid or exotic green turtle stocks being accidentally released into the Caribbean. Among other drawbacks, this would make Zoogeographic studies of green turtles much more difficult. In reply, Mr. Fisher assured the Group that Mariculture was working hard to breed its own stock of turtles, and had recently transferred its stock to inland concrete tanks, from which the possibility of accidental escape was negligible. He underlined the fact that, in addition, Mariculture took eggs from areas where they were doomed anyway whereas when hatched in the farm they had a high hatching and survival percentage.

Dr. Bustard described six cottage-industry pilot research turtle farms which had been started in Torres Strait under his supervision. Professor Carr mentioned that green turtles were being farmed, on a small scale, in Cuba and Mrs. Goodwin mentioned plans by Lawrence Rockefeller to begin captive culture in the Virgin Islands for re-stocking purposes.

Mr. Lusty outlined the part played by the European Turtle soup industry in marine turtle conservation and utilization. There was some discussion of the best size limits to set on those turtle populations which were not deemed to require complete protection. Mr. Lusty assumed that taking old turtles would cause less harm to populations than taking young ones; on the other hand, Drs. Hirth and Bustard recommended that in certain areas



in the South Pacific the maximum allowable length be set at 35", i.e. just short of mature size. Professor Hendrickson added that in Sarawak it was possible to observe which females were reproductively senile, and which were thus available for exploitation without jeopardizing the population. Professor Carr also stated that older females, before degeneration had set in, were more regular and copious in their laying. It was concluded that size limits would have to be tailored to suit the particular exploitation pattern of an area.

The delegates agreed that the European turtle soup market posed no threat to turtle survival; much more serious was the growing market for turtle products in Japan and the turtle steak market in coastal areas of the United States.

#### 4. FOOD AND AGRICULTURE ORGANISATION

The report from F.A.O. on its present and future marine turtle programme is contained in Paper 17.

Dr. Dietrich Sahrhage underlined that IUCN should encourage those countries that need it to request a marine turtle expert to assist them in marine turtle research and management. Additionally, where an F.A.O. fisheries project already existed, Dr. Sahrhage offered to act on the advice of the Group on specific 'turtle needs' in that area. Dr. Budowski offered IUCN advice also on the selection of experts for specific F.A.O. turtle projects.

The Group agreed to collaborate in the publication of F.A.O. Synopses of Biological Data on Species of Commercial Importance and to ensure no overlap with IUCN's series of Monographs on Sea Turtles. It was also deemed important that F.A.O. be provided with draft outlines for the preparation of Species Identification sheets for Statistical purposes on turtles, as well as with a draft outline of a leaflet with the description of hatchlings and small turtles which could be used to encourage fisheries people and other finders at sea to report captures of such turtles in order to obtain information on turtles during the 'lost year'. A joint project will be undertaken to produce a Field Manual on turtle identification, biology, management and conservation for fisheries workers and training purposes.

Examination of F.A.O. catch statistics revealed that Japan and Mexico produced by far the highest tonnage of turtle meat (16.6 and 14.7 thousand metric tons respectively in 1968). The next highest was Cuba with a figure of 1.2.

It was also pointed out that the total tonnage given for 1968 (the latest figure), 34 thousand metric tons or 34 million kilos, represented a harvest of approximately one third of a million 100 kilo turtles. It is assumed that only 50% reporting occurs (as in the case of Mexico) and that the actual average weight of turtles taken is less than 100 kilos; therefore approximately 1 million turtles are killed in a year.

The preliminary results of an exploitation survey by a member of the Group are contained in Paper 18. The need was stressed for more detailed information from customs returns, catch statistics and other sources.

5. INTERNATIONAL MARINE TURTLE CONSERVATION PROGRAMME

Individual species - Leatherback

In view of the precarious survival status of the leatherback turtle, Dermochelys coriacea, in South-east Asia, Dr. Bustard proposed that strong recommendations be made to the appropriate governmental agency in West Malaysia, stressing the importance of the Trengganu leatherback nesting colony and urging that the most densely-nested part of the beach, Ratau Dalam, be declared a nature reserve.

Hawksbill

It was stressed that the hawksbill turtle, Eretmochelys imbricata, was seriously endangered by the calipee and trophy trade. Members of the Group were unanimous in their decision to condemn the practice of killing hawksbill and other sea turtles for the primary purpose of selling the shell or the entire stuffed animal to tourists. Approval was given by the Group to suggestions for an anti-tortoiseshell campaign and for a rearing programme to reduce the pressure on wild stocks. The latter would be explored by Dr. Bustard.

IUCN Advisory Service

As a result of the discussions on turtle exploitation and turtle farming, it was decided that IUCN should inform all governments with appreciable sea turtle resources of the following statement:

"The IUCN Marine Turtle Specialist Group reiterates its concern at continuing uninhibited marine turtle exploitation and the growth of uncontrolled turtle 'farming' or rearing enterprises and hereby undertakes to advise government departments that wish to draw up turtle conservation and management schemes or that may be approached by 'enterprises wishing to slaughter turtles or purchase eggs. IUCN will give appropriate advice in the light of the national and overall status of the populations concerned".

It was stressed that this decision implied greater efforts on the part of the Group to build up the overall picture of the status of marine turtle stocks throughout the world and to determine which populations could sustain exploitation. It also implied a monitoring function for the Group.

Education Campaign

Mrs. Goodwin proposed that some twelve-month period in the not-too-distant future be designated 'The Year of the Turtle', during which efforts would be made to enlighten the public as to the precarious survival status of sea

turtles, and solicit their support for conservation projects. This proposal was supported by members of the Group and the World Wildlife Fund who offered to collaborate actively in the campaign. Mrs. Goodwin agreed to draw up a plan of procedure.

#### Captive culture

Members of the Group agreed that turtle protection or restoration programmes should concentrate on allowing the young turtles to follow as natural a life cycle as possible; thus, eggs should only be transplanted to hatcheries when absolutely necessary, and hatchlings from hatcheries should be allowed to run down the beach into the sea. Also hatchlings should not be transported to distant beaches for release, nor should they be kept in 'holding tanks' for prolonged periods of time. These restrictions would be waived, however, in the case of small-scale experimental programmes.

Other points mentioned were the need for a central tagging repository for the African region and a project for tagging young loggerheads which congregate round the Azores to determine whether they followed the Gulf Stream. This arose from the consideration of Paper 19 on Ocean Records of Turtles by Professor Leo Brongersma.

#### 6. RESEARCH PRIORITIES

Dr. Bustard presented the findings of the committee appointed at the 1969 meeting to evaluate research priorities (Annex 1). There was some discussion as to the desirability of establishing such rigid categories for projects, and Professor Carr expressed concern that novel projects which did not clearly lie within one of these categories might not receive fair consideration for funding. It was decided that all Group members would be consulted when projects from outside sources or outside the priority categories were being considered.

Detailed projects would be prepared by Group members within the broad categories delineated in Annex 1. This would provide a means of ascertaining gaps in knowledge and a basis for approaching individuals in key regions.

#### 7. ORGANISATION OF SSC MARINE TURTLE SPECIALIST GROUP

Members considered that the administrative servicing of the Group should be kept separate from the task of determining and filling gaps in world turtle knowledge. It was therefore decided to appoint Dr. Pritchard as Special Investigator to the Group and that the task of scientific and administrative co-ordination of the Group should be the responsibility of a separate person employed part-time or full-time at Morges to work specifically on marine turtles.

It was agreed that the turtle group newsletter should be written in and distributed from Morges, by the Co-ordinator of the Group, Group members being reminded to send contributions by postcard shortly before each issue went to press. It was decided the newsletter should be issued twice a year and that it should contain material on the work of Group members and problems encountered.

A wider representation was required on the Group but the Group should not be allowed to become unwieldy. A category of associate membership to the Group was established whereby concerned scientists could co-operate in the work of the Group without being required to attend meetings or make decisions.

The need for more funding was emphasized and it was suggested that agencies with interests in food-production, such as AID and the Rockefeller Foundation should be approached.

It was decided that:

- (a) four days should be allotted to the biennial meeting in future to allow for greater interchange of ideas;
- (b) it was desirable to hold the meeting from time to time in an area of particular concern to turtle conservation; if, therefore, a suitable offer for hosting the meeting was made within the next twelve months, this should be accepted. Group members were requested to bear this decision in mind;
- (c) the next meeting should take place in early April 1973.

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REPORT OF SCIENTIFIC CO-ORDINATOR  
OF THE IUCN MARINE TURTLE GROUP'  
FOR 1969-1971

by P.C.H. Pritchard  
Department of Zoology, University of Florida

Since 1969, a marine turtle secretariat has been maintained in Gainesville which has acted as the scientific centre for the Marine Turtle Group and as clearing-house for all queries and requests for action directed to myself from the IUCN Secretariat, members of the Group and from other biologists, conservationists and members of the general public interested in sea turtles. Talks on conservation both of sea turtles and in general have been given.

Information has been gathered from various sources, including members of the Group, on the leatherback turtle Dermochelys coriacea; this data has been published as IUCN Monograph No. 1, 1971. The promotion of similar species monographs is being continued, in consultation with FAO; work was commenced on the loggerhead Caretta caretta and Kemp's ridley Lepidochelys kemp reports. Dr. Hirth had agreed to write the green turtle Chelonia mydas report and Dr. Bustard the flatback turtle Chelonia depressa report, and both these were in progress.

Field work was conducted by myself at various periods in the two years. Two 2-month trips were made to the Galapagos Islands, tagging green turtles Chelonia mydas agassizi on the nesting beach and mapping nesting grounds throughout the archipelago. Leatherback tagging operations were continued during the summers in French Guiana, with a total of well over one thousand animals tagged on the world's most important beach for this species. This work is reported in Papers 4 and 5 of these proceedings and in the World Wildlife Yearbook 1970-71.

A visit was paid to Tamaulipas beach, Mexico, in May 1970, to investigate the re-opening of the close season on Kemp's ridley for a commercial enterprise. As a result of my report, interventions were instigated at the highest level. The arribada of nesting females finally failed owing to bad weather and the take of turtles consisted of only a few specimens. Further high-level interventions were instigated to the Government of Guyana and to the Government of Yemen and other decisions taken at the 1969 meeting were followed-up.

Contact was made with the management of Mariculture Limited, Grand Cayman Island, in 1969 after the first meeting of the Marine Turtle Group. The pros and cons of turtle farming were discussed and the way paved for a

fruitful collaboration with the Group. The presence of Mr. Mark Fisher with us today is an indication of this mutual interest in exchanging views, information and recommendations.

The work of the Group as a whole consists of a summation of individual actions, most of which will be described in the papers to follow.

Finally, I should like to express my appreciation of the continued support and interest of the World Wildlife Fund, through its United States National Appeal, for the work of the Marine Turtle Group and, in particular, for supporting my own work.

MARINE TURTLES IN QUEENSLAND, AUSTRALIA<sup>1</sup>

by H.R. Bustard

Research School of Biological Sciences, Canberra

1. National (Regional) Situation Report

(a) General

All but one of the world's seven species of sea turtle (Kemp's ridley is the exception) occur in Queensland waters and, apart from the leathery turtle, all have known nesting grounds in Queensland.

Populations of the green turtle (Chelonia mydas) are large as a result of active conservation over a period of 40 years. The species is widely distributed in Queensland, with the most important rookeries occurring in south-central Queensland (Capricorn and Bunker groups of coral cays, which form the southern limits of the Great Barrier Reef) and, in the north, in the Gulf of Carpentaria (Bountiful and associated islands) and around the northern limits of the Great Barrier Reef (Raine Island, Bramble Cay).

The flatback (Chelonia depressa) nests as far south as Bundaberg in south-east Queensland, with substantial rookeries further up the coast and on coastal islands as far south as Gladstone (south-central Queensland). Most important rookeries occur for the species on islands in the Gulf of Carpentaria (Crab, Bountiful). Since the latter are uninhabited Aboriginal Reserves, the flatback must be considered safe at the present time.

The loggerhead (Caretta caretta) nests extensively on certain islands in the Capricorn-Bunker Group at the south of the Reef, and on the adjacent mainland. An important rookery is under surveillance at Mon Repos beach near Bundaberg. Little nesting appears to occur in the north of the State.

The hawksbill (Eretmochelys imbricata.) long remained an anomaly in that no Australian nesting grounds had been reported although adult and part-grown hawksbills were of fairly common occurrence in Queensland waters. Breeding grounds for the species have now been located on a number of Torres Strait islands (see Research).

The Pacific Ridley (Lepidochelys olivacea) is now known to nest fairly extensively on the mainland and islands in the Northern Territory part of the Gulf of Carpentaria and reports of nestings in the Queensland area of the Gulf have been received. These will be checked as soon as possible. This species certainly nests in the Wellesley Islands at the south of the Gulf of Carpentaria.

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1 - This paper is not intended to be complete in itself and should be read in conjunction with Appendix X of 'Marine Turtles' IUCN Publs. N.S. Supp. Paper No.20 (1969). The present paper deals with advances during the last two years.

The leathery turtle (Dermodochelys coriacea) has a well-marked migration pathway down the coast of south-east Queensland. However, no Australian nesting grounds are known. Individuals are accidentally caught in shark nets and released. Tagging of such individuals is now underway, it being anticipated that about 50 will be tagged each year.

(b) Exploitation

All sea turtles in Queensland enjoy total protection (see (c)), so that there is no legal exploitation. Poaching is considered insignificant. Aborigines and Torres Strait Islanders, who are not covered by wildlife legislation, are allowed to take turtle for their own use. However, their influence is now extremely slight as they are becoming settled and do little hunting. The only exception to this is in the extreme north where turtles are still actively hunted particularly in parts of Torres Strait.

(c) Conservation

Queensland has an unbroken record of conservation stretching back almost 40 years. This culminated in the 1968 legislation, gazetted following advice from me, which extended total protection for turtles and their eggs from the green turtle to all six species and extended the area covered by the legislation to the whole of the State of Queensland (this includes all islands of the Great Barrier Reef and virtually all islands between north Queensland and Papua).

A number of important sea turtle rookeries were already National Parks (Heron Island, Fairfax Islands, Hoskyn Islands and Lady Musgrave Island in the Capricorn-Bunker Groups of islands). However, it became clear that the ultimate in sea turtle conservation would only be achieved when the 1968 legislation was combined with adequate National Parks to safeguard the future of all species nesting in the State of Queensland. Unfortunately, information on sea turtles was fragmentary or non-existent outside of the Capricorns, where my research programme has operated for the last seven years. It was essential to locate and map all key rookeries (see Research).

Education

We are continuing to foster wide public interest in sea turtles. Extensive public relations are conducted at our research headquarters at Heron Island and also at Mr Limpus's tagging station near Bundaberg. The programme of newspaper articles and releases, semi-popular magazine articles and radio and T.V. talks is being continued and extended where possible.

Research

In addition to my own large-scale sea turtle population ecology study based at Heron Island and adjacent islands of the Capricorn Group, I am pleased to be able to report that Mr. Colin Limpus has now been working on the loggerhead rookery at Mon Repos beach near Bundaberg for



several years. This rookery includes a small number of nesting flatbacks which are also under surveillance. Furthermore, I have now extended my research efforts to the northern end of the Great Barrier Reef. During summer 1970-71, tagging operations were started at Campbell Island (a mixed hawksbill/green turtle rookery), near Darnley Island in eastern Torres Strait. It is hoped to tag other islands in the area including one near Murray Island on the Barrier and possibly also Bramble Cay. Certainly a couple of continuing long-term tagging operations are planned for the extreme north.

Selected references to my own research work, particularly on green and loggerhead turtles are given in the bibliography.

The most significant developments to report since the last Morges meeting have all stemmed from generous support given me by Mr. Herbert Mills and the United States National Appeal of the World Wildlife Fund. With the U.S. Appeal's support I was enabled to carry out exhaustive sea turtle natural resources surveys throughout the whole of Queensland. Hence the picture has changed dramatically since my report to the 1969 Morges meeting. Information exists for the whole of the State and follow-up ground work is well advanced as a result of initial aerial surveys. Now that we know the key areas for the various species, applications are being made to secure additional National Parks to safeguard very important nesting beaches.

Furthermore, the support of the U.S. Appeal allowed my knowledge of the Queensland situation to develop to a stage where the Government became actively interested. At the 1969 meeting I was an active proponent of turtle farming - at a pilot research level. The Commonwealth (Federal) Government has now provided funds for research farms which are being sited in eastern Torres Strait. These will be operated at a research level under my overall control for a period of between 3 and 5 years. At the end of this time I will submit a full report on the work to both Federal and Queensland State Governments. This will enable Government to decide whether to allow commercial turtle farming subject, of course, to proper safeguards.

At the time of writing, 5 farms all based on the green turtle, are in operation and a small number of hawksbill turtles are being reared experimentally also. Dr. Harris, an ecologist with interests in energy flow through natural populations of animals, has been recruited to the project and will work both on the penned juvenile turtles as well as on the wild turtles utilizing the turtle grass beds. Productivity studies are long overdue and using this approach we are confident that much new information of both pure and applied interest can be gathered during the next few years.

2. National Requirements

(a) Research

It would appear that the logical research required in Queensland is now in operation. This is not to say that more funds and personnel could not be used to advantage. However, within the framework of our commitments and available funds I feel that real progress is now being made. Provision of additional outside funds for sea turtle research in Queensland no longer has a high priority. However, funds to enable the present delegate to attend this meeting could not be provided by the State of Queensland, and it is appropriate to point out that although I have received every co-operation from the State of Queensland over the many years I have worked there, all funds have had to be raised outside Queensland.

(b) Conservation

No problems exist at present due to the excellent legislation prohibiting exploitation. However, pollution, especially from mining operations in the future, remains a worrying middle-term problem.

APPENDIX I

Western Australia

The current situation is closely reminiscent of the Queensland scene of 7 years ago, when I started my long-term research programme there. The Government is aware of, and interested in, problems of sea turtle conservation. Exploitation is greatly restricted - only two people are licensed to take turtle and then only in specified areas. Full details of turtles taken are a feature of the permits, which are subject to annual renewal.

The Government would welcome any research activity on turtles in Western Australia but would not necessarily commit finance.

What is required is finance to carry out a sea turtle resources survey in Western Australia similar to the one I have just completed in Queensland. This would seem to be the sort of project which W.W.F. should support. The cost to them would not be large, especially when viewed in terms of the likely pay-off. I can state that the Government of Western Australia would give the most careful consideration to any requests for National Parks specifically for sea turtles (these can only be requested when we know what turtles occur where), and would be guided most closely by me, or the expert undertaking the work, in deciding about any future exploitation.

I have just had a letter from the Director of the West Australian Department of Fisheries and Fauna urging me to try to raise finance to undertake the turtle survey.

Western Australia remains one huge area of the world with stable Government and presumably sizeable sea turtle resources, for which information is almost completely lacking. Even the Western Australian (Natural History) Museum holds virtually no turtle material.

## APPENDIX 2

### Fiji

Since the last Morges Sea Turtle Meeting, I have visited Fiji twice and carried out investigations into the sea turtle situation there with support from the Fauna Preservation Society. A detailed report was submitted to the Fiji Government and the public version published in *Oryx* (September 1970).

### Bibliography

- BUSTARD, H.R. (1969) Marine turtles in Queensland, Australia', pp. 80-87 in IUCN Publs. N.S. Supp. Paper No. 20. Morges, Switzerland.
- \_\_\_\_\_ (1970a) The adaptive significance of coloration in hatchling green sea turtles'. *Herpetologica*, 26:224-227.
- \_\_\_\_\_ (1970b) 'The present status of sea turtles and the Fiji iguana in the Fiji islands'. *Oryx*, 10:317-322.
- \_\_\_\_\_ (in press) 'The status of the leathery turtle'. *Oryx*.
- \_\_\_\_\_ (in press) 'Turtles of coral reefs and coral islands'. in 'Goral Reefs', Vol. 1. edited by O.A. Jones and R.E. Endean, Academic Press, New York.
- \_\_\_\_\_ (in press) 'Sea Turtles: Ecology and Conservation'. Collins. London.
- \_\_\_\_\_ and P.M. GREENHAM (1968) 'Physico-chemical relationships in the nest of the green sea turtle, *Chelonia mydas* (L.)'. *Ecology*, 49:269-275.
- \_\_\_\_\_ (1969) 'The nesting behaviour of the green sea turtle *Chelonia mydas* (L.) on a Great Barrier Reef island' *Herpetologica*, 25:93-102.
- \_\_\_\_\_ and C. LIMPUS (1970) 'Nesting behaviour of loggerhead and flatback turtles in Queensland, Australia'. *Proc. Kon. Ned. Akad. Sci. C*.

BUSTARD, H.R. and C. LIMPUS (1969) Observations on the flatback turtle Chelonia depressa Garman'. Herpetologica, 25:29-34.

\_\_\_\_\_ (1970) 'First international recapture of an Australian tagged loggerhead'. Herpetologica.

\_\_\_\_\_ (in press) 'Loggerhead turtle movements'. Brit. J. Herpetol.

\_\_\_\_\_ and K. TOGNETTI (1969) Green sea turtles: a discrete simulation of density dependent population regulation'. Science, 163:939-941.

RESEARCH AND CONSERVATION PROBLEMS IN COSTA RICA

by Archie Carr

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Since the last meeting of the Marine Turtle Group in March, 1969, there have been both advances and setbacks in the outlook for sea turtle conservation in Costa Rica and the Caribbean. Since the beginning of our work at Tortuguero, Costa Rica, the green turtle population under study there has seemed to embody most of the problems and complexities that plague any effort to intervene on behalf of a migratory animal that is at once economically valuable, prone to cross international boundaries in its reproductive travel, and heavily exploited on both its breeding and feeding grounds.

In July 1968, with the help of FAO, representatives of Panama, Costa Rica and Nicaragua met at San José, Costa Rica, and reached an agreement to suspend exploitation of the green turtle for three years pending the development of a plan that would insure:

- (1) survival of the species, and a sustained yield of the green turtle resource, and
- (2) an equitable share in profits from the resource for Costa Rica, custodian of the nesting ground of West-Caribbean *Chelonia*, but without a year-around pasture ground or resident population.

After reaching this accord the delegates went home to get what was expected to be almost automatic ratification for it. Approval was promptly received from Panama and Costa Rica; but no further word of the matter came from Nicaragua, and in subsequent months exploitation of the Miskito Cay green turtles continued there. The Cayman turtle boats that formerly operated on the Miskito Bank were barred from the region, but Nicaraguan turtlers worked with increased intensity. So this promising first international migratory turtle agreement has now dissolved, and efforts to arrange for renewed negotiations ought to be made immediately.

At the Costa Rican nesting ground itself, the situation is somewhat more favorable. Although the harpoon boats have not been wholly barred from the waters off the rookery, their effort has been made less devastating by:

- (1) prohibiting them from approaching to within less than a mile of the shore, and enforcing the restriction by mounting repeated, irregularly-scheduled patrols by a Coast Guard launch; and

- (2) deploying wardens along the beach to disperse the poachers, who either kill the nesting turtles for calipee, or rig them with buoys and release them in the surf so that the waiting harpoon boats can easily pick them up.

For the offshore patrols, the Costa Rican Guard furnished a launch and crew, and the Caribbean Conservation Corporation provided fuel and logistic support. As lodging for the chore patrols, two camps were built by the Caribbean Conservation Corporation on its holdings on the heavily used middle section of the beach, and these were manned by personnel of the Military Police. This dual surveillance on land and sea markedly reduced inroads on the Tortuguero colony during the 1970 season. Moreover, because much of the best part of the nesting beach lies within the limits of the recently approved, but not yet inaugurated, Tortuguero National Park, that section will eventually receive additional attention from the park wardens.

#### Proposed Exploitation of the Pacific Ridley in Costa Rica

Another recent international conservation problem that arose in Costa Rica involved the Pacific Ridley, Lepidochelys olivacea, which nests all along the Pacific coast and at least occasionally forms big nesting aggregations (arribadas) there. In 1970, the Ministry of Agriculture was approached by a foreign representative of the turtle leather industry with a request for a licence to operate turtle boats and a processing plant. An argument advanced in support of the petition was that Mexico was harvesting the resource heavily, and that Costa Rica, by comparison, was regrettably backward in this respect. The capture, in Costa Rican waters, of several ridleys that had been tagged in Mexico was somehow construed as evidence that Costa Rica was contributing ridleys for the Mexican harvest - just as on the Caribbean Coast, Costa Rican green turtles were being harvested in Nicaragua. To some Costa Rican officials who were aware of the unstable survival position of the Pacific ridley in Mexico, the situation seemed to present an opportunity for their country to make a constructive, fore-sighted move comparable to its decision at the Tripartite Green Turtle Conference the year before. Other officials, however, felt that failure to grant the concession would be an unwarranted hindrance of the current effort to increase the production of the sea for human use. For several months, articles for and against the proposal appeared in the press, and sentiment on both sides grew strong. Finally, however, perhaps because word of the decline suffered by the Mexican ridley catch reached Costa Rica, the Minister of Agriculture denied the petition.

This was a precedent-setting decision, and one not easily reached; because the animal involved was not, in the ordinary sense of the word, a clearly endangered species. The Costa Rican officials recognized that the exploitation already going on in Mexico was not based on results of the careful research and statistical data needed to ensure sustained yield, and so should not be augmented by further slaughter elsewhere. In thus resisting pressure Costa Rica has again provided a model that other countries could profitably follow.

Results of Research and their bearing on Conservation Problems

Limits of the Homing Goal at the Tortuguero Rookery

The tagging programme at Tortuguero has continued to provide answers to questions that bear upon survival and management problems. One of these is the uncertainty regarding the character of the signs that are read by a female green turtle when at the end of her migratory journey she selects a place on the shore for her nesting emergence. Although it has not yet been proved, there appears to be a strong probability that when a young turtle makes her first visit to a rookery she goes ashore where she herself hatched several years before, and all her later re-nesting and re-migration returns are made at the same place. The nature and limits of the "goal" involved in these returns, however, have been wholly unknown. Local people familiar with green turtle rookeries often claim that a turtle comes back to "exactly the same spot" on each successive visit. This could by logic hardly be the case, because exact spots on ocean beaches rarely retain their characteristics from one year to another. Smells change and disappear, because wind and waves recover the surface or strip it away; drifted logs come and go; offshore vegetation grows, dies, or is modified by storms and hurricanes. Even the subsurface topography of the approaches to the beach - the arrangement of spits and gulches produced by the changing local current regimen - which might serve as site signatures, are in most places wholly revised within any given year. Obviously, then, the homing mechanism of a female turtle that hatched at Tortuguero, say, and passed her immature life in a Nicaraguan pasture, is not one of detecting such signs as those. A bird may culminate each year's breeding migration by nesting on the same limb of the same tree, but from logic alone, it seems unlikely that the homing goal of a green turtle could be any such clearly defined solid landmark as that.

In fact, it would seem probable that a discrimination process based on rigid topographic cues would, for a green turtle, bring ultimate disaster. A much more useful homing sense would be one that took the bearer back to a short section of the shore without depending on the evanescent features of foreshore topography as recognition signs. This logical conclusion now seems supported by tag-return data at Tortuguero. We are no closer to understanding the nature of the goal, but its limits can be at least roughly determined. What the usual (modal) female turtle returns to is not any recognizable physical feature of the shore, but simply a 200-metre section of it. The average for some 865 returns was found to be a 1.4 km interval, and the range in return-intervals was from 0-29 kilometres. While delimiting the goal in this way does nothing for our effort to explain the homing sense, and even less to solve the durable problem of understanding the open-sea navigation sense, it does suggest a mechanism for the ecologically advantageous tendency to rendezvous at a good stretch of shore despite year-to-year changes in the local physical features of that shore. Moreover, the range in return-intervals suggests that new nesting colonies might be formed by occasional strays from the main aggregations. There remains, of course, the problem of determining what there is about any single 200-metre

bit of a steadily changing ocean beach that make it recognizable to the arriving migrant.

#### Growth after Maturity, and the Reproductive Cycles

Little has been known of the growth rate of the Atlantic green turtle after sexual maturity is reached. The growth of females in intervals between successive returns to the Tortuguero nesting shore is so slight that for some years it fell within the limits of our measurement error. Now, finally, it can be shown that a turtle of the East-Caribbean colony, once she has nested, will grow in overall shell length about 2.54 mm per year. It took many years' accumulation of data, and considerable statistical manoeuvring to establish this figure, but it appears to be fairly reliable, for Costa Rican female green turtles at least.

Another question that has been answered was whether in a given female, the two-year and three-year nesting cycles are fixed, or whether she may shift from one to another as time goes by. It is now clear that such shifts occur, and that changes from the three-year to the two-year period are much more frequent than the other way around. A sudden unexplained increase in such shortened periods appears to have contributed to the exceptionally heavy nesting on Tortuguero beach during the 1969 season, and it seems probable that such shifts may regularly influence reproductive intensity. There is some evidence of a four-year nesting cycle at Tortuguero, but it will take more time to test the reality of this. Meanwhile the possible existence of normal cycles longer than three years should be looked for at other nesting grounds.

An obstacle to understanding population levels and changes in the Tortuguero colony has been the impossibility of determining whether a female that arrives without a tag is actually a new nesting recruit, or was simply missed by tagging crews on previous trips to the beach. This problem has been aggravated by what appears to be a broad range in shell-length in the turtles at the time they reach maturity. It seems evident that some of the larger individuals in a population are big because they are old, while others are above average in size because of hereditary or ecological factors - that is, because they grew big before becoming sexually mature and going to the nesting beach. It has thus not been possible to say that a given small nester is young, and that a given big one is old, and this uncertainty has hindered appraisal of events in the breeding colony. Although it is still not possible to distinguish between young and old females in the larger size groups, it is now clear that any Tortuguero female with a shell length of one metre or less that arrives without a tag is almost always a neophyte, and not just an individual that was missed on previous migrations.

Knowing this affords another means of explaining fluctuations in the nesting colony. At Tortuguero in 1969, besides the increase in breeding produced by the shortening of reproductive cycles, there was a significant increase in



the number of one-metre neophytes. While the increase caused by cycle-change was no true gain in the colony, that due to the arrival of more neophytes was a real increase. The greater number of recruits was perhaps attributable to some of the conservation advances made on the rookery during the period from six to ten years earlier. The importance of the one-metre index as a criterion in judging trends in the population is obvious.

#### The Question of Composite Breeding and Feeding Colonies

Once the green turtle had been shown to be a long distance migrant, the next question to be answered by the tagging programme was whether the whole breeding colony at Tortuguero came from a single residence ground or from several parts of the Antillean Caribbean region. The latter soon proved to be the case. This information made it clear that the population could be effectively protected only by international agreement. Now, a related but somewhat more intractable question of ecological geography seems about to be answered. It is whether a given resident population includes turtles from only one, or from more than one breeding ground. Information on this point is coming from the coast of Brazil, where tag returns from the Ascension Island programme have heavily overlapped those from the tagging project at the Eilanti Reserve in Surinam. While there is some evidence to support the strong geographic implication that Ascension and Surinam green turtles are genetically slightly different forms and that both are different from the Caribbean green turtle, this has not yet been corroborated. The Ascension nesters are recruited from both north and south of the Bulge of Brazil, and evidently from nowhere else. The northern localities extend northward along the coast to Paranaiba. During the past two years, returns of tags put on turtles at Eilanti Beach have come in from various localities south of the Amazon mouths. The southernmost of these was Natal. It is therefore clear that two green turtle populations of widely separated points of origin deploy along the northern coast of Brazil and overlap there for a distance of at least 500 miles.

SEA TURTLES IN THE GALAPAGOS ISLANDS

by P.C.H. Pritchard

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Two species of Sea turtle - the East Pacific green turtle, Chelonia mydas agassizi, and the hawksbill, Eretmochelys imbricata - have been recorded from the Galapagos Islands. The hawksbill is rare, and even local residents have never seen it nesting. The green turtle, however, is quite abundant and nests on many of the islands. Nesting takes place in nearly all months of the year, but is concentrated in the months of December, January, February and March. This nesting season coincides roughly with the 'wet' season in the lowlands; at other times of the year it is probable that the extreme heat and dryness of the sand in the nesting areas is detrimental to incubation of eggs as well as the excavation of the nests. The most important nesting areas are as follows:

James Island: Espumilla Beach in James Bay; also small unnamed beaches along north-east coasts.

Bartholomew Island: both beaches, but principally the south-west one.

Indefatigable Island: many small beaches along the north coast, from the north-east corner of the island to Borrero Bay.

South Seymour (Baltra) Island: extensive beaches on west and south-west parts of island.

Albemarle Island: Quinta Playa, between Villamil and Cape Rose; some nesting also at Urvina Bay, Black Cove (north of Tagus Cove), and on small beaches north-east of Cape Berkeley.

Some nesting also occurs on Bindloe, Hood, Charles, and Barrington islands, but the precise extent is unknown.

On many beaches, extensive areas of rough lava rocks are exposed by low tide, and turtles are forced to nest at mid- or high tide; where such rocks are absent, most nesting takes place in the first half of the night. Nesting occurs during all phases of the moon, but is most abundant at spring tide and full moon. Surprisingly little nesting occurs on two of the best and largest beaches in the islands - Tortuga Bay in south Indefatigable Island, and Villamil Beach in south Albemarle. This may be because of their exposure to direct impingement by the Humboldt Current.

Galapagos green turtles are substantially smaller than those of the Atlantic Ocean, the average carapace length of breeding females being about 32 inches, and the average weight probably about 150 lbs. Clutch size is also smaller,

and it is very rare to find a nest with more than 100 eggs, the average being about 80. Inter-nesting intervals are not known. About 185 turtles were tagged on various beaches in the islands in January to March 1970, and about the same number in early 1971; no turtles tagged in 1970 were found in 1971. The migrations of the Galapagos turtles, if any, remain unknown; a single turtle tagged at James Bay was recovered several months later at Puerto Nunez, Indefatigable Island. Turtles are reported to be seen much less frequently in the mid-months of the year than in the breeding season; on the other hand they have no necessity to leave the islands in search of food as they have plenty within very short distances of the nesting beaches. Caulerpa algae and mangrove roots and shoots apparently form a substantial part of the diet. Very little data are available on the presence of turtles off the Ecuadorian coast, but green turtles sold in the market in Guayaquil are said to have been caught near the island of Puna in the mouth of the Guayas River.

There is no evidence that turtles are presently diminishing in numbers in the Galapagos Islands, and no special conservation programmes are necessary except that a substantial total number of turtles should be tagged to investigate the possibility of their migrating to other areas and being slaughtered in excessive numbers. Present mortality in the islands may be summarized as follows:

Loss of eggs:

At James Bay (though not apparently on other beaches), nearly all eggs laid are eaten by feral pigs. José Villa spent four months on James Island in 1970, and shot about 1,500 pigs; however it is estimated that about twice this number remain and their reproductive potential is very high. A very small number of people eat turtle eggs, but I doubt if more than a dozen or two nests a year are used for this purpose. On beaches of very high nesting density (such as some of those of northern Indefatigable Island), turtles nesting towards the end of the season are liable to destroy the nests of earlier turtles by their own nest excavations.

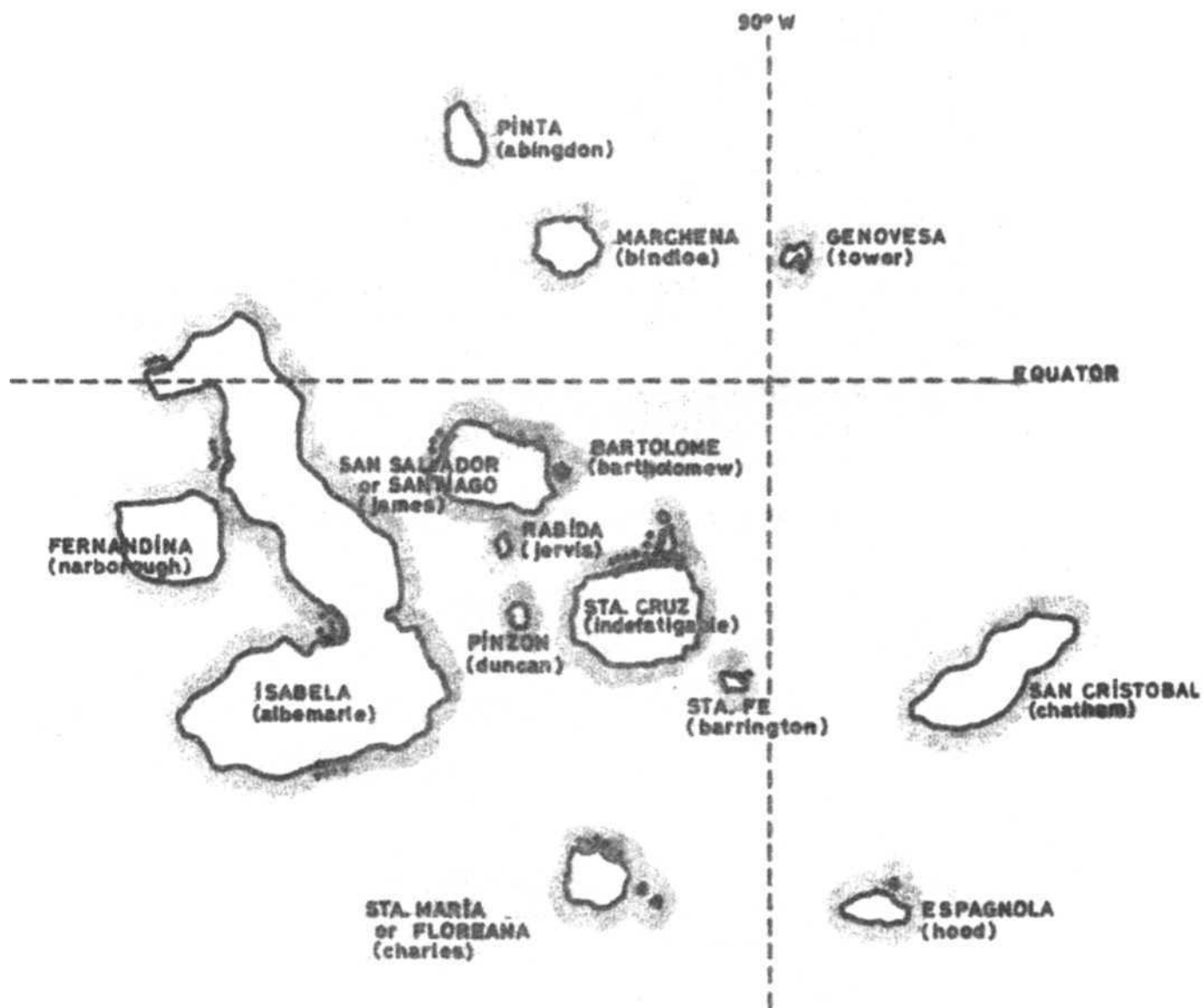
Loss of hatchlings:

Hatchlings are eaten in some areas by feral cats, as well as by night herons and some other birds. Frigate birds eat nearly every hatchling that emerges from its nest by daylight in some areas; however, daylight emergences are comparatively few and tend to occur during cloudy, damp weather when surface sand temperatures are lower than usual. Ghost crabs are plentiful on some beaches, and they probably kill small numbers of turtles.

Loss of adults:

A few people in the islands eat turtle meat from time to time, but nowhere could it be considered a regular item in the menu except at the Ecuadorian military base on Baltra Island, where between 20 and 30 personnel

are stationed. When supplies run low it is common for a turtle to be picked up on one of the southwestern beaches for the mess-hall. I was informed that one turtle is used for this purpose every two or three weeks. Probably a greater source of loss of turtles on Baltra is the death of turtles which become disorientated after nesting and fail to re-locate the sea. Baltra is a very low island, while the beaches are moderately steep. The sea cannot be seen from a turtle's eye level over the hump of the beach, and a small percentage of turtles lose their way after nesting, eventually to perish in the equatorial sun. In February 1971 about thirty turtles in various stages of decay, from almost intact animals to piles of powdering bones, could be seen behind the beaches of south-west Baltra. One comes across turtles dead from unknown causes, both floating or on beaches, from time to time in many parts of the archipelago. The extent to which the abundant sharks prey upon turtles is unknown, but groupers are known to feed upon hatchlings. Legislation presently in force prohibits the export of any turtle product to the mainland, and it is not even possible for scientists to obtain permits for the export of small numbers of hatchlings.



GALAPAGOS ISLANDS, SHOWING PRINCIPAL NESTING BEACHES OF EAST PACIFIC GREEN TURTLE, CHELONIA MYDAS AGASSIZI

SEA TURTLES IN FRENCH GUIANA

by P.C.H. Pritchard

Department of Zoology, University of Florida

The most important sea turtle nesting beach in French Guiana - and one of the most important in the world - is situated between Point Isère, at the confluence of the mouths of the Mana and Maroni Rivers, and the mouth of the Organabo River. Although there appears to be no standardized name for this beach, the name Silébâche is used by some of the local people. The beach is composed of silica sand with, in some parts, a considerable admixture of shell, and in many stretches the sand is fronted or underlain by mud. In one or two places over the ten-mile stretch of heavily-nested beach, mangroves reach right down to the sea. The beach is unstable, and large amounts of the beach material are eroded away each year and re-deposited further to the west; recent inundation with sea water has killed trees for one or two kilometres behind the beach, and the forest is now represented by bleak, rotten stumps standing in warm, muddy water.

The beach is by far the most important nesting ground in the world for the leatherback turtle, Dermodochelys coriacea. The peak months appear to be May to July, but considerable nesting takes place both before and after these dates. On a good mid-season night it is estimated that about 300 leatherbacks nest; on any night in July 1969 or 1970 the investigator could tag well over one hundred leatherbacks on a single walk to the end of the beach and back; these tagging programmes indicate that turtles re-nest at intervals of around ten days, and may nest seven or eight times within a season. A few turtles tagged by Lands Bosbeheer personnel in Surinam during both the 1969 and 1970 seasons were found re-nesting later in the same season on Silébâche Beach. As yet no recoveries of turtles from one season to another have been made.

Four other species of sea turtle have been recorded nesting at Silébâche; the green turtle (Chelonia mydas) and the olive ridley (Lepidochelys olivacea) are both moderately common, the former somewhat more than the latter; up to about five green turtles, and two ridleys, have been encountered in a single night. The loggerhead (Caretta caretta) has been seen once, and the hawksbill (Eretmochelys imbricata) two or three times.

Existing protective legislation:

No turtles may be killed or turtle products sold, nor eggs collected, between 1 May and 31 July (a period which encompasses the three months of most intensive breeding).

Enforcement:

Nil.

Mortality of adult turtles:

During both 1969 and 1970, a few dead leatherback turtles were seen on the nesting beach. In two cases it was evident that the turtle had become trapped behind huge piles of dead trees and roots, and had not been able to reach the sea after nesting. Death in such cases probably follows both from excessive insolation and exhaustion, coupled with respiratory problems on land. Several other turtles were found dead, but without signs of external injury or of having been trapped. It is possible that turtles occasionally die from the exertion of crawling on land, this possibly being the most strenuous phase of the animal's life cycle.

Up to 1967, a few adult leatherbacks were killed each year by shark fishermen, who used the animal's flesh for bait. However, this practice appears to have stopped; not only is it now illegal, but the principal organizer of the business, the former Mayor of the town of Iracoubo, is no longer resident in the country. Turtle meat is very rarely eaten in French Guiana, the meat having been fed in large quantities to political prisoners at St. Laurent and on Devil's Island, in the 1940's; consequently the meat is now a low-status food, only considered suitable for prisoners. Occasional turtles are killed on the nesting beach by jaguars. Since the jaguar itself is a diminishing species, and only a few turtles are killed in this way, no interference with this entirely natural predation is recommended.

Losses of turtle eggs:

The Carib Indians living on the banks of the Marowijne and Mana Rivers still collect leatherback eggs, but principally in the vicinity of their villages. Only rarely do they make the arduous trip to the main beach and, when there, probably do not collect more than 3 or 4 per cent of the eggs laid on any particular night. The practice is, strictly speaking, illegal, but it is probably not necessary, or even politic, to enforce the law unless violations get out of hand.

Rather large numbers of nests are lost by beach erosion; an appreciable proportion of nesting leatherbacks nest very close to the sea, and their nests are destroyed by the next spring tide or by the constant washing away of beach material. Short of a massive transplantation programme, there is nothing that can be done to offset this loss of eggs.

Towards the end of the breeding season, nests are so densely packed over several miles of beach that perhaps one turtle out of five destroys an earlier nest when excavating its own egg cavity.

Loss of hatchlings:

Ghost crabs are moderately numerous on the beach, and they kill some hatchlings. When a clutch emerges by daylight - as happens when the surface sand has been cooled by persistent rain - there is sometimes a heavy mortality from black vultures (Coragyps atratus) which are always present in quite large numbers on the beach.

Despite these various losses, the overall outlook for the population appears to be very good. Probably fewer than one adult nesting emergence out of several thousand results in the female turtle dying while on the nesting beach and, despite the various losses of eggs, it is possible on any night in June or July to see hundreds of hatchlings within fifty yards of camp; the total numbers reaching the sea successfully must be extremely high.

In 1969 and 1970, over 1300 adult turtles were tagged with 'Hasco' brand cattle-ear tags on the proximal part of the trailing edge of the front flipper; the tag is numbered, and on the reverse side a reward is offered in Spanish and English, and the University of Florida address given. As yet no tags from leatherbacks have been sent in nor have any season-to-season recoveries been made on the nesting beach, though they might be expected in 1971. On the other hand, hundreds of instances of re-nesting within a season have been recorded. The method of tagging is not 100.% satisfactory, as the shell of the turtle can be damaged by the tag during the vigorous foreflipper movements associated with nesting, and there is also some indication that the flesh posterior to the point of the tag can become necrotic and allow the tag to slip off.



NATIONAL AND REGIONAL REPORTS: MEXICO

by Gustavo Casas Andreu  
Sub-secretaria de Pesca, Mexico City

Progress in Programmes of Research and Management

Mexico has continued with its programmes of research and conservation of the sea turtles which visit its beaches. These programmes were initiated in 1966. The processes employed are known to all the specialists here present since they were put forward in the 1969 meeting by Sr. Montoya. For this reason I shall confine myself in this report to pointing out the results obtained during 1969-70.

Generally the programmes mentioned are carried out on beaches classified as major nesting zones, namely:

A. Pacific Ocean

- A.1. 'La Escobilla' Beach (96°44' Long. W and 15°47' Lat. N) in the Municipality of Cozoaltepec, State of Oaxaca. Lepidochelys olivacea, Chelonia mydas agassizii, Dermodochelys coriacea schlegeli and occasionally Eretmodochelys umbricata squamata nest here.
- A.2. 'La Piedra de Tlacoyunque' (101°82' Long. W and 17°16' Lat. N), Municipality of Tecpan de Galeana, State of Guerrero. All the species previously mentioned also come to nest in this locality.
- A.3. 'El Playon de Mismaloya' (105°00' Long. W. and 19°59' Lat. N), Municipality of Tomatlan, State of Jalisco. Again, all the species mentioned above come to nest on this beach.

B. Atlantic Ocean (Gulf of Mexico)

- B.1. 'Barra Coma' (97°50' Long. W and 23°10' Lat. N), Municipality of Villa Aldama, State of Tamaulipas. This locality is frequented only by nesting females of Lepidochelys kempii.

Results of the Research and Management Programmes

The programmes have been chiefly dedicated to Lepidochelys kempii and to Lepidochelys olivacea, and only incidentally to other species. The results have been:

Year 1969

- A.1. 'Playa La Escobilla', Municipality of Cozoaltepec, Oax. Work was started in the month of August and concluded in the month of November. Protection was given to a total of 30 females of Lepidochelys olivacea, which successfully laid eggs. 34,914 eggs were kept under watch, from which 22,234 hatchlings were obtained.
- A.2. 'La Piedra de Tlacoyunque', Municipality of Técpan de Galeana, Gro. Work began in the month of July and concluded in the month of November. Protection was given to a total of 1,000 females of L. olivacea which arrived on the beach to lay their eggs. Altogether 90,000 eggs were kept under watch during incubation, from which, during the period of the operation some 15,000 young turtles emerged, among which a mortality of 1.5% was recorded.
- A.3. 'Playon of Mismaloya', Municipality of Tomatlan, Jal. In this region, work was begun in the month of July and concluded in the month of September. Protection was given to a total of 150,000 females which nested in this zone. Altogether, some 237,700 eggs were kept under watch during incubation, from which a total of 187,500 young L. olivacea was obtained.

On the basis of this experience, it can be estimated that something of the order of 5 million hatchlings of L. olivacea emerged in natural conditions. The incubation period was 50 days on average, at a temperature of 29°C.

- B.1. 'Barra Coma', Municipality of Villa Aldama, Tama. In this zone the work was started in the month of April and concluded in the month of July. Protection was given to a total of 10,000 females of Lepidochelys kempii. Altogether 37,690 eggs were kept under watch during incubation, losses amounted to 6% and 35,428 hatchling Lepidochelys kempii were obtained.

Year 1970

- A.1. 'Playa La Escobilla', Municipality of Cozoaltepec, Oax. Work was begun in August and concluded in November. Protection was given to the total of 60,000 females of L. olivacea which nested on this beach. There was no control during laying and incubation, but the nests made by the turtles in undisturbed natural conditions were then given full protection from the attacks of dogs and large birds, which are very abundant in this area. This protection is very probably the accounted for the fact that there was only a 20% mortality.

In the month of August and again in October, masses of female L. olivacea arrived on the beach to nest, generally when there was a strong wind from the south.

- A.2. 'La Piedra de Tlacoyunque', Municipality of Tecpan de Galeana, Gro. For reasons outside our control, no work was done in this area during 1970, due to mistakes made in the administration of the funds required for financing the operation.
- A.3. 'Playon de Mismaloya', Municipality of Tomatlan, Jal. In this zone, work was begun in the month of July and concluded in October. Protection was given to a total of 60,000 females of L. olivacea, which came to nest on this beach. 128,200 eggs of L. olivacea were kept under watch during incubation, 76,200 hatchlings being obtained, which indicated a mortality of 40%. In this locality, also, the peak numbers of females visiting the beach were recorded in the months of July and August, during the incidence of very strong southerly winds.
- B.1 'Barra Coma', Municipality of Villa Aldama, Tampa. Work in this area was begun in the month of April and concluded in the month of August. Protection was given to the total of 2,000 females of L. kempii which arrived to nest on this beach. A total of 32,620 eggs was kept under watch during incubation and a mortality of 42% was observed. Thus only 19,748 hatchlings were obtained, in which there was a further mortality of 2% after birth, so that the total actually released into the sea was 19,353.

The presence on the beach of groups of females, small in comparison with those of the Pacific coast, was recorded in the months of April, May and June, when there was a strong north wind.

In order to check the weights and growth rate of newly emerged hatchling L. kempii, data were obtained from a sample of 100 hatchlings: at three days after emergence, their total length averaged 7.15 cm and their weight averaged 23.30 grams; at 23 days after birth, the average total length recorded was 7.71 cm and average weight 27.70 grains, that is to say an increase of 56 mm in length and 4.40 g in weight.

#### Marking Programme

In continuation of the tagging programmes carried out by Mexico since 1966, 160 specimens of Lepidochelys kempii were tagged in 1969 on the beaches of Barra Coma, Tampa. On the Pacific coast, 34 examples of L. olivacea were tagged on the beaches of Mismaloya, Jalisco, and 800 on La Escobilla Beach, Oaxaca.

The tagging of L. kempii has not produced results of any particular importance, the information obtained falling within the limits of what was already known. Similarly, recoveries of tagged L. olivacea have been of little significance, since they were all of turtles recaptured in the vicinity of the beaches on which they were marked.

### Productivity<sup>1</sup>

Analysis of the records shows that, as compared with the 1967/68 breeding seasons, when 752,765 marine turtles were captured (752,350 on the Pacific Ocean coast and 415 on that of the Gulf of Mexico), the total catch in the year 1969/70 seasons was only 104,361 (104,337 for the Pacific and 24 for the Gulf of Mexico, the latter figure probably an error which needs further checking). The general conclusion to be drawn from these provisional official figures is that there was a decline of no less than 86.1% in turtle production in Mexico as between 1967/68 and 1969/70. We have attributed this drop in production to two fundamental factors: first, that it is very probably due to a real decrease in the size of the turtle populations, even if there is insufficient scientific and technical information to prove conclusively that this is one of the reasons; and secondly, that it was due to a fall in the international market for the purchase of products derived from Mexican sea turtles. In the light of this very alarming fall in production, the Mexican Government, through the Fisheries Department of the Ministry of Industry and Commerce, is at the present time taking all necessary steps to put into effect measures (if needs be, drastic ones) for the conservation and building up of the marine turtle stocks to be found on the coasts of my country.

### Legislation

In respect of the last-mentioned point, the Mexican Government takes the view that its existing legislation for the protection of marine turtles is sound and probably only needs slight changes and additions to make it still better. It is also worth pointing out that the Mexican Government has every intention of strictly enforcing the law in order to ensure the more effective management of what is recognized as an important natural resource.

### Future Programme of Research into and Conservation of Marine Turtles in Mexico

1. To continue and amplify the programmes established during the last five years.
2. To initiate studies of population dynamics in marine turtles, as a basis for improved management of the resource.
3. The establishment of national reserves both on the nesting beaches and in the open sea.
4. To initiate experimental work on breeding of turtles under controlled conditions.

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<sup>1</sup> Figures given in this section have not yet been officially confirmed by the Mexican Government.

Extract from Técnica Pesquera, 25 December 1970, Mexico, D.F., pp. 7-8 (Translation).

Biologists are worried over inadequate protection of marine turtles

The obstacles that the Mexican turtle programme is encountering and the increased clandestine exploitation of eggs, meat, and turtle skin during the close season are causing Mexican and foreign biologists to worry over the fate of the Pacific ridley turtle, Lepidochelys olivacea, which is intensively exploited.

Until a short time ago, it was believed that the survival of the species was guaranteed by the programme of breeding and protection established by the Mexican Government, and by the precautions taken to insure rational exploitation. The situation now seems less promising, however, and could be said to be very disturbing.

As we pointed out in our last edition, this year money was available only to install two hatchery and surveillance camps on the Pacific coast where the ridley nests. The year before, there were three camps; and during the first season of the programme four were established. Moreover, the programme this year was delayed seriously and one of the three camps planned had not been installed by August 21, at least a month behind schedule. This was the camp at La Escobilla, in the State of Oaxaca. The reason for the delay was that the Secretary of the Navy did not allocate for the protection of the camp staff the detachment of Marines that had been requested. This protection is indispensable, since in that zone, which is isolated and lacking in government control, there are some very aggressive poachers. Last year there was an incident in which a clandestine egg poacher was killed, and it seemed likely that his companions, in revenge, would attack the workers at the camp.

La Escobilla is a very important nesting locality of the ridley, and if a camp is not installed there millions of eggs and tens of thousands of animals will be left in the hands of the poachers. If the butchery and pillage of nests that the biologists fear were allowed to take place, the consequences could be very serious.

Moreover, all along the Pacific coast illegal exploitation continues during the close season. The situation is particularly scandalous in the State of Guerrero: detailed reports of infringement have been repeatedly made to the authorities of the Port of Acapulco - with names of the poachers, licence numbers of vehicles that are being used, places where the illegally captured turtles have been taken, places where the eggs are stored, routes used in the illegal distribution -, but the fishery authorities have still

done nothing to stop the illegal traffic, although as we have previously indicated in Tecnica Pesquera, enforcement of the law could very easily be brought about in this locality.

All these adverse factors are nullifying the effects of the Mexican turtle programme, which was once pointed to as a world example of its kind. It is to be feared that there will soon be a drop in the ridley population, with resulting heavy losses to the industrial establishments that have made very large investments in the exploitation of this species.

MARINE TURTLES IN THE STATE OF SABAH, MALAYSIA

by G.S. de Silva  
Chief Game Warden, Sandakan

General

Two species of turtle, Chelonia mydas and Eretmochelys imbricata, nest on some mainland beaches in the State, also on several islands situated in the West and East Coast Residencies. A third species (unidentified) is reported to nest in the Kudat area (northern tip of the State) during the North-East Monsoon. It is known locally as "PENYU BULU" and is described to be a reddish (?) medium sized turtle. In other areas in the same region, the coastal inhabitants report a species known to them as "MORONG". The pagan Rungus refer to the same (?) turtle as "RAJA KAYA". It is quite possible that the same unidentified species is referred to by different names - a practice that is common locally. Attempts have been made to secure specimens, but moonsoon weather makes travelling by road impracticable and by boat impossible.

Chelonia mydas - Nesting beaches

During the last two years, it has been possible to explore new areas and investigations reveal that the Green Turtle nests on the following beaches in varying numbers: Pulau Selingaan, Pulau Bakungaan Kechil, Pulau Gulisan, Pulau Tegapil, Pulau Lankayan, Pulau Bilean, Pulau Koyan Koyaan, Pulau Nunu Nunukan, Pulau Mantanani Besar, Pulau Patanunan, Sikqati beach, Kurungan to Bangan, Rampayan Beach, Kualii Abai to Pulau Silad, Pulau Egot, Pulau Ukusan, Ambong Beach, Kg. Karambui, Koromkinjaan Beach, Pulau Sipadan and Pulau Kukuban. It is also known to nest on Labuan island, Tuaran and near Kota Kinabalu (rarely). With the exception of the first three islands mentioned, all the other areas need further investigation.

It is estimated that about 750 turtles nested on Pulau Selingaan, 175 on Pulau Bakungaan Kechil and 140 on Pulau Gulisan during 1970.

Eretmochelys imbricata - Nesting beaches

Pulau Selingaan, Pulau Gulisaan, Pulau Bakungaan Kechil, Pulau Bilean, Pulau Tegapil, Kota Belud, Pulau Mantanani, Pulau Lankayan and in the Kudat District. Many other areas need investigation. The best laying months for 1970 were January, February and March. It is estimated that 7 turtles nested on Pulau Selingaan, 2 on Pulau Bakungaan Kechil and 6 on Pulau Gulisaan during 1970.

### Exploitation

Turtle eggs are legally harvested under licence on Pulau Selinggaan, Pulau Bakungaan Kechil and Pulau Gulisaan. It is also legal for natives to collect turtles from Turtle Eggs Native Reserves, i.e. from the foreshore along the mainland from Tanjong Nosong in Kimanis Bay to Kota Kinabalu (Jesselton) wharf; from Pulau Tiga and Pulau Gaya; from Pulau Sipadan in Tawau Residency, Kudat District and the whole of the Kota Belud District, including the islands of Pulau Mantanani Besar, Pulau Mantanani Kechil, Pulau Langgisaan, Pulau Ukussan, Pulau Silar, Pulau Pandan-Pandan and Pulau Egot.

### Nature of Exploitation

Prior to 1966, all eggs laid in the areas constituted as Turtle Farms and Turtle Eggs Native Reserves were harvested. Due to lack of staff the close season in March has only been enforced in areas which are easily controllable. The consumer demand in Sandakan for turtle eggs is great and the current market price is 11 cents each (approximately 3½ cents U.S.). On the turtle farms, north of Sandakan, the eggs are harvested on annual licences issued exclusively to natives. The eggs are transported to Sandakan once a week by boat. The licences are offered to the land owners of the three islands at the rate of 2½ cents multiplied by the estimated average out-turn of the island for the year. The price of eggs in other areas is liable to fluctuation. There is no export market at present, but the eggs could presumably be sold in Singapore and Hong Kong. I am reliably informed that there is a demand for turtle eggs in Hong Kong's "red light district", but the potency of turtle eggs as an aphrodisiac is as yet unknown to the writer. However, these avenues for export have not been investigated. Table I gives the harvesting records for the three islands during the period 1965 - 1970.

### Turtle products

Nil.

### Conservation authorities

The Conservator of Forests is by act of law the Chief Game Warden. All game matters are handled and the laws enforced by the Senior Game Warden, who is the executive head of the Game Branch of the Forest Department. Under the Act, Deputy Game Wardens, Assistant Game Wardens, Hon. Game Wardens, Game Rangers and Assistant Game Rangers have been appointed.

### Legislation and present policy

With the repeal of the archaic Turtle Preservation Ordinance of 1952, the Fauna, Conservation Ordinance 1963 and the Fauna Conservation (Turtle Farms) Regulations 1964 came into operation, and all matters connected with turtle conservation passed into the hands of the Chief Game Warden. Under the old



ordinance, District Officers were responsible for all matters concerning turtles. With the formulation of a conservation policy, the issue of turtle hunting licences was discontinued forthwith and the close season in March was to be enforced. Owing to the paucity of staff, inadequate transport and the threat of piracy in the Sulu Seas, the latter directive was not implemented. However, in 1968, with the availability of transport, staff and funds, the laws were gradually enforced within the Sandakan Residency.

#### The need for conservation

Little attention has been paid to the fact that thousands of eggs have been annually harvested for over 30 years with insufficient eggs left intact to hatch. During the occupation, hundreds of turtles were slaughtered by the Japanese in rookeries north of Sandakan. Native pagans in the Kudat area, still slaughter turtles for food without inhibition and the concept of totally exploiting an easily procurable resource is ingrained. Local fishing vessels surreptitiously cater for the increasing demand on the mainland. Ships of other nations hunt turtles in the seas adjacent to our territorial waters and this is impossible to control. The Japanese, well aware of the demand, are raping the South China, Sulu and Celebes Seas. Turtles are also frightened away from the nesting beaches by brightly illuminated fishing vessels. Finally, dynamiting of fish occurs near islands frequented by nesting turtles. Dynamiters apprehended "in flagrante delicto" emphatically denied killing turtles deliberately. However, they freely admitted that occasionally a turtle or two were killed by the force of the explosions. Dynamiting fish near Pulau Belian has gone on sufficiently long to exterminate marine fauna in this area, and at the same time adversely affect breeding turtles found there. Explosives are purchased from Filipino fishermen, or from "kumpits" bringing immigrants to Sabah from the Philippines.

#### Conservation

Under the existing State Laws, Green and Hawksbill Turtles are protected. No turtle eggs can be collected anywhere in the State during the month of March in any year. This has been enforced since March, 1968 as previously stated. Lack of staff precludes the enforcement of this law elsewhere. Since 1966, a hatchery has been in existence on Pulau Selingaan and up to the end of October, 1970, 238,384 hatchlings have been released at sea. Tables II and III give hatchery statistics for the period 1966-1970.

Government has now accepted the recommendations of the Chief Game Warden and has agreed to obtain and convert Pulau Selingaan, Pulau Bakungaan Kechil and Pulau Gulisaan into a Game Sanctuary for turtles. This project has been included in the Second Malaysia Development Plan. Negotiations are now taking place between the owners of the islands and Government. To fund this project, a substantial sum of money has been raised through friends in the United States of America.

### Education

Illustrated talks have been given to schools and an excellent 16 mm film of turtle conservation in Sabah was produced by Bill Burrad Television Company, Los Angeles, California. It had a very good reception on international television, and has been made available for public showings in Sabah.

### Long Term Proposals

The Turtle Islands comprising Pulau Selingaan, Pulau Bakungaan Kechil and Pulau Gulisaan will be converted into a Game Sanctuary for marine turtles during the course of the Second Malaysia Development Plan (1971-1975).

### Research

A turtle tagging programme was inaugurated on 10 July 1970 and up to 31 December 1970, 651 turtles have been tagged (641 female Green Turtles, and 10 Hawksbill Turtles). Up to now there have been no long distance recoveries. Nesting patterns of tagged turtles suggest that re-nesting occurs between 6 to 8 times while at the breeding grounds.

Experiments are being conducted to find out the optimum conditions necessary for hatching transplanted eggs. This is done for the purpose of improving hatchery techniques and hatchling output. For the purpose of lowering the mortality rate from marine predators, turtles will be reared in pens or tanks for about 3 months prior to release.

### Personnel involved

Work is presently undertaken by the staff of the game branch. Hatchery staff comprises one Game Ranger, two Assistant Game Rangers, one boatman, and a labourer if and when necessary.

### National Requirements

#### Research

It is necessary that a survey be conducted throughout the State to ascertain the main colony sites for the two (possibly 3) species of turtles.

#### Interest of Government

The Government of Sabah is very interested in the conservation of turtles and has since 1966 financed all projects connected with marine turtle conservation. Government now proposes to acquire the Turtle Islands from private ownership and convert them into a Game Sanctuary under the Second Malaysia Development Plan. Government has also agreed to make available M\$ 150,000/- for the development of the Sanctuary for marine turtles.

In April 1970, 136 Hawksbill turtle and 126 Green turtle carapaces preserved in formalin were brought to Sandakan for transshipment to Nansi Corporation, Osaka, Japan, by a Filipino barter trader from Bongao. In September 1970, another consignment comprising 200 carapaces and 300 turtle plastrons and flippers were brought to Sandakan for transshipment to Osaka by another barter trader also from the Philippines. This consignment was accompanied by a certificate from the Fisheries Officer, Siasi, Sulu, Philippines, to the effect that the turtles were killed in Philippine waters. As the barter trade and transshipment is legal, the export was permitted. To prevent the ports of Sabah being used as convenient collecting centers for the export of turtle shell, etc. the competent authority has, in accordance with established conservation policy, taken up the matter with the Federal Government with a view to amending an existing gazette notification. When this has been effected the import of turtle products from any source into the State and their export from the State will be absolutely prohibited.

Table I  
Turtle egg harvesting records - 1965/1970

Island	1965	1966	1967	1968	1969	1970	Total for 6 years
P. Selingaan	284,940	236,191	437,258	175,097	405,345	359,848	1,898,679
P. Bukungaan Kechil	126,930	73,617	128,894	60,052	144,757	97,140	631,390
P. Gulisaan	63,580	55,622	111,123	63,648	100,228	82,605	476,806
	475,450	365,430	677,275	298,797	650,330	539,593	3,006,875

Table II  
Chelonia mydas - Hatchery Statistics - 1966/1970

<u>Period</u>	<u>No. of eggs</u>	<u>Hatchlings</u>	<u>% hatch</u>
1st August - 30th Sept. 1966	21,092	15,005	71.14%
27th July - 30th Sept. 1967	37,493	33,966	90.59%
4th March - 4th Nov. 1968	137,500	96,951	70.51%
1st Feb. - 31st Dec. 1969	50,053	31,729	63.39%
1st Jan. - 30th Oct. 1970	75,362	49,181	65.30%
Total:	<u><u>321,450</u></u>	<u><u>226,832</u></u>	

Table III

Eretmochelys imbricata - Hatchery Statistics - 1966/1970

<u>Period</u>	<u>No. of eggs</u>	<u>Hatchlings</u>
1966	—	—
1967	—	—
1968	17,615	8,331
1969	2,133	1,145
1970	4,756	2,076
Total:	<u>24,504</u>	<u>11,552</u>

SOUTH PACIFIC ISLANDS - MARINE TURTLE RESOURCES

by H.F. Hirth

Department of Environmental Biology, University of Utah

The numbers of marine turtles in the South Pacific, as almost everywhere else, are steadily decreasing. This is due to the fact that in many places in the South Pacific the turtles as well as their eggs are eaten and in some cases the carapaces are made into curios. However, there is much interest in marine turtles in the South Pacific. This interest ranges from the man-in-the-street to top government officials. People are particularly concerned with conservation, management and the feasibility of turtle mariculture.

Generally speaking, the most abundant turtle in the South Pacific is the green turtle. The hawksbill is the second most abundant species and in some places equals or surpasses the green in density. The loggerhead is the next most common and the leatherback the least common. I found no evidence of ridleys, but I have heard reports of a fifth "kind" of sea turtle particularly in the southwestern area of the Pacific.

French Polynesia: The most common marine turtle is the green turtle. Principal nesting grounds are Scilly, Mopelia, Bellinghausen, Tupai and some of the Tuamotu atolls. The peak nesting season appears to be October through December. A few hawksbills are caught by fishermen and there is authentic record of a leatherback caught in a seine.

Many males and females are speared as they mate off the nesting beaches on the atolls. Tahitian fishermen report a sex ratio in favor of males. Green turtle meat is considered a delicacy and is sold in Papeete markets. Between 1953 and 1967, up to 262 green turtles have been sold annually in Papeete. There is no market for eggs although eggs are eaten by islanders who live near the nesting beaches. The demand for cured shells is insignificant.

There are no conservation regulations in French Polynesia concerning marine turtles.

Western Samoa: There are no major nesting sites in Western Samoa although some nesting does take place on isolated beaches chiefly between October and January. Local fishery officials believe that the most common turtle in Samoan waters is the green, followed by the hawksbill. Turtle fishermen are confident that some green turtles remain in Samoan waters year around, and they state that juveniles are regularly caught off the village of Lefagaoali'i on Savai'i Island. Green turtles and a few hawksbills still

nest in the Tokelau Islands (September-October) but their numbers are said to be rapidly decreasing.

Samoans eat both meat and eggs of marine turtles whenever they can get them. No eggs and few turtles reach the main market in Apia because both are quickly consumed in the villages bordering the coast. Some hawksbill jewelry is sold in shops in Apia: the demand for it is moderate.

Currently there are no turtle regulations in Western Samoa although fishery officials hope to get a regulation passed soon which would provide complete protection for all sea turtles and their eggs.

Kingdom of Tonga: Three species of marine turtles are found in the Tonga Islands - the green, hawksbill and loggerhead. The green is the most abundant (at least it is the species most frequently caught by fishermen) and it is most common in the Ha'apai Group. Fishermen report that it nests there chiefly between November and February.

Green turtles (some loggerheads; rarely hawksbills) are caught by speargun and nets in feeding pastures off Tongatapu Island. According to experienced divers, small turtles (less than 25 cm in carapace length) are never seen on the pastures. Three men, working out of a small boat and diving all day will call it a "very good day" if they get two or three green turtles. The best turtle pastures are composed chiefly of Syringodium. Halodule and Halophila have also been found in green turtle stomachs.

Tongans eat turtle meat and eggs. Eggs are eaten by islanders who live near the nesting beaches - no eggs are found in the markets. Turtle meat is not a regular item on menus in any hotel or boarding house. Carapaces of adult greens and hawksbills are offered for sale but the demand is small. Hawksbill jewelry is made locally and sold to tourists or exported to Fiji. There is a small, but growing, demand for this kind of jewelry.

Turtle regulations currently enforced provide protection for all kinds of turtles and eggs between 1 December and 31 January. There are also regulations requiring the mesh of and length of turtle fences to be certain sizes (however, few turtles are caught by fencing anymore). But, the fishery regulations of Tonga are currently undergoing revision and if approved by Government the following regulations will go into effect: (1) No person shall at any time dig up, use, take or destroy turtle eggs of any species or in any way molest, take or kill any turtle the shell of which is more than 35 inches in length. No person during the months of January, February, November or December in any year shall in any way molest or take or kill any turtle of any size. This regulation shall not apply to turtles kept as pets or in aquaria. (2) No person shall be in possession of, sell, offer or expose for sale or export any turtle shell the length of which is greater than 35 inches. (3) No person shall in any way molest, take, kill or be in possession of the species Dermodochelys coriacea (leatherback) of any size at any time.

Fiji Islands: The two most common turtles are the hawksbill and green. Official records indicate the presence of some loggerheads and at least one leatherback has been documented.

Hawksbills are found inside the north loop of Great Astrolobe Reef in Kadavu. These turtles are usually taken by nets or by spearing although there are too few to even satisfy local demands. Some hawksbills (and perhaps greens) nest on islands in Malolo Pass. Individual green turtles are commonly encountered by skin-divers off the southern coast of Viti Levu.

Various kinds of marine grasses are found in Fijian waters (Halodule, Halophila, Syringodium), and one young green was observed feeding on Syringodium near Suva. Green turtles around Viwa also eat large quantities of red and green algae. Spearguns and seines are used to catch green turtles in the feeding pastures.

Many hawksbill curios are sold in shops in Suva. The demand for this product is growing because of the ever-increasing numbers of tourists visiting Fiji. Green turtle meat is sold in the market but there is no steady supply. It is possible to obtain green turtle steaks in restaurants from time to time.

As of September 1969, export of turtle shell (all species) was proscribed. Up to that time some shell was exported to Japan (for example, 302 pounds in 1969). Present legislation completely protects turtle eggs and all turtles the shell of which is less than 18 inches in length. And, all sizes are protected from 1 November to 28 February. However, new legislation is being proposed and will include the same provisions for turtles as are to be found in the new Tonga regulations (see above).

#### National Requirements

1. Because of their sincere interest in marine turtles and the lack of local expertise, fishery officials in the South Pacific should be placed on the mailing lists of turtle researchers. They should also receive reports of this I.U.C.N. conference as well as copies of the first marine turtle meeting. The addresses are as follows:

Director of Fisheries  
Tahiti, French Polynesia

Chief, Wildlife Branch  
Division of Fish and Game  
Hotel Street  
Honolulu, Hawaii

Chief Fishery Officer  
Apia, Western Samoa

Director, SPIFDA  
c/o SPC, Box 9  
Noumea, New Caledonia

Director,  
Department of Agriculture  
Nuku'alofa, Tonga

Director  
Department of Fisheries  
Suva, Fiji Islands

Director,  
Department of Fisheries  
Pago Pago, American Samoa

2. Tagging programs should be initiated in French Polynesia (Scilly, Mopelia and Bellinghausen); in Western Samoa (Fanuatapu, Namu'a, Nu'utele, Nu'ulua); in American Samoa (Rose Atoll); in the Kingdom of Tonga (Ha'apai Group); in Fiji (Lau, Yasawa and Mamanutha Groups); and in New Caledonia (Ile Ouen, Ile Surprise and Recifs d'Entrecasteaux). Emphasis should be placed on training local people in tagging and stock assessment. If predation on eggs and hatchlings is high than local officials should be trained in establishment of egg hatcheries. I.U.C.N. should cooperate with F.A.O. in these matters.

3. I recommend that Rose Atoll be recognized as a fully-protected nature reserve. It is uninhabited and is the breeding ground for both green and hawksbill turtles. The atoll is now "protected" by the Government of American Samoa. I.U.C.N. should support the Government of American Samoa in its attempt to keep Rose Atoll a nature sanctuary. In this regard, Rose Atoll would remain a breeding nucleus for sea turtles in the South Pacific in much the same way that Aldabra Atoll and Ascension Island are breeding nuclei in the Indian Ocean and South Atlantic, respectively

4. There is an urgent need for a comprehensive, ecological study of the hawksbill, especially in view of the growing world-wide demand for tortoise shell.



SEA TURTLE RESEARCH AND CONSERVATION IN SOUTH EAST AFRICA

by George H. Hughes  
Oceanographic Research Institute, Durban

Introduction

Once again the Natal Parks Board would like me to extend their thanks to I.U.C.N. for inviting them to participate in the Second Marine Turtle Specialists' Meeting.

The following report will review the results obtained in South East Africa during the past two years.

Since the last meeting generous funds have been made available for an extension of research into regions outside of South Africa by the Southern Africa Wildlife Foundation (S.A. appeal of WWF) and the Oceanographic Research Institute, Durban.

As a result of these funds becoming available, preliminary surveys of sea turtle populations have been made in Moçambique, Europa Island and South and South. Western Madagascar.

Mr. A.J. Bass, Oceanographic Research Institute, Durban, has recently made a survey of sharks in the St. Brandon Islands north of Mauritius and has provided some information on that area as regards sea turtle exploitation.

1. National and Regional Situation Reports

(a) Republic of South Africa

- (i) General: During the past two years the situation in South Africa has remained virtually unchanged. There is full protection of all sea turtles with no exploitation in any form.
- (ii) Conservation: The loggerhead Caretta caretta and leatherback Dermochelys coriacea continue to be the only two species known to nest extensively in South Africa although a lone olive ridley Lepidochelys olivacea nested just south of Durban at Warner Beach during the past summer.

The purchase of a "beach buggy" for patrolling the nesting beaches in Tongaland has improved conservation methods considerably, in that movement on the beaches is now possible with a degree of independence from the tides.

Protection of Tongaland is now in the eighth year and appears to be showing positive results. Despite fluctuations in population numbers the overall trend appears to be upwards as far as the loggerheads are concerned, but the much smaller population of leatherbacks is showing little response as yet. Table 1 summarizes the results to date:

Table 1. Total number of female loggerhead and leatherback turtles tagged during eight years of survey in Tongaland, Natal.

<u>YEAR</u>	<u>LOGGERHEADS</u>			<u>LEATHERBACKS</u>		
	<u>Total Tagged</u>	<u>Est. Pop. Survey Area</u>	<u>Est. Pop. Overall</u>	<u>Total Tagged</u>	<u>Est. Pop. Survey Area</u>	<u>Est. Pop. Overall</u>
1963/64	82	-	-	19	-	-
1964/65	221(+2)*	250+	-	11	-	-
1965/66	184(+13)	250+	-	24(+2)	-	-
1966/67	19K+18)	250+	-	3(+2)	-	-
1967/68	255(+40)	334+	417+	18	18+	-
1968/69	156(+28)	177+	217+	14(+5)	19+	-
1969/70	21K+74)	333+	466+	18(+10)	30+	77+
1970'71	162(+79)	309+	410+	11(+6)	13+	26+
Total	<u>1462</u>			<u>118</u>		

\* Figures in parentheses indicate number of recoveries of animals tagged in previous seasons.

(iii) Research: Tag recoveries of loggerheads from Tongaland indicate that the loggerheads nesting in Tongaland are recruited from virtually the entire east coast of Africa, south of the Equator (Fig.1).

It would appear that turtles tagged in Tongaland tend to return to Tongaland to lay. During a survey of Moçambique (see below) many Africans were questioned concerning the slaughter of nesting loggerheads and, whilst all were eager to discuss their prowess as turtle killers, none admitted having ever killed a tagged animal, with the exception of Thonga africans immediately north of the Natal border.

Knowledge of tagged loggerheads was acknowledged in Northern Moçambique (from non-nesting turtles) and although the tags had been discarded the descriptions matched those of tags employed in Tongaland.

A considerable set-back has arisen with the realisation that the plastic tags employed in Tongaland for the past 3 years were useless. Monel metal tags are now being used, but it will take a few seasons to regain the lost ground.

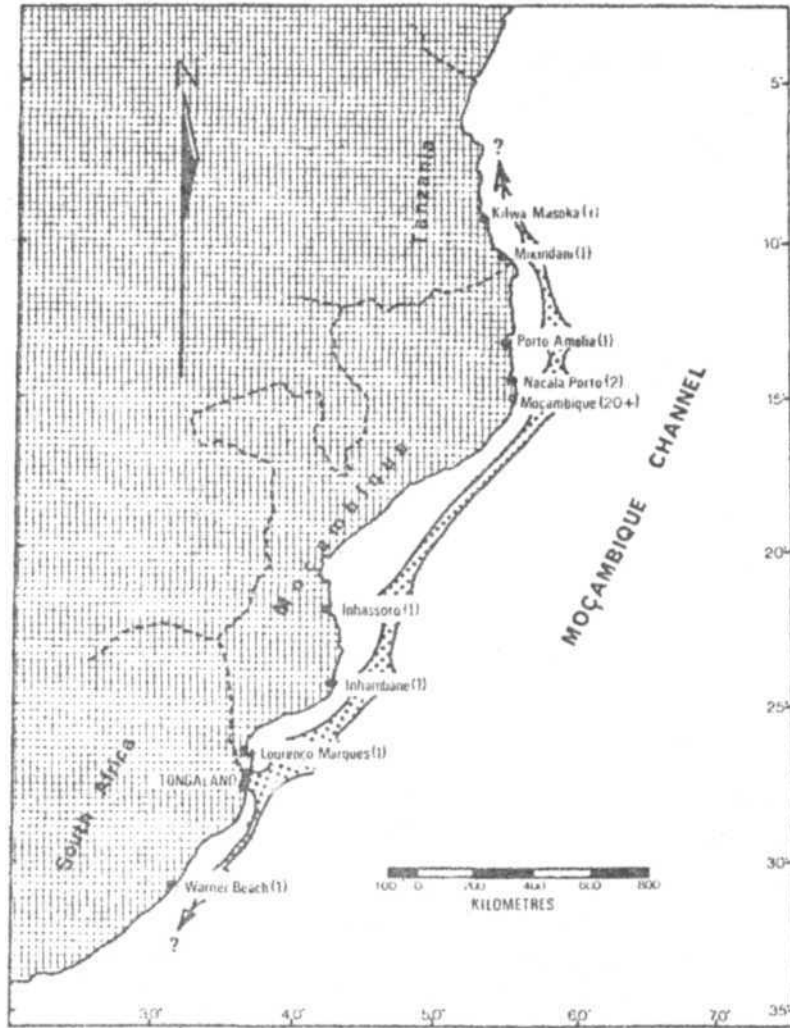


Fig. 1. South east Africa, showing non-nesting recoveries of loggerhead turtles tagged in Tongaland since the beginning of research in 1963. Figures in parentheses indicate number of recoveries at each locality.

With the continued discoveries of loggerhead and leatherback hatchlings along the South African east coast and more recently from the cold west coast (Hughes, 1970a, 1971a) attempts have been made to tag hatchlings by implanting a fine piece of stainless steel wire under a selected carapace scute (see Hughes, 1971a for method). Although many hatchlings have been stranded and returned to the Institute, none has borne a tag.

During the past two seasons the experimental pilot hatcheries have shown marked improvements in Tongaland from 52.0% hatching success in 1968/69 to 66.14% (1969/70) and 74.24% (1970/71). The ant problem which has had substantial adverse effects in the past appears to have been resolved with strategically placed tins of ant-poison around the hatchery.

The presence of olive ridley turtles off the South African coast has been finally confirmed by the finding of two carapaces at Cape Agulhas during 1970 (Hughes, 1971b) and the nesting of one female at Warner Beach (see above).

As yet the Tongaland turtle beaches have not been proclaimed as a turtle sanctuary but there is widespread enthusiasm for the reserve and every effort is being made to advance its declaration.

In concluding this section it must be stated that the sea turtle situation in South Africa is excellent with full protection being efficiently maintained and there is widespread sympathy for the international plight of sea turtles.

(b) Moçambique

- (i) General: Two preliminary surveys of Moçambique have been executed during the past two years (see Hughes, 1970b). Sea turtle populations are extensive with 5 species being represented: green, loggerhead, hawksbill, olive ridley and leatherback turtles. The most remarkable single discovery was the substantial population of olive ridleys in northern Moçambique.

Apart from a negligible trade in tortoiseshell from Moçambique Island, there is no commercial exploitation of sea turtles or their products in Moçambique.

- (ii) Conservation: Despite the laws providing complete protection of all sea turtles, local exploitation has resulted in declines in certain regions. Protection of nesting turtles has been non-existent.

However, during the past year there has been an upsurge of interest in marine conservation and plans have been formulated for the creation of a number of marine reserves and sanctuaries where sea turtles and dugong will benefit (see e.g. Tinley, 1970).

The three areas under consideration are:

- (a) The Paradise Islands Region - 200 kilometres of coast, embracing numerous islands and estuaries which include known turtle nesting beaches.
- (b) The Antonio Enes Region, consisting of the estuary at Antonio Enes, and two island strings: the Segundas and Primeiras (see below), a distance of 200 kilometres.
- (c) The Maputo Game Reserve region where boundaries, at present excluding a coastal strip, might be extended to embrace some of the turtle nesting beaches.

It should be borne in mind that these plans are still in their infancy but the initial suggestions have been greeted with enthusiasm. The results of the preliminary surveys carried out by the Oceanographic Research Institute have been made available to Mr. Ken Tinley of the Moçambique Veterinary Department and are proving helpful for strengthening his plea for more marine reserves.

- (iii) Research: As a result of the preliminary surveys the nesting range of loggerhead turtles in South East Africa is extended northwards from Tongaland by; 600 km, the nesting range of leatherbacks by 400 km, a new green turtle nesting colony has been found in the Primeiras Islands off Northern Moçambique (see Figure 2). A visit was made to these islands during August 1970, and although only 3 nesting females were found on the island visited (it was not the best time of the year), it confirmed the hitherto hearsay evidence of green turtle nesting and there are, apparently, substantial numbers there during the summer.

Further the olive ridley population is resident, in that evidence of nesting was found -no suggestions of mass nesting, however.

(c) Madagascar

- (i) General: A survey of the south and south-west coasts of Madagascar has been recently completed and it was found that 5 species of sea turtles are present in the area; green, loggerhead, hawksbill, olive ridley and leatherback.

Apart from a limited trade in tortoiseshell no commercial exploitation for export is undertaken although domestic exploitation is considerable. Table 2 summarizes the annual catch in an 800 kilometre region in S.W. Madagascar.

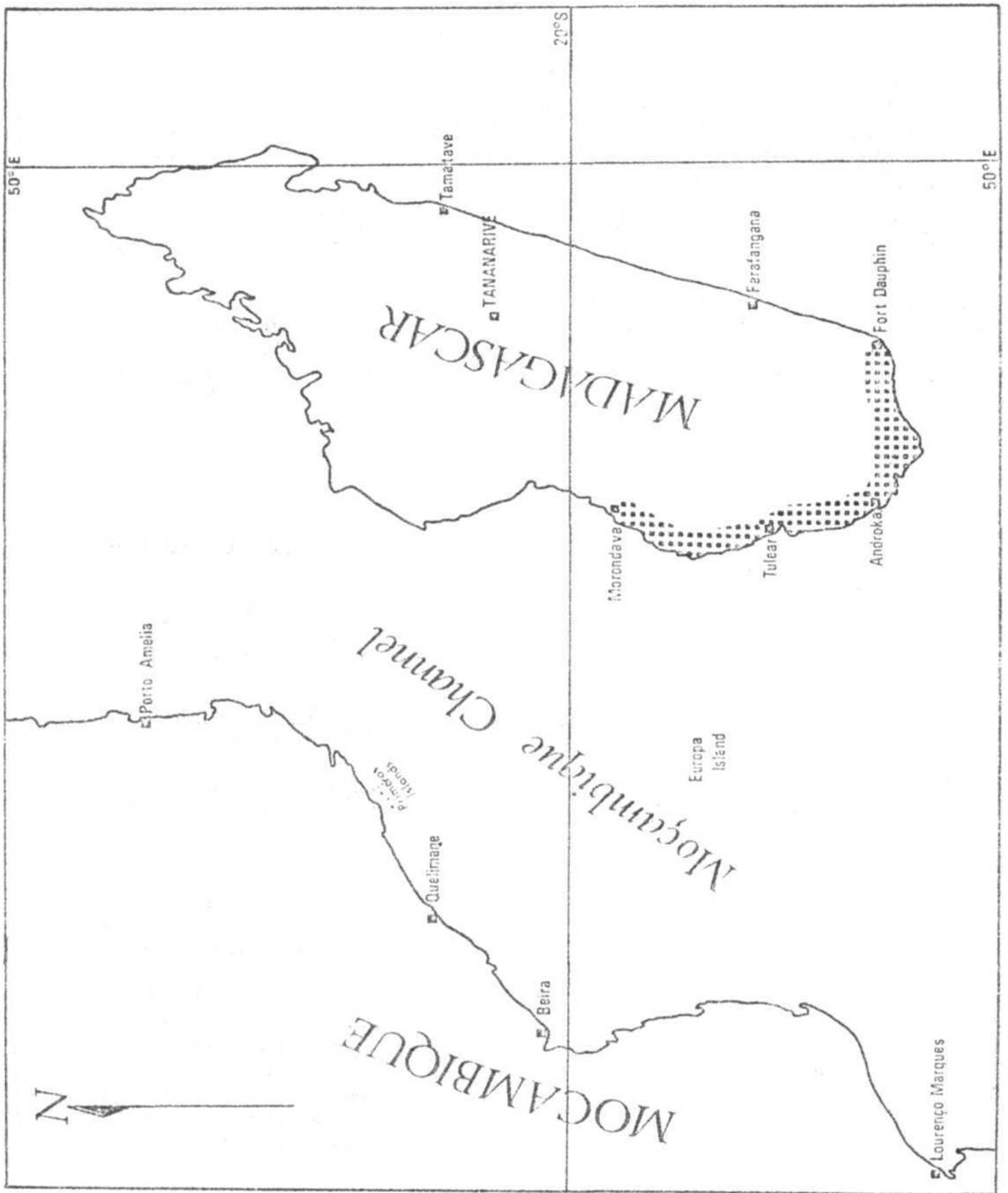


FIGURE 2. The Moçambique Channel showing locality of Europa Island, the Primeras Islands and the portion of Madagascar so far surveyed (Shaded).

Table 2.

Annual turtle catch of S. -Western region of Madagascar in estimated numbers, weight in kilogrammes and monetary value - 100 FMG (RD. 25) per kg. Figures in parenthesis indicate approximate mean weight of each group individual (after Hughes, 1971c).

<u>Species</u>	<u>Adult</u>	<u>S/Adult</u>	<u>Juvenile</u>	<u>Total</u>	<u>Est.gross weight</u> (kg)	<u>Est. Fmg.</u>	<u>Value*</u> <u>Rands</u>
C.tnydas	3411(170)	1166(100)	2245(15)	6,822	730,145	36,507,200	91,268
C.caretta	1612(100)	402(50)		2,013	181,300	9,065,000	22,663
E.imbricata	402(45)	402(10)	1206(10)	2,013	38,190	1,909,500	4,774
L.olivacea	2400(45)			2,400	108,000	5,400,000	13,500
		Grand Total:		<u>13,248</u>	<u>1,057,635</u>	<u>52,881,700R</u>	<u>132,205</u>

\* Value based on 50% gross weight.

(ii) Conservation: The laws governing sea turtle protection in Madagascar are adequate; they are:

(a) Resolution of 23rd May, 1923 (J.O. 9/6/23 p. 439).

Instituted areas reserved for turtles: Nosy Anambo (or Ilôt Boise", Nosy Iranja, Chesterfield Island, Nosy Trozona, Nosy Ve, and Europa Island.

The protected species are the green turtle Chelonia mydas and the hawksbill turtle Chelonia imbricata (as stated).

(b) Resolution of 24th October, 1923 (J.O. 17/11/23 p. 856).

It is forbidden to capture sea turtles; when they are laying; and when the width of the carapace, measured across the plastron, does not exceed 50 cm.

However, law enforcement is at a minimum. But at the International Conference on the Rational Utilization and Conservation of Madagascar's Natural Resources held in Tananarive (October 1970) a resolution was accepted to make greater efforts for sea turtle conservation.

Discussions with the Director of Marine Fisheries proved fruitful and his enthusiasm bodes well for the future. It is hoped that with various recommendations backed by the proven substantial value and potential of sea turtles to the coastal villagers of Madagascar, more strenuous efforts will be made to implement the law and provide more surveillance of their proclaimed turtle sanctuaries and, further, to establish a mainland sanctuary for loggerhead turtles.

(iii) Research: The most important single discovery in Madagascar was the large population of olive ridleys, never previously reported from Madagascar. No nesting ground was found (fishermen believe they 'spawn' in the sea) and no reports of leatherback nesting were made. Loggerheads and greens nest throughout the region surveyed, with a heavier concentration of loggerheads nesting in the south east in the Fort Dauphin area. Hawksbills were reputed not to nest on the mainland but on some of the smaller islands off the west coast.

Apart from the loggerhead, there did not appear to be any large concentrations of nesting sea turtles in the region surveyed and with the recovery of a green turtle, which had been tagged on Europa Island (see below), at Farafangana on the east coast of Madagascar, it would appear possible that many of the green turtles in the coastal waters of Madagascar are recruited from the green turtle nesting colony on Europa Island.

(d) Europa Island

(i) General: Europa Island is situated in the south Moçambique Channel (Figure 2) and has been long reputed as a green turtle nesting colony. Exploitation of the turtles ceased in 1923 and for 47 years the nesting animals have remained unmolested. It is thus one of the most natural populations extant, and almost certainly one of the largest known green turtle nesting colonies in the world.

A six week visit was made to the island from the 5 November to the 20 December 1970.

(ii) Conservation: Full protection is afforded the turtles by the French Government and it is fully intended to maintain the island as it is at present. Surveillance is carried out by the Meteorological Department, Reunion.

(iii) Research: During the month of November, 1970 at least 4,274 green turtle females nested on the beaches of Europa laying a total of 1,317,992 eggs. Competition for nesting space on the 6.665 km of beaches is intense, with over 700 females emerging per night. The sheer density of females on the beaches has resulted in substantial nest destruction by other females excavating their nest holes and some conservation exploitation (transfer of eggs and hatchlings to other areas) would in all likelihood benefit the population - for signs of overpopulation are evident.

Considerable numbers of females perished on the rocks, since they penetrated small gaps in a raised reef which prevents access to some beaches. After completing laying they could not find the gap again and died in the sun.



Nesting occurs in substantial numbers throughout the year with a marked decline in June and July, so the annual egg production on Europa must be astronomical.

Hirth (1968) stated that the ratio of males to females at Aldabra was in the region of 5:1 and suggested that this imbalance was probably due to biased hunting techniques. Recent observations show that it was correct in his assumptions in that on Europa the ratio of males to females was 1:3 or 4, an important difference. If one can regard Europa with its 47 years of protection as a natural breeding assemblage, then any green turtle nesting colony having sexual numerical equality or a predominance of males is in an unhealthy state and rigid protection should be given to nesting females.

Abysmal ignorance of the true state of affairs on Europa resulted in only 383 females being tagged but the recovery from Madagascar is promising and it is hoped to return for a short period to tag on Europa at a later date.

If this nesting colony continues to be given protection the future of the green turtle in the south western Indian Ocean is assured.

(e) The Mascarenes

- (i) General: From a sea turtle aspect little is known of the Mascarenes (Réunion, Mauritius and Rodriguez) or their dependancies, but that they benefit from sea turtles and their products is indisputable.
- (ii) Conservation: There appears to be few controls on sea turtle exploitation in Mauritius or its dependancy the St. Brandon Islands. Intense exploitation of nesting green turtles, over several hundred per year, must be doing inestimable damage to the green turtle populations in that area. One island in the group is nominally protected and a member of the Mauritius Fishing Development Company is starting to raise hatchlings experimentally (Bass, 1970). Mr. Bass included, in his report to Mauritius, a plea for more control.

Tromelin Island, a dependancy of Réunion, has full protection for its apparantly very substantial green turtle nesting colony. According to the Department of Meteorology, Reunion, the numbers of nesting turtles is only slightly smaller than on Europa Island. As on Europa there are only 4 personnel from the Met. Department.

Visits to both Tromelin and St. Brandon are planned for 1971.

2. Future Plans and National Requirements

With the generous contributions of the S.A. Wildlife Foundation (WWF) and the Oceanographic Research Institute, Durban, basic surveys of the Mascarenes and the rest of Madagascar are planned for the latter half of 1971.

The Gulbenkian Foundation, Lisbon, has made available 100,000.00 Escudos (R2,500.00) for continued work in Moçambique and it is hoped to revisit important areas during the summer season to 1972/73.

In order to complete the programme a basic survey of Kenya and Tanzania will be made for 1972. It is hoped that the S.A. Wildlife Foundation will provide funds to undertake this work.

It can be seen, therefore, that to complete the project a further two years will be required during which time the entire south western Indian Ocean will have been surveyed and full conservation and scientific reports completed.

From the activity to date more conscious efforts to conserve turtles are being mooted already and thus the only request to be made of IUCN is that support be given to an application for a further two years of research on the sea turtles of South East Africa.

#### Conclusion

At the present stage of research it is clear that no single species of sea turtle in South-East Africa is in any danger of extinction. Some local exploitation is certainly giving cause for alarm but the hopeful signs of governmental interest in all countries visited is promising and little effort is required to safeguard the sea turtles.

It is expected that within a few years there will be more marine reserves and sanctuaries for sea turtles in South-East Africa and the future of sea turtles in this area, still promising, will be assured.

#### Acknowledgements

I should like to express my deepest gratitude to the S.A. Wildlife Foundation (WWF) and the Oceanographic Research Institute, Durban, for their generous financial assistance and constant encouragement in the project.

My thanks go also to the Natal Parks Board, Pietermaritzburg, for granting me the privilege of representing them at this meeting and their continued efforts in conserving sea turtles in Tongaland.

#### References

1. BASS, A.J. 1970            Report on a shark survey at St. Brandon during November 1970. Oceanographic Research Institute int. Rep. Mimeo.

2. HIRTH, Harold 1968. The green turtle resource of South Arabia, and the status of the green turtle in the Seychelles Islands. F.A.O. TA 2467 1968.
3. HUGHES, G.R. 197Ca Further studies on marine turtles in Tongaland, III. Lammergeyer 12 : 7-25
4. HUGHES, G.R. 1970b Preliminary report on the sea turtles of Moçambique. Moç. vet. G. in press
5. HUGHES, G.R. 1971a Further studies on marine turtles in Tongaland V, Lammergeyer 13
6. HUGHES, G.R. 1971b The olive ridley sea turtle Lepidochelys olivacea (Eschscholtz) in East Africa. In preparation.
7. HUGHES, G.R. 1971c Preliminary report on the sea turtles of South and South West Madagascar and Europa Island. In preparation.
8. TINLEY, K.L. 1970 Proposed maritime national parks and dugong and marine turtle sanctuary in the Paradise Islands region of the Moçambique Coast. Int. rep. Moçamb. Vet. Dept. 1970.

SITUATION REPORT ON MARINE TURTLES NESTING IN SURINAM

by J.P. Schulz

Department of Development, Paramaribo

I. Biology

I.1. Colony sites.

Nesting beaches: same as in 1968 (see Proceedings 1969, p. 19<sup>1</sup>); westward movement of Bigisanti beach continued. Species: same (see Proceedings 1969, p. 20) plus Caretta caretta, a specimen of which was seen nesting in 1969 on Bigisanti, the only rookery in the world where 5 species breed together.

I.2. Total numbers of nests per season.

In Table I the estimated numbers of nests laid in 1964 and 1967-70, on the two nesting sites, are presented. These data might suggest a downward trend, but as the number of nests per annum fluctuates widely, the annual survey will have to be continued for a prolonged period before reliable conclusions about any long-term trends can be drawn.

Table I. Estimated numbers of nests laid in Surinam 1967-1970

		<u>Chelonia</u> <u>mydas</u>	<u>Lepidochelys</u> <u>olivacea</u>	<u>Dermodochelys</u> <u>coriacea</u>	<u>Eretmodochelys</u> <u>imbricata</u>
1967	Bigisanti	1000	85	70	10
	Galibi	?	2690	0	1
	Total Sur.	?	2775	70	11
1968	Bigisanti	750	80	150	3
	Galibi	3600	3210	0	2
	Total Sur.	4350	3290	150	5
1969	Bigisanti	775	115	270	9
	Galibi	1975	1510	10	1
	Total Sur.	2750	1625	280	10
1970	Bigisanti	850	90	220	3
	Galibi	2250	1660	15	1
	Total Sur.	3100	1750	235	4

<sup>1</sup> Proceedings of the working meeting of marine turtle specialists, organized by I.U.C.N. at Morges, Switzerland, 10-13 March 1969, I.U.C.N. Publ. N.S. Suppl. Paper No. 20, Appendix III.

I.3. Tagging; migrations and breeding cycles.

The following numbers of turtles have been tagged in Surinam since 1966:

Table II.

	<u>Green turtle</u>	<u>Olive Ridley</u>	<u>Leatherback</u>	<u>Hawksbill</u>	<u>Loggerhead</u>
1966	31	136	14	-	-
1967	44	443	2	-	-
1968	10	476	9	-	-
1969	825	595	87	4	1
1970	<u>1423</u>	<u>690</u>	<u>82</u>	<u>1</u>	<u>-</u>
Total	<u>2333</u>	<u>2340</u>	<u>194</u>	<u>5</u>	<u>1</u>

There are several reasons why we support that a rather high percentage of the turtles lose their tags, sometimes already during the first season. Nevertheless, the following conclusions are valid:

'Nest-site fixity' not as strong as currently supposed: during the 1970 breeding season 30 greens and 3 ridleys changed their nesting beach, moving from Bigisanti to Galibi beaches (distance c. 85 km). Seven leatherbacks were reported to move between Bigisanti and the Fr. Guiana beach (distance c. 120 km); Dr. Pritchard was the first to suggest that probably the leatherbacks nesting in Surinam are an 'overflow' of the population nesting in French Guiana. We are inclined to share his opinion.

Approx. 30<sup>1</sup> recoveries from sea further corroborated the fact that green turtles nesting in Surinam come from the South Atlantic, in the area off the Brazilian coast. The exact location of the feeding grounds is still uncertain. Olive ridley recoveries were reported from coastal waters and deep sea between the Venezuelan coast and the bulge of Brazil.

We are still in the dark as to the migration paths of the leatherbacks, because no recoveries have so far been reported.

Reproductive cycles.

Chelonia mydas: from 23 returns of turtles tagged 1966-1969 it is concluded that this species in Surinam could possibly breed in 4-, 3-, 2- and 1-year cycles (4, 9, 5 and 5 observations respectively).

Lepidochelys olivacea: breeds in 1- or 2-year cycles.

Dermochelys coriacea: only 1 return (after 3 years).

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<sup>1</sup> According to a communication from Dr. Pritchard; we received recovery data for only 19 animals.

I.4. Numbers of clutches per individual per season.

Chelonia mydas: an attempt was made to make an estimate of the number of clutches per female during the 1970 season, based on the field records of tagged individuals. From the data a provisional stochastic model has been drawn up: Several factors seriously influenced the reliability of estimates of parameters: a) unknown number of turtles that migrated between nesting beaches; b) unknown (perhaps rather high) number of turtles that lost their tag during the season and were retagged; and c) a relatively high percentage of unindentified nests' (i.e. tag number of turtle that nested not known, owing to lack of personnel on the extensive beaches). Dividing the number of green turtle nests (850) laid on Bigisanti in 1970 (the most reliable records available) by the number of tagged individuals (326) nesting on that beach during the season (incl. fevisitors tagged in previous years), yields the low figure of c. 2½ nests/individual. C. 110 turtles were not seen again at Bigisanti after being tagged; 18 were reported on Galibi beach, the others were not recorded for a second time, for one of the reasons mentioned above. Particularly at the end of the season many individuals were tagged that only nested once or twice; these turtles either were migrants from French Guiana or had lost their tag. Eliminating this group from the calculation, the rest (c. 220) laid an average of 3½ nests each during 1970; a figure that comes closer to the findings at other nesting grounds.

On the Galibi beaches, near the French Guiana rookeries, 1107 individuals were distinguished in 1970, that together laid 2250 nests, i.e. c. 2 nests/turtle, an even less likely figure than for Bigisanti. These turtles are assumed to have nested alternately on the Galibi and the French Guiana beaches, as it is very unlikely that so many tags dropped off.

Because of the many uncertainties, an estimate of the number of green turtle females that depend on the Surinam beaches can only be made by rough guess-work; provisionally we assume that the figure lies between 2000 and 3000.

Lepidochelys olivacea is supposed to nest on average twice per season: in 1970 and in 1969 c. 1250 and 900 ridleys (including an unknown number of individuals that were retagged because they had lost their tag) laid 1750 and 1625 nests respectively/Probably some 2000 ridley females ( $\pm 100$ ) depend on the Surinam beaches for breeding.

For Dermochelys coriacea it is impossible to estimate the average number of nests per annum, because of the migration between breeding grounds. In 1970, on Bigisanti, 13, 30, 11, 10, 6, 1 and 1 leatherbacks were seen to nest 0, 1, 2, 3, 4, 5 and 6 times respectively.

I.5. Emergence success of nests.

Research was continued in 1969, by R.L. Hill B.Sc. and D.J. Green B.Sc., and in 1970 by Hill, concerning incubation periods and hatching success of both natural and transplanted nests of green turtles, ridleys and leatherbacks.

An important discovery was that in previous years we have damaged unconsciously considerable numbers of eggs by locating nests with a probe (report in press). The few broken eggs in a green turtle and leatherback nest found by a probe lower the emergence percentage by 25-30%. Hence, many young have been 'lost' since 1964, when counting first begun. Rotting, broken eggs in ridley nests do not influence hatching success significantly. The small infertile eggs in leatherback nests (on the average 30% of total number per nest) lower the emergence percentage (without and with under-sized eggs, respectively 18 and 12½% emergence), probably because they rot and cause some of the larger fertile eggs to rot as well.

Emergence percentage was raised in replanted Chelonia and Lepidochelys nests by using better techniques as a result of Hill's investigations: in 1970 an average of 40% and 55%, respectively, was reached (compared with 85% and 60% in natural, protected nests). Actually the figures are lower than previously attained in 1969 because nests were transported long distances to a central hatchery. Higher figures are obtainable if nests are moved as short a distance as possible and the eggs carefully handled. Needless to say the central hatchery idea has been dispensed with where possible. Dermochelys nests show a disappointingly low natural emergence: average 40% - quite a few nests not hatching at all. In the best replanted nests the average is only 18%; in nests replanted over long distances it was as low as 6%.

Studies undertaken by Hill and Green revealed the damage done by the ghost-crab Ocypode quadrata to ridley nests on Bigisanti beach (quantitative report in press).

#### I.6. Miscellaneous.

Vital statistics. Ample data on dimensions of green turtles and ridleys were added to the information already collected in previous years. The results will be published in due course. In the scope of this report it is interesting to mention that in successive years it was shown that newly-tagged ridleys (some of which very probably nested for the first time) had the same dimensions as re-nesters, tagged in previous years. This would mean that ridleys do not grow after reaching sexual maturity.

Morphology: laminae counts: Hill made an extensive study of polymorphism of costal and vertebral laminae in Lepidochelys olivacea including adult females, and hatchlings from natural and replanted nests (report in press). A study of adult males is important to complete the picture.

## II. Exploitation and Conservation.

### II.1. Legislation and exploitation of eggs.

The legal status of the Bigisanti nesting grounds is jeopardized by the westward movement of the sand (c. 1.8 km/year), most of which is now situated W of the W boundary of the reserve. As a provisional measure the nests laid outside the reserve are made safe by claiming them every morning as government property, but the protection will have to be based on a more solid legal basis.

The Galibi nesting grounds (Eilanti, Baboensanti, Pruimenboom and Galibi beaches) were declared a nature reserve in 1969. Because this happened during the season, Caraiibs were allowed to continue egg-collecting, because an abrupt stop would have upset relations with them. In 1970, the Caraiib Indians, who during the last decade collected almost every green turtle and ridley egg that was laid in the area, were allowed to collect only 150,000 green turtle and 30,000 ridley eggs of a total of c. 350,000 and 200,000 eggs. The eggs were bought and sold through the Foundation for Nature Preservation. Most nests taken were laid too low and could not possibly be replanted because of the uniformly low beach platform in the area. Complete prohibition of egg-collecting would create strong political difficulties. Moreover, it is our intention to exploit the eggs as a source of protein on a sustained yield basis. This implies the urgent need for information to calculate the annual proportion of eggs to be harvested - still based on mere guesswork - on a quantitative basis. In 1971, the quota for ridley eggs will be reduced to not more than 20,000. If in the future the percentage of nests left untouched appears to be too low to build up the population to its former strength, fewer eggs will be removed.

During 1969-1970, Forest Service personnel continued constant surveillance in the conservation areas; turtle poaching was reduced to zero.

#### II.2. Active conservation measures.

On Bigisanti beach the protection of ridley nests by wire cages against ghost-crab damage is now standard procedure.

Each year a total of 600-700 nests endangered by spring tide inundation or beach erosion, are replanted. As mentioned above in section I.5., the emergence success in replanted nests has been raised, but replanted Dermochelys nests still show a disappointingly low fertility, although there has been some improvement.

Establishment of an experimental aquarium with a view to the future possibility of releasing young up to 6 months old away from the zone of initial predation, was discarded. We agree with Prof. Carr that '... it seems sounder practice to allow hatchlings to enter the sea directly from natural nests than to ... hold hatchlings for periods of growth in pens' (Proceedings 1969, p. 13).

#### II.3. Turtle farming.

23,525 green turtle eggs, part of the quota permitted to be collected in the Galibi sanctuary (see II.1 above) were sold to 'Mariculture', Grand Cayman Island. Moreover, 12 female turtles were caught on the beach and 9 transported to Grand Cayman, of which 8 survived and seem to prosper there. They will be returned to Surinam in 1976. Of the 16,418 young that hatched from the 23,525 eggs, 250 yearlings will be brought back to Surinam in 1971, half of which will be directly released on the beach. The remainder will be grown in a tank. Delegates to the 1969 meeting were strongly opposed to 'premature uncontrolled' mariculture of sea turtles, and agreed that schemes of this kind would constitute an intolerable drain on wild populations.



We do not believe that we are contravening this statement for the following reasons:

- a) Mariculture Ltd. controls its mariculture of seaturtles.
- b) Results from Mariculture's experiments are of utmost importance to future turtle farming in Surinam and elsewhere.
- c) The 23,525 eggs taken formed part of the 1970 quota of eggs to be harvested.
- d) The loss of 4 mature females by death and 8 for 7 years is nothing in comparison with losses of our population in Brazilian waters (see section IV.2. below) and with the information gathered about keeping these animals in captivity.

### III. Future Conservation and Research

In 1971, tagging will be continued on a reduced scale.

Green turtles in the Galibi region will not be tagged. Sufficient information regarding migrations to Brazil, interesting intervals, etc., has been accumulated. The only value of continuing tagging in this locality would appear to be that it might help to elucidate population dynamics, but that is made impossible (for the moment) by the fact that much nesting by the same population takes place on the French Guiana beaches. However, at Bigisanti, the population is more faithful to one nesting beach and wanderings are reasonably infrequent. Thus an accurate population estimate is feasible and data are also still required about the actual number of times per season the green turtles in the population nest: so tagging of greens at Bigisanti in 1971 will continue.

Ridleys will also still be tagged because there are few nestings outside Eilanti; and leatherbacks will be tagged with a special view to the possibility of more tag-recoveries both at home and abroad.

From 1972 onwards tagging will probably not be part of the turtle programme, unless the delegates to this meeting can offer strong reasons for its continuance. The important themes will be: (1) nest countings, and fixing of annual 'harvest' of eggs, so that the numbers of individuals per population can be increased and thereafter maintained, whilst still realizing some of the benefits that turtles can give to man; (2) nest replanting which has now been standardized to give maximum possible yields.

Marking of young, e.g. with a punch applicator on the side of the carapace is contemplated for 1971 and/or 1972 season. This would enable us to determine growth rates, age of sexual maturity, migrations in the immature stages, sex ratios, mortality rates, etc.

IV. National Requirements

IV.1. Financial aid.

Help from W.W.F. stopped abruptly early in 1970. Since then money has been wheedled from various sources in Surinam and abroad. Future finances are not assured.

IV.2. Protection in Brazilian waters.

We agree with Dr. Pritchard that, 'Surinam green turtles are undergoing considerable attrition in Brazil'. This is based on the large amount of tag returns from there. He doubts if anything can be done about it. Our opinion is that the least that should be done is an analysis of turtle catching in the area. Further steps rely primarily on concrete quantitative data. Our calculation of the proportion of eggs that can be taken also depends partly on this. Furthermore, it will become more and more difficult to defend in Surinam an increase in hatching output (by continuing the substantial reduction of the number of eggs taken from the beaches) without a decrease of adult slaughtering in Brazil. It is not possible for us alone to convince the Brazilian authorities concerned of the importance of these facts.

REPORT ON STATUS OF SEA TURTLES IN COLOMBIA

by Reinhard Kaufmann

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Santa Marta

1. Present situation

1.1 Nesting beaches: According to our explorations and interrogations of inhabitants along the Caribbean coast east of Santa Marta, sea turtles nest from the mouth of the Rio Piedras to a point about 3 kilometres east of the mouth of the Rio Don Diego, and again between the mouth of Rio Palomino and the village of Dioulla. These two beaches are separated by a rocky littoral. The coast of the Alta Guajira Peninsula (east of the provincial capital Riohacha) seems to be unsuitable for sea turtle nesting. Information is lacking for the coast west of Santa Marta, where, at least near Cartagena, sea turtle nesting probably occurs, since turtles and eggs are sold in the market of this town.

The Colombian nesting beaches, as confirmed by scientists up till now, have a total length of about 55 to 60 kilometres. Within this stretch of coast, the only beach I have studied frequently during recent years, is bounded by the mouths of the Rio Buritaca (west) and Rio Don Diego (east), and has a total length of 7.5 km. All data mentioned below refer to this beach.

1.2. Species nesting in Colombia: The following species have been observed by myself: Caretta caretta (caguamo or gogo), Chelonia mydas (tortuga blanca or verde), and Dermochelys coriacea (canal). According to information from local people, Eretmochelys imbricata (carey) is nesting on this beach too, which was confirmed by hatchlings I received in 1967 from a fisherman. Nevertheless, I myself have not yet succeeded in finding nesting females of this species. It is possible that Lepidochelys olivacea also nests.

1.3. Abundance of nesting species: Nowadays Chelonia mydas and Eretmochelys imbricata nest only occasionally, so that it is impossible to get any statistical information about their population size. Fishermen have told me that 15 to 20 years ago both species arrived frequently to nest on the Buritaca beach, so that one could observe at any point along the beach 10 to 12 emerging females each night.

The leatherback is fairly rare too. In May and June 1970, 7 nesting females, 4 other nests and 7 emergences of hatchlings were recorded on the beach. As the breeding of this species seems to begin in March, culminating in April, these data do not reflect the real number of leatherbacks nesting on this beach. Observations will therefore be taken up again early in the spring of next year.

The most abundant species of the beach is the loggerhead. According to my observations and calculations during the nesting seasons of 1966, 1967 and 1970, there is a total of about 675 emergences of loggerhead females each year. The season extends from the middle of April to the end of August. Counting only the nesting animals, but not emergences without nesting (here called "caracoleos"), one may estimate 300 nests per season, which corresponds to more than 2 nests per night. Since other neighbouring beaches have environmental conditions which are identical with those of the beach under investigation, one may suggest that their loggerhead nesting density should be the same. If so, some 2400 loggerhead nests per year can be calculated for the 60 kilometre total length of breeding beaches. My first few taggings indicate that loggerheads may nest 4 to 6 times each season. The population of this species can thus be estimated at 400 to 600 females.

1.4. Tagging: In 1970, for the first time I succeeded in tagging 32 loggerhead females and 2 leatherback females, thanks to Dr. Pritchard, Gainesville (Fla), who provided me with tags and applicators, paid for by a grant from Prof. A. Carr. A list of the tag-numbers has already been mailed to Dr. Pritchard. Tagging will be continued more intensively in the next breeding season.

1.5. Exploitation: On the nesting beaches described above, sea turtles are exploited mainly by the poorer natives of the area, for whom they are nearly the sole source of protein. There is also some turtle-hunting by people who come from the interior of the country, but it is on a smaller scale. The fact is, however, that when the females emerge for nesting, all that are found are killed and all their eggs are collected. The population of Colombian sea turtles is thus threatened by extinction. What the turtle hunters (locally called "tortugeros") do not need for their own use, is sold on the markets of the bigger coastal towns, such as Riohacha, Santa Marta, Barranquilla and Cartagena.

Since green turtles and hawksbills are nearly extinct, the main exploited species is now the loggerhead. Of the leatherback only the eggs are collected; the meat is not used.

Along the coast of Alta Guajira, where sea turtles cannot nest, animals are caught with nets by the native Indians. There are no statistics available of the annual catch of turtles and eggs.

1.6. Protection: Already in 1966, 1967 and 1968, the beaches between Mendiguaca River and a point 3 kilometres east of Don Diego River, have been guarded by the "Corporacion Autonoma Regional de Los Valles del Magdalena y del Sinu". It was based on two watchmen controlling each beach section, as delimited by the river mouths. This attempt at protection proved insufficient, the "tortugeros" being able to continue with hunting and collecting almost undisturbed.

In 1970, for the first time, the beach between Buritaca and Don Diego Rivers was protected effectively by about 10 beach guards of the "Instituto del Desarrollo de Recursos Naturales Renovables" (INDERENA), a governmental institution for conservation of natural resources. Only in very rare cases females were killed and nests dug up here. On all other nesting beaches the excessive exploitation continued as before.

2. Requirements.

2.1. Research:

2.1.1. Tagging should be continued during the next breeding seasons, with the purposes:

- i) to get more exact informations on the population size of all sea turtle species nesting east of Santa Marta;
- ii) to obtain biological data about multiple nesting;
- iii) to trace the migration of populations which nest on Colombian beaches.

2.1.2. All other kind of biological observations should be continued (measurements of adults, egg number per nest, egg size and weight, incubation time, size of hatchlings, etc.).

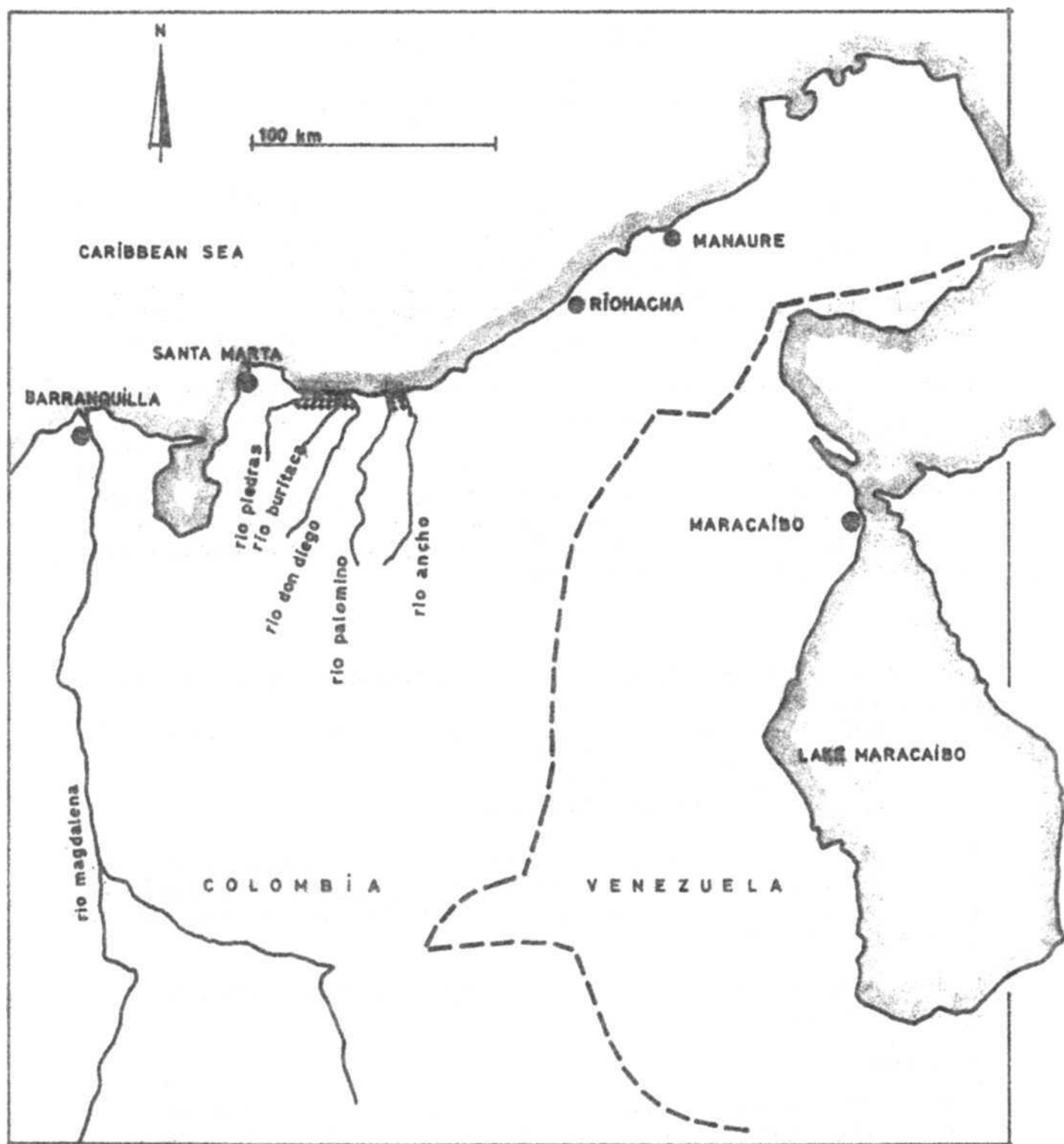
2.1.3. A terrestrial and aerial reconnaissance of the Colombian Caribbean shore line should be undertaken to get knowledge about other nesting beaches besides the ones described above.

2.1.4. The personnel employed as guards should be trained to be able to make the more basic biological observations.

2.2. Protection:

2.2.1. The INDERENA as the competent institution of the Colombian Government should be asked to establish and enforce clear laws on the matter of exploitation and conservation of sea turtles.

2.2.2. The Don Diego-Buritaca area should be declared a sea turtle sanctuary for re-stocking of the populations, during the next 5 to 10 years. Exploitation on the neighbouring beaches should be limited and controlled.



LOCALITY OF THE TURTLE BREEDING BEACHES ON THE NORTH-EAST COLOMBIAN COAST

SEA TURTLES IN TRINIDAD AND TOBAGO<sup>1</sup>

by P.R. Bacon  
University of the West Indies, Trinidad

General

Sea turtles are listed for attention in the marine research programme of the Trinidad and Tobago Government but the Fisheries Department has no active programme of study, exploitation or conservation of this resource. The collection of turtle statistics at the various fishing centres is not continued although records are kept in some of the wholesale fish markets.

Information on the sea turtles of Trinidad and Tobago is thus very limited, as it is from most other Caribbean islands, which is one reason why no report from this area was received at the previous meeting of the Marine Turtle Group in 1969. It is only since 1965 that any interest has been paid to turtles in Trinidad and Tobago by naturalists attached to the Trinidad Field Naturalists' Club. The Club, which is composed mainly of amateur personnel, has concentrated on patrols on easily accessible beaches where basic nesting data have been recorded.

Species

Four species are known to nest regularly in Trinidad, which are, in order of abundance,

Dermochelys coriacea - known locally as "caldon or coffinback";  
Chelonia mydas - "greenback";  
Eretmochelys imbricata - "hawksbill";  
Lepidochelys olivacea - "batali".

There is one nesting record for the north coast of Trinidad in July, 1970, which was almost certainly the loggerhead Caretta caretta. This species is seen frequently by fishermen off the north coast but was not known previously to nest in the island.

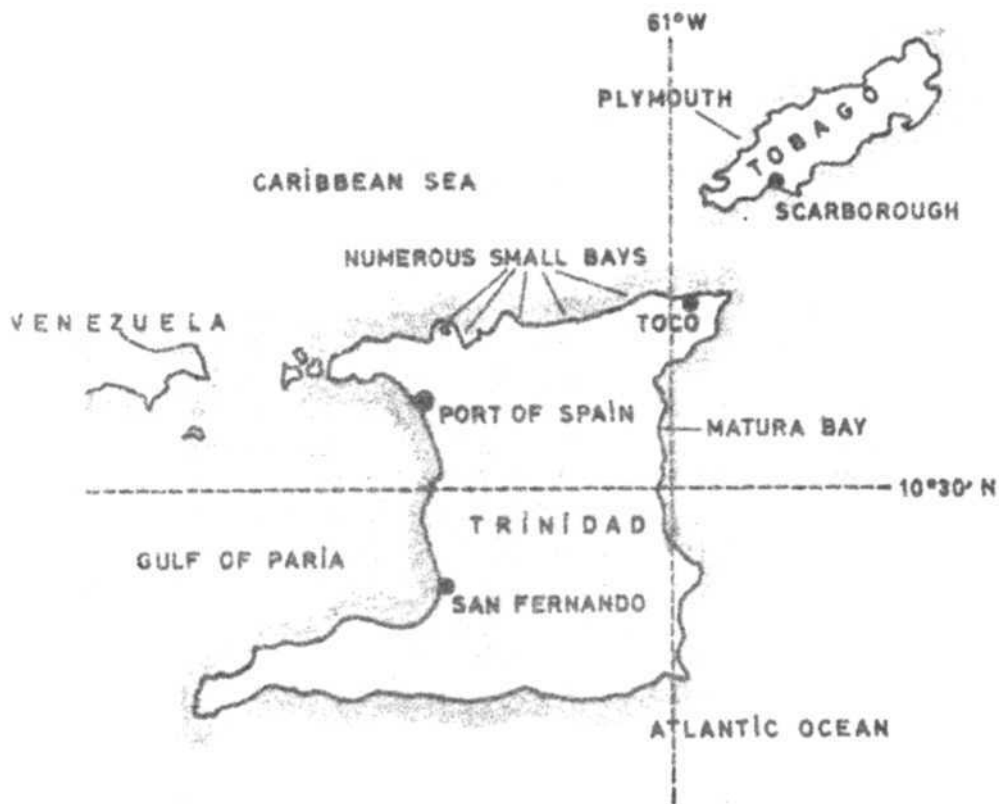
To date, only the leatherback, green and hawksbill turtles have been recorded in Tobago.

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<sup>1</sup> This report contains the personal views of the author and does not necessarily represent the view of the Trinidad and Tobago Government.

## Nesting areas

Fig. 1: Map of the islands of Trinidad and Tobago, showing the main turtle nesting areas.



Most of the nesting is confined to the north and east coasts of Trinidad, where almost any beach of any size has been used during the last few years. Absence of nesting on the south coast is probably due to the presence of steep cliffs with little sand below, while the west coast is predominantly muddy with coastal mangrove swamps.

Nesting has been studied in greatest detail on Mature beach on the east coast as this is readily accessible. This beach is probably the most important nesting area for leatherbacks. The green and hawksbill turtles nest mainly on the north coast and around islands between Trinidad and Venezuela, where these species can be seen feeding and resting during most months of the year.

In Tobago, leatherback nesting appears to be confined to the more sandy leeward coast, especially near Plymouth. Green and hawksbill turtles nest in small numbers all round the island and small individuals can be seen feeding in the reefs throughout the year.



### Relative abundance

Except for Dermochelys, no data are available on the numbers of sea turtles nesting each year in Trinidad or Tobago, or on the numbers killed on the beaches or at sea.

The leatherback nesting population for the whole island of Trinidad is estimated at from 200 to 250 mature females each season, with about 50% or this centred on the east coast at Matura Bay. The Tobago population numbers only a few dozens. Compared with the nesting populations of neighbouring Guyana and Surinam, the Trinidad and Tobago turtle populations are very small. They are, however, probably larger than those of most other Caribbean islands, few of which have all five species nesting.

### Exploitation

Little accurate information is available on the degree of exploitation. All turtles seen nesting on the north coast beaches are killed by local villagers and a large number of immature ones are taken in beach seines. A sufficient number of greens and hawksbills are caught at sea off the north coast to keep about 20 pirogues occupied during April, May and June. None of the fishermen is entirely dependent for his livelihood on harpooning and netting turtles as, during this period, ordinary fishing is neglected. All the meat and eggs are used for home consumption or find local markets. A number of hotels, especially in Tobago, also purchase turtle meat and green and hawkbill shell is sold locally.

### Conservation

#### 1. Legislation

At the present time the Protection of Turtle and Turtle Eggs Regulations, 1952, are in force (see Annex). As will be noted, these regulations under the Fisheries Ordinance prohibit killing of turtles, removal of eggs and the sale of meat or eggs only from the 1 June to the 30 September in any year. They are, therefore, very unsatisfactory as the sea turtles are not protected during April and May when most of the nesting takes place.

The Fisheries Department, under whose auspices turtle protection falls, does not have wardens to patrol beaches or visit fishing centres. Law enforcement falls, therefore, on the civil police who are already overburdened. The Fisheries Department does not have representation on the Wild Life Conservation Committee which advises the Government through the Ministry of Agriculture, Lands and Fisheries. The Forestry Department is represented, however, on this advisory committee and their game rangers have been assisting the Field Naturalists' Club over the past few years. The game rangers can exercise their authority only during the close season for the

hunting of animals on land, thus giving some protection to turtles on the beaches from 1 April to 30 September. Administrative confusion of the nature indicated by the situation greatly hampers progress in turtle conservation.

## 2. Education

During the last three years lectures have been given to schools, clubs and societies in both Trinidad and Tobago on the need to conserve turtles. Propaganda of this sort has met with a warm response and large numbers of interested persons have accompanied beach patrols - making things more difficult for the poachers.

## Research

Up to the present time research has been concerned almost entirely with Dermochelys. For this species, the nesting season is from March to August, possibly September, with most nesting taking place in April, May and early June. The majority of the nesting females emerge from the sea between 9 p.m. and midnight, spending about one and a half hours on the beach. The dimensions of the nesting females do not differ significantly from those recorded elsewhere - mean carapace lengths for all Dermochelys measured on Trinidad beaches from 1968 to 1970 was 158 cm with a range from 125 to 185 cm. Carapace widths averaged 106 cm with a range of 75 to 121 cm.

Tagging was begun in 1970. From the 16 leatherbacks tagged on Matura beach there were two tag returns indicating re-nesting intervals of 10 and 11 days respectively.

Small round holes through the fore flipper of nesting females have been seen commonly in Trinidad leatherbacks. Three of the 16 animals tagged on Matura beach in 1970 had these holes. These may be holes left after old tags have fallen out - which would indicate that the animals had come from other nesting areas where tagging had been carried out before 1970.

Other records for Dermochelys include clutch sizes from 65 to 130 eggs; Adults observed eating the jellyfishes, Physalia and Stomolophus, in coastal waters; the high incidence of fresh injuries on females arriving at the nesting sites; the presence of the commensal barnacle Platylepas on the carapaces and limbs; and the great loss of eggs due to beach erosion - especially at the start of the wet season in early June.

## Intended research

Beach patrols will be continued throughout 1971. One group will concentrate on Matura beach to collect further data on leatherbacks and others will work on the north coast to gather data on the nesting of the other species.

During the 1971 season we intend to seek the services of a fisherman from the Fishing Cooperative at Toco to collect turtle exploitation statistics. He would be able to record the date and location of all turtles caught at sea, measure and weigh them before they were slaughtered and follow the marketing of the meat. From other fishermen and villagers he could obtain some nesting data in addition. It would be possible from this information to estimate the amount of exploitation of turtles, at least in this area, which is necessary before discussions on turtle conservation in Trinidad and Tobago can proceed further. We are approaching various local organizations for funds for this project - which can be carried out better by someone resident in the north than by any members of the Field Naturalists' Club visiting the area in their spare time.

Further lectures to schools are planned for 1971, although it will not be possible to reach many districts. Funds are required urgently for the printing of literature for distribution to schools and village community centres.

At the end of the turtle nesting season we hope to advise the Trinidad and Tobago Government on the revision of the laws to give adequate protection to all species during their breeding period. It would help greatly to know what other territories, particularly in the Caribbean, are doing in this respect to protect similar small populations of sea turtles.

ANNEX

Government Notice No. 192

TRINIDAD and TOBAGO

Regulations made by the Governor in Council under Section 3 (1) (c) of  
the Fisheries Ordinance, Ch. 25. No. 9.

1. These Regulations may be cited as the Protection of Turtle and Turtle Eggs Regulations, 1952.
2. It shall not be lawful for any person between the 1st day of June to the 30th day of September in any year to take or remove or cause to be taken or removed any turtle eggs after they have been laid and buried by the female turtle or after they have been buried by any person.
3. It shall not be lawful for any person between the 1st day of June to the 30th day of September in any year to be in possession of or to offer or expose for sale, or to cause to be offered or exposed for sale, or to purchase turtle eggs.
4. It shall not be lawful to catch, kill, or harpoon or otherwise take possession of any turtle or to offer or expose for sale or cause to be offered or exposed for sale or to purchase any turtle or turtle meat between the 1st day of June to the 30th day of September, of any year.
5. These Regulations shall not apply to turtles, turtle meat or turtle eggs lawfully imported into the Colony. Provided that the onus of proving that the same was lawfully imported into the Colony shall be on the person alleging the same.
6. Any person who contravenes these regulations shall on summary conviction be liable to a fine of Forty-eight Dollars or to imprisonment for two months.
7. The Protection of Turtle and Turtle Eggs Regulations, 1951 are hereby repealed.

Dated this 14th day of October, 1952.

W. S. ARCHER  
Acting Clerk, Executive Council

Approved by resolution of the Legislative Council this 14th day of November, 1952.

G. E. L. LAFOREST  
Clerk, Legislative Council

SEA TURTLES IN INDONESIA

by I.S. Suwelo  
University of Indonesia, Djakarta

Summary

All kinds of sea turtle populations throughout the world are exploited principally as a source of food. It so happens that these turtles occur mainly in areas where the human diet is notably low in high grade protein, such as Indonesia.

Turtle eggs contain higher protein than most fowl eggs (see Table I). It is very possible that in the future turtle eggs could be used as a source of protein in Indonesia.

In order to get some biological data concerning the life habit and the productivity of sea turtle eggs, especially of the green turtle, Chelonia mydas Linn., preliminary research was carried out at the sand beach of Pangumbahan, about 200 km west of Bogor.

According to some herpetologists, it is quite possible that there are five species of sea turtles in the Indonesian waters; they are: Chelonia mydas, the most common species; Eretmochelys imbricata, Caretta caretta, Lepidochelys olivacea and Dermochelys coriacea, the rarest species.

The sand beaches used as breeding grounds by sea turtles are widespread along the Indonesian coasts (Figure 1). Table II summarizes the distribution.

The sea turtle is an oviparous animal, laying eggs and hatching then in their nests. Although there is no break in the breeding season, there is a pronounced cyclical variation in the intensity of breeding, with a marked maximum (see Table III). The timing varies in different areas. The peak of the breeding season seems to have some correlation with the monsoonal periods (Figure 2).

The turtle's nest is about 70 cm in depth, sometimes more, with a radius of 25 - 40 cm. Each female produces different amounts of eggs per nest depending on the species and age, usually between 100 and 200 eggs. Chelonia mydas at Pangumbahan produces in average 107 eggs per clutch. The egg is whitish and spherical, the skin is not hard, and the average diameter is 45 ram.

The incubation period of the eggs varies; it seems that the period is affected by climatic temperature fluctuations.

The results of the investigation of 28 nests at Pangumbahan show that green turtle eggs hatch within  $\pm$  50 days after laying. Although egg laying is an instinctive habit, it is apparently influenced by certain factors. The primary response may be toward light (phototaxis).

Table I

Analysis of turtle and fowl egg components (from Somadikarta & Anggorodi, 1962)

<u>Egg samples</u>	<u>Protein</u> <u>Nx 6.25</u> %	<u>Fat</u> %	<u>Fibre</u> %	<u>Ash</u> %	<u>Water</u> %
1. Unspecified turtle egg*	29.25	9.81	-	0.40	76.41
2. <u>Eretmocbelys imbricata</u>	22.02	16.43	0	3.03	59.34
3. <u>Dermochelys coriacea</u>	17.72	14.03	0	1.62	67.46
4. <u>Chelonia mydas</u>	16.50	11.61	0	1.87	66.66
5. Unspecified turtle egg*	12.29	9.80	-	0.40	74.23
6. <u>Gallus domesticus</u> (ajam, local breed)	13.42	19.99	0	1.74	73.71
7. <u>Gallus domeasticus</u> (ajam, Leg-horn)	11.84	10.66	0	2.17	74.49
8. <u>Gallus domesticus</u> (ajam, R.I.R.)	11.47	9.23	0	1.35	75.61

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\* Samples examined in Laboratorium, "Kolonial Museum", Haarlem, Holland (Quintus Bosz, 1911).

Table II

The distribution of sea turtles in Indonesia.

<u>Island</u>	<u>Chelonia</u> <u>mydas</u>	<u>Eretmochelys</u> <u>imbricata</u>	<u>Caretta</u> <u>caretta</u>	<u>Dermochelys</u> <u>coriacea</u>
Sumatra	+	+	+	+
Biliton	+	-	-	-
Natuna	-	+	-	-
Borneo	+	+	+	-
Djawa	+	+	+	-
Madura	+	+	-	-
Sumba	-	+	-	-
Flores	+	+	-	-
Solor	-	-	+	+
Sulawesi	+	+	+	-
Ambon	+	+	+	-
Banda	+	+	-	-
Obi	+	+	-	-
Ternato	-	+	-	-
Kei	-	+	-	-
Aru	+	+	+	-
Irian	+	+	+	+

Table III

<u>Location</u>	<u>Breeding season</u>	<u>Time of maximum</u> <u>egg production</u>	<u>Incubation period</u> <u>of eggs</u>
Sarawak	All year round	May - Sept.	49-57 days
Malaya	All year round	Dec. - Jan.	47-78 days
P. Berhala	All year round	Nov. - Jan.	47-70 days
Ko Khram	All year round	March - Sept.	45-50 days
Ceylon	All year round	Jan. - March	--
Australian Timor	All year round	Oct. - Feb.	--

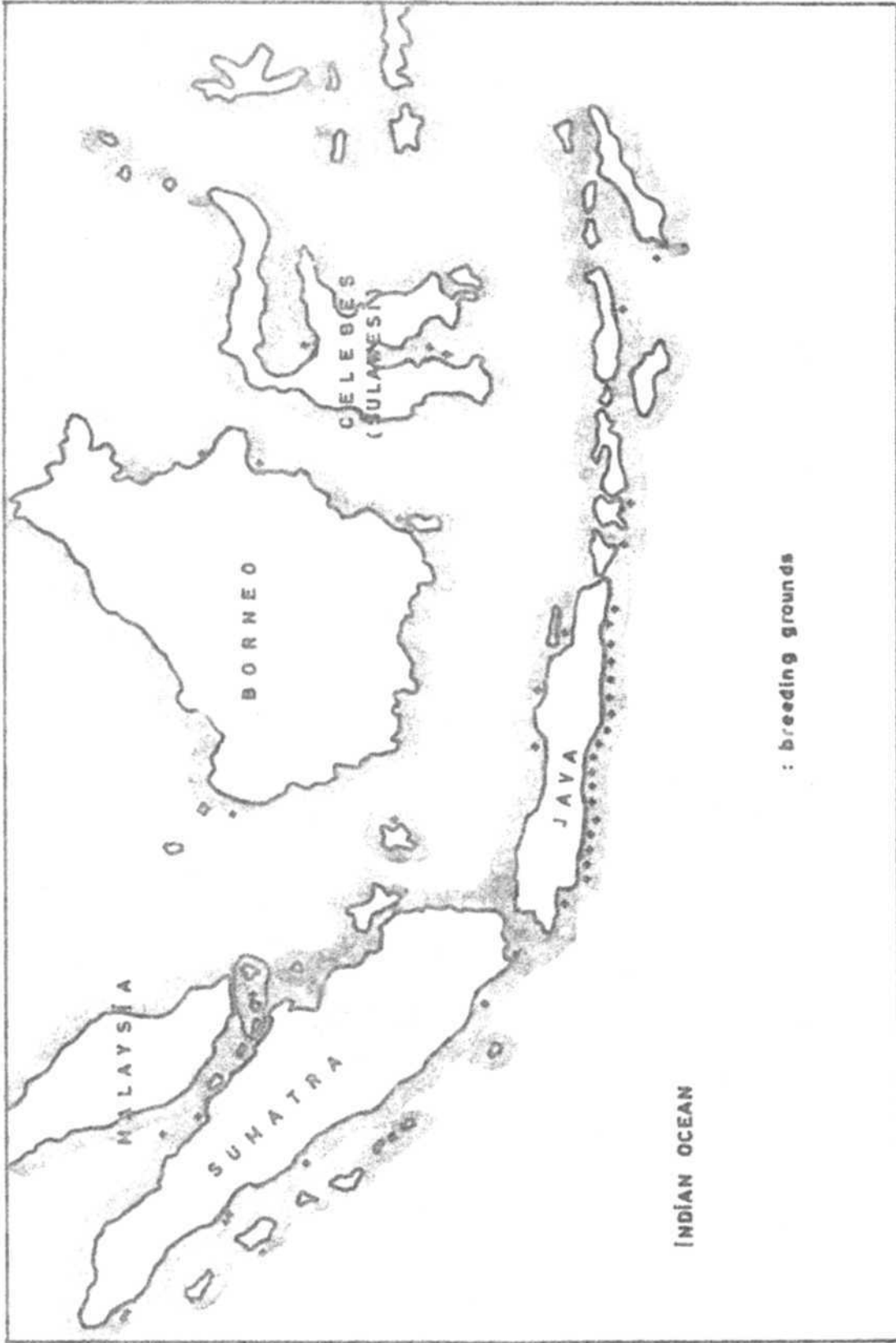


Figure 1. The geographical distribution of turtle breeding grounds in Indonesia (from Meer Mohr, 1927, Rappard, 1936, Somadikarta, 1962)



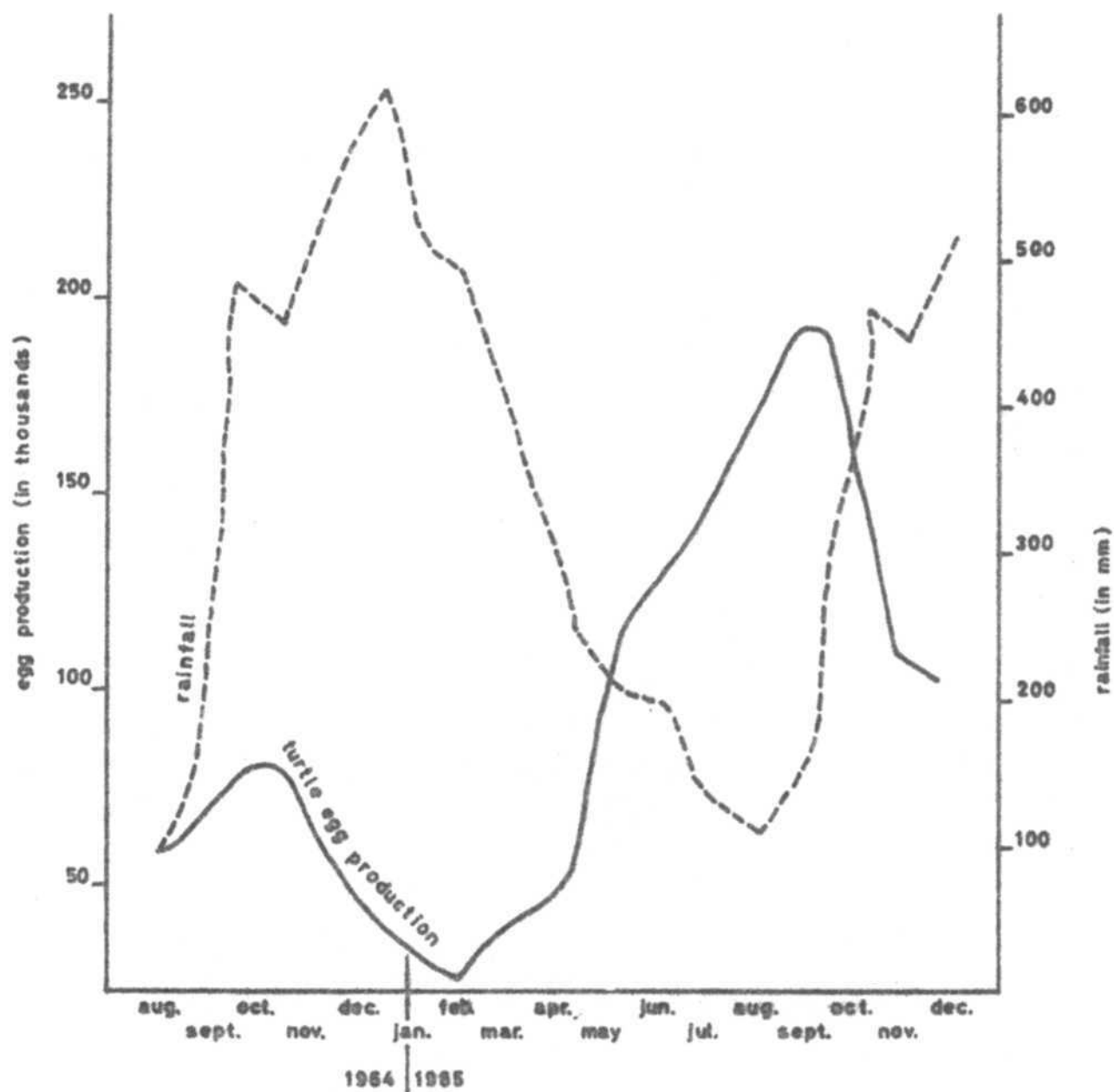


Figure 2. The relation between egg production and rainfall distribution at Pangumbahan in 1964 and 1965.

SUMMARY OF INFORMATION ON PROGRESS IN CAPTIVE CULTURE TECHNIQUES  
MADE BY "MARICULTURE"

by Mark Fisher  
Newplace, Framfield, Sussex

"Mariculture" was set up in 1968 as a private company in the Cayman Islands in the British West Indies to farm the green turtle. My family are shareholders in this company and I am a member of its management committee. In the two years that we have been operating we think that we have learned how to find, collect, transport and hatch turtle eggs with some 90% success. Through very costly experimentation and effort we have begun, and I repeat, begun to learn what to keep the turtles in, how to control their environment and particularly about their diseases. As from the end of May this year all our turtles, and we have over 40,000 on our two farms, will be kept in concrete or fibre glass tanks on dry land. Our pumping station will pump thousands of gallons a minute through these tanks and our breeding pond. Our breeding efforts so far have not been particularly encouraging due to the delay in the starting up of our pumping station, which means that the one million gallon pond is being used to hold several thousand young turtles until their new tanks are completed and on stream. We shall clear this pond of all non-breeders soon and we hope to have turtles mated and eggs laid on our artificial laying beach in the foreseeable future. It is worth mentioning that we have had fertile eggs laid on our beach but these were only from females that were gravid when put into the pond. Much remains to be discovered about the breeding of turtles.

We are, of course, experimenting with nutrition which is one of our most pressing and important problems. Our current weight gains vary enormously but we do have encouraging growth results and feed conversion ratios. Mariculture has just reached the point where we have started to sell limited quantities of high quality turtle to the world market.

I am sure that turtle farming can, and will, contribute to the conservation of turtles, in the following ways:

1. The farmed turtle will be produced in quality and quantity designed to meet the customers' requirements. Current hunting and poaching methods cannot compete and should therefore diminish.
2. Due to improvements in mortality and growth rates as compared with natural conditions much more use will be made of eggs taken from wild rookeries until eggs can be produced in captivity. It is worth mentioning that many of the eggs that we have collected would have otherwise been destroyed by the unsuitable nature of the soil, as in Ascension Island, by beach erosion, as in Guyana, or by other turtles.

3. Private companies like Mariculture can often have a powerful say with governments who should be interested and concerned with conservation. For example Mariculture persuaded the government of Cayman Islands to introduce legislation to restrict the slaughter of turtles there.

4. I am sure that I speak for the other directors when I say that some of the information that we have acquired and will acquire in the future, particularly with reference to breeding, could be made available to this group for conservation purposes. Some of the information that may be learned would probably take years to acquire if it were not for intensive farming, since accurate information as to growth rates and breeding characteristics can only be ascertained from large numbers of repetitive statistics taken in comparable and controlled situations. I think it is reasonable to suggest that modern farming, feeding and management techniques should ultimately produce a much bigger turtle in a shorter time, With better feeding we may get the females to produce eggs at an earlier age and possibly lay every year instead of every three years.

As with any small business that is struggling to pioneer something new we have been through many trials and tribulations in our first two and a half years. Many questions remain to be answered and many battles remain to be fought. However, if Mariculture survives, as I am sure it will, to the point that the demand for turtle products in the growing world can be satisfied from farming sources, as opposed to current primitive hunting methods, then surely a great stride will have been taken in saving the turtle.

THE TURTLE SOUP INDUSTRY

by John Lusty

Managing Director, John Lusty Ltd., London

I am pleased to have an opportunity to contribute to this meeting, as I am a very keen conservationist myself, especially as regards the Green Turtle, and have been for over 35 years, which is probably much longer than most other participants except Professors Carr and Brongersma. This is understood if you give it a few moments' thought, because an important part of my business depends on the survival of this animal.

Many rude, unkind and indeed untrue things have been said and published about the soup manufacturers, attacking and often blaming them as the prime reason for the decline in the world turtle population, although more recently there has been a better understanding of the real situation. But consider for a moment the following facts:

- 1) All species are in danger, not just the Green Turtle, which is normally the only one used for soup.
- 2) The number of turtles taken for soup manufacture on a commercial scale is really very small and consists of the large older turtles, male and female, which have been breeding for at least 10 but more likely 20 years and so have had plenty of opportunity to reproduce many time over. They have generally reached the age when, as with a flock of chickens or herd of cows, they are no longer as productive as they used to be. As with chickens it is good husbandry to cull the older birds to leave more food for the more productive youngsters. Also the old fowl makes much better soup, so it is with the Green Turtle.
- 3) In those areas where the decline and threat to extinction is greatest it is a fact that the taking of eggs to supplement food supplies for the local population has become popular, indeed commercialized. In the East this may be justified because the eating of animal flesh is against some religions, but elsewhere surely it is wrong, because you will get much more food from a fully grown turtle of 100 kilos or more than from a tiny egg.
- 4) In other areas where neither the eggs nor the turtles are much eaten by the local population, but from which a large proportion of the turtles used for soup manufacture come, there is no serious decline or threat to extinction.
- 5) In some areas turtles are slaughtered for their red or steak meat for local consumption and it is from such places that the soup manufacturers obtain much of the gelatinous meat, known as Calipee or Calipash, which is

the most important part used in soup making. So the manufacturer is using a by-product which would otherwise most probably be wasted and, where this happens, it no doubt gives rise to the reports of skeletons and wastage. The high prices paid for this dried calipee play an important part in the local economy. So to those who make scathing remarks about turtle soup being a luxury I would say - "Have you considered the contribution it is making to the welfare of those people, who have very little else to sell from their remote and generally near barren islands and coasts and who also depend on the turtle for their meat? They would still kill to survive themselves, but with your help they could be encouraged to be more selective in their killing and to appreciate the importance of the laying female."

By years of careful attention to the number of turtles taken from any one place, by spreading the demand over a wide area, by encouraging, indeed insisting on, the conservation of the green turtle by protection of the nests and the young at hatching time, by boycotting anyone offering large quantities of supplies of turtles of less than 100 kilos, I believe we as manufacturers have played an important part in helping the survival of this species. While I do not speak for all manufacturers, I do know that some of the largest users of turtle do appreciate the situation and we have done much to encourage the main suppliers towards protecting nests, young and laying females.

As regards numbers used for soup manufacture, I can only give you an estimate because my competitors do not tell me how many they use but I have a shrewd idea of the number used in U.K. and Europe, which I put at less than 1,000 per year whole frozen turtles, about another 1,000 cut up and frozen, mainly from the Australian area and the dried calipee from say 3,000 to 4,000 others, of which the steak meat has been consumed locally. This last figure may be smaller since the Seychelles ban of recent years. Most turtles sent to Europe nowadays originate in north-east Africa and South Arabia. From the Caribbean in the past 25 years we have received less than 400 whole turtles and dried calipee from another 1,000. The American market would hardly be likely to consume more as their turtle soup is so weak.

I have considered only the Green Turtle, not the Hawksbill, Ridley or others, which we do not use.

My recommendations to you to ensure the survival of the turtle are:

- 1) A close season of 3 months during the main local laying period.
- 2) Much more protection of the nest and eggs against beasts as well as man and limiting of the number of eggs allowed to be taken.
- 3) Much more protection of the newly hatched turtles, where possible removing as many as possible to seas where there are less predators and plenty of seaweed cover.

- 4) Ban the taking of any green turtle of less than 50 up to 75 kilos (depending on the area).
- 5) Encourage such organizations as Mariculture in the Caymans to farm turtles, so that in the foreseeable future the Green Turtle at least will become a source of protein much more readily available to augment the world food supplies.

After your last meeting here, Mr. Tom Harrison enumerated seven points as essential to turtle survival. I agree with six of these, but not with the third point concerning the "consumer end". Unless this end is protected, then, as I have already mentioned, the strictly scientific total protection will have serious effects on local economics and pressure would be brought to bear on local governments to reverse protective measures.

Commercial consideration is vital and commercial farming for commercial reasons will give that economic stimulus to local populations to support their venture, their industry and their livelihood.

ACTIVITIES OF FAO IN THE FIELD OF MARINE TURTLE RESEARCH AND MANAGEMENT

by D. Sahrhage

Marine Biology and Environment Branch, FAO, Rome

In accordance with suggestions and recommendations made during the First Meeting of the IUCN Marine Turtle Specialists Group in March 1969, FAO has undertaken or is engaged in a number of activities which can briefly be summarized as follows:

1. The Committee on Fisheries of FAO, at their Fourth Session in April 1969, took note of the problems of turtles and the action being undertaken by IUCN, FAO and other bodies. The Committee recommended that, while the main action might continue to be taken by other bodies, FAO should be kept informed, and should make available its machinery and expertise in fishery research, stock assessment and management.
2. The FAO/UNDP(SF) Central American Regional Fisheries Development Project cooperated in and facilitated a tripartite meeting on the Green Turtle (*Chelonia mydas mydas*) in San José, Costa Rica, in September/October 1969 between representatives of Costa Rica, Nicaragua and Panama. Based on biological studies carried out by a group of biologists of the Caribbean Conservation Corporation under Prof. A. Carr, an agreement was made for the total prohibition of the capture of green turtles or the taking of their eggs for commercial and/or industrial purposes, for a period of three years, during which the machinery for ensuring the conservation of this resource and its sound management would be studied. Through its field projects in the region (Central American Project, Mexico) FAO is encouraging other governments to join this agreement.
3. Dr. Harold F. Hirth (USA) undertook, as Marine Turtle Consultant of the FAO/UNDP(SF) Project for the South Pacific Islands Fisheries Development Agency, from September to December 1970 an extensive review of the stocks of marine turtles of the South and South-west Pacific and made various detailed recommendations for further activities in the fields of turtle research, management and farming, as well as training of local personnel in these fields. Dr. Hirth visited in particular Hawaii, Tahiti, Western and American Samoas, New Caledonia, Tonga and Fiji. He recommended that the Rose Atoll in American Samoa should be protected as it is an important breeding ground for both hawksbill and green turtles. This Atoll would make a good site for an ecosystem study. Dr. Hirth further recommended a thorough four-months nesting and tagging study in French Polynesia, possibly to be supplemented by the establishment of an egg hatchery. Also recommended were a series of small-scale turtle rearing experiments in Western Samoa which could provide basic information required before large-scale turtle farming

or restocking could achieve any form of commercial success. In order to provide base-line data for turtle mariculture, the turtle grass pastures in Fiji should be studied. Furthermore, Dr. Hirth recommended a survey of nesting grounds in New Caledonia. A turtle tagging programme was also recommended for the region.

To implement these recommendations it would be necessary to obtain outside financing from agencies and institutions interested in the conservation and management of turtles, including IUCN. With the advice of the Marine Turtle Group IUCN might wish to consider proposed individual schemes and suggest sources for funding.

Another marine turtle consultant, Dr. S.R. Hendrickson (USA), is expected to undertake further survey work on the turtle resources in this area in summer 1971.

4. The Government of Southern Yemen has unofficially requested the services of a turtle expert for some months in 1971. If the present negotiations succeed, this work will mainly be concerned with the assessment of the turtle populations on the major nesting beaches and the densities on the feeding pastures. The results will be compared with the figures obtained by Dr. Hirth during his work in this area as FAO turtle expert in 1966/67. Of particular importance is also the training of local personnel in turtle assessment and management.

5. Upon requests from governments and where appropriate, FAO will also, in various other field projects in developing countries, assign turtle specialists to assist in the field of turtle research and management.

6. FAO assisted in obtaining information on sea turtle stocks and their exploitation, especially in areas not yet covered by the review made at the First Meeting of the Marine Turtle Group. Relevant information was sent to IUCN and/or to Mrs. M.M. Goodwin as a contribution to her turtle exploitation survey.

7. Work on improving the turtle catch statistics has continued and better coverage by countries, species and areas is now available as presented in FAO Fisheries Circular No. 270 (Part 72), copies of which were distributed at the Second Session of the Marine Turtle Group. After further improvements these data will be included in Volume 30 of the "FAO Yearbook of Fishery Statistics".

8. For inclusion in the series of Species Synopses on the Biology of Living Aquatic Organisms published by FAO, Dr. H.F. Hirth is preparing a synopsis on the Green Turtle (Chelonia mydas) which is expected to be published during 1972. Attempts are also made for the preparation of synopses on the other marine turtle species of major commercial importance.



9. It is intended, as part of the FAO project on Species Identification Sheets for Statistical Purposes, to include a series on the economically important sea turtle species. However, it has not been possible yet to implement the preparation of sheets dealing with turtles, and the Second Session of the Marine Turtle Group might consider further steps required for this programme.

10. There is also a need to consider again the preparation, publication and distribution of an identification guide with the description of the hatchlings and small turtles which could be used to encourage fisheries people and other finders at sea to send specimens with details of the capture to the turtle specialists or to the nearest fisheries office. This question was discussed during the First Session of the Marine Turtle Group and it was felt that such a measure would contribute greatly to obtain information on turtles during the "lost year". It has not been possible so far to prepare the identification guide.

11. FAO is considering a recommendation made by Dr. Hirth that a Field Manual on Marine Turtles dealing with turtle identification, biology, management and conservation should be prepared. Such a manual may be useful for fisheries workers becoming involved in turtle problems, and also for training purposes. This could possibly be arranged as a joint project with IUCN.

SOME ASPECTS AND PROBLEMS OF THE USE AND EXPLOITATION OF MARINE TURTLES

by Mary Margaret Goodwin  
San Juan, Puerto Rico

Introduction

There is still, as this report shows, a great paucity of information regarding the economic exploitation of marine turtles. It stems from three causes:

1. The number of turtles, (or any part thereof), used is a rigidly guarded secret on the part of nearly all the industries using marine turtles, because of the competitive aspect within the industry, and also due to the fear of action by conservationists.
2. At the source of supply for turtles, the local fisheries officers keep very poor records, if indeed they keep any at all. This is due to four factors:
  - a. they are usually not required to keep such records;
  - b. they are frequently poorly trained (eg. in the Caribbean);
  - c. they are often local fishermen who got the job through friends in the government locally, and they have little interest or understanding in conservation or records;
  - d. they may themselves be the local exporters of turtles.
3. No accurate records are kept by either U.S. or British customs as to the number of turtles, live or frozen, or turtle parts, which enter the country. No answer was received from German customs, but if this was in the affirmative it would be of great help since a great amount of the turtle products for Europe enter by way of Germany. Turtles entering Britain or the U.S. are grouped under 'fishery products', 'marine animal oils' or 'reptiles' and not specifically as turtles, turtle products or otherwise.

The available information, such as it is, is given here by island and by country:

Aves

An estimate by fisheries men in the Caribbean gives a rough total of 150 males and females together, with no indication of what the percentage is for either sex. The fishing for turtles in Aves is mainly by boats from Martinique, St. Lucia and Dominica. August is the closed season in St. Lucia (actually from 1 June to the end of August). However, one fisherman in St. Lucia has special permission to import and handle turtles from Aves at that time. August is the month when most of the turtles are caught on Aves since September and October are extremely dangerous due to hurricane weather. Several boats have been lost in the last two seasons.

St. Lucia

An American group, as yet unknown, is buying whole, live green turtles and flying them to Puerto Rico. A source has been found within the Puerto Rico customs this year who has agreed to cooperate to find out about the shippers and the amounts being brought in.

Puerto Rico

Beyond doubt there is a large supply of marine turtles in Puerto Rico, .. on land that is. The green turtle is available as a food in nearly all hotel restaurants, and throughout the island at the small coastal restaurants. It is available frozen in the major supermarket chain on the island. The store will not divulge their source but they are very likely a part of the group that buys out of St. Lucia. I expect to have some ideas as to amounts they sell, markets (which are probably outside Puerto Rico as well), and sources of supply. In a house by house survey of nearly all the major fishermen on the northeast and east coast of Puerto Rico, I found the walls of many of the rooms were covered in small hawksbill shells, the average size of which was 12 to 15 inches or smaller. All of these are used for the tourist trade and the fishermen purposely catch them that size. The last major turtle inventory, which was for the initial study of Puerto Rico's fishes, was in 1898-99 and 1900. Since that time only short field notes and chance records have been kept.

Hawaii

From Dr. Hendrickson's educated guess, there is a figure of 13,500 lbs. of turtle steak at \$2.00 per pound which makes an average of \$27,500 earned per year for meat and another \$10,000 earned from 200 shells sold per year. On where they are sold, I have no information.

Republic of Somali

(Bur Gavo to Merca, a distance of 250 miles or 400 km): Figures were obtained from William Travis by George Hughes: 6 camps over a 12-month period: 8436 green turtles taken, of which 5193 were males and 3243 were females. 79% were caught by netting, 14% were caught by remora-fishing and 4% were caught by turning on the beach; 3% were caught by other means.

Bagiuni Islands (now the Juba Islands);

Mr. Travis estimates that he took 3800 in one year himself from this area but does not say what year.

Mombasa, Kenya

An attempt by letter to reach the Whiteheads in Mombasa to verify Travis' estimate of 2400 to 2800 for their per annum take was unseccessful.

Abidjan, Ivory Coast

(Figures for 1967 and 1968, only, available). Total sea turtles landed and sold as food:

1967 - 516	(Dec: 49)
1968 - 797	(Feb: 70, May:72, June:83, Nov: 129).

(The figures in brackets represent the highest number per month). The landed weight is estimated by the fishermen as anywhere from 30 to 60 kilos. A local expert's impression is that the fishermen eat 10% of the total catch on board the boat. About 50% of the total catch, of all sizes of turtles (small and large), is thrown back to the sea due to the limited storage capacity of the boats. The two main species caught are Caretta caretta gigas, Deraniyagala, and Lepidochelys olivacea olivacea, Eschscholtz. The fishermen receive from 1000 CFA to 2000 CFA for the landed turtle, depending on weight. The purchaser may sell directly to the market or to a retail operation. Resale price, again depending on weight, is about 3000 CFA. Market price is 100 CFA for two kilos of meat (U.S. dollar equivalents can be obtained by multiplying the CFA amount by .004).

#### Sarawak

According to information from Tom Harrisson,  $\frac{1}{4}$  to 1 million eggs are sold for local food annually and the total financial sum is about M\$20,000.

These are the only areas for which I have information. Attempts at correspondence have been pretty futile. I know, for example, that Nieman Marcus is one of the largest single purchasers of turtle shells in the U.S. They buy direct from the source and then have the handbags and tortoise shell jewelry made up. Attempts to locate other manufacturers of turtle product effects have been quite frustrating. There is some hope if we can get help from Polly Bergen, the reference for which is in an annex to this report.

#### Conclusions and Recommendations

1. There must be a concerted effort on the part of all the members of the Turtle Group to seek out sources of supply in those areas closest to them, and some fairly correct estimates of catches.
2. Support and cooperation must be sought from all available sources to gain information at the manufacturing end of the economic cycle and an estimate of market and financial gains made. Although that is one of the primary purposes of this study, it will take some probing in many instances to discover the demand for turtle products.
3. A cooperative plan should be developed by FAO to enlist the services of fisheries officers in all countries exporting turtles to keep accurate annual records, and to assess local use.
4. IUCN should seek the cooperation of such agencies as the Ministry of Fisheries in England and the Department of Interior in the United States and the appropriate agencies in Germany to require the Customs to keep an accurate record of turtle imports for one year, or more.
5. A review and revision of the seasonal regulations protecting turtles should be undertaken to bring all of them uniformly in line with conservation requirements, so that a situation such as that in St. Lucia does not continue to exist.

6. A telegram should be sent by this committee to the Prime Minister of St. Lucia, requesting that the permit for importation and handling of turtles from Aves or other Windward Islands will not be allowed this year.

7. There should be a massive program to educate the local fishermen and children and teenagers in all countries where marine turtles are caught or nest, to teach them the value of the marine turtle, and its endangered status, as well as the need for their help in conserving marine turtles. As much as possible, these programs should be tailored to local circumstances. Moreover, a major attempt should be made to reach the women's fashion market and educate them in the need for the conservation of the marine turtles. In short what this specific proposal recommends is that the Marine Turtle Group declare a public education program called "The Year of the Turtle".

ANNEX

Polly Bergen File

A special attempt has been made to reach Polly Bergen and her cosmetics market. A meeting was held with Polly Bergen on February 5th of this year. She is under the impression from the material she receives from the Caribbean Conservation Corporation that the green turtle is in no danger of extinction, anywhere. She is willing to read all the requests this committee might make of her and would attempt to meet them to the best of her ability. She states that she now has a "life time supply" of turtle oil, which she buys as a by-product from soup manufacturers and occasionally from direct sources. She is willing to help this study by supplying her list of sources. It is evident from her new publicity campaign: and from her new plans that less emphasis is now being put on Oil of the Turtle and more on Polly Bergen. She eventually hopes to discontinue the Oil of the Turtle and admitted that it was only a device to get started. She is open to a proposal to aid the committee in some small financial way.

OCEAN RECORDS OF TURTLES (NORTH ATLANTIC OCEAN)

by L.D. Brongersma

Rijksmuseum van Natuurlijke Historie, Leiden

Most data on the distribution of turtles are based upon specimens that have been captured or sighted in coastal waters, or that have been observed on the nesting beaches., and little has been published about their occurrence in the open ocean, far from land. Schmidt (1945) even suggested that the open ocean might form a barrier to the distribution of turtles. However, today we know that turtles do cross wide stretches of open ocean. Thus, the Green Turtle (Chelonia mydas (L.)) migrates from Brazilian waters to the island of Ascension, a distance of about 1260 nautical miles (Carr & Hirth, 1962: 36-37); Chelonia mydas (L.) and Eretmochelys imbricata (L.) occasionally visit the island of St. Helena (Loveridge, in litt.), a distance of 1010 nautical miles from Africa. Moreover, repeatedly turtles are observed, far from their, breeding area, in European Atlantic waters.

In the past it was believed that turtles found stranded on the shores of Western Europe had been brought to the area by ship. Turtles that died during the voyage were thrown into the sea, and some of these might be washed ashore on European beaches. Of the turtles that stranded alive it was assumed that they had escaped from wrecked ships. It cannot be denied that some turtles found on our shores really were brought to the area by ship. This pertains especially to the Green Turtle, which in the past was transported alive to Europe to the manufacturers of turtle soup. In 1889 an American merchantman putting to sea from Antwerp, jettisoned some turtles, and three of these (one still alive) were stranded on the Dutch island of Walcheren. In February 1934 three dead Green Turtles were washed ashore on the Dutch coast, and in December 1937 another dead specimen was found; in all four, initials had been cut into the plastron, such as is done by fishermen in the Caribbean area. These turtles will have formed part of a consignment sent to Europe to manufacturers of soup.

When in 1729 a live Leathery Turtle (Dermodochelys coriacea (L.)) was captured in the mouth of the river Loire, it was suggested that this turtle might have followed ships that had just arrived in France, coming from China. In 1741 or 1742, a Mr. Laborie returning to France from San Domingo included a live young turtle, weighing between 20 and 25 pounds (French measure), among his provisions for the voyage. This turtle, being fed on scraps from the galley, grew so nicely that it was decided to keep it alive until La Rochelle was reached. However, the ship was wrecked on the French coast, and it was assumed that the turtle escaped from the wreck. When in 1754 a turtle weighing about 800 pounds was captured in the same area, Mr. Laborie claimed this to be his lost turtle that had grown up in the mean-time. This conclusion proves to be erroneous. As Mr. Laborie took the young turtle to serve as food, one may assume that it was a Green Turtle; the one taken in 1754 was, however, a Leathery Turtle.

Today we are convinced that turtles do come to European Atlantic waters of their own accord, helped along by the currents.

Some 18th century authors may have believed that the turtles in British waters came from the Mediterranean. This may be inferred from such statements as the one by Pennant (1769: 1) who, when dealing with the presence of the Leathery Turtle in British waters (Cornwall), wrote that the species was only to be found in the Mediterranean and in our southern seas; and from the remark about a turtle taken off the Yorkshire coast in 1748 or 1749, of which it was said that it was a Mediterranean Tortoise. According to information received from southern Spain, turtles pass through the Straits of Gibraltar in both directions, and it cannot be totally excluded that occasionally a turtle coming from the Mediterranean may continue its journey westwards and northwards along the coasts of Spain and Portugal.

However, this may be, today we are convinced that most turtles that are found in European Atlantic waters come from the Western Atlantic Ocean and/or from the Gulf of Mexico. Indeed, the West-Indian origin of our turtles has been suggested already by Pennant (1774: 166), who writing about the Hebrides, stated: "American tortoises, or turtle, have been more than once been taken alive on these coasts, tempest-driven from their warm seas". Necker (1809: 90) spoke about the great current, i.e., the Gulf Stream, bringing tropical seeds, turtles, etc. to Europe.

There are several arguments to refute the transportation-by-ship hypothesis.

1. It may be pointed out that most specimens found in European Atlantic waters belong to species that are of little or no economic value (at least in Western Europe), viz., Dermochelys coriacea (L.), Caretta caretta (L.), and Lepidochelys kempfi (Garman); the only species of economical value, Chelonia mydas (L.), reaches Europe but rarely of its own accord.
2. Moreover, turtles were known to occur in Western Europe long before Columbus made his first voyage to America (end of 15th century), and long before the sea route to the East Indies was discovered. Petrus Berchorius (c. 1325) described what can only have been the shell of a turtle, which he saw at Boulogne, and it seems that Albertus Magnus (13th century) also was aware of the occurrence of turtles on Western European coasts.
3. Turtles for the manufacturing of soup are no longer shipped to Europe alive, but they are slaughtered at the port of shipment and transported to Europe in a frozen state. Even now that turtles are no longer shipped alive, live turtles still are found in European Atlantic waters.
4. The number of records of live turtles over the last fifty years is too high to assume that all these have escaped from wrecked ships. In times gone by ships transporting turtles may have been wrecked without much attention having been paid to their cargo, but it is highly unlikely that such an event would escape notice today.



These arguments have been mentioned here, because the transportation-by-ship theory is still adhered to by some people, and even occasionally by zoologists.

The strongest argument for concluding that our turtles cross the Atlantic from American waters to Europe is formed by the specimens of Lepidochelys kempii which have been found on Western European shores (Ireland: 6; Scotland: 2; Wales: 3; England: 9; the Netherlands: 2; Channel Islands: 1; Atlantic coast of France: 2), and which have been taken in the Azores (1) and in Madeira (3). The only known nesting beaches are found on the Gulf coast of Mexico (and some nesting taking place in southernmost Texas), and, therefore, we must conclude that Kemp's Ridleys found in Europe came all the way from the Gulf of Mexico. If Lepidochelys kempii succeeds in crossing the ocean, it is only reasonable to conclude that Caretta caretta will do the same. This conclusion is even more warranted as the two species sometimes appear in the same general area in the same seasons, e.g. during the 1938-1939 turtle invasion in British waters (Parker, 1939), and when, in December 1954, a specimen of L. kempii and one of C. caretta were stranded on the Dutch coast (Brongersma, 1961: 2, 33).

If turtles move across the Atlantic Ocean more or less regularly it may be asked whether there are any sight records to prove this. Those sight records that I was able to trace could not all be identified as to species, but of those that were identified nearly all were loggerheads (C. caretta).

Records have been obtained from various sources. To stimulate interest in recording turtles at sea, a short article was published in the Marine Observer (Brongersma, 1968a) and as a result of this numerous records have been obtained through the mediation of Lieut.-Cmdr L.B. Philpott, of the Meteorological Office, Bracknell (Berks.) and that of Miss A.G.C. Grandison, British Museum (Natural History), London. Other records were culled from the reports on the Oceanographical researches by H.S.H. Prince Albert I of Monaco (mainly from the Azores area). The difficulty with records provided by the merchant fleet is, that merchant ships pass through restricted shipping lanes, and although the reports give information about the presence of turtles they give even more information about the shipping lanes. Therefore, especial value must be attached to information given by ships that do not use the official shipping lanes. Thus, observations made by H.N1.M.S. Snellius, which took part in NAVADO II, steaming across the Atlantic Ocean in strictly East-West and West-East routes, are of additional interest. Also observations have been included from MILOC '67, during which H.N1.M.S. Snellius (including the present author aboard), N.R.P. Corte Real and N.R.P. Diogo Cao together sighted 75 turtles. Additional observations were received from the U.S. Hydrographical Office. In this way records were obtained from areas where merchantmen pass only rarely.

It is extremely difficult to identify turtles from a passing ship, and especially if the observations have to be made from some distance. A number of turtles that have been reported by merchantmen and by ships of the various

navies concerned cannot be identified, although the majority of the records may refer to loggerheads (Caretta caretta). Still, the most important feature is that turtles (whatever species they may have been) were reported from the open ocean. To the article in the Marine Observer sketches of the carapaces and heads of the various species were added to facilitate identification. It proved that these figures were taken 'too literally'. During growth the shape of the scutes of the carapace (most evident in the vertebrals) undergoes distinct changes, and it proved that this was not apparent to the observers, who sometimes identified turtles upon the shapes of the scutes indicated in the figures, which did sometimes represent an adult and sometimes a juvenile specimen. To obtain better results it would be necessary to give illustrations of specimens of different ages for each of the species.

Records are most numerous in the Azores area. That turtles were abundant in the Azores area was known already to Van Linschoten (1595), who in his sailing directions for ships homeward bound from the East Indies remarked that when one proceeded from  $36^{\circ}$  to  $39 \frac{1}{3}^{\circ}$  N one would come to the island of Flores where many turtles would be seen to float on the surface. H.S.H. Prince Albert I of Monaco explored the Azores area for many years, and many turtle records were made. Moreover, the Azores are situated on a much used shipping route. When on board of H.Nl.M.S. Snellius in the area North of the Azores, I was rather astonished by the number of turtles. The weather was none too good, and the sea was often fairly rough; standing on the bridge one had to limit one's survey of the sea to a stretch of about fifty yards wide on one side of the ship. If on the port side two or three turtles passed the ship, it stands to reason that other turtles may have passed on starboard, and also at greater distances from the ship. Hence, the number of turtles present in the area must have been many times higher than the number sighted. In a recent note about the turtles of Madeira it was estimated (Brongersma, 1968b:131) that about a thousand C. caretta were captured around the island annually. Mr. Dalberto Teixeira Pombo, of Sta. Maria, Azores, who recently visited Madeira, writes me that my estimate is much too low, and that more probably some four thousand loggerheads are taken and slaughtered annually.

The number of records of turtles observed at sea at some distance off the East coast of North America is low. It is understood (L. Ogren, in litt.) that many more observations have been made by aircraft that regularly fly over the sea to register the surface temperature, etc. It is to be regretted that publication of these records has been delayed, for together with the data on the temperature and on the fluctuations in the course and strength of the Gulf Stream, the data on turtles will be of great interest.

From the observations it appears that turtles are fairly wide-spread in the North Atlantic Ocean, at least between  $30^{\circ}$  and  $50^{\circ}$  N, with the exception of Marsden square 114, from which no records are available as yet. A few records come from parts of the ocean (Marsden squares 151, 149, 148, 147), where one could expect to meet with turtles on their way to Europe. An interesting feature is that most of the sighted turtles are young to half-grown, and that

as far as identifications could be made most of them are C. caretta. The presence of loggerheads around the Azores and around Madeira is of interest, as turtles do not come ashore to nest on these islands (Azores: Carr, 1957: 48; Madeira: local information). The fact that only rarely adult turtles have been observed, and that most of the specimens are young may have a bearing on the problem of the 'lost year'.

A few observations have been made on hatchling turtles at sea off the East coast of North America (cf. Carr, 1967:58). It seems that the hatchlings after entering the sea move well away from the coast, and that they may travel along with the Gulf Stream. As very small turtles are not easily detected at sea, it is not astonishing that the majority of the records come from far away from the nesting beaches, i.e., from areas where somewhat older and larger turtles are to be found.

Parker (1939: 129) suggested that turtles might have been started upon their voyage involuntary by hurricanes, and later (Parker, 1951: 153-154) it was suggested that the movement of turtles might be associated with the migrations of eel larvae from the Sargasso Sea to Europe. It was assumed that the turtles would feed on the predatory fish, which in their turn fed upon the eel larvae. However, there is as yet no clarity about turtles feeding on actively moving fish and one would suppose that the more slowly moving eel larvae, present in large numbers, would form an easier prey. The present author rather favours the idea that spending the first part of their life in the open sea forms a normal part of juvenile turtles' life history, at least of C. caretta and of Dermochelys coriacea (Brongersma, 1970). Juveniles coming from the Gulf of Mexico or from the East coast of North America will travel with the Gulf Stream, and most of them may keep to the branch turning to the Azores and Madeira, and stay for a time in an area where food is abundant. Some may come into the branch that passes to Europe. In this way the occurrence of young C. caretta and young L. kempfi in European Atlantic waters might be the outcome of their normal pattern of life (i.e., spending part of their life in the open sea). If this point of view is correct the turtles when grown to maturity should return to the American nesting beaches. At one time I supposed that this would mean continuing the voyage with the current that passes westwards between 30° and 20° N. However, no turtles have been recorded from this area. There is another snag in this hypothesis. If American hatchlings would move to the Azores and Madeira with the current and from there back to America by a more southern, westward current, it should also be assumed that turtles that hatched on African beaches would travel by the southern route to American waters, to return eastwards with the Gulf Stream. As yet there is no evidence to support this assumption. One wonders if, after all, hatchlings from the Moroccan coast might not move across and partly obliquely against the current towards the Azores and to Madeira, an area where food is abundant. If this happens the consequence would be that the Western and Eastern Atlantic populations would meet. A further question arises, viz., whether the loggerheads that have travelled to the Azores from America, return perhaps by swimming home against the current, and whether all of them do this, or do some of them go to Africa?

As long as we have no method of marking hatchlings in such a way that they can easily be recognized on the beach when full-grown, it will be difficult to solve these problems. However, if in the Madeira area, where a very great number of loggerheads are taken every year, a project could be started to tag turtles one might at least get to know where these go to nest. If such a project were to be successful an arrangement should be made to pay a fee to fishermen for bringing in turtles to be tagged and released. Such an agreement should include a guarantee that tagged turtles are not to be recaptured and slaughtered. In any case it is important that some protection should be given to turtles in the Madeira area.

Although the above notes do not attempt to solve the problem of the lost year, it seemed worth while to present the available data about the occurrence of turtles in the open ocean.

#### References

- BRONGERSMA, L.D., 1961. Notes upon some Sea Turtles. - Zool. Verh. Leiden, 51, (2) + 46, 9 figs., 2 pls.
- \_\_\_\_\_, 1968a. Turtles. - Marine Observer, 28: 28-34, 12 figs.
- \_\_\_\_\_, 1968b. Notes upon some Turtles from the Canary Islands and from Madeira. - Proc. Kon. Ned. Akad. Wet., C, 71: 128-136, 1 fig.
- \_\_\_\_\_, 1970. Het "Verloren" Jaar en de Verspreiding van enkele Zeeschildpadden. - Versl. gew. Verg. Afd. Natk., Kon. Ned. Akad. Wet., 79: 70-72.
- CARR, A., 1957. Notes on the Zoogeography of the Atlantic Sea Turtles of the Genus Lepidochelys. - Rev. Biol. Trop., 5: 45-61, 3 figs.
- \_\_\_\_\_, 1967. No one knows where the Turtles go. - Natural History, N.Y., 76: 46-51, 8 figs.
- \_\_\_\_\_, & H. HIRTH, 1962. The Ecology and Migrations of Sea Turtles, 5. Comparative Features of Isolated Green Turtle Colonies. - Amer. Mus. Novit., 2091: 1-42, 10 figs.
- LINSCHOTEN, J.H. van, 1595. Reys-Geschrift van de Navigation der Portugaloyzers in Orienten, inhoudende de Zeevaart, zoo van Portugael naer Oost Indien als van Oost Indien weder naer Portugael, enz. Amsterdam, Cornells Claesz., 147 pp.
- NECKER, L.A., 1809. Coup-d'oeil sur la nature dans les Iles Hébrides; Mémoire lu à la Société de Physique et d'Histoire Naturelle de Genève, le 31 août 1809. - Bibl. Britannique, 42, ser. Sci. Arts: 55-92.
- PARKER, H.W., 1939. Turtles stranded on the British Coast, . 1938-1939. - Proc. Linnean Soc. Lond., Sess. 151: 127-129.
- PENNANT, T., 1769. British Zoology, 3rd ed., 3, Class III. Reptiles. IV. Fish. London, Benj. White, xii+358+(1), pls.
- \_\_\_\_\_, 1774. A Tour in Scotland and Voyage to the Hebrides MDCCLXXII, Part I. Chester, J. Monk, (1)+vii+439 pp., 44 pls.
- SCHMIDT, K.P., 1945. Problems in the Distribution of the Marine Turtles. - Marine Life, Occ. Pprs., 1, no. 3, 7-10.

Annex

RESEARCH PRIORITIES FOR EFFECTIVE CONSERVATION AND MANAGEMENT

1. Mapping of sites of group-nesting of marine turtles

This project will provide basic data on group-nesting of marine turtles which is required for a realistic international programme for the conservation of marine turtles.

Detailed mapping is required of all known sites of group-nesting of all genera and species of marine turtles, together with a survey of, and census at, all intervening nesting areas. It is considered that such information is essential for sea-turtle conservation on anything other than a local scale. A world-wide annual questionnaire programme will be carried out under the direction of the Special Investigator of the Marine Turtle Group.

2. Research into captive culture techniques for marine turtles

This project will cover captive culture research work (under sound scientific control) and also field management studies where an adequate level of control over a population can be achieved.

Turtle farming enterprises already exist on a commercial basis but inadequate research has been undertaken into the feasibility of captive breeding of artificially raised turtles or into the effects of increased supplies of turtle products in world demand. Delegates to the first working meeting of marine turtle specialists in March 1969 were not in favour of the establishment of turtle farms until such basic studies had been undertaken.

3. Population ecology studies of marine turtles

This project will cover careful studies of the ecology and demography of a number of different nesting colonies, to improve our present elementary understanding of population structure, colony proliferation and relations between breeding and feeding populations, and will include studies on feeding, productivity, navigation and the "lost year".

4. Taxonomic - Zoogeographic studies of marine turtles

This project is concerned with establishing the ranges of the various species and races of marine turtles before exploitation eliminates most of them and speciation is disturbed by the introduction of turtles into waters where they do not normally occur.

These studies will indicate how best to conserve present stocks, as well as providing data on these stocks, i.e. where it would be best to invest limited conservation funds for maximum return.