PROCEEDINGS OF THE WESTERN ATLANTIC TURTLE SYMPOSIUM

W. A. T. S.

S. T. A. O.

San Jose, Costa Rica
17-22 July 1983

IOCARIBE

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VOLUME 1

PROCEEDINGS OF THE WESTERN ATLANTIC TURTLE SYMPOSIUM

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SYMPOSIUM ON
SEA TURTLE RESEARCH
OF THE WESTERN ATLANTIC
(POPULATIONS AND SOCIOECONOMICS)

17-22 July 1983
San Jose, Costa Rica

Sponsored By The
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i.a Address of Dr. Manuel M. Murillo, President of IOCARIBE, at the Inaugural Session of the Western Atlantic Turtle Symposium

The talks which we started today have the multiple purpose of bringing our knowledge up to date about the biological peculiarities of the marine turtle populations of the western Atlantic; to know and analyse the scope of the National Reports prepared by the scientific and technical personnel of more than thirty nations of the region; to consider options for the orderly management of the marine turtle populations; and in general to provide an adequate forum for the exchange of experiences among scientists, administrators, and individuals interested in making contributions for the preservation of this important natural resource.

This symposium was created in Fort de France, Martinique, as a result of a meeting of experts convened by IOCARIBE in November, 1977, for the formulation of a scientific research program on the living resources of the Caribbean area. Its realization, to become a relevant scientific event, is due to the strong support of the nations of the region, of various international organizations, of the scientists and technical personnel that have worked with dedication in the preparation of the reports and in the compilation of the data, as well as to the commitment and dedication of a group of idealists who gave the best of their capabilities to accomplish the responsibilities assigned to the Steering Committee, to the Technical Team and Local Committee of Costa Rica.

It is hoped that the success achieved in all aspects of the preparatory stages will be greatly improved by the contributions and by the quality of the discussions which will be generated by each one of the sessions during this symposium. In this context, the contributions of the National Representatives acquire fundamental importance, particularly in the special session when they discuss the definition of goals for the immediate future.

The basis of the data derived from the National Reports will serve as a starting point for the identification of critical areas where it will be necessary to concentrate all efforts in the future. In this sense it is appropriate to bear in mind that IOCARIBE is now in a transitional stage, that may lead to a change in its condition from pilot program to a permanent subcommission of the Intergovernmental Oceanographic Commission. In that condition IOCARIBE could perform its job as a Sponsoring Organization of the programs resulting from WATS, for which a Steering Committee would be designated which would be in charge of the promotion of research and the continuous actualization of the data base through close contact with the National Representatives, as it is now with other developing programs. Another task of IOCARIBE would be to coordinate actions with the international organizations or appropriate agencies in order to present to the different countries the best options that would ensure the conservation and management of the turtle populations.

In the context of oceanographic research in support of the living resources carried out on a global scale under the orientation of IOC, the WATS constitutes an excellent example of the benefits derived from regional cooperation, when this responds to priorities chosen by the nations involved.

The organizational model of WATS is in itself an important contribution, as it is easily adapted for the analysis of other important marine resources for the nations of the region, about which there is scanty information or for which management requires a previous stage of research.

The contributions resulting from the next five days of work will set the guidelines for multiple future actions. It is because of this that we feel honored with your presence and we reaffirm our commitment to collaborate with you in any way, in order to assure the success of the symposium. I can not terminate without making a formal recognition of the Government of Costa Rica, well represented here by the Minister of Agriculture and Livestock, for the continuous support to IOCARIBE. In the same way, I express my recognition to the colleagues of the three WATS Committees and to Harvey Bullis and Fred Berry, whom we consider with pride the godfathers of this Symposium, my gratitude for their ideas and their permanent dedication. I also want to thank you all for your attendance.

Thank you.

San Jose, July 18, 1983

i.b <u>Address of Mr. Jorge Csirke, FAO observer, at the Inaugural Session of the Western Atlantic Turtle Symposium</u>

Mr. Francisco Morales Hernandez, Minister of Agriculture and Livestock of Costa Rica, the National Representatives, Ladies and Gentlemen:

I wish to express the deep satisfaction of the UN Food and Agriculture Organization (FAO), for the wonderful reception given to the Western Atlantic Turtle Symposium (WATS), being inaugurated today. The attendance at this event by so many distinguished individuals, by the National Representatives of more than 30 nations within the region and by the international community of experts, confirms the great significance of sea turtles in the region.

FAO is aware of the socio-economic importance represented by these natural resources within the region. If the goal is to achieve the recuperation of the severely depleted populations and to utilize and manage the potential value of their colonies, present research needs to be expanded, conservation as well as management practices revised and, if necessary, improved.

It is expected that this symposium will arrive at technical conclusions and recommendations which will indicate directions for future research. This should also apply to the conservation and management policies for these resources.

FAO's participation as co-sponsor of this Symposium was a result of a recommendation from the Third Meeting of the Western Central Atlantic Fisheries Project (WECAF), which took place in La Habana, Cuba, in November 1980. Following the same spirit, and always as a result of the expressed interest of the member states of the Organization, FAO has supported various activities related to sea turtle research within WECAF, and was also able to implement many of its recommendations in a timely fashion.

Now, FAO is greatly interested in the results of this meeting. Within our mandate, we will support those actions recommended by the Symposium.

The UN Organization for Food and Agriculture (FAO) wishes to sincerely express its support for the success of this meeting.

Thank you.

San Jose, July 18, 1983

i.c Address of Dr. Robert R. Lankford, Administrator to WATS, at the Inaugural Session of the Western Atlantic Turtle Symposium

Senor Francisco Morales Hernandez, Minister of Agriculture and Livestock, National Representatives, members of the WATS Committees, Ladies and Gentlemen:

It is with pleasure that I extend to you the greetings and best wishes from the Chairman of the Intergovernmental Oceanographic Commission, Professor Inocencio Ronquillo of the Philippines, who unfortunately had to cancel his attendance at the last moment, and from the Secretary of the Commission, Dr. Mario Ruivo in Paris.

My presentation this morning, although very brief, will be a task which gives me a great deal of both personal and professional satisfaction. Very simply, ladies and gentlemen, my rewarding task this morning is to acknowledge with thanks the truly gratifying support which the Western Atlantic Turtle Symposium has been provided from many sources.

The term support, may be thought of in many ways; there is the support of experience -- there is the support of hard work and endless effort, there is the very necessary economic support, and equally important, we can identify moral support. WATS, very fortunately, has benefited from all of these different types of support. It is therefore my great pleasure to acknowledge publicly, and for the record of this symposium, the unstinting and generous help which has brought us to this most important meeting in San Jose.

First and foremost, I wish to recognize with personal appreciation the human component, and the countless thousands of man-hours which have gone into WATS during its more than three years of development. Specifically, I refer to our various committees:

(a) The Steering Committee which has provided the organizational know-how and the development philosophy and guidance to WATS.

(b) The Technical Team, the sea turtle experts who have assisted many participating countries in the training of investigators and the preparation of their National Reports.

(c) The Local Committee of Costa Ricans who have given of their valuable time and their capabilities to provide the local needs.

(d) And finally, the dedicated efforts of the various Symposium Panels, the local staff in the symposium secretariat, and particularly my administrative assistant, Ms. Maria Teresa Koberg.

Although time doesn't permit naming all of those people who have given their time and energy, I feel compelled to call to your attention four individuals who have been particularly important:

(a) Dr. Peter Bacon of the University of the West Indies in Jamaica, who in a FAO report suggested the need to conduct a region-wide investigation and compilation of information on sea turtles in the Caribbean Sea;

The agenda of the Symposium was developed by the Steering Committee to begin with presentation of the National Reports, followed by three and one-half days of panel sessions on 14 sea turtle topics and concluded by a Future Actions discussion and planning session, participated in by the National Representatives.

The Steering Committee nominated individuals from around the world to serve as Chairs, Alternate-Chairs, Rapporteurs, and Panel Members of the Panel Sessions. A Biologist was nominated to present a Biological Synopsis for each of the six sea turtle species during the first six panel sessions. The Steering Committee prepared guidelines and formats and designated background documents for each of the panel sessions that were distributed to the panel members prior to the Symposium. Three Audience Response Sessions were designated to allow and record input from all registered attendees on all of the topics discussed at the Symposium.

A Poster Session and Exhibition area was planned, and poster presentations and abstracts were widely solicited. Posters were requested that related to sea turtle research, primarily of the western Atlantic area, and especially relating to sea turtle populations and socio-economics.

The Steering Committee reviewed the WATS budget at its September 1982 meeting and accelerated its efforts to solicit additional contributions to WATS from national and international organizations and institutions.

The WATS Secretary maintained correspondence with, and distribution of notices of plans and events to, the National Representatives, Steering Committee, Technical Team, panel members, and the general WATS mailing list.

Official national participation in the Symposium effort was outstanding. Thirty-five (35) of the 38 WATS - area countries officially participated:

Anguilla, Antigua, Bahamas, Barbados, Belize, Bermuda, British Virgin Islands, Cayman Islands, Colombia, Costa Rica, Dominica, Dominican Republic, French Guiana, Grenada, Guadalupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Nicaragua, Panama, Puerto Rico, St. Kitts-Nevis, St. Lucia, St. Vincent, Suriname, Trinidad-Tobago, Turks-Caicos, U.S. Virgin Islands, United States, Venezuela.

Reports on National Report format tables were received from ALL 38 WATS-area countries. Official National Reports were received from 33 of the countries; Draft National Reports for two (Belize and Colombia); and Ad Hoc Data Reports for the other three (Brazil, Cuba, Netherlands Antilles). Supplemental Data Reports were received from seven countries.

At the Symposium, 31 National Representatives participated, representing 33 countries (2 N. Reps. were absent). Nineteen members of the Steering Committee and Technical Team were very active during the meeting. More than 300 registered participants were present.

The meeting occupied five very full days, with the ad hoc injection of films, slide-projections, conclaves, and discussions.

around the larger Caribbean islands, recording survey data on standardized survey forms. This would provide the first comprehensive perspective of sea turtle nesting areas for the region.

A brochure, announcing the Symposium, its structure, and its objectives, was printed and mailed to interested individuals and institutions on the WATS mailing list of more than 900 addresses. The brochure stated the focus and purpose of WATS:

> "Sea turtles of the Western Atlantic Ocean once constituted an important natural resource. This resource has been severely reduced and now contributes little to the regional economy. Attention needs to be focused on the questions of research, conservation, and management if turtle stocks are to be replenished to the levels of their full potential."

A National Report Form of 21 tables was developed, printed, and distributed in early 1982 to all National Representatives and Technical Team members to facilitate tabular and descriptive recording of available data on sea turtle populations and socio-economics. The Steering Committee defined four categories of reports for the Symposium:

(1) National Report (NR) - Official, presented by National Representative.

(2) Draft National Report (DNR) - Unofficial, prepared by the Technical Team, presented to the Symposium, and entered into the data base, in the circumstance of no presentation of a NR by the National Representative of a participating country.

(3) Ad Hoc Data Report (AHDR) - Prepared on NR format by the Technical Team and entered into the data base for countries that did not officially participate in the Symposium.

(4) Supplemental Data Report (SDR) - Official, presented by the National Representative. To include all data collected after NR was compiled and submitted by the National Representative.

A Sea Turtle Manual of Research and Conservation Techniques was planned and written by Peter C. H. Pritchard and 11 other volunteer authors, illustrated, printed (July 1982), and distributed to promote sea turtle research, to define terms, techniques, and reporting formats, and to assist in identifying species. A revision of the manual was begun in late 1982, with two editors and an additional author, and printed (November 1983).

A Glossary of Terms was prepared by Kenneth Dodd to identify and clarify terms that would be used at the Symposium.

An Annotated Bibliography of Sea Turtle Research in the Western Central Atlantic was written by Peter R. Bacon, to be published with the Proceedings of this Symposium.

A WATS Computerized Data Base system was developed at the SEFC Miami Laboratory by Harvey R. Bullis and Nancy Thompson. As the National Reports were received, they were entered into the system.

The objectives of WATS were defined:

(1) To assemble the information derived from the National Reports into a regional sea turtle data base.

(2) To conduct discussions of this information to validate the data base, identify critical problem areas, and examine potential directions for future action.

(3) To consider the establishment of a continuing institution to assume responsibility for guiding future regional efforts concerned with conservation and management of sea turtle stocks.

The IOCARIBE Regional Secretary, Robert R. Lankford, officially requested of the appropriate ministry of each of the 38 area countries:

- that each nation accept the invitation to participate in WATS;
- that each nation officially appoint a National Representative to WATS;
- that each National Representative be responsible for the development of a National Report for their country and its presentation to the Symposium meeting.
- that each official National Report include the best available data on sea turtle populations and socio-economics for each country; and
- that all National Representatives attend the Symposium meeting to consider and discuss the status of data on the six species of sea turtles in the region, to consider conservation and management options, and to develop recommendations for future actions.

Steering Committee meetings were held on planned or _ad hoc_ bases as follows: July 1979 at San Jose; November 1979 at Washington (during the World Conference on Sea Turtle Conservation); February 1980 at San Jose; November 1980 at San Jose (during GCFI Annual Meeting); September 1982 at San Jose; November 1982 at Nassau (during GCFI Annual Meeting); January 1983 at Miami; February 1983 at Gainesville; and July 1983 at San Jose (the day before the Symposium). These meetings were attended as possible by Steering Committee and Technical Team members. They were cumulatively successful in guiding the developing detail planning of the Symposium and the research and data collecting that was being generated.

Sea turtle research and data collection were instituted in some participating countries and were augmented in others often with the deployment of Technical Team members as planned and requested. A Technical Team member was assigned to each participating country, with arrangements made to produce an _ad hoc_ data report for any country that did not participate.

The major thrust of WATS-sponsored sea turtle research was on surveys of nesting beaches, both ground surveys and aerial beach surveys. The Steering Committee established an aerial beach survey goal of making at least one aerial survey, preferably during the estimated peak of the nesting season, along every mile of continental shoreline from North Carolina to Brazil and necessary legal and administrative measures to ensure the continued availability of marine turtle stocks within the region; Instructed the Secretary of IOCARIBE to take the initiative in bringing this recommendation to the attention of appropriate international organizations and to inform the IOCARIBE Member States of subsequent development and action.

This recommendation was presented to the IOCARIBE Plenary that met in San Jose in 1978 which, in turn, adopted a resolution to support cooperative international sea turtle research. On the basis of this recommendation, a proposal was made in September of 1978 to the new Chairman, Manuel M. Murillo, to have IOCARIBE sponsor a Sea Turtle Symposium for the western Atlantic that would be concerned with the problems of developing a data base for population studies and a broad regional evaluation to look at the impact on turtle stocks of management in the area.

Since turtles had comprised an important historical food and commerce resource of the region, the question naturally arose concerning the appropriateness of IOCARIBE assuming a major role in a fishery-related activity. In the early discussions consideration was given to approaching the West Central Atlantic Fisheries Commission (WECAFC). Discussions with the WECAFC project manager indicated that while the Commission could be supportive of cooperative investigations, the urgency of other problems did not permit the supporting WECAFC project to assume a leading role. Also it was recognized that there was an urgent need for an assessment of sea turtle stocks that could not be quickly implemented in the WECAFC project. Following these considerations it was agreed that the non-partisan role of IOCARIBE as a cooperative scientific organization would be valuable and effective in developing the required sea turtle data base.

In February 1979, a meeting was held at the University of Costa Rica in San Jose by officials of IOCARIBE, the Western Central Atlantic Fisheries Project (WECAF) and the Southeast Fisheries Center of the U.S. National Marine Fisheries Service (SEFC, NMFS). The concept of WATS was formalized, and the basic organizational structure was developed:

- IOCARIBE became the sponsor of the Western Atlantic Turtle Symposium (WATS).

- IOCARIBE, WECAF, and SEFC supported WATS by donation of funds and administrative and research personnel.

- An international Steering Committee was formed to guide the planning for and conduct of WATS.

- An international Technical Team was formed to assist in sea turtle research and data collection in any area or country where requested or needed.

- Sea turtle research work in the area already under way by the Western Atlantic Sea Turtle survey and by Mexus-Gulf was directed to WATS.

- A Local Committee was formed in San Jose to assist in preparation of Symposium arrangements and facilities.

ii. THE HISTORY OF WATS

Harvey R. Bullis
Peter R. Bacon
Frederick H. Berry

The Symposium had its antecedents in the CICAR Program that operated between 1968 and 1976. Following a symposium on the Status of Marine Scientific Research held on Curacao in 1968, an institute known as the Cooperative Investigation of the Caribbean and Adjacent Regions (CICAR) was formed under the sponsorship of the Intergovernmental Oceanographic Commission (IOC). During the early meetings of CICAR, Peter R. Bacon, a marine biologist from Trinidad and Tobago, proposed international cooperation to study sea turtle populations in the Caribbean.

A small working group was established and a report on Appraisal of Stocks and Management of Sea Turtles in the Caribbean and Adjacent Regions was prepared by Peter R. Bacon. Following this, the 6th Session of the International Coordination Group for CICAR, meeting in Cartagena in July 1973, recommended that available data on sea turtle resources, exploitation rates and management practices be compiled, to be disseminated to scientists in the region and to the international conservation agencies concerned; that captive-culture be developed in CICAR countries; that the possibilities of resuscitating depleted turtle populations be examined and that a common conservation program for the CICAR region be formulated.

The CICAR Program terminated with the symposium in Caracas in 1976, but member countries wishing to continue cooperative international scientific research requested IOC sponsorship of a follow-on organization. In early 1976 an international team of scientists met in Mayaquez, Puerto Rico, and developed continued program recommendations. Although specific plans for sea turtle research were not formulated, the group took note of the importance of turtles in the socio-economics of the Caribbean area and agreed to recommend follow-on involvement.

The Intergovernmental Oceanographic Commission Association for the Caribbean and Adjacent Regions (IOCARIBE) was established under IOC. When the formative session of IOCARIBE met in Caracas in 1976, a coordinating committee headed by Harvey R. Bullis was developed to transform program priorities from the May workshop into an international research format. This planning group met in Fort-de-France, Martinique, in November-December 1977. Included in their Caribbean research programs was a resolution that concern for West Atlantic sea turtles should form part of the IOCARIBE terms of reference.

The 1977 IOCARIBE Interdisciplinary Workshop on Scientific Programs in support of Fisheries Projects took three actions: Recommended that a total regional program for the protection, rehabilitation and management of marine turtles be established through appropriate cooperation among such international organizations as IOCARIBE, the Western Central Atlantic Fisheries Commission (WECAFC), the Gulf and Caribbean Fisheries Institute (GCFI), and the International Union for the Conservation of Nature (IUCN); Strongly urged all governments within the IOCARIBE region to consider the ensuing program for protection, rehabilitation and management with a view to implementing establish a regional entity with scientific, technical, and economic capacity, that will be in charge of the execution of the research and education programs, and the formulation of recommendations to guarantee the protection of this resource. Furthermore, due to the cultural peculiarities that link the inhabitants of the Caribbean Region to the turtle resource, this entity should incorporate among its responsibilities the development of programs which may specifically reach those who utilize this resource.

The conviction that regional action is fundamental in order to protect the marine turtle populations prompted the Government of Costa Rica to support the programs sponsored by the Association of the Intergovernmental Oceanographic Commission for the Caribbean and Adjacent Regions (IOCARIBE), organizer of this Symposium, in which an ambience of honest harmony and objectivity prevails among scientists, administrators, associations and interested persons contributing the best of their knowledge.

I look forward to the recognition of this symposium as a very important scientific regional effort which will contribute better management options for the marine turtle populations.

Thank you very much.

San Jose, July 18, 1983

i.d Address of Mr. Francisco Morales Hernandez, Minister of Agriculture and Livestock, at the Inaugural Session of the Western Atlantic Turtle Symposium

It is for me a great pleasure to give to you the warmest welcome in the name of the President of the Republic of Costa Rica, Mr. Luis Alberto Monge, the Government, and the people of our country. Welcome again to this land of peace and culture-loving people.

A few weeks ago, I had the pleasure to inaugurate a Scientific Meeting with attendants from different parts of the world, who in response to the invitation of the Food and Agriculture Organization of the United Nations (FAO), spent two weeks analyzing in a holistic way the scientific information accumulated in recent years about the neritic fish populations. The result of this meeting of experts was an accruement of important information directly applicable to the management of such an important resource. Today again I am proud to be in this meeting with a distinguished group of scientists, National Representatives of a significant number of countries of the Caribbean Region, and of concerned citizens interested in contributing with their knowledge to the preservation of marine turtles, a natural resource presenting biological, social and economic implications, that has to be objectively analyzed and in detail. I hope that at the end of this meeting, your contributions will be available to the community of this region, leaving valuable knowledge and viable alternatives within the context of the economy of our cultural patterns, that will facilitate the effective management of the marine chelonian species.

For those of us who have the responsibility to administer the living resources of the sea, it is of capital importance to have access to the most recent scientific information that may facilitate the adoption of compatible options for an adequate management of the natural populations, to benefit our societies and humanity as a whole.

It can not escape from the consideration of this forum that as our societies progress and technical development is stimulated, new demands arise for the utilization of the natural resources. The effort of fishing these species is a case in point where this impact is easily observed, even though it is a resource utilized for subsistence purposes; in this context we consider it of vital importance to have reliable and timely information which will best facilitate the making of decisions.

When a migratory resource is analyzed, whose populations are exposed to the pressure of exploitation carried out by the turtle fishermen of different nations, its management turns out to be even more complex when it involves species with their vital cycles distributed within the jurisdictional waters of different nations. Together with fishing regulations, it is necessary to establish effective measures for the protection of the environment that comprises the various habitats utilized by these species.

Within this perspective it is convenient to analyze the specific case of marine turtles, whose management, together with the adoption of measures that may guarantee the survival of all the species, has to be considered as a task for which the international community is responsible. It is fundamental to

(b) Mr. Harvey Bullis, formerly of the U.S. National Marine Fisheries Service, who moved Dr. Bacon's ideas into action, the one I consider the godfather of WATS;

(c) Dr. Manuel Murillo, of the University of Costa Rica, and long-time Chairman of IOCARIBE, and now President of WATS; and finally

(d) The Secretary of WATS, Mr. Fred Berry of the National Marine Fisheries Service in Miami, whose energy and incredible abilities as an organizer have been the principal force and moving spirit of WATS.

The Symposium has indeed been fortunate to have had the benefit of their interest, their talent and guidance, and their dedication to the Symposium. On the slightly more mundane side, mundane but nevertheless a critical and necessary factor, there have been the economic contributions which have made this Symposium possible. WATS has been generously supported by financial contributions from:

(a) The governments of Canada, the Cayman Islands, France, the U.S. Virgin Islands, and the United States;

(b) From the private sector, The Caribbean Conservation Corporation and the Mariner's Aid to Sea Turtles have provided generous support;

(c) And from intergovernmental organizations, financial contributions have been received from the UN Food and Agriculture Organization (FAO) and from the Intergovernmental Oceanographic Commission (of UNESCO), the parent organization of IOCARIBE.

And finally, Mr. Chairman, I wish to acknowledge with pleasure and sincere appreciation, the sincere and warm interest and the wonderful "Tico Welcome" which we have received from the people and from the Government of Costa Rica. This truly has been a rich and rewarding experience. I ask you, Sr. Morales, to express the joint and unanimous appreciation of all the participants and all who have been involved in this most important regional event to the President of the Republic of Costa Rica, the Honorable Luis Alberto Monge A.

San Jose, July 18, 1983

The Banquet Speaker was Dr. Jay Savage, Professor and Chairman of the Department of Biology at the University of Miami. His scintillating and memorable delivery was "The Way of the Turtle"--an anthropological analysis of the sea turtle fraternity.

At the conclusion of the banquet, Friday night, July 22, the Western Atlantic Turtle Symposium became a unique part of history. Then, prospects for WATS-II were born.

iii. LIST OF PARTICIPANTS

iii.a Speakers Table - National Theater

(1) Hon. Francisco Morales
(representing the Government
of Costa Rica)
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Ministerio de Agricultura y Ganaderia
San Jose, Costa Rica

(2) Mme. Paulette Austin
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(3) Dr. Juan Chong
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(4) Mr. Ricardo Reyes Cerrato
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(6) Dr. Manuel M. Murillo
President to WATS
Director de CIMAR
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(7) Mr. Harvey R. Bullis
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(8) Mr. Frederick H. Berry
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(9) Dr. Robert R. Lankford
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iii.b National Representatives

Country Invited	National Representative
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Country Invited	National Representative
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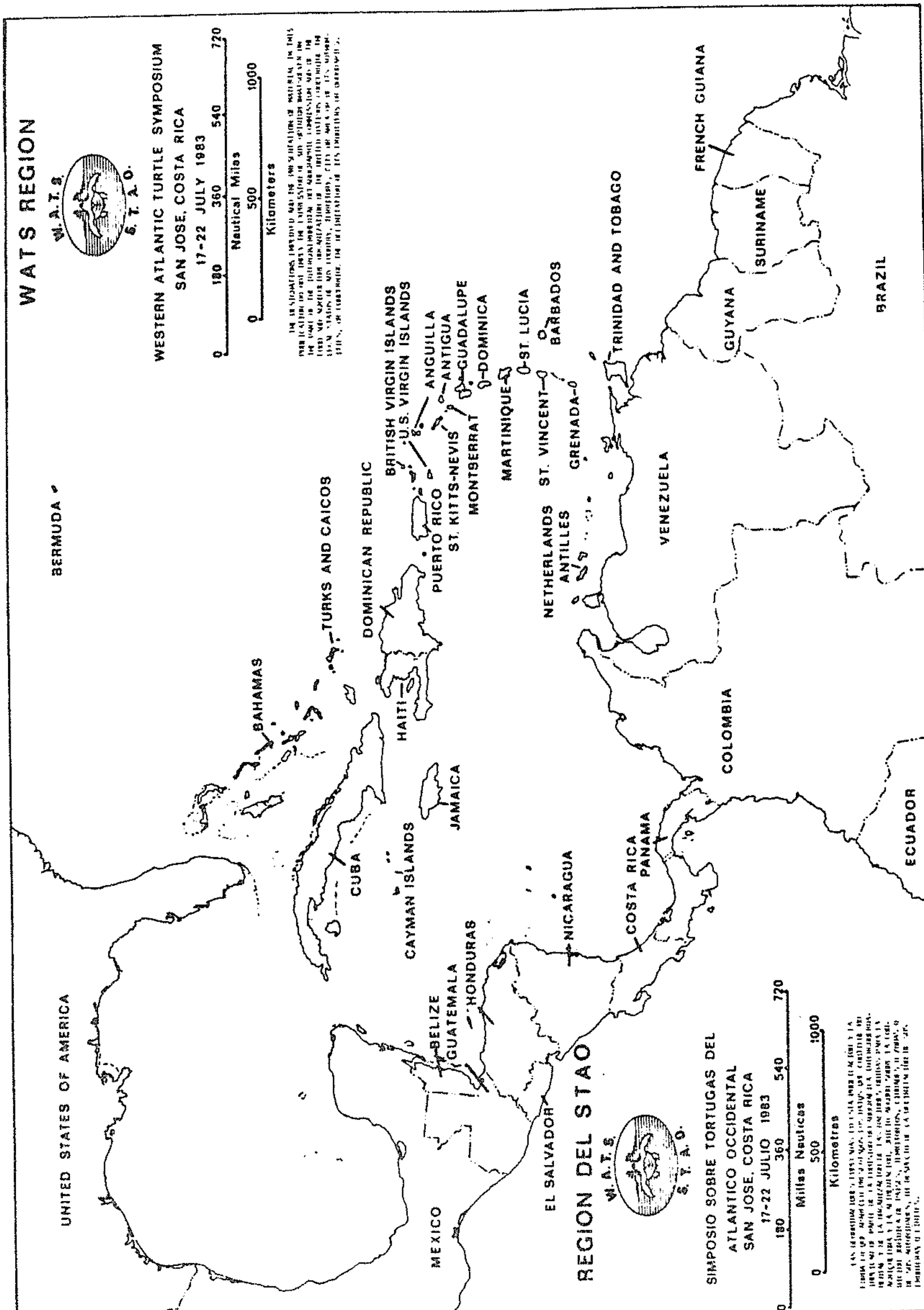
WATS REGION
W.A.T.S.
S.T.A.O.
WESTERN ATLANTIC TURTLE SYMPOSIUM
SAN JOSE, COSTA RICA
17-22 JULY 1983
0 180 360 540 720
Nautical Miles
0 500 1000
Kilometers
REGION DEL STAO
W.A.T.S.
S.T.A.O.
SIMPOSIO SOBRE TORTUGAS DEL
ATLANTICO OCCIDENTAL
SAN JOSE, COSTA RICA
17-22 JULIO 1983
0 180 360 540 720
Millas Nauticas
0 500 1000
Kilometros
UNITED STATES OF AMERICA
BERMUDA
BAHAMAS
TURKS AND CAICOS
DOMINICAN REPUBLIC
HAITI
CUBA
CAYMAN ISLANDS
JAMAICA
PUERTO RICO
BRITISH VIRGIN ISLANDS
U.S. VIRGIN ISLANDS
ANGUILLA
ANTIGUA
GUADALUPE
DOMINICA
ST. KITTS-NEVIS
MONTSERRAT
MARTINIQUE
ST. LUCIA
ST. VINCENT
BARBADOS
GRENADA
TRINIDAD AND TOBAGO
NETHERLANDS ANTILLES
VENEZUELA
GUYANA
SURINAME
FRENCH GUIANA
BRAZIL
COLOMBIA
ECUADOR
PANAMA
COSTA RICA
NICARAGUA
HONDURAS
GUATEMALA
BELIZE
EL SALVADOR
MEXICO

Hour	Sunday 17th	Monday 18th	Tuesday 19th	Wednesday 20th	Thursday 21st	Friday 22nd	Saturday 23rd
0800	**0800** Registration	**0800** Registration	**0800-0900** Overview Synopsis	**0800-1000** Hawksbill, Species Synopsis	**0800-1000** Conservation	**0800-0930** Status of Species	0800-2000 Ad Hoc Meeting: Eastern Pacific Sea Turtle Research
0900		**0900-1030** Opening Address Introductions (National Theater)	**0900-1030** Green Turtle, Species Synopsis				
1000				**1030-1200** Leatherback, Species Synopsis	**1030-1200** Utilization	**1000-1200** Management Options	**0800-1700** WATS Editorial Comittee Meeting
1100			**1100-1200** Green, Species Synopsis (Cont.)				
1200		Lunch	Lunch	Lunch	Lunch	Lunch	
1300		**1330-1530** Presentation of National Reports	**1300-1500** Loggerhead, Species Synopsis	**1330-1515** Research Techniques	**1330-1515** Culture	**1330-1430** Audience 3 Response	
1400	**1400-1800** Steering Committee Meeting					**1430-1530** Future Actions	
1500			**1530-1700** Kemp's Ridley, Species Synopsis	**1530-1700** Habitat Alteration Impacts	**1530-1700** Enforcement and Regulations		
1600		**1600-1730** Presentation of National Reports (Cont.)				**1600-1700** Future Actions (Cont.)	
1700		**1730-1800** Announcements	**1700-1800** Olive Ridley, Species Synopsis			**1700-1800** Rapporteur Reports, Summary	
1800	Dinner	Dinner	Dinner	Dinner	Dinner		
1900			Reception			Banquet - Guest Speaker Dr. J. Savage - University of Miami	
2000	**2000-2200** National Representatives Meeting	**2000-2200** Cultural Activity (National Theater)	**2000-2200** Nature Films	**2000-2200** Audience 1 Response	**2000-2200** Audience 2 Response	**ADJOURN**	

WATS COMPUTERIZED DATA BASE

FROM THE
WATS NATIONAL REPORTS
FOR THE
WESTERN ATLANTIC TURTLE SYMPOSIUM
IN
SAN JOSE, COSTA RICA

DURING
17 - 22 JULY 1983

REVISED 2/12/1984

Prepared and Maintained At The:
Sea Turtle Data Base and Population Analysis Project
Southeast Fisheries Center
National Marine Fisheries Service
National Oceanographic and Atmospheric Administration
U.S. Department of Commerce
75 Virginia Beach Drive
Miami, FL 33149 USA

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Table H.2 Green sea turtle - Chelonia mydas: Statistics of marine turtle utilization including exports from Table 15 of the WATS National Reports.

Table H.3 Leatherback sea turtle - Dermochelys coriacea: Statistics of marine turtle utilization including exports from Table 15 of the WATS National Reports.

Table H.4 Hawksbill sea turtle - Eretmochelys imbricata: Statistics of marine turtle utilization including exports from Table 15 of the WATS National Reports.

Table H.5 Kemp's ridley sea turtle - Lepidochelys kempi: Statistics of marine turtle utilization including exports from Table 15 of the WATS National Reports.

Table H.6 Olive ridley sea turtle - Lepidochelys olivacea: Statistics of marine turtle utilization including exports from Table 15 of the WATS National Reports.

Table H.7 Sea turtles of unknown species: Statistics of marine turtle utilization including exports from Table 15 of the WATS National Reports.

Table I Socio-economic statistics for marine turtle utilization from Table 16 of the WATS National Reports.

Table J Turtle culture and headstart activities from Table 17 of the WATS National Reports.

TABLE A. GEOGRAPHIC AND JURISDICTIONAL INVENTORY FROM TABLE 1 OF THE WATS NATIONAL REPORTS

COUNTRY	LINEAR KM COASTLINE	CONTINENTAL SHELF AREA KM2	SEAWARD EXTENSION OF JURISDICTION
ANGUILLA	65.0	1996.0	376.5
ANTIGUA	281.0	3400.0	502.1
BAHAMAS		124320.0	649.5
BARBADOS	91.9	320.0	765.3
BELIZE	250.0	7450.0	9.6
BERMUDA	183.0	871.0	371.5
BRAZIL	7408.0		416.1
BRITISH VIRGIN ISLANDS	300.0	4500.0	1000.0
CAYMAN ISLANDS	204.0	255.0	4.8
COLOMBIA	1560.0		
COSTA RICA	215.8	18000.0	80306.4
CUBA	3575.0		
DOMINICA	162.5		412.0
DOMINICAN REPUBLIC	1575.0	9484.0	238250.0
FRENCH GUIANA	450.0		741.6
GRENADA	165.4	2780.0	686.0
GUADALOUPE	375.0		741.6
GUATEMALA	148.0	2100.0	763.0
GUYANA	380.0		
HAITI	1535.0	5000.0	
HONDURAS	693.0	370.4	760.6
JAMAICA	560.0	2560.0	819.2
MARTINIQUE	230.0		741.6
MEXICO(GULF)	1760.0		2152.0
MEXICO(CARIBBEAN)	753.0		1145.0
MONSERRAT	49.0	140.0	324.8
NETHERLANDS ANTILLES(S)	330.0	3100.0	5.4
NETHERLANDS ANTILLES(N)	44.0	2265.0	3.0
NICARAGUA	500.0	60000.0	9600.0
PANAMA	1246.0	11447.0	640.0
PUERTO RICO			
ST. KITTS-NEVIS	102.5		9.6
ST. LUCIA	191.0		4.8
ST. VINCENT	150.0	2484.0	10.0
SURINAME	400.0		967.8
TRINIDAD-TOBAGO	494.4		392.8
TURKS AND CAICOS	212.2		600.0
UNITED STATES	6493.9	1160000.0	580.0
US VIRGIN ISLANDS	277.9	1972.0	667.7
VENEZUELA			
TOTAL	33411.5	1424814.4	345419.3

TABLE B. COASTAL SHORELINE HABITAT INVENTORY
FROM TABLE 2 OF THE WATS NATIONAL REPORTS (IN KM)

COUNTRY	SAND	REEFS	ROCKS	CLIFFS	VEGETATION	LAGOONS
ANGUILLA						
ANTIGUA	102.0	7.0	96.5	12.0	102.0	1.0
BAHAMAS						
BARBADOS	41.9			32.3		
BELIZE	105.0	278.2	16.5	2.0		
BERMUDA	11.5		138.5	30.0	1.5	
BRAZIL						
BRITISH VIRGIN ISLANDS	69.1	45.0	90.0	78.0	54.2	
CAYMAN ISLANDS	52.4					
COLOMBIA	780.0					
COSTA RICA	183.8	18.0	6.8		201.8	
CUBA						
DOMINICA	19.5		75.0	68.0		
DOMINICAN REPUBLIC						
FRENCH GUIANA	32.0				290.0	
GRENADA	36.6	4.0	80.3	28.0	123.5	16.0
GUADALOUPE						
GUATEMALA	50.0				97.0	1.0
GUYANA	160.0				120.0	
HAITI						
HONDURAS		94.0	6.0	4.0		
JAMAICA	321.3	0.1	220.6	118.7	100.1	
MARTINIQUE	30.0					
MEXICO(GULF)	857.0	10.0	22.0	2.0		13.0
MEXICO(CARIBBEAN)	160.0	118.0			300.0	
MONSERRAT	6.2		42.0	42.0		
NETHERLANDS ANTILLES(S)						
NETHERLANDS ANTILLES(N)						
NICARAGUA	336.0		29.0	18.0	113.0	
PANAMA						
PUERTO RICO						
ST. KITTS-NEVIS	29.1	24.5	67.5	48.0		
ST. LUCIA	22.0			57.1		1.0
ST. VINCENT	120.0	7.0	3.0	1.0	4.5	
SURINAME	62.2				385.0	15.0
TRINIDAD-TOBAGO	48.1		192.7	45.8	185.3	
TURKS AND CAICOS	52.5	10.0	17.0		100.7	
UNITED STATES						
US VIRGIN ISLANDS	80.0	23.8	82.0	82.1	33.8	6.0
VENEZUELA						
TOTAL	3768.2	639.6	1185.4	669.0	2212.4	53.0

TABLE C. INVENTORY OF KNOWN TURTLE NESTING BEACHES
SUMMARIZED IN TOTAL KM BY COUNTRY
FROM TABLE 3
OF THE WATS NATIONAL REPORTS

COUNTRY	NESTING COASTLINE	NESTING SPECIES	RECORDED NESTING MONTHS
ANGUILLA			
DOG ISLAND		EI CM	
PRICKLY PEAR CAYS		CM EI	
SCRUB ISLAND		DC	
ANTIGUA	54.5		
CARLISE BAY	0.3	EI	JUL
CURTAIN BLUFF	0.3	DC	APR
MORRIS BAY	0.5	EI	SEP
CRABB HILL BAY	0.6	EI	AUG
DARKWOOD BEACH	0.6	EI	AUG
FRYES BAY	0.4	EI	AUG
VALLEY CHURCH BAY	0.4	EI	JUN
PEARNS	0.6	EI	JUL
PINCHIN BAY	0.5	EI CM	JUN-JUL
RUNAWAY BAY	1.0	EI	OCT
ELYES BAY	0.7	DC	APR-MAY
DUTCHMAN BAY	0.3	DC	APR
PASTURE BAY	0.2	EI CM	JUN-JUL
GRAPE BAY	0.2	EI CM	JUN-JUL
LONG BAY	0.7	EI	JUL
HOG HOLE	0.1	EI	JUL
GREEN ISLAND	1.3	EI	JUL-OCT
MILL REEF	0.8	EI	AUG
MACHIN BAY	0.1	DC	AUG
INDIAN CREEK	0.1	EI	JUL
WINDWARD BAY	0.1	EI	
DIEPPE BAY	0.6	EI	
TURTLE BAY	0.5	EI	
RENDEZVOUS BAY	0.7	EI	
TUCKS BAY	0.5	EI	
COCOA POINT BEACH	5.0	EI DC CM	APR-NOV
SPANISH WELL POINT	0.1	EI	MAY
CONTINOUS BEACH	21.0	CM EI DC	APR-NOV
NORTH BEACH	1.0	EI CM	APR-OCT
RABBIT ISLAND BEACH	4.0	EI CM	MAY-NOV
HOG POINT TO TWO FOOT BAY	4.0	CM EI	MAY-NOV
RUBBISH BAY	0.5	CM EI	MAY-OCT
CASTLE BAY	0.5	CM EI	MAY-NOV
WELCH POINT BEACH	1.5	EI CM	MAY-OCT
PELICAN BAY	4.5	EI CM	MAY-NOV
SPANISH POINT	0.3	EI	MAY-NOV

TABLE C cont.

BARBADOS			
CATTLEWASH BEACH		EI	MAY-OCT
BATH BEACH		EI	MAY-OCT
FOUL BAY BEACH		EI	MAY-OCT
BELIZE	94.9		
AMBERGRIS	15.0	CM CC	JUN-JUL
HALF MOON	2.0	CM CC	JUN-JUL
LONG	5.0	CC EI	JUN-AUG
CAULKER	9.0	CM CC	JUN-JUL
CHAPEL	5.0	CM CC	JUN-AUG
GOFF	1.0	EI	JUN-AUG
PLACENCIA	22.0	CC EI	JUN-JUL
RANGUANA	0.5	CC EI	JUN-AUG
LIME	0.5	CC EI	JUN-AUG
HUNTING	0.5	CC EI	JUN-AUG
NICHOLAS	0.2	CC EI	JUN-AUG
FRANK'S	0.2	CC EI	JUN-AUG
PAMPION	0.3	CC EI	JUN-AUG
ROUND	0.3		
SILK	0.2	CM EI	
SOUTH WATER	0.3		
TABACCO	0.9		
SAPODILLA	2.0	CM EI CC	JUN-AUG
GLOVERS	10.0	CC EI CM	JUN-AUG
TURNETTE	20.0		
BRAZIL			
STATE OF PARA		EI CM	MAY-AUG
STATE OF MARANHAO		CM EI	DEC-FEB
STATE OF PIAUI		EI CM	DEC-MAR
STATE OF CEARA	20.0	EI DC	
MAXARANGUAPE		EI	DEC-MAR
CARALIBAS		CM EI CC	JAN-MAR
MARACAJAU		EI CM	JAN-MAR
ZUMBI		EI CC	
CAICARA		CM EI CC	
ATOL DAS ROCAS		EI CM	DEC-MAR
STATE OF PERNAMBLICO		CM EI	DEC-MAR
STATE OF ALAGOAS		CM EI	JAN-FEB
STATE OF BAHIA		CM LO EI CC	
BRITISH VIRGIN ISLANDS	76.6		
POMATO PT TO WEST END, ANEGADA	3.2	EI CM	JUN-OCT
WEST END TO COW WRECK	3.4	EI CM	JUN-OCT
COW WRECK TO WINDLASS LOW PT	3.5	EI CM	JUN-OCT
WINDLASS LOW PT TO SOLDIER PT	3.0	EI CM	JUN-OCT
SOLDIER PT TO LOBOLLY PT	3.4	EI CM	JUN-OCT
LOBOLLY PT TO EAST PT	6.9	EI CM	JUN-OCT
SALTHEAP PT TO POMATO PT	3.7	EI CM	JUN-OCT
WELL BAY BEACH, BEEF ISLAND	0.2	EI CM	JUN-OCT
LONG BAY BEACH	0.4	EI CM	JUN-OCT

TABLE C cont.

LITTLE BAY BEACH	0.3	EI CM	JUN-OCT
MANCHIONEEL BEACH, COOPER ISLAND	0.7	EI CM	JUN-OCT
CARVEL BAY BEACH	0.3	EI CM	JUN-OCT
MARKOE BAY BEACH	0.6	EI CM	JUN-OCT
HALLOVERS BEACH	0.9	EI CM	JUN-OCT
NORTH EAST BEACH, EUSTATIA ISLAND	0.6		
SOPER'S HOLE BEACH, FRENCHMANS CAY	0.4		
SOUTH BEACH	0.5		
CRABBE HILL BEACH, GEORGE DOG	0.2		
SOUTH BAY BEACH, GINGER ISLAND	0.4		
WEDEGEO BAY BEACH	0.2		
CAM BAY BEACH, GREAT CAMANOE	0.4	EI CM	JUN-OCT
LOW BAY BEACH	0.2		
LEE BAY BEACH	0.3		
NORTH BAY BEACH	0.4		
NORTH BAY BEACH, GREAT DOG	0.4		
SOUTH BAY BEACH	0.5		
CAMP BAY BEACH, GREAT TABAGO	0.1	CM EI	JUN-OCT
NORTH WEST BEACH	0.2		
HOLLOW BEACH, GREAT THATCH ISLAND	0.5	EI CM	JUN-OCT
WHITE BAY BEACH, GUANA ISLANDA	0.6	EI DC CM	JUN-OCT
MUSKMELON BAY BEACH	0.5		
NORTH BAY BEACH	0.9		
SADDLE BAY, JOST VAN DYKE	0.2		
WHITE BAY	0.6	EI CM	JUN-OCT
UPPER DOG HOLE	0.4	EI CM	JUN-OCT
GREAT HARBOUR BEACH	0.3	EI CM	JUN-OCT
GARNER BAY BEACH	0.2	EI CM	JUN-OCT
EAST END BEACH	0.2	EI CM	JUN-OCT
LONG BAY BEACH	0.6	EI CM	JUN-OCT
NORTH SIDE BAY BEACH	0.3		
NORTH BEACH, MOSQUITO ISLAND	0.4	CM EI	JUN-OCT
DEVLILBILL BAY BEACH, NECKER ISLAND	0.4		
BUFF BAY BEACH, NORMAN ISLAND	0.7	EI CM	JUN-OCT
LITTLE REEF BAY BEACH, PETER ISLAND	0.3		
DEADMAN BAY BEACH	0.8	CM EI	JUN-OCT
SPRAT BAY BEACH	0.6		
STONEY BAY BEACH	0.9		
SAND PIERRER BAY BEACH	0.6		
OPUNTIS PT. TO ASBESTOS PT.	1.6	CM EI	
ASBESTOS PT. BEACH, PRICKLY PEAR	1.8		
BANDY PT. BEACH	1.4		
VIXEN PT. BEACH	0.9		
SANDY SPIT BEACH	0.1	CM EI	JUN-OCT
SANDY CAY BEACH	0.7	CM EI	JUN-OCT
SOUTH BAY BEACH, SALT ISLAND	0.2		
SALT ISLAND BAY BEACH	0.3		
SALT ISLAND BAY BEACH	0.2		
SOUTHEAST BEACH, SCRUB ISLAND	0.2		
NORTH BAY BEACH	0.3		
SANDY POINT BEACH, TORTOLA	0.2		
SEA COW BAY BEACH	0.6		
BRANDYWINE BEACH	0.6	EI CM	JUN-OCT
HALFMOON BAY BEACH	0.8		JUN-OCT
HODGES BAY BEACH	0.8	CM EI	JUN-OCT
LITTLE BAY BEACH	0.5	CM EI DC	JUN-OCT
LONG BAY BEACH	1.4	DC EI CM	JUN-OCT
JOSIA'S BAY BEACH	0.9	CM EI DC	JUN-OCT

TABLE C cont.

COOTEN BAY BEACH	0.6	EI DC CM	JUN-OCT
TRUNK BAY BEACH	0.8	CM EI DC	JUN-OCT
COOPER BAY BEACH	0.7	DC EI CM	JUN-OCT
LOWER BAY BEACH	1.2	CM EI DC	JUN-OCT
CONE GARDEN BAY BEACH	1.8		
LONG BAY BEACH, WEST	2.2		
SOUTHEAST BEACH, VIRGIN GORDA	1.2	EI CM	JUN-OCT
ST. THOMAS BAY BEACH	1.3	EI CM	JUN-OCT
SAVANA BAY TO TETOR BAY BEACH	1.1		
TRUNK BAY TO TETOR BAY BEACH	1.0	CM EI DC	JUN-OCT
GORDA SOUND BEACH	0.4	EI CM	JUN-OCT
BIRAS HILL BEACH	0.3		
BERCHERS BAY BEACH	0.9		
HANDSOME BAY BEACH	1.8		
COPPER MINE BAY TO TADDY BAY BEACH	1.4		
CROOK BAY BEACH	1.1		
CAYMAN ISLANDS	100.8		
RUM POINT	5.0		
NORTH SIDE	10.7		
BLUFF BAY	4.0		
EAST END	5.7		
FRANK SOUND	3.8		
BODDEN BAY	6.0	CC	JUN
SOUTH SOUND	3.2		
WEST BAY	7.2		
BARKERS BEACH	3.6		
SOUTH SHORE, CAYMAN BRAC	10.0		
NORTH SHORE, CAYMAN BRAC	12.0		
SOUTH SHORE, LITTLE CAYMAN	16.4		
NORTH SHORE, LITTLE CAYMAN	13.2		
COLOMBIA	72.0		
PLAYAS ACANDI	4.0	DC	MAR-JUL
LA PLAYONA	12.0	DC	MAR-JUL
RIO PIEDRAS-RIO DON DIEGO	25.0	CC	APR-AUG
RIO PALOMINO-PUEBLO DIBULLO	28.0	CC	APR-AUG
PLAYA BLANCA ISLA BARU	3.0	EI	
COSTA RICA	63.5		
TORTUGUERO-BOCA DEL RIO PARISMINA	35.4	EI CM DC	APR-NOV
RIO PARISMINA-RIO MATINA	28.0	DC CM	JUL-SEP
CUBA			
CAYOS DE SAN FELIPE		EI CC CM	APR-AUG
BARACOA		CC	MAY-AUG
VARIAS PLAYAS EN EL SUR		CC CM	
CAYOS EN EL GOLFO BATABANO		CC CM	

TABLE C cont.

VARADERO		CC	APR-JUL
CAYOS DEL NORTE		CM	MAY-AUG
CAYOS DEL SUR		CM	MAY-AUG
VARIOS CAYOS, PROVINCIA VILLA C		CC	
CAYO FRANCES		CC	MAY-AUG
CASILIDA-TUNAS DE ZAZA		EI	
CAYO COCO		CC	
CAYOS DOCE LEGUAS		CM	MAY-AUG
CAYO ROMANO		CC	
CAYO CABEZA		CM	MAY-AUG
CAYO BOCA RICA		CM CC EI	APR-MAY
PLAYAS DEL NORTE, LAS TUNAS		EI	
PLAYAS DE GIBARA		CC EI	
PLAYA LARGA		CM CC EI	APR-AUG
CAYO LARGO DEL SUR, ISLA DE LA JUVENTUD		CC EI CM	APR-AUG
OTROS CAYOS Y PLAYAS		EI CM	APR-AUG
DOMINICA	7.8		
TOUCARI BAY BEACH	0.4	EI CM	SEP
PETITE BAIE	1.9	EI	APR
BATALI ESTATE BEACH	0.3	EI DC CM	APR-OCT
SALISBURY BEACH	0.3	EI CM DC	APR-OCT
MERO BEACH	0.7	CM	AUG
ROCKAWAY BEACH	0.3	EI	JUN
ROSALIE BAY	0.5	DC	SEP
LONDONDERRY BEACH	1.8	DC	APR
WOODFORD HILL BAY	1.6	DC	JUN
DOMINICAN REPUBLIC			
SOSUA-BOCA YASICA		UK	JUN
PUNTA GORDA-R. SAN JUAN			
RIO LIMON-PUERTO DEL VALLE		UK	JUN
CABO CABRON-CABO SAMANA		UK	JUN
PUNTA GORDA-PUNTA LIMON		UK	JUN
PUNTA LIMON-BOCA NISIBON		UK	JUN
BOCA NISIBON-BOCA MAIMON		UK	JUN
PUNTA MACAO-CABO ENGANO		UK	APR
ISLA SAONA		UK	APR
RIO NIZAITO-RIO BANI		UK	APR
PUERTO BELLO-CABO SAN LUIS		UK	APR
CABO SAN LUIS-CABO BEATA		UK	APR
FRENCH GUIANA	26.3		
MONTJOLY	4.0	LO DC	JUN
SINNAMARY-KAROUABO		DC	JUL
ORGANABO	3.5	CM LO DC	JUL
AZTEQUE	3.7	CM CC LO	JUL
FAREZ	4.0	LO CM DC	APR-JUL
POINTE ISERE	4.0	EI CM LO CC DC	APR-AUG
KAWANA	3.1	DC LO	MAR-AUG
AWARA-BOIS TOMBE	2.0	CM DC	JUN-AUG
LES HATTES-YA:LIMA:PO	2.0	LO CM DC	MAY-AUG

TABLE C cont.

GRENADA	29.2		
PALMISTE BAY	2.0	CC CM DC	MAY-AUG
ST. MARK BAY	1.0	CM	JUN-JUL
SOUTH BAY, ISLE DE CAILLE	0.5	EI	JUN-JUL
NORTH BAY, ISLE DE CAILLE	0.5	CM EI	JUN-JUL
BACOLET BAY	1.0	CM CC EI	APR-AUG
ST. DAVID'S BAYS	3.0	EI CC CM DC	JUN-JUL
POINT SALINES BAYS	2.0	CM CC EI	JUN-JUL
POINT SALINES BAYS(WEST)	1.5	EI CM CC	JUN-JUL
DUQUESNE BAY	0.5	EI CM	MAY-AUG
LA SEUIS BAY		DC EI CM	MAY-AUG
DAVID BAY	1.0	EI CM DC	APR-SEP
IRVING BAY	1.5	EI DC	APR-AUG
RATHAN BAY	0.5	DC EI CM	APR-AUG
LEVERA BEACH	1.5	EI CM DC	APR-SEP
GREAT RIVER CONFERENCE BEACH	5.2	CC DC EI CM	APR-SEP
SANDY ISLAND	2.0	EI CM	APR-AUG
NORTH BAY, ISLE DE RONDE	1.0	CM EI	APR-AUG
HALFMOON BAY, ISLE DE RONDE	1.0	EI CM	APR-AUG
GRENADA BAY, BATHWAY	2.0	DC CM EI	APR-SEP
ANTOINE BAY	1.5	EI CM DC	APR-SEP
GUADALOUPE			
ILET A FAJOU		CM EI	
ILET A CARET		CM EI	
PLAGE RAMEE		EI CM DC	
ILET A KAHOUANNE		EI CM CC DC	
GRANDE ANSE VERS DESHAIE		EI CM	
GRANDE ANSE VERS TROIS-RIVIERES		EI CM	
SAINT CLAIR		CM CC EI	
PLAGE VIARD		CC EI CM	
ANSE BERTRAND		EI CM	
PORT LOUIS		EI CM	
SAINT FRANCOIS		EI CM	
ILET DE LA PETITE TERRE		EI CM	
LES SAINTES		EI CM	
BALLET MARIE-GALANTE		EI CM	
LA DESIRADE		EI CM	
GUATEMALA			
PUNTA DEL CABO-RIO MOTAGUA	45.0	DC CM EI CC	MAR-JUL
GUYANA			
SHELL BEACH	6.0	LO DC CM EI	JUN-AUG
WAINI PT. BEACHES	15.0	LO DC CM EI	JUN-AUG
PAPAYA BEACH			
FATHER'S BEACH			
TURTLE BEACH			
TIGER ISLAND BEACH			
ZEELANDIA BEACH			
DAUNTLESS PT. BEACH			
MAHAICA-MAHAICONY BEACH			
63 BEACH			

TABLE C cont.

HAITI	72.5		
ANSE A PITRE-BELLE ANSE	27.0	CM CC EI	MAY
CAYES-JACMEL-RAYMOND	5.0	CC CM	JUL
MAYETTE-COTES DE FER	2.5	EI CM	JUL
COTES DE FER-MONILLAGE	5.0	CM CC	JUL-AUG
LES CAYES-ST. JEAN	10.0	EI CC	AUG-SEP
ANSE DU DIABLE	4.0	CC	JUL-AUG
PTE A GRAVOIS-PORT SALUT	5.0	EI CC	AUG
BAIE DE CARACOL	6.0	CM	JUL-AUG
PETITE ANSE	2.0	CM CC	JUL-AUG
ANSE A CHOUCHOU	2.0	CM EI	JUL-AUG
FOUD LAGRANGE	4.0	CC CM	JUL-AUG
HONDURAS			
CEIBA		DC	APR
RIO SICO		CC	JUL
BOCA LAGUNA DE BRUS		CC	JUL
BOCA LAGUNA TATA		CC	JUL
RIO CRUTA		CC	JUL
ISLA DE UTILA		CC	JUL
ISLA DE GUANAJA		CC	JUL
IRIONA		CC	JUL
JAMAICA	48.0		
GUN CAY	0.1	EI CC	MAY-OCT
EASTERN CAY	0.1	EI CC	
LIME CAY	0.3	EI	MAY-OCT
SOUTH CAY		EI CC	
LOWZIE BAY		EI	
MANATEE BAY	0.8	EI CC	FEB-JUN
COLOQUAR BAY		EI CC	
THREE-SANDY BAY	0.1	EI	MAY
SALT ISLAND CAY	0.1	EI	MAY-OCT
LONG POND		EI	MAY-OCT
BIG PORTLAND CAY	0.1	EI CC	FEB-JUN
LITTLE PORTLAND CAY	0.1	CC EI	JUN
BARE BUSH CAY	0.1	CC EI	JUN
PELICAN CAY	0.1	EI	FEB-JUN
PEAKE BAY		EI	AUG-NOV
PIGEON ISLAND	0.1	EI	JUN
MILLER BAY		EI CC	AUG-NOV
NEEDLE CAY		EI CC	
BEAU CHAMP	0.1	EI	JUN-DEC
GUTS RIVER	1.2	EI	MAY-SEP
MACKHAM BAY	0.1	EI	JAN-SEP
OLD WOMANS POINT	0.1	EI	MAY-SEP
CALABASH BAY	0.4	EI	
MALCOLM POINT	0.1	CM EI	
LUANA BEACH	0.4	EI	JUN-DEC
SAND HILL	0.1	CM	
AUCHINDOWN	0.1	EI	
PARKERS BAY		EI	
LONG BAY	8.1	EI	MAY-SEP
JACK'S HOLE		EI	

TABLE C cont.

BRIGHTON BEACH		EI CM	
CRAB POND POINT		EI	
TAN-TAN BAY		EI	
SABBITA BEACH		EI	
HOPE WHARF	0.1	CC EI	
ROBINS POINT		EI	
ST. JOHNS POINT	0.8	EI	
LITTLE BAY	1.2	EI	
MARY'S BEACH	0.1	EI	JUN-OCT
WHITE SANDS BEACH		EI	
PAMPY'S BEACH		EI	
LITTLE BAY		EI CC	
LONG BAY		EI	MAR-SEP
LANCES BAY	0.1	EI	FEB-DEC
GREEN ISLAND		EI	AUG-OCT
JOHNSTON BEACH		EI CC	MAR-NOV
BARBICAN BEACH	0.1	EI	MAR-SEP
MEAGRE BAY		EI	
SALT HOUSE BEACH		EI	MAR-SEP
TRYALL BEACH		EI	MAR-SEP
BLACK BAY		EI	MAR-SEP
HOPEWELL BEACH		EI CC	MAR-SEP
HABBINDON		EI	
OLD HOUSE POINT		EI CC	
SUCCESS BEACH		EI	
RED HOUSE BEACH		EI	MAR-SEP
ROSE HALL BEACH		EI	
MINI HALL BEACH		CC EI	
BILLY CLARKE BEACH		EI CC	
SHARK BAY		CC EI	
PAT CHUNG BEACH	0.1	EI	MAR-NOV
PEAR TREE BOTTOM		EI	
DEVIL'S KITCHEN		EI	MAR-SEP
ROCKY WOOD POINT		EI	
HALF-MOON BAY		EI	MAR-SEP
BUSH CAY		EI	MAR-SEP
SPRING BAY		EI	
WHITE BAY		EI	MAR-SEP
STEWART BAY		EI	
MANGROVE POINT		EI CC	MAR-SEP
THATCH TREE		EI	
BRACO BEACH	1.2	EI	
SILVER SAND BEACH	0.8	EI	MAR-NOV
QUEEN'S WAY BEACHES		EI	SEP-NOV
APWOOD BEACH	0.4	EI	SEP-NOV
SALEM BEACH		EI	
LLANDOVERY		EI CC	
WINDSOR BEACH	0.8	EI CC	MAR-SEP
DRAX HALL BEACH	0.1	EI	FEB-OCT
MAMEC BAY	0.1	EI	FEB-OCT
SHAW PARK BEACH	0.1	EI	MAR-AUG
MEGARTORBON BEACH	0.1	EI	MAR-AUG
RIO NUEVO BEACH	0.1	EI	MAR-SEP
GOLDEN HEAD BEACH		EI	
TOWER ISLE BEACH		EI	
LADDER BAY		EI	MAR-AUG
ROARING RIVER		EI	MAR-AUG
SALT BAY COVE		EI	JAN-SEP
SHEARNESS BAY	0.1	EI	MAR-NOV
WAY WATER VEIL		EI	FEB-JUL

TABLE C cont.

ANNOTTO BAY	6.4	EI	FEB-JUL
BUFF BAY	0.1	EI	APR
ORANGE BAY	0.8	CC CM EI	APR
HOPE BEACH		CC EI	MAR-OCT
BARRAS HOLE		EI	MAY-SEP
HORSE WOOD BEACH		EI	MAY
WINDSOR BEACH	0.8	EI	APR
DOCTOR WOOD BEACH		EI	APR-NOV
SPRING GARDEN BEACH		EI	MAR-OCT
PASSLEY GARDEN'S		EI	MAR-OCT
HERMITAGE		CM EI CC	MAR-OCT
DRAPER'S BEACH	0.1	EI CC	MAY-NOV
FAIRY HILL	0.1	CC EI	MAR-OCT
SAN SAN	6.4	CC EI	MAR-OCT
FRENCHMAN'S COVE	0.1	CC EI	MAY-NOV
TURTLE COVE	0.1	EI CC	MAY
LONG BAY	8.1	EI CC	MAR-SEP
TURTLE BAY		EI CC	
DALVEY	0.8	EI	AUG
HOLLAND BAY	0.8	EI	AUG
ROCKY POINT	0.4	CM EI	MAY-JUL
ROCKY CAY		EI	FEB-JUN
MORANT BAY		EI CC	
DUHANEY PEN		EI CC	APR-NOV
WHITE HORSES	0.8	EI	APR-SEP
YALLAHS	3.2	EI	APR-NOV
COW BAY		EI	APR-NOV
GRANT'S PEN BEACH		EI	
NINE MILES BEACH		EI	
MARTINIQUE			
COUP GARON		DC EI	
MACABON		DC EI	
BAY D'ANGLAIS		DC EI	
POINTE DES SALINES		DC EI	
FLET A MADAME		EI	
SAINTE PHILOMENE		EI	
ANSE COULEUVRE		EI	
MEXICO(GULF)	749.0		
WASHINGTON-SAN RAFAEL	88.0	LK CC DC CM	APR-AUG
S. RAFAEL-LA PESCA	121.0	CC CM LK DC	APR-AUG
RANCHO NUEVO	69.0	LK DC CM CC	APR-AUG
EL TORDO-CHAVARRIA	28.0	CM LK CC	APR-AUG
TAMPICO-TUXPAN	62.0	CM CC LK	APR-AUG
TUXPAN-VERACRUZ	63.0	CM LK CC	MAY-SEP
VERACRUZ-FRONTERA	27.0	EI LK CC CM	MAY-SEP
CARMEN-SABANCUY	60.0	CM CC EI	MAY-SEP
SABANCUY-CELESTUN NORTH	67.0	CM CC EI	MAY-SEP
CELESTUN-RIO LAGARTOS	72.0	CM CC EI	MAY-SEP
RIO LAGARTOS-C. CATOCHE	92.0	CC EI CM DC	MAY-SEP

TABLE C cont.

MEXICO(CARIBBEAN)	133.8		
ISLA BLANCA	2.4	DC EI CM CC	MAY-SEP
ISLA CONTOY	1.9	DC CC EI CM	MAY-SEP
ISLA MUJERES	4.0	EI CC CM DC	MAY-SEP
ISLA COZUMEL	18.1	DC CC CM EI	MAY-SEP
C. CATOCHE-P. SARGENTO	12.4	CM CC DC EI	MAY-SEP
NIZUC-PTO. CARMEN	34.0	DC EI CM CC	MAY-SEP
PUERTO CARMEN-TULUM	18.0	CM DC EI CC	MAY-SEP
TULUM-B. ASENCION	18.0	DC EI CM CC	MAY-SEP
P. NORTE B. ACENCION-XCALAC	25.0	CM EI CC DC	MAY-SEP
MONSERRAT	3.5		
FARM BAY	0.6	EI DC	
YELLOW HOLE	0.1	EI CM	
RENDEZVOUS BAY	0.6	EI	
LITTLE BAY	0.3	EI	
CARR'S BAY	0.4	EI	
BUNKUM BAY	0.1	EI CM	
WOODLANDS BAY	0.3	EI	
LIMEKILN BAY	0.1	CM EI	
OLD ROAD BAY	0.3	EI	
FOX'S BAY	0.7	EI	
NETHERLANDS ANTILLES(S)	3.7		
KLEIN BONAIRE	0.5	CC EI	JUN-SEP
WASHIKEMBA	0.2	CC EI	JUN-SEP
SOROBON	0.4	CC CM EI	JUN-SEP
SALINA	1.0	EI CC CM	JUN-SEP
PLAYA GRANDI	0.5	EI CC CM	JUN-SEP
KLEIN CURACAO	1.0	CC EI	JUN-SEP
EAST POINT BAY	0.1	CM CC EI	JUN-SEP
NORTH COAST, ARUBA		EI	
NETHERLANDS ANTILLES(N)	1.5		
CONCORDIA BAY	1.2	CM EI	
CORRE CORRE BAY	0.2	DC	
CAVE OF RUM BAY	0.1	EI	
NICARAGUA	435.5		
BARRA RIO GRANDE	52.0		
PRINZAPOLKA	10.0		
WALPASIKSA	10.0		
WOUNTA	14.0		
HAULOVER	21.0		
BARRA DE WAWA	22.0		
PUERTO CABEZAS	18.0		
BARRA SANAWALA	22.0		
PUNTA GORDA	8.0		
BARRA DE DAKURA	10.0		
SAN JUAN DEL NORTE	27.0		

TABLE C cont.

CANO DIABLO	43.0	EI	AUG
BARRA PUNTA GORDA	21.0		
MONKEY POINT	29.0		
BARRA HONSON	18.0		
BLUEFIELDS (FALSO BLUFF)	42.5	EI	JUN-JUL
PUNTA BARRA	15.0		
PUNTA PERLAS	30.0		
TASBA PAWNIE	12.0		
LAGUNA AMLISTINGNI	11.0		
PANAMA			
RIO SAN SAN-RIO CHANGUINOLA		DC	APR
RIO CHANGUINOLA-BOCA DEL DRAGO		DC	APR
NORTE DE LIME POINT(ISLA COLON)		DC	APR
FLORIS BEACH (ISLA COLON)		DC	APR
WIZARDS BEACH (BASTIMENTOS)		DC	APR
DREFFE BEACH (BASTIMENTOS)		DC	APR
LONG BEACH (BASTIMENTOS)		DC	APR
RIO CHIRIQUI-RIO CANAVERAL		DC EI	MAY
PENASCO DE GUAPAN-RIO CHIRIQUI		DC	APR
ESTE DEL RIO PASAU		DC	APR
RIO CALOVEBORA-SANTA CATALINA		DC	APR
RIO CONCEPCION-RIO GUASARO		DC	APR
ESTE DE BELEN		DC	APR
PUNTA PLATANAL-COCLE DE NORTE		DC	APR
ESTE DE ICACAL		DC	APR
GOBEA		DC	APR
SALUD-PALMAS BELLAS		DC	APR
CHAGRES		DC	APR
CUANGO		DC	APR
PLAYA CHIQUITA		DC	APR
PLAYA COLORADA	9.0	DC	APR-AUG
PORTOGANDI-NW RIO NAVAGANDI		DC	APR
NAVAGANDI			APR
PLAYA NAPAKANTI-RIO TIWAR			APR
BAHIA AGLATOMATE			MAR-APR
RIO PITO-RIO ARMILA			APR
PUERTO RICO			
WEST BEACHES OF CULEBRITA ISLAND		EI	NOV-JAN
NORTH BEACHS OF CULEBRITA ISLAND		EI	NOV-JAN
SOUTH BEACHES OF CULEBRITA ISLAND		EI	NOV
NORTHWEST BEACH, CULEBRITA ISLAND		EI	NOV
SOUTH BEACH, NORTH CAY, CULEBRA ISLAND		EI	NOV
MONA ISLAND	8.0	EI	OCT
CULEBRA ISLAND		DC	
VIEQUES ISLAND		CM EI DC	JAN
PLAYA RESACA, CULEBRA ISLAND		EI	NOV-JAN
PLAYA BRAVA, CULEBRA ISLAND		EI	NOV-JAN
PLAYA LARGA, CULEBRA ISLAND		EI	JAN

TABLE C cont.

ST. KITTS-NEVIS	24.4		
SANDY POINT, ST. KITTS	2.2	EI CM DC	MAR-MAY
NEWTON GROUND	0.4	EI CM	MAY-OCT
DIEPPE BAY	0.4	EI CM	MAY-OCT
SANDY BAY	0.2	EI CM	MAY-OCT
CONAREE	9.6	DC CM EI	JUN-SEP
NORTH FRIARS BAY	0.6	EI CM DC	MAR-MAY
SAND BANK BAY	0.6	DC CM EI	MAY-SEP
MOSQUITO BAY	0.7	CM EI	MAY-SEP
MAJORS BAY	0.1	CM EI	MAY-SEP
COCKLESHELL BAY	0.6	CM EI	MAY-SEP
BALAST BAY	0.7	CM EI	MAY-SEP
GARVEY'S	0.5	CM EI	MAY-SEP
CHALLENGERS'S	0.8	CM EI	MAY-SEP
PINNEY'S BEACH, NEVIS	4.5	CM EI	MAY-OCT
HURRICANE HILL	1.2	EI	MAY-OCT
NEW CASTLE	0.8	EI	MAY-OCT
RED CLIFT	0.2	CM EI DC	MAR-MAY
INDIAN CASTLE	0.3	DC CM EI	MAR-MAY
ST. LUCIA	8.4		
GRAND ANSE	1.6	DC	MAY-JUL
CARIBLUE	0.2	EI	AUG
ANSE GER	0.3	DC	JUN
ANSE TROUMASEE	0.7	DC	JUN
TROU L'ORANGER	0.1	CM EI	JUN-JUL
ANSE MICOUD	0.7	DC EI	JUN
ANSE CHASTANET	0.2	EI CM	JUL
DENNERY	0.4	EI	JUL-AUG
ANSE DE SABLES	2.4	EI CM	
ANSE COMMERETTE	0.2	EI CM	MAY-JUN
HONEYMOON BEACH		EI CM	JUL
FOND D'OR	1.0	DC EI	JUN
ANSE LAPINS	0.6	CC EI	JUN
ST. VINCENT	10.3		
RICHMOND BEACH, ST. VINCENT	1.5	EI	
CHATEAU-BELAIR BAY	0.7	EI	
PETIT BORDER BAY	0.2	EI	
TROMAKA BAY	0.2	EI	
CUMBERLAND BAY	0.2	EI	
WALLILABOU BAY	0.2	EI	
KEARTON'S BAY	0.1	EI	
PETER'S HOPE BAY	0.1	EI	
MOUNT WYNN BAY	0.3	EI	
LOWMAN'S BAY	0.2	EI	
BRIGHTON BAY	0.4	DC EI	
STUBBS BAY	0.2	DC EI	
BIABOU BAY	0.3	DC EI	
SOUTH UNION BAY	0.5	EI	
GEORGETOWN BAY	1.5	DC EI	
SANDY BAY	0.5	EI	

TABLE C cont.

MISS IRENE, GRENADINES	0.1	EI	
CAMPBELL	0.1	EI	
CHATHAM BAY	0.5	EI	
BLOODY BAY	0.5	EI	
RAFFAL	0.5	CM EI	APR-AUG
FRIGATE ISLAND	0.2	EI CM	APR-AUG
RICHMOND BEACH	0.8	EI CM	APR-AUG
SPRING BEACH	0.2	CM EI	APR-AUG
FRIENDSHIP BEACH	0.2	EI CM	APR-AUG
ADAMS BEACH	0.1	EI CM	APR-AUG
SURINAME	31.8		
GALIBI	3.0	CM LO DC	JAN-AUG
BABOENSANTI	3.0	LO CM DC	JAN-AUG
EILANTI	1.9	LO CM DC	JAN-AUG
KROFAJAPASI & MOTKREEK	11.0	CM DC LO	JAN-AUG
MATAPICA	5.0	CM LO EI DC	JAN-AUG
KATKREEK & DIANASTRAND	7.9	DC LO CM EI	FEB-AUG
TRINIDAD-TOBAGO	66.3		
MACQUERIPE BAY	0.1	EI	AUG
MARACAS BAY	1.9	DC	
LAS CUEVAS BAY	2.2	DC	MAR-AUG
BLANCHISSEUSE BAY	1.4	DC	
PARIA BAY	1.0	DC	MAR-AUG
MURPHY BAY	1.0	DC	MAR-AUG
PETIT TACARIBE	0.3	DC	MAR-AUG
GRANDE TACARIBE	1.2	DC	MAR-AUG
MADAMAS BAY	0.6	DC	MAR-AUG
MATELOT BEACH	0.2	DC	MAR-AUG
GRANDE RIVIERE BAY	1.1	DC	APR-AUG
L'ANSE DEFOUR BAY	0.7	DC	APR-JUL
GRAND L'ANSE BAY	0.4	DC	APR-JUL
CUMANA BAY	1.1	DC	APR-JUL
MATURA BAY(NORTH)	3.3	CM LO DC	MAR-AUG
MATURA BAY(CENTRAL)	4.2	DC	MAR-AUG
MATURA BAY(SOUTH)	5.7	DC	MAR-AUG
MANZANILLA BAY	18.8	DC CM LO	APR-AUG
MAYARD BAY	20.1	DC	
SALT POND CHACACHACARE	1.0	EI	JUL
TURKS AND CAICOS	3740.0		
BIG AMBERGRIS CAY	60.0	CM EI	APR-AUG
BIG SAND CAY	90.0	EI	APR-AUG
BUSH CAY	10.0	EI	
COTTON CAY	10.0	EI	
EAST CAICOS ISLAND	800.0	EI CC CM	APR-AUG
EAST CAY	21.0	EI	APR-AUG
FISH CAY	30.0	EI CM	APR-AUG
FRENCH CAY	40.0	CC EI CM	APR-AUG
GIBB CAY	12.0	CM EI	
GRAND CAICOS ISLAND	600.0	CM EI CC	

TABLE C cont.

GRAND TURK ISLAND	250.0	CC EI CM	APR-AUG
HIGHAS CAY	30.0	CM EI CC	APR-AUG
HORSE CAY	2.0	EI	
LITTLE AMBERGRIS CAY	120.0	CM EI	
LONG CAY (EAST CAICOS)	40.0	EI	
NORTH CAICOS ISLAND	150.0	EI CC CM	APR-AUG
PARROT CAY	140.0	CM EI CC	APR-AUG
PINE CAY	200.0	CC EI CM	APR-AUG
PROVIDENCIALES	240.0	CM EI CC	APR-AUG
SALT CAY	90.0	EI CC CM	
SAND BORA CAY	40.0	CM EI	
SHOT CAY	15.0	CM EI	APR-AUG
SOUTH CAICOS ISLAND	160.0	CM EI CC	APR-AUG
STUBBS CAY	90.0	EI	APR-AUG
WATER CAY	160.0	CM EI CC	APR-AUG
WEST CAICOS ISLAND	300.0	CC EI CM	APR-AUG
WEST SAND SPIT	35.0	CM EI CC	
WHITE CAY	5.0	EI	APR-AUG
UNITED STATES	1865.4		
PADRE ISLAND & MUSTANG ISLAND, TX	210.0	LK CC	APR-JUN
CAT ISLAND, MS	5.7	CC	JUN
WEST SHIP ISLAND	6.5		
EAST SHIP ISLAND	3.8		
HORN ISLAND	22.9	CC	JUN
PETIT BOIS ISLAND	11.3		
GULF SHORES, AL	15.0	CC	JUL
FT. WALTON BEACH, FL		DC CC	
ST. JOSEPH STATE PARK	19.2		
ST. GEORGE ISLAND		CC	
ST. VINCENT ISLAND	11.3	CC	JUN-AUG
NORTH LONGBOAT KEY	8.0	CC EI	MAY
CASEY KEY	7.6	CC	MAY-AUG
MANASOTA KEY	12.9	CC	JUN-JUL
CAYO COSTA STATE PRESERVE	8.0	CC	JUN-JUL
SANIBEL ISLAND	18.5	CC	MAY-JUL
WIGGENS PASS STATE RECREATION AREA	13.4	CC	JUN-JUL
VANDERBILT BEACH	8.0	CC	
BONITO BEACH	9.7	CC	
NAPLES AREA BEACHES	8.0	CC	MAY-AUG
CAPE ROMANO	4.8	CC	
FT. JEFFERSON NATIONAL MONUMENT	4.8	CC	APR-OCT
EVERGLADES NATIONAL PARK BEACHES	56.6	CC	MAY-AUG
BAHIA HONDA STATE RECREATION AREA	0.8	CC	AUG
SOLDIER KEY		EI	OCT
BILL BAGGS CAPE FLORIDA	2.4	CC DC CM	MAY-AUG
NORTH KEY BISCAYNE	9.6	CM CC	MAY-SEP
MIAMI BEACH TO HAULOVER	16.1	CM CC	MAY-AUG
BROWARD COUNTY BEACHES	36.6	CM CC DC	MAY-SEP
BOCA RATON PUBLIC BEACH	4.2	DC CC CM	MAY-SEP
HIGHLAND BEACH	4.5	CM CC DC	MAY-AUG
PALM BEACH SHORES	0.9	CC DC	MAY-AUG
LOST TREE VILLAGE	2.8	DC CC CM	MAY-AUG
JUNO BEACH	1.6	EI CM CC DC	MAY-AUG
JUPITER ISLAND	12.3	CM CC DC	MAY-SEP
HOBE SOUND NATIONAL WILDLIFE REFUGE	5.6	CC DC CM	APR-SEP

TABLE C cont.

ST. LUCIE INLET STATE REC. AREA	3.4	CC	MAY-SEP
HUTCHINSON ISLAND	36.0	CC DC CM	APR-SEP
FT. PIERCE INLET STATE REC. AREA	3.2	CM CC	MAY-AUG
SEBASTIAN INLET STATE REC. AREA	5.0	CM CC	JUN-JUL
ST. LUCIE & INDIAN RIVER COUNTIES	28.6	CC	
SOUTH BREVARD COUNTY	20.0	CC CM	MAY-AUG
INDIALANTIC & MELBOURNE BEACH	9.3	CM CC	MAY-AUG
CENTRAL BREVARD COUNTY	20.9	CC CM	MAY-AUG
NORTH BREVARD COUNTY	50.0	CC	MAY-AUG
VOLUSIA COUNTY	25.0	CC CM EI	MAY-AUG
FLAGLER BEACH STATE REC. AREA	0.7	CM CC	MAY-JUL
ST. JOHNS COUNTY BEACHES	66.0	CC	MAY-AUG
ST. MATANZAS NATIONAL MONUMENT	1.2	CC	JUN
ANASTASIA STATE RECREATION AREA	4.0	CC	JUN-JUL
BIG TALBOT ISLAND	3.2	CC	MAY-AUG
LITTLE TALBOT ISLAND	8.0	CC	MAY-AUG
CUMBERLAND ISLAND, GA	29.7	CC DC	MAY-AUG
LITTLE CUMBERLAND ISLAND	5.8	CC	MAY-AUG
JEKYLL ISLAND	14.6	CM CC	MAY-AUG
ST. SIMON'S ISLAND	6.5	CC	MAY-AUG
SEA ISLAND	9.6	CC	MAY-AUG
LITTLE ST. SIMON'S ISLAND	11.4	CC	MAY-AUG
EGA ISLAND	2.9		
WOLF ISLAND	5.6	CC	MAY-AUG
SAPELO ISLAND	9.7	CC	MAY-AUG
BLACKBEARD ISLAND	13.2	DC CC	MAY-AUG
ST. CATHERINE'S ISLAND	21.1	CC	MAY-AUG
OSSABAW ISLAND	18.7	CC	MAY-AUG
RACCOON KEY	1.8	CC	MAY-AUG
PINE & LITTLE WASSAW ISLAND	3.8	CC	MAY-AUG
WASSAW ISLAND	10.5	CC	MAY-AUG
CABBAGE ISLAND	3.0	CC	MAY-AUG
PETIT CHOU ISLAND	1.3	CC	MAY-AUG
WILLIAMSON ISLAND	2.9	CC	MAY-AUG
LITTLE TYBEE ISLAND	5.3	CC	MAY-AUG
TYBEE ISLAND	5.6	CC	MAY-AUG
TURTLE ISLAND, SC	4.0	CC	MAY-AUG
DAUFUSKIE	8.1	CC	MAY-AUG
HILTON HEAD ISLAND	29.0	CC	MAY-AUG
ST. PHILLIPS/BAY PT. ISLAND	6.3	CC	MAY-AUG
LITTLE CAPERS	4.0	CC	MAY-AUG
PRITCHARD ISLAND	4.0	CC	MAY-AUG
FRIPP ISLAND	6.0	CC	MAY-AUG
HARBOR/HUNTING ISLAND	9.0	CC	MAY-AUG
OTTER ISLAND	4.3	CC	MAY-AUG
PINE ISLAND	4.1	CC	MAY-AUG
EDISTO ISLAND	8.2	CC	MAY-AUG
EDINGSVILLE BEACH	2.9	CC	MAY-AUG
BOTANY BAY ISLAND	7.2	CC	MAY-AUG
SEABROOK ISLAND	5.6	CC	MAY-AUG
KIAWAH ISLAND	15.8	CC	MAY-AUG
FOLLY BEACH	10.4	CC	MAY-AUG
MORRIS ISLAND	5.4	CC	MAY-AUG
SULLIVAN'S ISLAND	6.3	CC	MAY-AUG
ISLE OF PALMS	10.0	CC	MAY-AUG
DEWEES ISLAND	4.0	CC	MAY-AUG
CAPERS ISLAND	5.2	CC	MAY-AUG
BULLS ISLAND	10.5	CC	MAY-AUG
RACCOON KEY	9.0	CC	MAY-AUG
LIGHTHOUSE ISLAND	3.3	CC	MAY-AUG

TABLE C cont.

CAPE ISLAND	8.0	CC	MAY-AUG
MURPHY ISLAND	9.0	CC	MAY-AUG
CEDAR ISLAND	4.3	CC	MAY-AUG
SOUTH ISLAND	4.0	CC	MAY-AUG
SAND ISLAND	4.0	CC	MAY-AUG
NORTH ISLAND	13.5	CC	MAY-AUG
DEBIDUE ISLAND	7.1	CC	MAY-AUG
GRAND STRAND	71.0	CC	MAY-AUG
SUNSET BEACH, NC	4.0	CC	JUN-JUL
OCEAN ISLE BEACH	4.8	CC	JUN-JUL
HOLDEN BEACH	12.0	CC	JUN-JUL
OAK ISLAND	21.0	CC	JUN-AUG
BALDHEAD ISLAND	13.0	CC	MAY-AUG
CAROLINA BEACH TO CORNCAKE INLET	20.0	CC	JUN-JUL
MASONBORO INLET TO CAROLINA BEACH	13.0	CC	JUN-JUL
WRIGHTSVILLE BCH. TO MASONBORO INLET	6.0	CC	JUN-JUL
FIGURE EIGHT ISLAND	5.6	CC	JUN-JUL
NEW TOPSAIL INLET TO RICH INLET	5.6	CC	JUN-JUL
TOPSAIL BEACH	35.0	CC	JUN-AUG
ONSLOW BEACH	11.5	CC CM	MAY-AUG
BROWN ISLAND	5.0	CC	JUN-AUG
BEAR ISLAND	6.0	CC	MAY-AUG
BOGUE BANKS	39.0	CC	MAY-AUG
SHAKLEFORD BANKS	14.5	CC	JUN-AUG
CORE BANKS TO CAPE LOOKOUT	88.0	CC	MAY-AUG
OCRACOKE ISLAND	35.0	CC	MAY-AUG
HATTERAS ISLAND	103.0	CC	MAY-AUG
BODIE ISLAND	15.0	CC	MAY-AUG
CURRITUCK BANKS	74.0	CC	JUN-JUL
US VIRGIN ISLANDS	34.6		
BUCK ISLAND	1.2	DC CM EI	MAY-OCT
NEW FORT BEACH	0.2	CM DC	MAY-OCT
SHOY'S BEACH	2.1	EI DC CM	MAY-OCT
GREEN CAY BEACH	0.2	EI DC	MAY-OCT
PRUNE BEACH	0.8	EI DC	MAY-OCT
COAKLEY BEACH	0.6	EI DC	MAY-OCT
TEAGUE BAY	0.7	EI	MAY-OCT
SMUGGLER'S COVE	0.2	CM EI	MAY-OCT
KNIGHT BAY	0.4	CM	MAY-OCT
BOILER BAY	0.3	EI	MAY-OCT
TEYTAUD'S BEACH	0.4	EI	MAY-OCT
EAST END BAY	0.3	EI	MAY-OCT
ISAAC BAY	0.7	EI DC	MAY-OCT
JACK BAY	0.7	EI DC	MAY-OCT
GRAPETREE BAY	0.2	EI CM	MAY-OCT
TURNER HOLE	1.1	CM EI	MAY-OCT
ROD BAY	0.8	CM EI	MAY-OCT
ROBIN BAY	1.7	CM EI	MAY-OCT
HALFPENNY BAY	0.8	EI	MAY-OCT
MANCHIONEEL BAY	2.1	EI DC CM	MAY-OCT
CANEGARDEN BAY	1.7	EI	MAY-OCT
MANNING'S BAY	0.7	CM	MAY-OCT
SANDY POINT	5.4	CM DC EI	MAY-OCT
LA GRANGE	0.7	EI CM	MAY-OCT
SPRAT HOLE	1.1	EI	MAY-OCT
BUTLER BAY	0.2	EI	MAY-OCT
HAM'S BAY	0.3	EI	MAY-OCT
MAROON HOLE	0.1	EI CM	MAY-OCT

TABLE C cont.

DAVIS BAY	0.3	DC CM EI	MAY-OCT
NORTH STAR	0.3	EI	MAY-OCT
CANE BAY	0.9	EI	MAY-OCT
RUST UP TWIST	0.2	EI	MAY-OCT
SALT RIVER (WEST)	0.2	EI CM	MAY-OCT
NELTIEBERG BAY	1.2	DC EI	JUN-NOV
LITTLE HANS LOLLIK	0.1	EI DC	JUL-NOV
COCONUT BAY, HANS LOLLIK	1.0	EI	JUN-NOV
DRY BAY, HANS LOLLIK	0.1	EI	JUN-NOV
LITTLE BAY, HANS LOLLIK	0.1	EI	OCT
SANDY BAY, INNER BRASS	0.1	EI	JUN-NOV
PENN BAY	0.1	EI	JUN-NOV
CARET BAY	0.1	EI	JUL-NOV
BOTANY BAY	0.1	EI DC	JUL
SANTA MARIA BAY	0.1	EI	JUL-OCT
BORDEAUX BAY	0.1	EI	JUL-SEP
WEST CAY BAY	0.1	EI	JUL
MANDAHL BAY	0.1	EI	JUL
HULL BAY	0.1	EI	JUL
CLUCLUSE BAY	0.1	EI	AUG-SEP
DOG ISLAND	0.1	EI	AUG
GREAT ST. JAMES ISLAND	0.1	EI	NOV
CANEEL HAWKSNEST	0.2	EI	AUG-OCT
JUMBI BAY	0.1	EI	AUG-OCT
TRUNK BAY	0.4	EI	JUL-SEP
WINDSWEPT	0.2	EI	JUN-AUG
MAHO BAY	0.2	EI	SEP
FRANCIS BAY	0.5	EI	JUL-AUG
SALT POND BAY	0.2	EI	JUN-DEC
GREATER LAMESHURE BAY		EI	JUL-AUG
LITTLE LAMESHURE BAY	0.2	EI	MAY-AUG
EUROPA BAY		EI	SEP
EASTERN REEF BAY	0.3	EI	JUN-SEP
GENTI BAY	0.5	EI	JUL-DEC
WESTERN REEF BAY	0.5	EI	JUN-NOV
COCOLOBA POINT	0.1	EI	JUN-NOV
TURQUOISE BAY		EI	
JUDITH'S FANCY		EI	
LITTLE BAY		EI	

VENEZUELA

ISLA DE AVES	1.3	CM	MAY-AUG
ARCHIPELAGO LOS ROQUES		CC CM EI	MAY-DEC
EDO. SUCRE		EI CM DC	

TABLE D SUMMARIES OF GROUND & AERIAL TURTLE NESTING SURVEYS FROM TABLES 4 AND 5 OF THE WATS NATIONAL REPORT

			GROUND SURVEYS					AERIAL SURVEYS			
COUNTRY	SPECIES	YEAR	NO. OF SURVEYS	AVE # NIGHT	AVE # PER KM	EST # SEASON	PEAK MONTH	NO FLIGHTS	TOTAL # TRACKS	AVE # PER KM	MONTHS OBSERVED
ANTIGUA	CM	1980				1	JUL				
	CM	1981				2	JUN				
	CM	1982		7	0.128	83	AUG				
	DC	1981				3	APR				
	DC	1982				1	AUG				
	EI	1980				1	SEP				
	EI	1981				4	JUN				
	EI	1982		15	0.275	148	OCT				
	UN	1982						1	9	0.165	AUG-AUG
BELIZE	CC	1980				3					
	CC	1982	3			31					
	CC	1983				6					
	CM	1982	2			19					
	EI	1980				1					
	EI	1982	1			19					
	EI	1983				11					
	UN	1982						3	8	0.084	FEB-FEB
BRAZIL	CC	1982									
	CM	1982									
	DC	1982									
	EI	1982									
BRITISH VIRGIN ISLANDS	CM	1982						1	19	0.248	AUG-AUG
	EI	1982							23	0.300	AUG-AUG
	UN	1982							39	0.509	AUG-AUG
COLOMBIA	CM	1983						1	3	0.042	JUN-JUN
	DC	1983							18	0.250	JUN-JUN
	UN	1983						1	1	0.014	JUN-JUN
COSTA RICA	CM	1978	64	24	0.378	4592					
	CM	1979	67	4	0.063	738					
	CM	1980	66	26	0.409	5166					
	CM	1981	65	9	0.142	1783					
	CM	1982	66	20	0.315	3999					
	UN	1981						1	3	0.047	AUG-AUG
	UN	1982						16	2742	43.181	AUG-AUG
DOMINICA	CM	1982				4	AUG				
	DC	1982				4	JUN				
	EI	1982				6	JUN				
	UN	1982				1	SEP				
DOMINICAN REPUBLIC	UN	1980						3	36		APR-APR

TABLE D cont.

FRENCH GUIANA	CM	1982	121	144	5.475	952					
	DC	1982	154	631	23.992	24711					
	LO	1982	153	26	0.989						
GUYANA	DC	1983						1	6	0.286	AUG-AUG
HONDURAS	DC	1982						1	1		AUG-AUG
	UN	1982						3	9		AUG-AUG
JAMAICA	CC	1982		9	0.188	50					
	CM	1982									
	EI	1982		511	10.646	4669					
	UN	1981						4	14	0.292	SEP-SEP
	UN	1982						6	25	0.521	OCT-OCT
MEXICO(GULF)	CC	1982		21	0.028	225		2	6	0.008	JUN-JUN
	CM	1982		51	0.068	265	JUN	1	46	0.061	JUN-JUN
	DC	1982		4	0.005	40			2	0.003	JUN-JUN
	EI	1982		62	0.083	580			62	0.083	JUN-JUN
	LK	1982		8	0.011	1190			18	0.024	JUN-JUN
	UN	1982						1	86	0.115	JUN-JUN
MEXICO(CARIBBEAN)	CC	1982		24	0.179	160			5	0.037	JUL-JUL
	CM	1982		42	0.314	237	JUL		20	0.149	JUL-JUL
	DC	1982		3	0.022	33					
	EI	1982		8	0.060	88					
	UN	1982						1	66	0.493	JUL-JUL
NICARAGUA	EI	1981		2	0.005	36	JUN	1	25	0.057	JUN-AUG
PANAMA	DC	1981						2	523	58.111	APR-APR
	DC	1982		346	38.444		MAY				
	EI	1982		17	1.889		MAY				
PUERTO RICO	CM	1981				4					
	DC	1978				9					
	DC	1981				26					
	EI	1978				2					
	EI	1981				23					
	EI	1982				22					
ST. KITTS-NEVIS	DC	1983		2	0.082	23					
ST. LUCIA	CC	1982									
	CM	1982	5	2	0.238	6					
	DC	1982	10	5	0.595	22		4	10	1.190	MAY-MAY
	EI	1982	9	4	0.476	11		1	1	0.119	JUL-JUL
SURINAME	CM	1982		37	1.164	4060	APR	1	16	0.503	FEB-FEB
	DC	1982		36	1.132	3646	JUN		65	2.044	FEB-FEB
	EI	1982				13					
	LO	1982				993					
TRINIDAD-TOBAGO	DC	1982	51	6	0.090	1169	MAY	6	53	0.799	AUG-AUG
	EI	1982	2	1	0.015		JUL	1	1	0.015	AUG-AUG
	LO	1982	41	1	0.015		JUL				
	UN	1982						2	11	0.166	AUG-AUG
TURKS AND CAICOS	CM	1982							1	0.000	AUG-AUG
	EI	1982						1	22	0.006	AUG-AUG

TABLE D cont.

UNITED STATES	CC	1978	2010			4697				
	CC	1979	2490			3470				
	CC	1980	2400			3564	16	807	0.433	AUG-AUG
	CC	1981	1950			3653				
	CC	1982	46253	1	0.001	20305	15	3500	1.876	AUG-AUG
	CM	1979				1				
	CM	1980				1				
	CM	1982	710			214				
	DC	1981				2				
	DC	1982	410			44				
	EI	1980	31			1				
	EI	1981	1			1				
	EI	1982	1			1				
	LK	1982	240			2				
US VIRGIN ISLANDS	CM	1978				44				
	CM	1980				2				
	DC	1978				53				
	DC	1979				1				
	DC	1980				1				
	DC	1981				27				
	DC	1982				21				
	EI	1978				156				
	EI	1979				68				
	EI	1980				136				
	EI	1981				136				
	EI	1982				68				
VENEZUELA	CC	1979	60			7				
	CM	1979	62	8	6.154	752				
	CM	1980	137			85				
	CM	1981					2	7	5.385	JUL-JUL
	CM	1983					1	11	8.462	JUN-JUN
	DC	1983					1	4	3.077	JUN-JUN
	EI	1979	275			60				
	EI	1983					2	2	1.538	JUN-JUN

TABLE E.1

LOGGERHEAD SEA TURTLE-- CARETTA CARETTA--
ESTIMATED NUMBERS OF NESTING FEMALES BY COUNTRY FOR 1977-1982
FROM WATS NATIONAL REPORTS, TABLE 6

COUNTRY	1977	1978	1979	1980	1981	1982	REPORT CAT.
ANGUILLA							NR
ANTIGUA							NR
BAHAMAS							NR
BARBADOS							NR
BELIZE						40*	DNR
BERMUDA							NR
BRAZIL							AHDR
BRITISH VIRGIN ISLANDS							NR
CAYMAN ISLANDS							NR
COLOMBIA							DNR
COSTA RICA							NR
CUBA							AHDR
DOMINICA							NR
DOMINICAN REPUBLIC				60			NR
FRENCH GUIANA							NR
GRENADA						100	NR
GUADALOUPE							NR
GUATEMALA							NR
GUYANA							NR
HAITI							NR
HONDURAS							NR
JAMAICA						210	NR
MARTINIQUE							NR
MEXICO(GULF)					225		NR
MEXICO(CARIBBEAN)					160		NR
MONSERRAT							NR
NETHERLANDS ANTILLES(S)							AHDR
NETHERLANDS ANTILLES(N)							AHDR
NICARAGUA							NR
PANAMA							NR
PUERTO RICO							NR
ST. KITTS-NEVIS							NR
ST. LUCIA							NR
ST. VINCENT							NR
SURINAME							NR
TRINIDAD-TOBAGO							NR
TURKS AND CAICOS						50	NR
UNITED STATES				18297	28448*	28884	NR
US VIRGIN ISLANDS							NR
VENEZUELA							NR

OBS = OBSERVATIONS ONLY, NO QUANTITATIVE DATA RECORDED
* = ESTIMATED YEARLY AVERAGE (1977-1982)

CODES FOR NATIONAL REPORT CATEGORY:
- NR = NATIONAL REPORT
- DNR = DRAFT NATIONAL REPORT
- AHDR = AD HOC DATA REPORT
- NONE = NO REPORT

TABLE E.2 GREEN SEA TURTLE--CHELONIA MYDAS

ESTIMATED NUMBERS OF NESTING FEMALES BY COUNTRY FOR 1977-1982

FROM WATS NATIONAL REPORTS, TABLE 6

COUNTRY	1977	1978	1979	1980	1981	1982	REPORT CAT.
ANGUILLA							NR
ANTIGUA						39	NR
BAHAMAS							NR
BARBADOS							NR
BELIZE						19*	DNR
BERMUDA							NR
BRAZIL							AHDR
BRITISH VIRGIN ISLANDS					75		NR
CAYMAN ISLANDS							NR
COLOMBIA							DNR
COSTA RICA	3169	21899	3993	23932	4392		NR
CUBA							AHDR
DOMINICA						2	NR
DOMINICAN REPUBLIC				260			NR
FRENCH GUIANA	120	83	112				NR
GRENADA						200	NR
GUADALOUPE							NR
GUATEMALA							NR
GUYANA							NR
HAITI							NR
HONDURAS							NR
JAMAICA						100	NR
MARTINIQUE							NR
MEXICO(GULF)					265		NR
MEXICO(CARIBBEAN)					237		NR
MONSERRAT							NR
NETHERLANDS ANTILLES(S)							AHDR
NETHERLANDS ANTILLES(N)							AHDR
NICARAGUA							NR
PANAMA							NR
PUERTO RICO	4				4		NR
ST. KITTS-NEVIS							NR
ST. LUCIA						6	NR
ST. VINCENT							NR
SURINAME	4300	7200	4500	4000	6000	4500	NR
TRINIDAD-TOBAGO							NR
TURKS AND CAICOS						75	NR
UNITED STATES					182*		NR
US VIRGIN ISLANDS							NR
VENEZUELA						200	NR

OBS = OBSERVATIONS ONLY, NO QUANTITATIVE DATA RECORDED

* = ESTIMATED YEARLY AVERAGE (1977-1982)

CODES FOR NATIONAL REPORT CATEGORY:

NR = NATIONAL REPORT

DNR = DRAFT NATIONAL REPORT

AHDR = AD HOC DATA REPORT

NONE = NO REPORT

TABLE E.3 LEATHERBACK SEA TURTLE- -DERMOCHELYS CORIACEA--
ESTIMATED NUMBERS OF NESTING FEMALES BY COUNTRY FOR 1977-1982
FROM WATS NATIONAL REPORTS, TABLE 6

COUNTRY	1977	1978	1979	1980	1981	1982	REPORT CAT.
ANGUILLA							NR
ANTIGUA					1	1	NR
BAHAMAS							NR
BARBADOS							NR
BELIZE							DNR
BERMUDA							NR
BRAZIL							AHDR
BRITISH VIRGIN ISLANDS					2		NR
CAYMAN ISLANDS							NR
COLOMBIA						100	DNR
COSTA RICA							NR
CUBA							AHDR
DOMINICA						3	NR
DOMINICAN REPUBLIC				380			NR
FRENCH GUIANA	6792	7607	5197				NR
GRENADA						25	NR
GUADALOUPE							NR
GUATEMALA							NR
GUYANA							NR
HAITI							NR
HONDURAS							NR
JAMAICA							NR
MARTINIQUE							NR
MEXICO(GULF)					40		NR
MEXICO(CARIBBEAN)					33		NR
MONSERRAT							NR
NETHERLANDS ANTILLES(S)							AHDR
NETHERLANDS ANTILLES(N)							AHDR
NICARAGUA							NR
PANAMA						1000	NR
PUERTO RICO	5	9			26		NR
ST. KITTS-NEVIS							NR
ST. LUCIA						22	NR
ST. VINCENT							NR
SURINAME	3900	1500	2700	1000	1300	2500	NR
TRINIDAD-TOBAGO						62	NR
TURKS AND CAICOS							NR
UNITED STATES					38*		NR
US VIRGIN ISLANDS					26	19	NR
VENEZUELA							NR

OBS = OBSERVATIONS ONLY, NO QUANTITATIVE DATA RECORDED
* = ESTIMATED YEARLY AVERAGE (1977-1982)
CODES FOR NATIONAL REPORT CATEGORY:
NR = NATIONAL REPORT
DNR = DRAFT NATIONAL REPORT
AHDR = AD HOC DATA REPORT
NONE = NO REPORT

TABLE E.4 HAWKSBILL SEA TURTLE--ERETMOCHELYS IMBRICATA--
ESTIMATED NUMBERS OF NESTING FEMALES BY COUNTRY FOR 1977-1982
FROM WATS NATIONAL REPORTS, TABLE 6

COUNTRY	1977	1978	1979	1980	1981	1982	REPORT CAT.
ANGUILLA							NR
ANTIGUA						76	NR
BAHAMAS							NR
BARBADOS						OBS	NR
BELIZE						31*	DNR
BERMUDA							NR
BRAZIL							AHDR
BRITISH VIRGIN ISLANDS					50		NR
CAYMAN ISLANDS							NR
COLOMBIA							DNR
COSTA RICA							NR
CUBA							AHDR
DOMINICA						3	NR
DOMINICAN REPUBLIC				420			NR
FRENCH GUIANA							NR
GRENADA						500	NR
GUADALOUPE							NR
GUATEMALA							NR
GUYANA							NR
HAITI							NR
HONDURAS							NR
JAMAICA						300	NR
MARTINIQUE							NR
MEXICO(GULF)					480		NR
MEXICO(CARIBBEAN)					88		NR
MONSERRAT							NR
NETHERLANDS ANTILLES(S)							AHDR
NETHERLANDS ANTILLES(N)							AHDR
NICARAGUA					25		NR
PANAMA						10	NR
PUERTO RICO	33	2			23	22	NR
ST. KITTS-NEVIS							NR
ST. LUCIA						11	NR
ST. VINCENT							NR
SURINAME	OBS	OBS	OBS	OBS	OBS	OBS	NR
TRINIDAD-TOBAGO							NR
TURKS AND CAICOS						200	NR
UNITED STATES					2*		NR
US VIRGIN ISLANDS				21	24	25	NR
VENEZUELA							NR

OBS = OBSERVATIONS ONLY, NO QUANTITATIVE DATA RECORDED
* = ESTIMATED YEARLY AVERAGE (1977-1982)
CODES FOR NATIONAL REPORT CATEGORY:
NR = NATIONAL REPORT
DNR = DRAFT NATIONAL REPORT
AHDR = AD HOC DATA REPORT
NONE = NO REPORT

TABLE E.5 KEMP'S RIDLEY SEA TURTLE--LEPIDOCHELYS KEMPI--
ESTIMATED NUMBERS OF NESTING FEMALES BY COUNTRY FOR 1977-1982
FROM WATS NATIONAL REPORTS, TABLE 6

COUNTRY	1977	1978	1979	1980	1981	1982	REPORT CAT.
ANGUILLA							NR
ANTIGUA							NR
BAHAMAS							NR
BARBADOS							NR
BELIZE							DNR
BERMUDA							NR
BRAZIL							AHDR
BRITISH VIRGIN ISLANDS							NR
CAYMAN ISLANDS							NR
COLOMBIA							DNR
COSTA RICA							NR
CUBA							AHDR
DOMINICA							NR
DOMINICAN REPUBLIC							NR
FRENCH GUIANA							NR
GRENADA							NR
GUADALOUPE							NR
GUATEMALA							NR
GUYANA							NR
HAITI							NR
HONDURAS							NR
JAMAICA							NR
MARTINIQUE							NR
MEXICO(GULF)	680	656	754	693	705	621	NR
MEXICO(CARIBBEAN)							NR
MONSERRAT							NR
NETHERLANDS ANTILLES(S)							AHDR
NETHERLANDS ANTILLES(N)							AHDR
NICARAGUA							NR
PANAMA							NR
PUERTO RICO							NR
ST. KITTS-NEVIS							NR
ST. LUCIA							NR
ST. VINCENT							NR
SURINAME							NR
TRINIDAD-TOBAGO							NR
TURKS AND CAICOS							NR
UNITED STATES							NR
US VIRGIN ISLANDS							NR
VENEZUELA							NR

OBS = OBSERVATIONS ONLY, NO QUANTITATIVE DATA RECORDED

CODES FOR NATIONAL REPORT CATEGORY:
- NR = NATIONAL REPORT
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- AHDR = AD HOC DATA REPORT
- NONE = NO REPORT

TABLE E.6

OLIVE RIDLEY SEA TURTLE --LEPIDOCHELYS OLIVACEA--
ESTIMATED NUMBERS OF NESTING FEMALES BY COUNTRY FOR 1977-1982
FROM WATS NATIONAL REPORTS, TABLE 6

COUNTRY	1977	1978	1979	1980	1981	1982	REPORT CAT.
ANGUILLA							NR
ANTIGUA							NR
BAHAMAS							NR
BARBADOS							NR
BELIZE							DNR
BERMUDA							NR
BRAZIL							AHDR
BRITISH VIRGIN ISLANDS							NR
CAYMAN ISLANDS							NR
COLOMBIA							DNR
COSTA RICA							NR
CUBA							AHDR
DOMINICA							NR
DOMINICAN REPUBLIC							NR
FRENCH GUIANA							NR
GRENADA							NR
GUADALOUPE							NR
GUATEMALA							NR
GUYANA							NR
HAITI							NR
HONDURAS							NR
JAMAICA							NR
MARTINIQUE							NR
MEXICO(GULF)							NR
MEXICO(CARIBBEAN)							NR
MONSERRAT							NR
NETHERLANDS ANTILLES(S)							AHDR
NETHERLANDS ANTILLES(N)							AHDR
NICARAGUA							NR
PANAMA							NR
PUERTO RICO							NR
ST. KITTS-NEVIS							NR
ST. LUCIA							NR
ST. VINCENT							NR
SURINAME	550	450	400	550	600	400	NR
TRINIDAD-TOBAGO							NR
TURKS AND CAICOS							NR
UNITED STATES							NR
US VIRGIN ISLANDS							NR
VENEZUELA							NR

OBS = OBSERVATIONS ONLY, NO QUANTITATIVE DATA RECORDED

CODES FOR NATIONAL REPORT CATEGORY:
- NR = NATIONAL REPORT
- DNR = DRAFT NATIONAL REPORT
- AHDR = AD HOC DATA REPORT
- NONE = NO REPORT

TABLE F. ESTIMATED NUMBERS OF FORAGING TURTLES BY SPECIES*
IN NATIONAL WATERS FROM TABLES 7 AND 8
OF THE WATS NATIONAL REPORT

COUNTRY	YEAR	ESTIMATES BY SPECIES CC	CM	DC	EI	LK	LO	UN
ANGUILLA	1980	1						
	1982		+		+			
BAHAMAS	1982	+	+	+	+			
BARBADOS	1982	+	+		+			
BERMUDA	1982	100	1000	5	50			
BRAZIL	1982	+	+		+		+	+
BRITISH VIRGIN ISLANDS	1982	+	+		+			
CAYMAN ISLANDS	1982		+		+			
COLOMBIA	1976		45					
	1983	+	+		+			
CUBA	1982	+	+		+			
DOMINICA	1982		+		+			
DOMINICAN REPUBLIC	1980		5	2	4			8
GRENADA	1982	+	+	+	+			
GUATEMALA	1982	+	+					
HAITI	1982	+	+		+			
HONDURAS	1982							+
JAMAICA	1982	+	+	+	+			
MEXICO(GULF)	1982	+	+	+	+	+		
MEXICO(CARIBBEAN)	1982	+	+	+	+	+		
MONSERRAT	1982		+		+			
NETHERLANDS ANTILLES(S)	1982	+	+		+			
NETHERLANDS ANTILLES(N)	1982		+		+			
PANAMA	1982	+	+	+	+			
ST. KITTS-NEVIS	1983		+	+	+			
ST. LUCIA	1982		48		15			
ST. VINCENT	1982		+		+			
TRINIDAD-TOBAGO	1982		+	+	+			
TURKS AND CAICOS	1982		+		+			
US VIRGIN ISLANDS	1982		214		133			
VENEZUELA	1983		+				+	

* SPECIES ARE CODED AS FOLLOWS:

CC = C. CARETTA EI = E. IMBRICATA
CM = C. MYDAS LK = L. KEMPI
DC = D. CORIACEA LO = L. OLIVACEA
UN = UNKNOWN

+ =OBSERVATIONS ONLY, NO QUANTITATIVE DATA RECORDED

TABLE G. NATURAL MORTALITY ESTIMATES BY LIFE STAGES
UNIT BY SPECIES FROM WATS NATIONAL REPORTS TABLE 10

COUNTRY	SPECIES	NESTS/EGGS	HATCHLINGS	JUVENILES	ADULTS	NESTING FEMALES

(OBSERVATIONS ONLY, NO DATA)

TABLE H.1 STATISTICS OF MARINE TURTLE UTILIZATION
INCLUDING EXPORTS AS REPORTED
IN THE WATS NATIONAL REPORTS TABLE 15
FOR LOGGERHEAD SEA TURTLE-- CARETTA CARETTA--

COUNTRY	YEAR	# OF EGGS	MEAT(KG)	SHELLS(KG)	SKINS(#/KG)	STUFFED JUVENILES
BAHAMAS	1980		1103.0			
	1981		1833.0			
	1982		1437.0			
GRENADA	1980		1500.0			
	1981		1500.0			
	1982		1500.0			
MEXICO(CARIBBEAN)	1980			OBS		

OBS=OBSERVATIONS ONLY, NO QUANTITATIVE DATA RECORDED

TABLE H.2 STATISTICS OF MARINE TURTLE UTILIZATION
INCLUDING EXPORTS AS REPORTED
IN THE WATS NATIONAL REPORTS TABLE 15
FOR GREEN SEA TURTLE--CHELONIA MYDAS

COUNTRY	YEAR	# OF EGGS	MEAT(KG)	SHELLS(KG)	SKINS(#/KG)	STUFFED JUVENILES
BAHAMAS	1980		801.0			
	1981		1831.0			
	1982		2409.0			
COSTA RICA	1980		63660.0			
	1981		24150.0			
	1982		20177.0			
GRENADA	1980		2500.0			
	1981		2500.0			
	1982		2500.0			
MEXICO(GULF)	1980			OBS		
NICARAGUA	1980		47470.0			
SURINAME	1980	250000				
	1981	250000				
	1982	250000				
TRINIDAD-TOBAGO	1982		OBS	OBS		

OBS=OBSERVATIONS ONLY, NO QUANTITATIVE DATA RECORDED

TABLE H.3 STATISTICS OF MARINE TURTLE UTILIZATION
INCLUDING EXPORTS AS REPORTED
IN THE WATS NATIONAL REPORTS TABLE 15
FOR LEATHERBACK SEA TURTLE- -DERMOCHELYS CORIACEA--

COUNTRY	YEAR	# OF EGGS	MEAT(KG)	SHELLS(KG)	SKINS(#/KG)	STUFFED JUVENILES
GRENADA	1980		1000.0			
	1981		1000.0			
	1982		1000.0			

OBS=OBSERVATIONS ONLY, NO QUANTITATIVE DATA RECORDED

TABLE H.4 STATISTICS OF MARINE TURTLE UTILIZATION
INCLUDING EXPORTS AS REPORTED
IN THE WATS NATIONAL REPORTS TABLE 15
FOR HAWKSBILL SEA TURTLE--ERETMOCHELYS IMBRICATA--

COUNTRY	YEAR	# OF EGGS	MEAT(KG)	SHELLS(KG)	SKINS(#/KG)	STUFFED JUVENILES
BAHAMAS	1980		3954.0	651		
	1981		1578.0			
	1982		771.0	860		
CAYMAN ISLANDS	1977			91		
	1978			454		
	1981			682		
GRENADA	1980		5000.0			
	1981		5000.0			
	1982		5000.0			
NICARAGUA	1980			109		
	1981			4721		
	1982			4131		
TRINIDAD-TOBAGO	1982		OBS	OBS		

OBS=OBSERVATIONS ONLY, NO QUANTITATIVE DATA RECORDED

TABLE H.5 STATISTICS OF MARINE TURTLE UTILIZATION
INCLUDING EXPORTS AS REPORTED
IN THE WATS NATIONAL REPORTS TABLE 15
FOR KEMP'S RIDLEY SEA TURTLE--LEPIDOCHELYS KEMPI--

COUNTRY	YEAR	# OF EGGS	MEAT(KG)	SHELLS(KG)	SKINS(#/KG)	STUFFED JUVENILES

OBS=OBSERVATIONS ONLY, NO QUANTITATIVE DATA RECORDED

TABLE H.6 STATISTICS OF MARINE TURTLE UTILIZATION
INCLUDING EXPORTS AS REPORTED
IN THE WATS NATIONAL REPORTS TABLE 15
FOR OLIVE RIDLEY SEA TURTLE --LEPIDOCHELYS OLIVACEA--

COUNTRY	YEAR	# OF EGGS	MEAT(KG)	SHELLS(KG)	SKINS(#/KG)	STUFFED JUVENILES
TRINIDAD-TOBAGO	1982		OBS	OBS		

OBS=OBSERVATIONS ONLY, NO QUANTITATIVE DATA RECORDED

TABLE H.7 STATISTICS OF MARINE TURTLE UTILIZATION INCLUDING EXPORTS AS REPORTED IN THE WATS NATIONAL REPORTS TABLE 15 FOR UNKNOWN SPECIES

COUNTRY	YEAR	# OF EGGS	MEAT(KG)	SHELLS(KG)	SKINS(#/KG)	STUFFED JUVENILES
BARBADOS	1976		2200.0			
	1982		2200.0			
CUBA	1976			6985		
	1977			3984		
	1978			6600		
	1979			2350		
	1981			2650		
DOMINICAN REPUBLIC	1981		142717.0			
	1982		51707.0			
GUATEMALA	1981	OBS				
	1982	OBS				
JAMAICA	1981		56989.0	136		
	1982		40823.0	136		
PANAMA	1976			61000		
	1977			35000		
	1978			27000		
	1979			27000		
	1980			18000		
	1981			13000		

OBS=OBSERVATIONS ONLY, NO QUANTITATIVE DATA RECORDED

TABLE I. SOCIO-ECONOMIC STATISTICS FOR MARINE TURTLE UTILIZATION FROM TABLE 16 OF THE WATS NATIONAL REPORTS

COUNTRY	NO. EMPLOYED FISHING	PROCESSING	SELLING	TOTAL EMPLOYED	TOTAL ANNUAL INCOME
ANGUILLA	10			10	$
BELIZE	25			25	$
BRITISH VIRGIN ISLANDS	15		3	18	$ 30000
COSTA RICA	57	9	7	73	$ 28735
GRENADA	50			50	$ 15000
JAMAICA		10	926	936	$ 45000
TRINIDAD-TOBAGO	12			12	$
TURKS AND CAICOS	80			80	$ 15000
TOTAL	249	19	936		

TABLE J.1 TURTLE CULTURE AND HEADSTART ACTIVITIES
REPORTED IN TABLE 17 OF THE WATS NATIONAL REPORT
FOR LOGGERHEAD SEA TURTLE-- CARETTA CARETTA--

COUNTRY	YEAR	NUMBER EGGS COLLECTED	NUMBER EGGS HATCHED	NUMBER TURTLES RELEASED	NUMBER TURTLES HEADSTART
BERMUDA	1981	42	5	5	0
CUBA	1979			6300	
MEXICO(CARIBBEAN)	1981	1000	600	600	0
UNITED STATES	1977-1982	95078	64381	62983	0

TABLE J.2 TURTLE CULTURE AND HEADSTART ACTIVITIES
REPORTED IN TABLE 17 OF THE WATS NATIONAL REPORT
FOR GREEN SEA TURTLE--CHELONIA MYDAS

COUNTRY	YEAR	NUMBER EGGS COLLECTED	NUMBER EGGS HATCHED	NUMBER TURTLES RELEASED	NUMBER TURTLES HEADSTART
BERMUDA	1976	252	0	0	0
BERMUDA	1981	3153	397	388	9
CUBA	1980			3300	
MEXICO(CARIBBEAN)	1981	800	480	80	400
SURINAME	1978	38545	28548	25118	2434
SURINAME	1979	52317	35064	30505	3996
SURINAME	1980	50131	33614	22112	11502
SURINAME	1981	39865	26785	15110	11420
SURINAME	1982	26780	19304	11582	7722
UNITED STATES	1971-1982			>14000	

TABLE J.3 TURTLE CULTURE AND HEADSTART ACTIVITIES
REPORTED IN TABLE 17 OF THE WATS NATIONAL REPORT
FOR LEATHERBACK SEA TURTLE- -DERMOCHELYS CORIACEA--

COUNTRY	YEAR	NUMBER EGGS COLLECTED	NUMBER EGGS HATCHED	NUMBER TURTLES RELEASED	NUMBER TURTLES HEADSTART
FRENCH GUIANA	1981	5339	2239	2239	0
FRENCH GUIANA	1982	7349	3604	3604	0
SURINAME	1979	1174	835	835	0
TRINIDAD-TOBAGO	1981	158	51	15	4
TRINIDAD-TOBAGO	1982	261	58	45	4

TABLE J.4 TURTLE CULTURE AND HEADSTART ACTIVITIES
REPORTED IN TABLE 17 OF THE WATS NATIONAL REPORT
FOR HAWKSBILL SEA TURTLE--ERETMOCHELYS IMBRICATA--

COUNTRY	YEAR	NUMBER EGGS COLLECTED	NUMBER EGGS HATCHED	NUMBER TURTLES RELEASED	NUMBER TURTLES HEADSTART
MARTINIQUE	1982	140	0	0	0
MEXICO(CARIBBEAN)	1981	800	480	400	80
TRINIDAD-TOBAGO	1982	165	75	43	24
VENEZUELA	1979-1982		5000	4000	

TABLE J.5 TURTLE CULTURE AND HEADSTART ACTIVITIES
REPORTED IN TABLE 17 OF THE WATS NATIONAL REPORT
FOR KEMP'S RIDLEY SEA TURTLE--LEPIDOCHELYS KEMPI--

COUNTRY	YEAR	NUMBER EGGS COLLECTED	NUMBER EGGS HATCHED	NUMBER TURTLES RELEASED	NUMBER TURTLES HEADSTART
MEXICO(GULF)	1979	96470	65814	63996	1818
MEXICO(GULF)	1980	89270	48486	45984	2502
MEXICO(GULF)	1981	92319	55548	53715	1833
MEXICO(GULF)	1982	78100	48082	46512	1570
UNITED STATES	1978				3081
UNITED STATES	1979				1845
UNITED STATES	1980				1818
UNITED STATES	1981				1864
UNITED STATES	1982				1524

TABLE J.6 TURTLE CULTURE AND HEADSTART ACTIVITIES
REPORTED IN TABLE 17 OF THE WATS NATIONAL REPORT
FOR OLIVE RIDLEY SEA TURTLE --LEPIDOCHELYS OLIVACEA--

COUNTRY	YEAR	NUMBER EGGS COLLECTED	NUMBER EGGS HATCHED	NUMBER TURTLES RELEASED	NUMBER TURTLES HEADSTART
HONDURAS	1981	23741	13068	13608	0
HONDURAS	1982	26713	10738	10738	0
SURINAME	1979	1632	702	702	0
TRINIDAD-TOBAGO	1982	60	5	0	3

2. A SUMMARY OF NUMERICAL AND OTHER QUANTITATIVE DATA DERIVED FROM DESCRIPTIVE MATERIALS IN THE WATS NATIONAL REPORTS FOR FISHERIES, FORAGING, AND NESTING, BY SPECIES.

By Harvey R. Bullis

19 July 1983, revised 13 October 1983

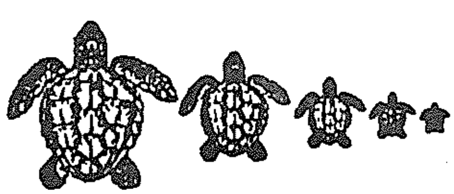
Column captions:

FISHERY NOS.:	Number of turtles caught (annual).
FISHERY WT.(kg):	Weight of meat, unless shell is added (annual).
PRES. OF FORAGERS:	Sighting of turtles in foraging areas.
LEVELS OF NEST. ACT.:	Estimated relative amount of nesting (L, M, H, VH).
NO. NEST. F (T-6):	Estimated number of nesting females (annual), from Table 6 in National Report.
NO. NEST. F INFER:	Estimated number of nesting females or relative amount of nesting, indicated from other sections of National Report.

Symbols used in the tables:

F = Where terms "significant" or "major" have been used to describe levels of fishery exploitation; or where numerical values were presented; F represents a harvest of more than 100 turtles.

f = Where descriptive material indicated "small numbers" or "insignificant" fishery catches; or where numerical values were presented; f represents a harvest 1 to 100 turtles.



R = Reported without quantifying information.

VH = Inferred "very heavy" nesting activity from unquantifiable descriptive information.

H = Inferred "heavy" nesting activity from unquantifiable information.

M = Inferred "moderate," nesting activity from unquantifiable information.

L = Inferred "low," nesting activity from unquantifiable information.

LOGGERHEAD SEA TURTLE, *Caretta caretta* Data and Information Synopsis on Western Atlantic Sea Turtle Fisheries and Populations From WATS National Reports

	FISHERY		PRES. OF	LEVELS OF	NO. NEST.	NO. NEST
	NOS.	WT.	FORAGERS	NEST.ACT.	F (T-6)	F INFER
ANGUILLA			+			
ANTIGUA						
BAHAMAS	F	7184	+	L		
BARBADOS	f		+			
BELIZE	415		+	R		
BERMUDA			+			
BRAZIL		4111	+	M-VH		>2000
BRITISH VIRGIN IDS.			?		?	?
CAYMAN IDS.	F		+	L		5
COLOMBIA	f					
COSTA RICA						
CUBA	284		+			R
DOMINICA	f					
DOMINICAN REPUBLIC	F		+	M	60	>100
FRENCH GUIANA						
GRENADA	30-40	1500	+		100	
GUADALUPE						
GUATEMALA			+	M		
GUYANA						
HAITI	F	328	+	M?		
HONDURAS				M		
JAMAICA	32	3170	+		210	
MARTINIQUE	f		+			
MEXICO GULF	f		+		225	
MEXICO CARIB			+		160	
MONTSERRAT						
NETHERLANDS ANTILLES			+			
			+			
NICARAGUA						
PANAMA			+			
PUERTO RICO			+			
ST. KITTS-NEVIS						
ST. LUCIA					?	
ST. VINCENT						
SURINAME						
TRINIDAD-TOBAGO						
TURKS-CAICOS	F		+	M		50
U.S. VIRGIN IDS.						
U.S.A.			+	VH	28,448	
VENEZUELA				L		

CARETTA CARETTA

Green Sea Turtle, *Chelonia mydas*: Data and Information Synopsis on Western Atlantic Sea Turtle Fisheries and Populations From WATS National Reports

CHELONIA MYDAS

	FISHERY		PRES. OF FORAGERS	LEVELS OF NEST.ACT.	NO. NEST. F (T-6)	NO. NEST F INFER
	NOS.	WT.				
ANGUILLA			+	L		
ANTIGUA	150		+	M	39	>65
BAHAMAS	F	12346	+			
BARBADOS	F		+			
BELIZE	350		+	L		
BERMUDA			+			
BRAZIL	F	8399	+	VH		>4000
BRITISH VIRGIN IDS.	100		+		75	
CAYMAN IDS.	170		+			
COLOMBIA	F		+	L		
COSTA RICA	1547	63660	+	VH	15,000	23,000
CUBA	329		+			R
DOMINICA	F		+			4
DOMINICAN REPUBLIC	F		+	H	260	>500
FRENCH GUIANA	F		+		112	
GRENADA	100-150	2500	+	H	200	
GUADALUPE	F		+	R		
GUATEMALA	F		+			R
GUYANA	F		+	M?		
HAITI	F	250	+	M?		
HONDURAS			+	R		
JAMAICA	27	4980	+		100	
MARTINIQUE			+			
MEXICO GULF	F		+		265	
MEXICO CARIB	F		+		237	
MONTSERRAT	F		+	L		
NETHERLANDS ANTILLES S			+			R
NETHERLANDS ANTILLES N			+			R
NICARAGUA	720	4747	+			
PANAMA			+			
PUERTO RICO			+		4	
ST. KITTS-NEVIS	F		+	L		
ST. LUCIA	6		+	L	6	
ST. VINCENT			+			
SURINAME	250,000 eggs		+	VH	1500	4500
TRINIDAD-TOBAGO	F		+			
TURKS-CAICOS	800	4000	+			75
U.S. VIRGIN IDS.			+			R
U.S.A.			+		182	
VENEZUELA			+	R	>200	>500

DERMOCHELYS CORIACEA

	FISHERY		PRES. OF FORAGERS	LEVELS OF NEST.ACT.	NO. NEST. F (T-6)	NO. NEST F INFER
	NOS.	WT.				
ANGUILLA				L		5
ANTIGUA			+	L	1	
BAHAMAS			+			
BARBADOS						
BELIZE						
BERMUDA			+			
BRAZIL				L-M		
BRITISH VIRGIN IDS.	2				2	
CAYMAN IDS.						
COLOMBIA						100
COSTA RICA	f		+	VH		>600
CUBA						R
DOMINICA					3	4
DOMINICAN REPUBLIC			+	H	380	>750
FRENCH GUIANA	F		+	VH	5197-7607	
GRENADA	5-10	1000	+	M	25	
GUADALUPE						
GUATEMALA						R
GUYANA	F		+	L		
HAITI						
HONDURAS				L		
JAMAICA			+			
MARTINIQUE						
MEXICO GULF			+		25	
MEXICO CARIB			+		33	
MONTSERRAT					2	
NETHERLANDS ANTILLES						R
NICARAGUA			+			
PANAMA	F		+	VH		>1000
PUERTO RICO			+		26	>30
ST. KITTS-NEVIS	F		+	M	12	>20
ST. LUCIA	F		+	M	22	>22
ST. VINCENT	F			L		>4
SURINAME				VH	2500	3600
TRINIDAD-TOBAGO	F		+	VH	62	>250
TURKS-CAICOS						
U.S. VIRGIN IDS.				L-M	20	>20
U.S.A.			+		38	
VENEZUELA	f			R		

ERETMOCHELYS IMBRICATA

	FISHERY		PRES. OF FORAGERS	LEVELS OF NEST.ACT.	NO. NEST. F (T-6)	NO. NEST F INFER
	NOS.	WT.				
ANGUILLA	f		+	L		
ANTIGUA - BARBUDA	250		+	H	76	>76
BAHAMAS	F	3856	+	L		100
BARBADOS	f		+	M		30
BELIZE	360		+	M-H		>100
BERMUDA			+			
BRAZIL	F	1684	+	M-H		>800
BRITISH VIRGIN IDS.	100		+	R	50	
CAYMAN IDS.	F	682 Shell	+	R		
COLOMBIA	f		+	R		
COSTA RICA			+			R
CUBA	202	6600 Shell	+	H		
DOMINICA	F		+		3	6
DOMINICAN REPUBLIC	F	20,117 Shell	+	H	420	1000
FRENCH GUIANA						
GRENADA	100-200	5000	+	H		100
GUADALUPE	F			R		
GUATEMALA	f		+			R
GUYANA	F		+	M		
HAITI	F	242	+	L-M?		
HONDURAS				R		
JAMAICA	472	33975	+	H	300	
MARTINIQUE	F		+	R		
MEXICO GULF			+	M	480	
MEXICO CARIB	f		+		88	
MONTSERRAT	f		+	L		
NETHERLANDS ANTILLES			+	M		>75
			+	L		
NICARAGUA	F	910 Shell	+	M	25	400?
PANAMA	F	2860 Shell	+	L		
PUERTO RICO			+		22	
ST. KITTS-NEVIS	F		+	L-M		>10
ST. LUCIA			+	M	11	
ST. VINCENT	F		+	M-H		>20
SURINAME						R
TRINIDAD-TOBAGO	f		+	M-H		
TURKS-CAICOS	50	400	+	M	200	
U.S. VIRGIN IDS.			+	M	25	
U.S.A.			+		2	
VENEZUELA	f		+	R		

LEPIDOCHELYS KEMPI

	FISHERY NOS.	FISHERY WT.	PRES. OF FORAGERS	LEVELS OF NEST.ACT.	NO. NEST. F (T-6)	NO. NEST F INFER
ANGUILLA						
ANTIGUA						
BAHAMAS						
BARBADOS						
BELIZE						
BERMUDA						
BRAZIL						
BRITISH VIRGIN IDS.						
CAYMAN IDS.						
COLOMBIA						
COSTA RICA						
CUBA						
DOMINICA						
DOMINICAN REPUBLIC						
FRENCH GUIANA						
GRENADA						
GUADALUPE						
GUATEMALA						
GUYANA						
HAITI						
HONDURAS						
JAMAICA						
MARTINIQUE						
MEXICO GULF			+		621	
MEXICO CARIB						
MONTSERRAT						
NETHERLANDS ANTILLES						
NICARAGUA						
PANAMA						
PUERTO RICO						
ST. KITTS-NEVIS						
ST. LUCIA						
ST. VINCENT						
SURINAME						
TRINIDAD-TOBAGO						
TURKS-CAICOS						
U.S. VIRGIN IDS.						
U.S.A.			+	L		R
VENEZUELA						

Olive Ridley Sea Turtle, Lepidochelys olivacea: Data and Information Synopsis on Western Atlantic Sea Turtle Fisheries and Populations from WATS National Reports

LEPIDOCHELYS OLIVACEA

	FISHERY NOS.	FISHERY WT.	PRES. OF FORAGERS	LEVELS OF NEST.ACT.	NO. NEST. F (T-6)	NO. NEST F INFER
ANGUILLA						
ANTIGUA						
BAHAMAS						
BARBADOS	?					
BELIZE						
BERMUDA						
BRAZIL			+	L		
BRITISH VIRGIN IDS.						
CAYMAN IDS.						
COLOMBIA						
COSTA RICA						
CUBA						
DOMINICA						
DOMINICAN REPUBLIC						
FRENCH GUIANA			+			>500
GRENADA			+			
GUADALUPE						
GUATEMALA						
GUYANA	?		+	M		
HAITI						
HONDURAS						
JAMAICA						
MARTINIQUE						
MEXICO GULF						
MEXICO CARIB						
MONTSERRAT						
NETHERLANDS ANTILLES						
NICARAGUA						
PANAMA						
PUERTO RICO						
ST. KITTS-NEVIS						
ST. LUCIA						
ST. VINCENT						
SURINAME			+		500	200
TRINIDAD-TOBAGO	?		+			R
TURKS-CAICOS						
U.S. VIRGIN IDS.						
U.S.A.						
VENEZUELA						R

Sea Turtles, Unknown Species: Data and Information Synopsis on Western Atlantic Sea Turtle Fisheries and Populations from WATS National Reports

	FISHERY		PRES. OF FORAGERS	LEVELS OF NEST.ACT.	NO. NEST. F (T-6)	NO. NEST F INFER
	NOS.	WT.				
ANGUILLA						
ANTIGUA						
BAHAMAS						
BARBADOS	F	2,200				
BELIZE						
BERMUDA						
BRAZIL						
BRITISH VIRGIN IDS.						
CAYMAN IDS.						
COLOMBIA						
COSTA RICA						
CUBA						
DOMINICA						
DOMINICAN REPUBLIC	F	51,712				
FRENCH GUIANA						
GRENADA						
GUADALUPE						
GUATEMALA	f		+			
GUYANA						
HAITI						
HONDURAS						
JAMAICA	F	40,823				
MARTINIQUE						
MEXICO GULF						
MEXICO CARIB						
MONTSERRAT						
NETHERLANDS ANTILLES S	7					
NETHERLANDS ANTILLES N						
NICARAGUA						
PANAMA		1,300				
PUERTO RICO						
ST. KITTS-NEVIS						
ST. LUCIA						
ST. VINCENT						
SURINAME						
TRINIDAD-TOBAGO						
TURKS-CAICOS						
U.S. VIRGIN IDS.						
U.S.A.						
VENEZUELA						

ADDENDUM to Summary of Numerical Data

The seven tables of the "Summary of Numerical and Other Quantitative Data derived from descriptive materials in the WATS National Reports for Fisheries, Foraging, and Nesting, by species" gave records or references found in the National Reports. Subsequently, the Editors compiled a summary of these records to indicate the presence or absence of the three events (Nesting, Foraging and Exploitation) for each species, and a category of unknown species, by country. Because some of the National Reports were preliminary or incomplete we utilized another WATS data source to augment this eighth table. This was: "Surveys of Sea Turtle Populations and Habitats in the Western Atlantic," by Archie Carr, Anne Meylan, Jeanne Mortimer, Karen Bjorndal, and Thomas Carr, 1982, NOAA Tech. Memo. NMFS-SEFC-91, 90 pp.

The New Table should provide a simplified reference to the circum-regional occurrence of sea turtles, but not to their relative abundance or degree of exploitation.

The 40 Reports recorded on the revised Summary Table indicate the following totals:

Species	Total Areas Reporting		
	Nesting	Foraging	Exploitation
Caretta caretta	22	29	18
Chelonia mydas	34	40	31
Dermochelys coriacea	31	18	14
Eretmochelys imbricata	37	39	29
Lepidochelys kempi	2	2	0
Lepidochelys olivacea	6	6	2
Unknown species	0	1	6

The Editors, 8 March 1984

Editors Summary of Nesting (N), Foraging (F), and Exploitation (E) Records of Sea Turtles by Species and by Country. (underscored = from Carr et al, 1982).

	Cc	Cm	Dc	Ei	Lk	Lo	Ukn.
ANGUILLA	F	NF	N	NFE			
ANTIGUA		NFE	NF	NFE			
BAHAMAS	NFE	NFE	N	NFE			
BARBADOS	FE	FE		NFE		E	E
BELIZE	NFE	NFE		NFE			
BERMUDA	F	F	F	F			
BRAZIL	NFE	NFE	N	NFE		NF	
BRITISH VIRGIN IDS.		NFE	NE	NFE			
CAYMAN IDS.	NFE	FE		NFE			
COLOMBIA	NFE	NFE		NFE			
COSTA RICA		NFE	NFE	NF			
CUBA	NFE	NFE	N	NFE			
DOMINICA	FE	NFE	NE	NFE			
DOMINICAN REPUBLIC	NFE	NFE	NF	NFE			E
FRENCH GUIANA		NFE	NFE			NF	
GRENADA	NFE	NFE	NFE	NFE		F	
GUADALUPE	NF	NFE	N E	NFE			
GUATEMALA	NFE	NFE	N	NFE			FE
GUYANA		NFE	NFE	NFE		NFE	
HAITI	NFE	NFE		NFE			
HONDURAS	NFE	NFE	NF	NFE			
JAMAICA	NFE	NFE	F	NFE			E
MARTINIQUE	FE	FE	N E	NFE			
MEXICO GULF	NFE	NFE	NF	NF	NF		
MEXICO CARIB	NFE	NFE	NF	NFE			
MONTSERRAT		NFE	N	NFE			
NETHERLANDS ANTILLES S	F	NF	N	NF			E
NETHERLANDS ANTILLES N	F	NF		NF			
NICARAGUA	N	FE	NF	NFE			
PANAMA	NF	NF	NFE	NFE			E
PUERTO RICO	NF	NFE	NF	NF			
ST. KITTS-NEVIS		NFE	NFE	NFE			
ST. LUCIA	NF	NFE	NFE	NFE			
ST. VINCENT	F	F	N E	NF			
SURINAME		NFE	N	NFE		NF	
TRINIDAD-TOBAGO		NFE	NFE	NFE		NFE	
TURKS-CAICOS	NFE	NFE		NF			
U.S. VIRGIN IDS.	F	NF	N	NF			
U.S.A.	NF	NF	NF	NF	NF		
VENEZUELA	N	NF	N E	NFE		N	

Cc = Caretta caretta
Cm = Chelonia mydas

Dc = Dermochelys coriacea
Ei = Eretmochelys imbricata

Lk = Lepidochelys kempi
Lo = Lepidochelys olivacea

Ukn. = Species not identified

3. OVERVIEW SYNOPSIS

Harvey R. Bullis

In the earliest discussions that formulated this symposium, there were widely varying views as to the need to concern ourselves with the problems of marine turtle populations. In spite of the years that noted scientists and conservationists such as Dr. Archie Carr had attempted to focus attention on these animals, many residents of the western Atlantic region believed that the sea turtle situation was in status quo.

Discussions at the Martinique workshop (1977) raised three important questions. First, how many sea turtles are there and where are they? Second, how many sea turtles do the people of the region want? Third, how many sea turtles do we need to maintain populations of what we want? Scientists from 26 countries participated in those discussions, and from that meeting the idea of WATS was conceived.

During the initial meeting of the WATS Steering Committee, doubt existed as to the level of participation that might be expected. Initial goals were to have participants from at least 25 governmental entities throughout the western Atlantic region. It now appears that these goals were far too modest, because we have participating in the meeting today representatives of 35 of the 38 countries of the region. In fact, only three members of this international community are not formally represented - Brazil, Cuba and Netherlands Antilles. Furthermore, we have 38 national reports, draft national reports, or ad hoc data reports covering all countries of the region. Judging from the remarkable level of interest displayed at this time, it is obvious that we had a problem waiting for a symposium.

Perhaps some comment should be made on the timing. Originally it was proposed to hold this symposium in 1980. It quickly became apparent that this was unrealistic and the schedule was advanced to 1981, then 1982 and finally 1983. I believe the entire Steering Committee would conclude that if we had postponed it for one more year it would have been even better. Nevertheless, the high level of interest and enthusiasm for the goals of this Symposium displayed in the presentation of national reports by the national representatives yesterday clearly indicates that we needed to start this cooperative international endeavor this year.

Since one of the principal objectives was to formulate a regional sea turtle data base, it was necessary to develop a standardized national report format that would initially include almost every aspect of quantitative sea turtle information that might be available. In hindsight we can see that formatting the national reports might have been given further thought in the beginning. Nevertheless, there was some hope of obtaining technical data from some non-technical sources which dictated the format that was used. Obviously, much work still needs to be done in formatting the sea turtle data base. The Southeast Fisheries Center in Miami, Florida, has keypunched and tabulated those data categories that were best represented in the WATS national reports. Since six of these reports were not submitted until this week, the document you have in hand entitled "WATS Computerized Data Base" is incomplete even for this meeting. However, you should find it informative and helpful during the species panel discussions.

In addition to the WATS Data Base document, you should have all received another document entitled "A Summary of Numerical and Other Quantitative Data Derived from Descriptive Materials in the WATS National Reports for Fisheries, Foraging, and Nesting by Species." This last document attempts to provide potential additional quantitative information in the text of the national reports. These are subjective interpretations of descriptive materials which might be used as a key to refer to those individual national reports that seem to provide additional provocative or contradictory information. You should consider this a self-destruct document in that it represents only subjective interpretations of this information, but hopefully it will clue the species panels' participants to additional information not contained in the data tabulations. Also, any disagreements or corrections to these interpretations should be considered during the panel discussions.

Taking a look at information contained in the national reports on a species by species basis shows the following:

For Caretta caretta, 17 countries report nesting colonies for incidental nesting. There appear to be two major nesting areas for the species in the WATS area; 24 countries report the species foraging near coastal waters; six countries report minor fisheries of less than 100 individuals; and seven countries report major fisheries harvesting more than 100 turtles per year.

For Chelonia mydas, 25 countries report nesting, three countries with current major centers of activity; 38 countries report foraging in their waters; seven countries report minor harvesting, and 20 countries report major harvestings.

For Dermochelys coriacea, 25 countries report nesting, five with current large centers of nesting activity; 17 report foraging in their area, partly because Dermochelys is a pelagic species and is encountered almost everywhere on the high seas, as far as my personal experience goes; and three minor fisheries exist for Dermochelys, and seven major fisheries.

Eretmochelys imbricata is reported nesting in all countries that reported to this symposium except two. So there were 36 countries reporting some level of nesting. There appears to be no high level of nesting in any particular country, as far as the data reports are concerned. Wide ranging numbers were reported for nesting in all countries except Suriname and French Guiana. They are in Honduras, but it didn't seem apparent in the report how many there were. Similarly, hawksbills are reported in coastal areas in all countries of the region, except Suriname and French Guiana. Five countries report minor fisheries for hawksbills, and 20 countries report major fisheries.

For the ridleys, Lepidochelys, this problem is simpler. One country reports nesting for Kemp's; a rare nesting in the United States is a second country, but this is insignificant. Two countries report foraging. For the olive ridley, four countries record nesting, with centers of nesting in two countries. Five countries record foraging in other areas, with two more questionable records, and an insignificant fishery in one country.

Incidence of Sea Turtle Activities by Numbers of Countries in the WATS Region from Information in the National Reports.

Species	Nesting	Foraging	Small Fishery[1]	Large Fishery[2]
Cc	17	21	7	7
Cm	29	38	6	22
Dc	27	17	4	7
Ei	36	34	9	19
Lk	2	2	0	0
Lo	6	7	3	0

[1]Less than 100 captures per year.
[2]Apparently more than 100 captures per year.

When the objectives of WATS were established, the validation of the data presented in the national reports was considered essential. However, some questions have arisen concerning the interpretation of the word validate in this context. In fisheries terminology, validation means an examination of collected data prior to formally accepting it into the system. An important function of the species panels is to examine these data for obvious error, discrepancy, or inconsistency. If there are compelling reasons to alter the numbers presented in the WATS national reports, now is the time to do it.

This first attempt to assemble numbers needs to be recognized for what it is - the start of a data base. As additional information is collected, these numbers will expand in dynamic functions. Organizing a starting point is a most difficult task.

During the presentation of the national reports yesterday afternoon, the National Representatives reviewed their contents with clarity. However, this review was from a country-by-country perspective. The text-table above summarizes the total number of countries presenting information on the incidence of one or more of the six species in their waters and on their beaches.

With these data, as fragile and as statistically vulnerable as they may be, we can say that we have in a preliminary way the start to obtaining the answer to the first question raised at the Martinique Workshop - "How many sea turtles are there and where?" I am sure that these figures will be subject to intense scrutiny in the immediate future and will be greatly improved upon the next time we meet.

The importance of the WATS area sea turtle resource to the social and economic requirements of many of the participating countries was clearly established in yesterday's presentations by the national representatives. I do not think it is too early to ask questions two and three again - "How many turtles do we want, and how many do we need to maintain the numbers we want?"

4. PANEL SESSIONS

4.1 Green Turtle

4.1.1 Green Turtle Overview of Biology (Larry Ogren)

It has been said that the green turtle, *Chelonia mydas*, is the most valuable reptile in the world. For a time, it was also the most studied. These early investigations provided understanding of the other species as well. Recent investigations, stimulated by a renewed interest in protection of depleted populations, have brought attention to major differences and similarities between the other species. Also, early interest and research in the reproductive biology of the adult female and orientation behavior of neonates are expanding to include a much broader field of research, less parochial in coverage. However, we are still lacking information on those aspects of the population dynamics critical to conducting intelligent conservation practices and making the proper management decisions. Specifically, these problem areas include recruitment, age at maturity, longevity, and mortality. Current population estimates and past trends for the green turtle in some areas of the circum-Caribbean region are totally lacking. For other countries a considerable amount of information has been gathered over the past 30 years. In this synopsis, we will rely heavily upon the demographic information available for the Tortuguero, Costa Rica, colony. Additional information on population characteristics can be obtained from studies of the Suriname green turtle. This overview will primarily address those in the audience who are unfamiliar with sea turtles.

For supporting documents, the best synoptic coverage of the green turtle can be found in Hirth (1971) and Groombridge (1982). Details on the biology of this species not covered in the overview will be covered in the panel discussion that follows. Our primary objective is to provide an assessment of the WATS data base dealing with the population estimates that have been developed in the national reports.

The green turtle is generally considered a highly migratory animal. This wide ranging travel, the routes of which are almost totally unknown, is a characteristic of the species. Beginning with the neonates, extensive developmental or immature movements are believed to take them to all regions within the western North Atlantic system. The places where they are observed to remain for various periods of time are called developmental habitats. After attaining adulthood, the green turtle's migratory habits become somewhat more routine. Some do range widely, but most appear to establish regular feeding grounds and nesting beaches and periodically migrate between them. These migrations become a permanent feature of their ecologic behavior. The distances traveled between these two areas can be quite extensive, covering hundreds of miles. The affinity the breeding population exhibits for nesting on a particular stretch of beach is remarkable. This is referred to as philopatry. Along this beach, the females show a propensity to return to nest on a selected section during the extended nesting season, and from one migratory period, two or three years later, to the next. This is called site-fixity, and the two or three year period is called the remigration interval. The female mates off the nesting beach and usually nests several times during the season at 12-14 day intervals. The term used for this reproductive feature is called the internesting period. These terms will probably be used throughout the panel sessions on reproductive biology that follows this overview and have been discussed in detail by Carr, Carr and Meylan (1978). The values of these terms, derived from tag recapture data, provide the basis for making population estimates of various nesting aggregations. For the green turtle, these average values are as follows: renesting interval, 12 days; remigration interval, 2.5 years; numbers of nests per season, 2.8. A refinement to the usual method used to determine the size of the nesting population takes into account the ratio of neophyte or first-time nesters and remigrants. It will be discussed in detail in the panel discussion.

To continue with the synopsis, we must say the green turtle is a circumtropical species complex whose taxonomic relationships are poorly understood. Most recognize that Chelonia mydas may well consist of many discrete breeding units that are genetically isolated from one another. This is supported by the overwhelming data on the philopatry of the Tortuguero, Costa Rica, population. The greatest morphological divergence of the complex exists between the eastern Pacific "black" turtle and the rest of the mydas complex. The distinctive "black" turtle, smaller and darker than the others, may be given full specific ranking. It will probably assume the name Chelonia agassizii some day (Carr, 1975). However, the systematics of the complex are incomplete and changes in the nomenclature await further study.

(Morphological features of the green turtle were illustrated by numerous slides.) It is noted that it is the second largest species of sea turtle, attaining a weight of 225 kg or more. The length of the carapace, on an average, is about 1 meter. Scute and scale numbers, or counts, are used to differentiate the species. It is the only species with a single pair of large scales (prefrontals) on the head, located between the eyes.

The female lays an average of 110 eggs per clutch. The eggs take about two months to develop. The hatchlings emerge from the nest about two days after hatching and crawl directly to the sea. They swim rapidly offshore on a course perpendicular to the beach. After that, they are only seen on rare occasions, swimming along weedlines in the pelagic environment. After several months, the "lost year" period, the young turtles, now "dinner plate" size, are found in the shallow coastal waters, feeding and migrating through a series of geographically separate developmental habitats, changing their omnivorous feeding habit to one of herbivory as they grow in size. The herbivorous adults eventually establish themselves in areas of extensive turtle grass, Thalassia. These areas usually lack suitable high energy beaches necessary for nesting. Hence, a migratory behavior develops between feeding pastures and distant nesting beaches. Little is known about the environmental cues or sensory organs involved that provide the requisite navigational ability to migrate successfully between these two habitats. However, the fact remains that they do. It has been hypothesized that the neonates are imprinted on beaches they emerge from and return to their natal beaches to breed (Carr, 1972A). Whether or not this is true remains to be determined. The internationality of all the jurisdictional areas included within the migratory range of the green turtle poses important problems to proposed conservation management schemes.

In the western central Atlantic, the green turtle is a depleted species. Important nesting aggregations once occurred at Bermuda, Cuba, south Florida

(Keys), and Cayman Islands. Historical records are lacking for many areas elsewhere in the Caribbean and western North Atlantic, but almost everywhere nesting populations are either non-existent or reduced to a few hundred. The exceptions to this, however, are the three largest nesting assemblages remaining today. These localities are: Tortuguero, Costa Rica; Suriname; and Aves Island, Venezuela. Numbers of nesting females per season for these three areas average 15,000, 1,500 and 800, respectively. This greatly reduced reproductive effort for the WATS region is further compromised by certain biological constraints characteristic of the species. This has been called the consequences of herbivory (Bjorndal, 1982B). Although the extensive pastures of turtle grass present throughout the region today would suggest an abundance of food, the nutritional properties of this primary forage item of the green turtle are low. This results in slow growth rates, delayed sexual maturity, and low annual reproductive effort (the modal being 2.5 years). Also, in order to maintain existing population levels and offset high juvenile mortality, a long reproductive life is required.

References: See Appendix 6, Bibliography.

4.1.2 Rapporteur Report of the Green Turtle Species Synopsis Panel Session

CHAIR: Karen Bjorndal, University of Florida, USA

RAPPORTEUR: Peter Bacon, University of the West Indies, Jamaica

BIOLOGIST: Larry Ogren, National Marine Fisheries Service, USA

PANEL: Eduardo Bravo, Direccion de Pesca y Vida Silvestre, Costa Rica

James Burnett-Herkes, National Representative, Bermuda

Jacques Fretey, National Representative, Guadeloupe and Martinique

John Fuller, Lord Nelson Club, Antigua

Harold Hirth, University of Utah, USA

Joe Parsons, National Representative, Cayman Islands

Peter Pritchard, Florida Audubon Society, USA

Joop Schulz, Deventes, Netherlands

The Chair introduced the panel members and outlined the topic for discussion. The biologist gave a brief review of the biology and ecology of *Chelonia mydas*, after which there was discussion, as follows:

CHAIR: Noted that the major problem in research on green turtles was estimation of population size. The most satisfactory formula was probably:

(Number of recruits) + (Number of remigrants x remigration interval)

PRITCHARD: Mentioned the problem of estimating populations from single or few night's nesting counts. Formula should probably be:

(Numbers nesting that night) x (Internesting interval)

i.e., Number nesting x 14 = Nesting female population.

BURNETT-HERKES: Raised the problem of population estimation for foraging turtles in an area like Bermuda where nesting does not occur. As turtles are difficult to catch at sea, estimates are generally poor.

HIRTH: Noted that false crawls and multiple body pits might confuse nest number counts.

CHAIR: Noted great fluctuations year to year in numbers of nesters.

SCHULZ: Stressed the need for highly trained persons for recognition of true nests and false body pits.

PARSONS: Noted that even in true nests green turtles sometimes lay few eggs.

BACON: Reminded members of the manual of Sea Turtle Research Techniques and requested that the section on track and nest recognition be reviewed to aid researchers in correct interpretation of nesting data.

OGREN: Suggested that tags in present use were inadequate and that tag loss remained a major restraint in accurate population estimation.

CHAIR: Agreed and reported 20% tag loss at Tortuguero.

SCHULZ: Noted that within-season tag loss had been recorded in Suriname (see Mrosovsky comment below).

HIRTH: Raised subject of clutch size and noted that if larger, more experienced breeders have larger clutch size this had implications for management.

BURNETT-HERKES: Confirmed slow growth rates of _C. mydas_ in the Caribbean.

FULLER: Reminded the panel that most Caribbean populations of green turtle are small and this must be borne in mind for management.

CHAIR: Reminded members of other tagging methods such as living tags (to be discussed in the Research Section). In reply to a question from Pritchard, confirmed that big turtles are not necessarily older and that growth slows at maturity as energy is channeled into reproduction.

SCHULZ: Did not believe that larger turtles, or populations with larger turtles, necessarily lay more eggs. He confirmed that turtles grow little after maturity.

BURNETT-HERKES: Underlined the lack of knowledge about Tortuguero turtle foraging areas and also where immature foragers might go to nest later on.

OGREN: Agreed that knowledge was sparse, except for Tortuguero and for foraging at Ascension and in Suriname.

SCHULZ: Showed a diagram of Suriname green turtles going to forage in Brazil. Their migration was counter-current and there is the possibility that their hatchlings are transported in the opposite direction or utilize rich Guianas estuaries as developmental habitat.

OGREN: Noted that there is much direct observational data on juvenile foraging areas.

FULLER: Reported juvenile green turtles in waters of Antigua, Barbuda and north of Guadeloupe.

BURNETT-HERKES: Suggested that sub-adults may mix in the eastern Caribbean. A study of this would be feasible in the smaller islands as it is low technology, low manpower work; but this project would require funding support.

FRETEY: Reported that some female green turtles foraging in Brazil may remain for two to three years before returning to nest, or it is possible that they migrate further out to sea.

SCHULZ: Did not believe that hatchling green turtles in Suriname went north with currents. Noted that plate-sized juveniles are recorded from Brazil.

PRITCHARD: Pointed out that this international nature of sea turtle populations had important implications for management. He noted that this was important because a breeding turtle may shift its breeding site from one jurisdiction to another. These shared turtle stocks were the subject of WATS.

SCHULZ: Deplored the lack of cooperation shown by Brazil, particularly with Suriname, in managing the turtles.

OGREN: Pointed out that nesting beaches are important, but so are foraging areas (actual, historical, or potential). Suitable nesting areas were associated with current systems in the oceanic habitat, so these were essential in making a nesting beach "suitable," e.g., the Tortuguero stretch of the long Costa Rican coastline.

BURNETT-HERKES: Asked if there was a good method of sexing immatures.

OGREN: Replied that NMFS was still working on this problem.

The Chair opened the discussion to National Representatives and other participants at this point.

CINTRON: (National Representative of Puerto Rico) - Asked whether the percentage of turtles not seen again after nesting might be poor navigators or turtles nesting elsewhere.

CHAIR: Disputed this on evidence for Tortuguero as no Tortuguero nester had ever been recorded on another beach.

PRITCHARD: Pointed out that this may be an artifact as only the northern section of Tortuguero is patrolled regularly. The Chair agreed that this was possible. He (Pritchard) noted also that sea turtle lines are ancient, but beaches are ephemeral, so some mechanism must allow colonization of new beaches.

BURNETT-HERKES: Reported close site fixity of Bermuda turtles, sometimes for seven years. The average distance between recaptures being 1.5 km and greatest distance, 4 km.

HUNTE: (National Representative of Barbados) - Suggested that food is readily available for green turtles, so food is not a limiting factor in breeding.

CHAIR: Agreed, but suggested they were nutrient limited rather than food limited. She considered that exploitation was the most important limiting factor at present.

PRITCHARD: Stated that it was normal for a turtle not to breed each year, as the large egg production and migrations made great physiological demands.

HUNTE: Asked whether if exploitation was stopped the rate of recovery would be slow.

CHAIR: Agreed that a long time was needed for recovery, so conservation efforts must be long-term.

PRITCHARD: Suggested that recovery would be quicker where adults had been exploited rather than eggs.

HIRTH: Cautioned that variation in biology might mean that factors other than exploitation were controlling population size.

DAMMANN: Questioned whether there was evidence for sperm storage in female green turtles.

MROSOVSKY: (University of Toronto) - Reported that a 15% tag loss was recorded in Suriname in a single month survey. He suggested that a population-estimation formula for green turtles on a "number per night" basis could be calculated from the Suriname data.

WITHAM: (Florida Department of Natural Resources, USA) - Asked whether site-fixed foragers might not be at a nutritional disadvantage. Also queried how many beaches were as well surveyed as Tortuguero in order to suggest statements about the site fixity of Tortuguero green turtles.

The Chair opened discussion on the WATS data base for Chelonia mydas.

BOULON: (National Representative of Virgin Islands) - Corrected the figure on Table 5 for C. mydas in U.S. Virgin Islands to read > 280. This was added to the Summary of Numerical Data on Table I also.

ROSS: (Harvard University, USA) - Suggested that confidence limits should be put on data base numbers.

CHAIR: Suggested that the data base should include a code for the method of arriving at population estimates.

There being no further comments, corrections, or additions to the *Chelonia mydas* data sheets, they were accepted for the WATS data base.

Critical Problem Areas:

The problem areas identified were:

(1) Need for accurate formulae for estimating population size.

(2) The inadequacy of the WATS data base.

Suggestions for Future Actions:

(1) Research should be continued throughout the region to improve the WATS data base.

4.1.3 Audience Response

Comment by Students of Universidad Nacional (Heredia, Costa Rica):

The green turtle, *Chelonia mydas* shows a three-year cycle. What scientific explanation is there for the relationship between length, weight, sexual maturity, and this period of ovulation?

Response:

Insufficient information is available to answer at this point.

Comment by L. D. Brongersma:

Movement of juveniles with the currents. There are no sightings of turtles in the southern westward current of the gyre.

4.2 Loggerhead Turtle

4.2.1 Overview of the Biology of the Loggerhead Turtle, *Caretta caretta* L. in the Western Atlantic Ocean (Llewellyn M. Ehrhart)

Deraniyagala's (1939) morphologically thorough account of the Indo-Pacific loggerhead, Caretta caretta gigas, has been followed by other useful synopses, including those of Carr (1952), Ernst and Barbour (1972), Pritchard (1979), and Groombridge (1982).

The loggerhead is a relatively large marine turtle whose ecologic strategy involves neritic residence (Hendrickson, 1980) and a diet of molluscs, crustaceans, sea urchins, sponges, Scyphomedusae, Salpae, squids, syngnathid fishes, horseshoe crabs, and basket stars (Brongersma, 1972; Mortimer, 1982). All western Atlantic loggerheads are assigned to the subspecies C. caretta. The species generally shows less genetic variability than green turtles (Smith et al., 1977), and perhaps other kinds of sea turtles, and there is little evidence of race formation. However, Stoneburner (1980a, 1980b) has found morphologic and other differences between populations in South Carolina and Florida, and certain differences in life history patterns among populations along the southeastern U.S. coast may promote some degree of reproductive isolation.

The Cheloniidae in which Caretta is placed with Lepidochelys, Eretmochelys, and Chelonia, appears to be a good, natural group. Modern sea turtles as a group (including the seemingly aberrant leatherback, Dermochelys) show considerable phylogenetic cohesion (Ackman et al., 1971; Frair, 1964, 1972; Zug, 1966). Caretta is placed with Lepidochelys in the subfamily (tribe) Carettini by Carr (1942) and Zangerl (1958). The question of the placement of Eretomochelys in that subfamily or with Chelonia in the subfamily Chelonini continues to be debated (Hendrickson, 1980; Pritchard, 1979).

The loggerhead is a large, reddish-brown and yellow turtle with a disproportionately large head. In addition to general coloration, it is distinguishable from other sea turtles on the basis of the following characteristics:

(1) Presence of horny scutes on a thick bony shell;

(2) Presence of five costal scutes, the most anterior in contact with the nuchal;

(3) Two pairs of prefrontal scales, often with one or more supernumerary scales between them;

(4) Lack of a serrate margin on the lower tomium;

(5) Presence of three inframarginal scutes, lacking pores associated with Rathke's glands, on each side;

(6) A group of variously-shaped inframandibular scales posterior to the tomium of the lower jaw; and

(7) Eyes (orbits) that are intermediate in size between those of Eretmochelys and Lepidochelys.

The mean weight of 803 adult female loggerheads from central Florida was 116 kg (255 lbs.); the range was 70.2 kg (154 lbs.) to 187 kg (412 lbs.). For comparison, 15 adult female green turtles averaged 136.2 kg (300 lbs.), which is 17% heavier than the loggerheads. Mean straight-line carapace length for a representative group of adult females (from Florida) was 92.2 cm; over-curvature carapace length mean was 99 cm.

The breeding range of Caretta caretta is often described as "anti-tropical," in reference to the fact that the majority of nesting occurs north of the Tropic of Cancer or south of the Tropic of Capricorn. Major nesting areas are in South Carolina and Georgia, on the Florida east coast (especially from Volusia County to Palm Beach County), at Cape Sable in Florida, and on the northeastern coast of the Yucatan and Quintana Roo, Mexico (Sternberg, 1981; Bacon, 1981; Carr et al., 1982). Significant nesting also occurs in Tabasco-Campeche in Mexico; on the Inaguas, Andros and Abaco in the Bahamas; near Rio Buritaca in Colombia; and perhaps on a number of Cuban beaches. The nesting range of the loggerhead exhibits a curious discontinuity on the eastern and western rims of the Caribbean.

Carr, Carr, and Meylan's (1978) model of green turtle ecologic geography is used here as a guide to loggerhead life history. To the best of our knowledge, males migrate with the females to the waters off the nesting beaches, where mating takes place. Mating begins somewhat more than a month before nesting. Copulating pairs are seen frequently off the coast of southeastern U.S. in April and May, but rarely or never in June, July, or August. There is a question about the temporal relationship of copulation, fertilization and egg laying. For loggerheads the most parsimonious explanation seems to be that, for an individual female, one or more matings take place prior to the onset of nesting, that additional inseminations are unnecessary for the fertilization of one season's ova (which may comprise one to eight or nine clutches), and that the males return to the foraging areas about the time that nesting begins.

During nesting emergences, female loggerheads use an alternating sequence of footfalls, fashion shallow body pits, and dig with a rigidly stereotyped action of the hind flippers (Carr, 1982). They spread the hind flippers postero-laterally and gently raise their medial edges as eggs are extruded. They cover the eggs with alternating movements of the hind limbs and then obliterate the nest site by hurling sand over it with the front flippers.

There is considerable variation in egg number among clutches (the range is about 60 to 170), but little year to year variability in means. Mean clutch size varies from about 100 to 126 throughout the region. The eggs vary considerably in weight and size, but there is little annual variability in mean weight (ca. 41 g) and mean minimum diameter (ca. 42 mm). The same is true for hatchlings, which weigh 20 g, on the average.

Nearly all of the population estimates that we have are based on numbers of nesting females. Unfortunately, estimating the numbers of even these fairly accessible animals is fraught with problems. One needs accurate assessments of the mean number of nests per female per season (generally thought to be about 2.5 for Caretta); mean multiannual remigration intervals (also thought to be about 2.5 for Caretta) and natural sex ratios, in order to make reliable estimates of adult populations. The estimates we have include: 400 females per year at Santa Marta, Colombia (Kaufman, 1975); 500 per year at Quintana Roo, Mexico (Marquez, 1976); 1300-1800 "laying females" in the St. Andrew Sound area of Georgia (Richardson and Richardson, 1978) and 41,500 adults in the southeastern U.S. (Carr and Carr, 1977). Several investigators are currently employing pelagic aerial survey techniques to make population estimates that include immature turtles.

Loggerhead turtles may spend much of the so-called "lost year" as members of the sargassum raft community (Caldwell, 1968; Smith, 1968; Carr and Meylan, 1980). I regard the post-hatchling stage(s) of loggerhead life history as being even more enigmatic than that of Chelonia because, although relatively small green turtles ("dinner plates") are regular components of populations on coastal marine grass pastures, loggerheads smaller than 45-50 cm or 20 kg are virtually unknown among populations that are otherwise composed of immature animals. A 45-50 cm turtle is a relatively large animal, and it seems to me that if they are remaining in the sargassum community until they reach that size, we would be able to observe them there. I don't believe that we have such observations, but I'm hopeful that information brought to light at this Symposium will begin to solve that puzzle.

Developmental and adult foraging habitats for western Atlantic loggerheads are mapped. Although it seems clear that there is a marked separation of habitats by life history stage for loggerheads of the Florida Atlantic seaboard, this may not be typical of western Atlantic populations in general. Also, the tendency seen in Florida loggerheads for a clear geographic separation of nesting beaches and adult foraging grounds may not be typical of loggerheads throughout the region. I would suppose that many of the participants in this symposium have good information to contribute to this, and that data from the national reports will also be invaluable in shedding light on the ecologic geography of Caretta caretta in the western Atlantic.

References

(1) Deraniyagala, P. E. P. 1939. Tetrapod reptiles of Ceylon. Colombo Museum Publications.

(2) Other references: See Appendix 6, Bibliography.

4.2.2 Rapporteur Report of the Loggerhead Species Synopsis Panel Session

CHAIR: Colin Higgs, Bahamas

RAPPORTEUR: Herman E. Kumpf, USA

BIOLOGIST: Llewellyn Ehrhart, University of Central Florida, USA

PANEL: Wendell Clarke, National Representative, The Bahamas

John Fletemeyer, Biologist, USA

William Gordon, National Representative, USA

Sally Hopkins, South Carolina Wildlife and Marine Resources Department, USA

Sixto Inchaustegui, National Representative, Dominican Republic

Colin Limpus, Queensland Turtle Research, Australia

Mirna Marin, National Representative, Honduras

Kerwyn Morris, National Representative, St. Vincent

Joseph Powers, Southeast Fisheries Center, USA

James Richardson, University of Georgia, USA

Ross Witham, Florida Department of Natural Resources, USA

The Chair opened with an outline of the session and a charge to the panel. The order of the session was as follows:

(1) Overview biological synopsis by Dr. Llewellyn M. Ehrhart, United States.

(2) Critique of the biological synopsis by the panel.

(3) Assessment of the WATS data base.

(4) Identification of critical problem areas in the data base as well as population trends.

(5) Listing, in order of priority, of potential directions for future action.

(6) Commentary by National Representatives dealing with the synopsis and data base.

The biological overview synopsis presented a background of biological information covering taxonomy, identification, reproduction, distribution, life history features, population estimates, and general ecology. Excellent graphic material accompanied the verbal presentation. The text of this species synopsis is attached at 4.2.1.

The critique of the biological overview synopsis produced pertinent additions to the data base, insight into research techniques, as well as further information needs.

LIMPUS: Offered the observation that one should expect and accept differences within the population as animals adapt their activities to particular situations.

RICHARDSON: Commented on the two behavioral groupings of turtles he has studied in Georgia, USA, where nesting of one segment was five times versus once a year. Richardson further pointed out that it is deceptively simple to state one number for a population estimate and that new estimates will continue to be produced as research continues.

HOPKINS: Reported that the original estimates of nesting females per annum in 1973, for the state of South Carolina, are similar to those estimates produced for the draft southeastern United States Turtle Recovery Planning, 1982.

POWERS: Discussed aerial surveys and gave insight regarding the methodology of block sampling for pelagic surveys and the necessity for ground truth corroboration for nesting beach aerial surveys. He further pointed out that such aerial surveys are measuring only a segment of the population but are vital for providing elements for a population model.

HOPKINS: Stressed the importance of assessing nest success, not just nesting occurrence. Because of subsequent predation and erosion of the beach, hatching success varies greatly. This comment was endorsed by Lew Ehrhart.

WITHAM: Offered the observation that it appears that when there is land development in the vicinity of beaches there is little predation, but where there is little development the natural predation appears higher.

CHAIR: Polled the representatives on the panel for their specific remarks pertaining to the loggerhead turtle situation in their countries.

INCHAUSTEGUI: Remarked that there was no confirmed loggerhead nesting in his country and that the estimates of loggerheads on the eastern and southwestern coasts were made by fishermen in interviews.

MARIN: Listed a number of concerns dealing primarily with artificial incubation, determination of sexes and stated that inventories were difficult.

CHAIR: Posed the question as to why the Bahamas had such large numbers of foraging turtles and little, if any, nesting. He wondered if those loggerheads foraging in the Bahamas nest in Cuba and if there were tag returns from the large expanse of islands in the southern Bahamas island chain.

EHRHART: Speculated that none of his tag returns were from the southern Bahamas because of the lack of fishermen to observe and capture turtles.

The panel then briefly discussed turtle tagging and the tags utilized.

LIMPUS: Stressed the need to survey isolated islands and that tagging should be carried out on sub-adults, i.e., less than breeding size, as part of a long-range program.

GORDON: Questioned whether tags and tagging protocol needed improvement in order to be useful in obtaining information for developing appropriate regional management measures.

MORRIS: Questioned the statement that only foraging but no nesting took place in the Antilles when the WATS overview synopsis reported nesting in Grenada and St. Lucia.

The panel next took up the validation of the WATS data base. No additions, corrections or deletions were made regarding the loggerhead data on nesting data, estimates on number of nests, population sizes and historical trends. Several recommendations or reservations on the use of the data base were made by the panel.

RICHARDSON: Cautioned against the direct correlation of nesting females to hatchlings and juveniles foraging off nesting beaches.

LIMPUS: Noted that the several nodal points of high populations in the southeastern United States should perhaps not be lumped just because they are in one country. These population nodes should be kept separate if they do indeed form natural separate groupings.

HOPKINS: Pointed out the dramatic drop in numbers of nests from Cape Canaveral, middle east coast of the state of Florida and the rest of the state.

POWERS: Emphasized the need to know what stocks there are, i.e., loggerhead stock identification.

GORDON: Utilized the analogy of the Pacific salmon and the use of magnetic tags to monitor and delimit the stock that originated in one country and then dispersed into the open ocean.

MARIN: Pointed out that one stock identification method should not be mutually exclusive (biochemical or mechanical tagging) and that for certain countries mechanical tagging is easier even though an educational program on tagging may be necessary.

CINTRON: Expressed his opinion that tag returns will be low from areas where possession of any turtle species is illegal.

JOSEPH: Asked if current patterns could be responsible for the distribution of foraging loggerheads at the northern and southern extremes of the Pan-Caribbean region.

FLETEMEYER: Said that his studies of hatchlings and one-year olds indicated that current was a determining factor.

RICHARDSON: Stated that young turtles like to stay inshore in shallow waters.

BURNETT-HERKES: Raised the generic question of what information should be included in the next version of the WATS national reports. He felt that the field biologist should be the key individual to assess the type of information and make recommendations to the national organizational entity for transmittal to the WATS Steering Committee.

Critical problem areas and future actions were discussed and are summarized in the attached table (Table 1).

Priority Needs:

(1) Data on whole life cycle with emphasis on early life stages (hatchlings, juveniles and immature animals).

(2) Improve distribution of information.

(3) Develop and test stock identification methodology.

(4) Implement new effective management measures.

(5) Increase efforts towards public information and education.

Table 1: Critical problem areas and future actions as determined for the loggerhead turtle (Species Synopsis Panel Session, WATS).

Critical Problem Areas	Future Actions
1. Reduction of habitat	1. Conduct research
- Available nesting habit is being reduced	- Determine optimum habitats
- Reduction in forage areas	- Document "nest success"
	- Continue aerial, beach surveys for data base development
	- Improve and implement tag and tagging protocol
	- Evaluate stock identification methods
2. Continued incidental catch of turtles	2. Development and implement new turtles management methods
- Indiscriminant harvesting technologies	
3. Inadequate data base for conservation and management	3. Modify and strengthen national report requirements and format
- Specific stock identification lacking	
- Distribution information spotty	
- National report data missing	

4.2.3 Audience Response

Comment by N. Rouse:

Loggerhead migration on Palm Beach reefs with special reference to 1981 was described using slides of graphs. There appeared to be more males than females compared with the past 10-20 years.

4.3 Kemp's Ridley Turtle

4.3.1 Kemp's Ridley Turtle Overview of Biology (Rene Marquez)

The biology, distribution, and present situation of the Kemp's ridley turtle (*Lepidochelys kempi*) presents special characteristics that have forced a definition of research, administration, and conservation techniques that are very different from those applied to the other species of sea turtles. Some of the more significant peculiarities of this species are, for example, the apparent existence of only one reproducing population, only one important nesting beach (Rancho Nuevo), a virtual confinement of all the population within the Gulf of Mexico, and diurnal nesting and feeding based mainly on crustaceans, especially shrimp. These peculiarities force us to define a series of research techniques that cannot be easily applied to other species; for example, every year, the total number of females that nest in Rancho Nuevo is evaluated by means of the direct counting of turtles and nests, and by tagging and recapture during the reproductive season; likewise, the total number of eggs laid and the hatchlings that reach the sea are known.

Almost all the existing female population reproduces from April to August on one beach, that is, a coastal strip 27 km long, from Barra del Tordo to the north.

The story of the discovery of this colony and its nesting beach has been repeated many times and it reflects the result of an irrational exploitation of a resource in all possible ways and in all phases of its biological development, from egg to adult. This occurs in all the distribution area from Florida to Campeche and includes the nesting beach in Rancho Nuevo, where before 1965, almost all of the eggs produced in each nesting season were extracted.

It was in 1963, through a documentary film made in 1947, that there were "arribadas" of up to 40,000 turtles. But 20 years later, when the Mexican government installed the first protection camp (1966), these "arribadas" only reached 2,000 turtles. Five years later this decline continued and the largest "arribadas" barely reached 250 turtles. This situation has apparently been stabilized for more than 10 years. From 1966 on, when the first camp was established, research and protection have continued to the present day without interruption, each year an average of 21,000 hatchlings are released and beginning in 1978, through a non-official agreement between the Secretariat of Fishing of Mexico and the Fish and Wildlife Service of the United States of America, protection efforts have been intensified, doubling the number of hatchlings released in the sea (an average of 53,000). Of these hatchlings, 2.8% have been used in an experiment to establish a new nesting area in Isla Padre, Texas, using the theories of imprinting and headstarting, through hatcheries during 9 to 12 months and the subsequent liberation of these small turtles in different parts of the Gulf of Mexico.

The future of this species is still uncertain, in spite of the efforts undertaken during the last 17 years. This is due mainly to the incidental capture that occurs during shrimp trawling on the coasts of the Gulf of Mexico. This capture is difficult to avoid during traditional shrimp fishing, since this turtle is frequently found feeding on these and other crustaceans.

For this reason a device should be placed on the net during trawling that will permit the turtles to leave the net and thus avoid being drowned. This mechanism is being experimented on by the shrimp fleet in northeast and northwest parts of the Gulf of Mexico (NOAA, 1981). Hopefully, it will be used in all the Gulf, at least during sea turtles' nesting months, as well as in specific areas where the existence of the species is known.

Analysis of the Present Situation (Rancho Nuevo)

Since 1966, when the protection of and research on this resource began, each year other activities have been developed, such as the tagging of adult females, the transfer of nests to incubation corrals, and the freeing of hatchlings. Before 1965 the eggs on the beach were almost all poached. Recruitment was reduced almost to zero during at least a decade. This implies that when work began we found an aged population doomed to extinction. From that moment on, several thousand hatchlings were produced per year (an average of 21,000) but the population continued to decrease because the growth rate of this species is slow.

Apparently, conditions stabilized in the mid 1970's and from then on, few changes have occurred. The level is low, around 800 females per season, and this represents a decrease in the population of reproducing females of roughly 98% in less than 25 years.

From 1978 on, conservation efforts increased with the contribution of equipment and personnel from the United States (from the Fish and Wildlife Service). In this way the number of protected hatchlings doubled (an average of 53,000), which makes it possible to expect positive results in a few years time.

From the beginning of the camps, egg poaching in Rancho Nuevo beach has definitely been reduced to a minimum. Each season only 8% of the nests are lost through poaching. Natural mortality of the nests on this beach increases due to meteorological phenomena, one of which is extremely high tides that produce flooding of the nesting strip or a high degree of erosion that eliminates the sandy zone. Barriers, high enough to impede the arrival of turtles during the nesting season, are also formed. Problems are also caused by storms and hurricanes that flood nests for several days, drowning the eggs in the incubation corrals. These causes and the depradation or infestation by ants, fungus or bacteria, produce a survival rate between 50 and 70% at the end of the incubation period. Thus, at the present time, between 50,000 and 60,000 hatchlings are released each year (see Table 1, column Hr.). Considering this recruiting through a cohort analysis (Marquez et al., 1981), the results of which are also presented in Table 1, and following the method that the same study explains, we find that the population could improve with the tendency observed graphically in Figure 1. Here, recruitment is clearly positive and is defined by the slope R = 0.170.

If pressure due to the incidental capture by the shrimp fleet on the turtle population would decrease markedly, the population would present more obvious signs of recovery.

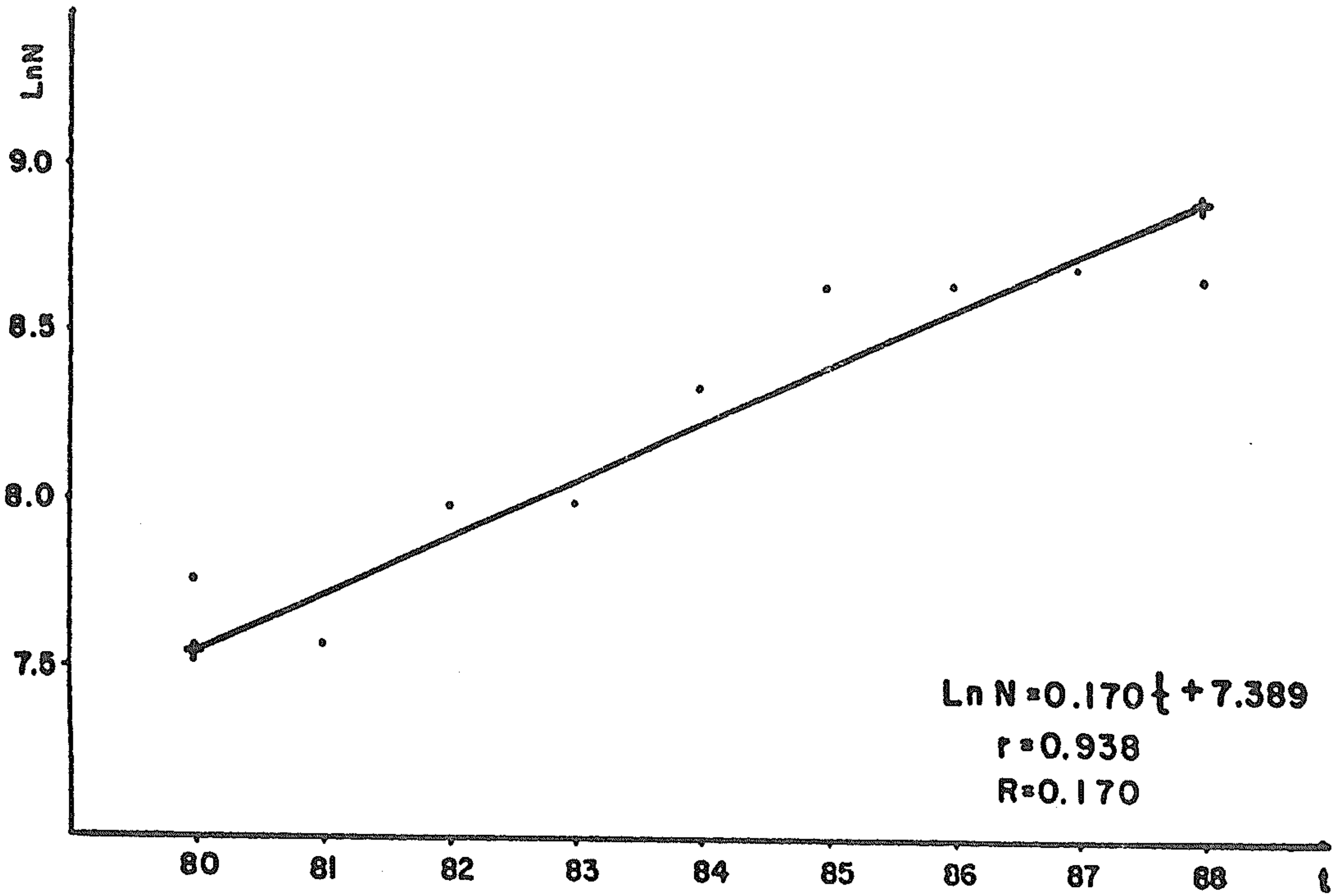


Figure 1: Prognosis of the annual theoretical recruiting rate for Lepidochelys kempi during the period 1980-1988.

On the other hand, a few small arrivals have been observed outside the Rancho Nuevo area (Marquez and Villalobos, in preparation). These could be a big help to the population's recovery, if more protection is given through the establishment of a camp in the area of Tecolutla, Veracruz.

As a result of the studies begun in 1978 between the Fish and Wildlife Service of the United States and the Secretariat of Fishing of Mexico, six to 11 month old Kemp's ridley turtles have been released in several parts of the Gulf of Mexico. The numbers are indicated in Table 2 (Mexus-Golfo, 1982).

Table 2: Kemp's ridley turtles released in the Gulf of Mexico after six to 11 months of headstarting in the NMFS Laboratory in Galveston, Texas.

Date		Number	
Born	Released	Released	Retained
1978	1979	2008	45
1979	1980	1439	166
1980	1981	1728	0
1981	1982	1521	126
1982	1983	1324	25

Turtles that were retained have been kept in order to try to form a breeding population in different areas aimed at strengthening natural recruitment. This work is done mainly in the Miami Seaquarium and in the turtle farm on Grand Cayman Island. Some of these animals are now five years old and show secondary sexual characteristics; it is possible to expect that they will soon begin to reproduce.

Conclusions

In accordance with what has been presented, the Kemp's ridley population is unbalanced, although it shows a possibility of improvement if the present protection program continues. Diagnosis at this moment indicates undoubtedly that the species is IN DANGER OF EXTINCTION.

References

(1) Marquez, M. R., C. Penaflores S., A. Villanueva O., and Y. Diaz F. 1981. A model for diagnosis of populations of olive ridleys and green turtles of west Pacific tropical coasts. In: K. Bjorndal (ed.), The Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington, D.C., 153-158.

(2) Mexus-Golfo (in press). Informe de Tortugas Marinas, Mexus-Golfo. Logros y Planes para 1982-1983. Reunion Anual de Mexus-Golfo, 25 de Agosto de 1982. Veracruz, Ver., 34 p.

(3) NOAA. 1981. Construction, installation, and handling procedure for National Marine Fisheries Service's Sea Turtle Excluder Device. NOAA Technical Memorandum, FNFS-SEFC-71, 1-13.

4.3.2 Rapporteur Report of the Kemp's Ridley Turtle Species Synopsis Panel Session

CHAIR: Jorge Carranza-Frazer, Instituto Nacional de Pesca, Mexico

RAPPORTEUR: Horace Walters, Steering Committee, WATS

BIOLOGIST: Rene Marquez, Technical Team, WATS

PANEL: David Bowman, Department of the Interior, USA

Patrick Burchfield, Gladys Porter Zoo, Texas, USA

William Gordon, National Representative, USA

Roderick Mast, National Marine Fisheries Service, USA

Edith Polanco, National Representative, Mexico

Jack Woody, Fish and Wildlife Service, USA

CHAIR: The session commenced with the Chairman formally introducing Dr. Rene Marquez, the biologist who was to present the biological synopsis on the Kemp's ridley, as well as the other members of the panel. Dr. Marquez, in presenting the synopsis, was quite thorough and was assisted with a series of slides. Upon conclusion, the Chairman commented on the fact that Kemp's ridley has been protected for the last 16 years through a number of measures either directly imposed or incidentally as a result of particular condition. However, the population had remained stable, although it could have been expected that it should be increasing. In this context, the Chairman encouraged panel members to consider and discuss the work being undertaken by Marquez with specific regard to the major nesting sites and associated problems, the number of eggs, turtles, and measures to conserve the species.

MARQUEZ: Indicated that the number of hatchlings freed each year has been increasing. He also went on to cite the number of adult turtles which were available after seven years of freeing these hatchlings. Marquez indicated that if the mortality rate did not change and the conditions remained stable, the population obviously should increase. It was concluded, therefore, that there had been a stabilization of the population over the past 10 years.

WOODY: Explained the work undertaken through an agreement between the United States and Mexico. This program allowed NMFS to import 2,000 eggs per annum to the U.S. for experiment. He pointed out that this was not a management tool. This experiment was intended to establish another population on the Texas Gulf coast. To do this, sand was brought to Mexico in styrofoam boxes in which collected eggs would be placed and flown to the U.S. Upon the completion of the hatching process, they were flown to Galveston where they were tagged and kept for one year before release. In so doing, this imprinting process was intended to encourage mature turtles to return. This program will continue at least for another four years to complete the 10 years duration.

CHAIR: Indicated that even though the program did not immediately produce good results, the exercise could have implications for other species. It was Marquez's view that this species had special characteristics and probably the results of this experiment could not be applied indiscriminately to other species, however, since this work involved only one population and may have unique genetic problems related to its behavior and habits.

MARQUEZ: Pointed out that the Gulf of Mexico provided two foraging areas for this species. Some of the population went north and some south. This information had been obtained from tags and was considered accurate. Work on migration routes had also been conducted with remote sensing and tagging. The migration routes and feeding areas are important in the Kemp's fishery. It is concluded, therefore, that since Kemp's feeds on crustacea and shrimp, capture of this species could be very high by shrimpers; but somehow this turtle has been able to avoid extinction and has remained stable. Information on capture, however, has been difficult to collect since capture is forbidden. Snapper and spear fishermen as well as divers have an impact on the fishery and their catches are hard to quantify. A special net with an excluder device has been developed in the U.S. which helps reduce the capture of this species. Information on the corrals was presented and their difference from individual nests was identified. This work tended to limit high predation and the possibility of flooding and gave balanced temperature. Hatcheries provided more secure incubation. Problems associated with the species were identified as follows: (1) the shortage of money to undertake additional work; (2) the avoidance of capture by shrimp trawlers; (3) the dissemination of information, especially to people who live on beaches with limited access to them; and (4) finding pathways of migration to identify timing and movement, to help reduce mortality of the species.

4.3.3 Audience Response Session

Comment by J. Frazier:

Dr. Carranza raised two important questions: Why has the Kemp's population not increased and what are the problems on the feeding grounds? In discussion, pressures on this species, predation and take, either incidental or purposeful, have been mentioned. Yet, the two foci of foraging are subject to intense environmental perturbations. First, the Mississippi drains a massive area that (a) has been subjected for decades to pesticides and herbicides, and (b) has great human activity where toxic wastes are common. Secondly, the Bahia de Campeche has been the site of large and repeated oil pollution. Is it not possible that massive environmental perturbation concentrated in the only two foraging areas is related to the status of the population?

Response:

Yes, but this is a conclusion from unorganized data. The potential problem is recognized.

Comment by D. Owens:

In the mid-1960's, Mexican scientists walked the beach at Rancho Nuevo. In the early 1970's, Hendrickson provided a jeep. In the late 1970's, the U.S. Fish and Wildlife Service provided the much more efficient three-wheel motorcycles. In the early 1980's, Florida Audubon provided an airplane. In the 1960's a few scientists lived in a tent. Now there is a small village of scientists. Considering this increase in observational technology, as well as the intensification of effort involved, how can we believe that actual nesting numbers are on the rise? This is a question for Rene Marquez, Dr. Schulz, Florida turtle tagging programs and others who tag.

Response by R. Marquez:

From a movie made in 1947, it was estimated that 40,000 turtles were nesting. The population decreased to maybe 1,000, then 400 nesting females. But when protection started some 20 years ago, the population stabilized and then the population began experiencing a recruitment of about 5% each year to the nesting population.

Comment by C. R. Shoop:

Since most Kemp's ridley strandings in the U.S. are along the Atlantic coast, does the panel actually believe all of these animals are waifs? The number of juveniles along the eastern U.S. is substantial, almost all are very healthy, and the observations have been made every year. Surely, some emphasis in research on these eastern U.S. animals is in order.

Response:

The panel does not have data to reach conclusions on the question of Kemp's ridleys on the Atlantic coast. Are they or are they not "waifs?" Research is in order.

4.4 Olive Ridley Turtle

4.4.1 Overview of Biological Data on the Olive Ridley (Joop Schulz)

As the Chairman already indicated, I shall limit myself to the basic essentials of the olive ridley biology. This means I shall not touch the taxonomy and nomenclature. There is no need to go into detailed description of the morphology. Suffice to say that the olive ridley is the smallest of the sea turtles and seldom weighs more than 50 kg. The average weight of nesting females in Suriname is 36 kg. The carapace is almost round in outline; 500 females measured in Suriname had an average length of 68.5 cm (63-75 cm) and an average width of 60 cm (53-66 cm).

The olive ridley can be distinguished from the green turtle and the hawksbill by the usually higher and asymmetrical number of costals (for detailed account of shell characteristics see Pritchard, 1969; Hill, 1971). The olive ridley can be distinguished from the loggerhead by having two pairs of prefrontals and the inframarginal pores (secretory glands which possibly aid in sex or species recognition).

The young are easy to distinguish from those of the green turtle by having two pairs of prefrontals, the greater number of costals and by the presence of strong dorsal keels on all vertebrals and costals.

Distribution

The olive ridley has a wide distribution in the tropical oceans of the world and it is probably the most numerous sea turtle. However, next to Kemp's ridley, it is the rarest species in the western Atlantic region. This surprisingly contrasts with the impressive numbers of ridleys that occur just on the other side of Central America, along the Pacific coast.

It is a very sporadic wanderer in the extreme eastern Caribbean. A few have been reportedly sighted and caught in the waters around Grand Cayman, the Bahamas and Barbados. Very occasional nesting has been reported on beaches in Honduras, Cuba, Jamaica, Trinidad, and Turks and Caicos. (The last mentioned sighting appears somewhat doubtful since it does not fit the pattern of the nesting strategy of the olive ridley which nests almost exclusively on mainland coasts and not on oceanic islands.)

Based on the data available, I believe we can safely state that in our region the olive ridley is most common in the waters off the South American coast from eastern Venezuela (Isla Margarita) to French Guiana, with stragglers as far as Natal in Brazil.

The vast majority of these ridleys used to converge up to the 1960's on a 400 m long stretch of beach in Suriname, called Eilanti. There they arrived during the season (May-July) in three waves (the so-called "arribadas" about which I will make some comments later on). On other beaches in Suriname and neighboring Guayana and French Guiana, ridleys came ashore in small clusters or individually. However, the picture changed dramatically a few years after the discovery of the beach. In 1973 there was only one small arribada, a dim reflection of the nesting waves in previous years. This is more disquieting because of complete protection of nests established in 1967.

The dramatic drop in numbers nesting on Eilanti was only partially compensated for by an increase in numbers nesting on the French Guiana beaches. I will not speculate on the causes of this decline in numbers (beach erosion, incidental catch by shrimping vessels, etc.).

I am almost certain that no nesting whatsoever takes place between French Guiana and the state of Bahia in Brazil. Farther south we have definite reports about olive ridleys nesting in Bahia and Sergipe.

Reproduction

I have not been able to get information on courtship and mating, or whether it occurs just off the nesting beaches, as happens with the green turtle. Marquez and co-authors in their 1976 synopsis give data on sex-ratios for the Pacific coast populations.

What determines the locations of nesting beaches is unknown. The olive ridleys nesting in the Guianas outside the main nesting beach, Eilanti, appear to be very plastic in their beach preferences.

I have now come to a behavioral trait peculiar to the genus *Lepidochelys*, which in Pritchard's words constitutes perhaps the most spectacular manifestation in reptile life. The fantastic reproductive aggregations known as arribadas or arribazones. Throughout most of its range the olive ridley is a diffuse individual nester, but there are at least 14 places in the world where large aggregations have been seen nesting (most of these places were discovered during the last decade). This strategy of synchronous nesting makes the olive ridley a tempting target for animal predators, poachers, and exploitation. We could endlessly philosophize over the survival merits of arribadas. For instance, it could be satiation of predators by, to use Mrosovsky's words, "putting all the eggs in one basket, but making it so heavy that the thieves cannot carry it away or not all of it." Of course, this strategy also has its weaknesses, as for instance, the considerable mortality in nests caused by females digging up each other's nests. Numbers can more easily fall below a critical level so that the population cannot sustain itself. For more on this subject I refer to Mrosovsky's recently published book "Conserving Sea Turtles."

Behavior on the beach is, in general, similar to that of other species, but ridleys show a peculiar stereotyped process after covering the eggs; the female compresses the sand over the finished nest by rocking laterally and slapping the sand with alternate sides of the plastron (the other turtles are perhaps too heavy to do this).

In the Guianas, olive ridleys come ashore exclusively during dark. The nest pit, of course, is shallower than that of the other turtles (often less than 30 cm), which makes the eggs more vulnerable to predation by ghost crabs.

On Suriname beaches where ghost-crabs abound, crab damage is very severe. Eilanti has practically no ghost crabs, which easily leads to the assumption that because of this the beach was chosen for arribadas. The small olive ridley lays the smallest (and tastiest!) eggs. Average clutch size is some 116 (35-156) (Marquez reports average clutch size of 95).

Incubation time in Suriname is 46-62 days, varying considerably during the season (I published detailed data in 1975). Hatching success (i.e., the average emergence of the young) is 60% on Eilanti, but much lower on the other beaches with ghost-crabs.

The number of times a female nests per season has not been definitely defined. From the number of arribadas it could be concluded to be three. This is not true. We estimate that on Eilanti the majority of ridleys nest only once with an average of 1.4 nests per female per season, with an inter-nesting cycle of 14 or 28 days. This is based on recordings of tagged animals. For the Pacific coast it was determined that a female lays at least two to three times, but I wonder how this figure was arrived at under the confused, crowded conditions of an arribada of 20,000 females and over per night that could render the records untrustworthy.

The Breeding Cycle

It is remarkable that although the olive ridley occurs in vast numbers, in various parts of the world, very few data have been published on the reproductive biology of the species. Suriname is a notable exception. There, almost 3,000 olive ridleys were tagged between 1966 and 1972. The tagged females showed remarkably high remigration rates (over 50%), and the data would suggest that in Suriname at least most of the ridleys are annual nesters (a property unique among sea turtles). For the Mexican Pacific coast populations, it is claimed that the majority nests every two years.

Where does the Guiana nesting population stay between the nesting season? The map shows at-sea recovery data for 59 Suriname-tagged olive ridleys. Their recoveries span 4,500 km of the mainland coast of South America extending from Natal in Brazil to the Gulf of Venezuela. Almost half of the recoveries were reported from locations off the coast of the Guianas, many of which were made outside the nesting season. This indicates that some of the turtles remain in the general region of the nesting place. One of the turtles was recaptured 1,900 km away only 23 days after tagging, which means a minimum travel speed of 83 km/day.

About one third was caught near Trinidad, around Isla Margarita, and along the coast of eastern Venezuela. This is perhaps due to the presence of a rich food source at the Orinoco mouth, but the explanation could also be a different fishing pressure, as this area is very heavily fished.

There remains something to be said about the feeding habits of olive ridleys. Although conspicuous advances in the study of sea turtle ecology have been made in the last two decades, the feeding ecology of the animals is still poorly known. That goes in particular for the olive ridley. Most of the data summarized in literature are qualitative descriptions of stomach contents, which gives good indications of principal items in the diet, but much more than that has to be known (i.e., feeding regime, habitat, etc.). Available published information, mainly about the Pacific coast ridleys, indicates that in some places shrimp predominates in the diet, while in other places varying amounts of crab, sessile and pelagic tunicates, and numerous other small invertebrates have been found in the digestive track. The abundance of both benthic fauna and substrate suggests that olive ridleys are primarily bottom feeders.

Reports about olive ridleys captured in prawn trawls at depths ranging from 80-110 m indicate that they are capable of foraging in very deep water. This probably is the reason why so many ridley tags were returned by prawn trawlers in the Guiana continental shelf and in east Venezuela waters. Only a few Suriname tagged ridleys have been caught far off the coast, and the fact that olive ridleys have been rarely identified in the open sea reflects a tendency for ridleys to remain in coastal waters.

Hatchling diet is totally unknown; and, as far as juveniles are concerned, we have not found specimens. If someone in this audience has seen them, we would like to hear about it. So, during the nine years it takes an olive ridley to reach maturity (according to Marquez), they completely withdraw from observation, at least in our region.

4.4.2 Raporteur Report of the Olive Ridley Turtle Species Synopsis Panel Session

CHAIR: Henry A. Reichart, Steering Committee, WATS

RAPPORTEUR: Rene Marquez, Technical Team, WATS

BIOLOGIST: Joop Schulz, Deventer, Netherlands

PANEL: Steve Cornelius, Montana, USA

Mario Espinal, Direccion General de Recursos Naturales Renovables, Honduras

Mario Hurtado, Guayaquil, Ecuador

Jaime Incer, National Representative, Nicaragua

Fernando Rosales Loessener, National Representative, Guatemala

Anne Ramboux, c/o UNDP, Guatemala

Douglas Robinson, Universidad de Costa Rica, Costa Rica

The Chairman opened the meeting by introducing the participants and outlining the most important topics to be dealt with. Next, the relevant work started with the reading of Dr. Joop Schulz's report: Overview of Biological Data on the Olive Ridley. Dr. J. Schulz was thanked for his excellent synoptic resume. Reichart summarized the data on the synthesis of the national reports for the purpose of focusing the discussion on the species review report and its computerized data base.

Table C: No quantitative data are furnished; only nesting and seasonal data. Nesting does exist in: Brazil, French Guiana, Suriname, Guyana, and Trinidad and Tobago. It has been stated that nesting exists in Venezuela, but there are no reports in this regard in the data base.

Table D: Land Surveys: These are raw data and the 1983 data are not included. The 1982 data appear for: French Guiana, Suriname, and Trinidad and Tobago.

Aerial Surveys: The following must be noted:

French Guiana:	No traces (August 22, 1982)
Suriname:	0
Trinidad and Tobago:	0

Table E-6: Estimation of Numbers of Females:

Brazil	R (= nesting reported)
Cuba	R (Table C doesn't mention anything)
Guatemala	R (Table C doesn't mention anything)
Honduras	R (Table C doesn't mention anything)
Turks and Caicos	R
Venezuela	(not listed under Table C)
Suriname	(in 1967-1968, 2100-300), now 550-800
French Guiana	Nesting takes place, but it is now shown under Table E-6.

Table E-6: Fishery, Level Unknown for:

Bahamas	F
Barbados	F or f
Cayman Islands	F
Haiti	F

Table F: Feeding Zones:

Are omitted in the case of French Guiana, Suriname, and Guyana.

Table H-6: Utilization:

Trinidad and Tobago - meat, shell - observations

Discussion was started with the question posed by Joop Schulz at the end of his presentation: Why are there so few olive ridleys in the western Atlantic and why is their number decreasing?

ROBINSON: Expressed concern about the fact that some forms of protection affect the sex proportion and the reproductive system, and this could explain the decreasing number of the olive ridley.

SCHULZ: Explained that the nests were not manipulated, but that the area was protected against predators.

CORNELIUS: Asked in what way Schulz had estimated the nest hatching success in Suriname?

SCHULZ: Replied that he had used small corrals (enclosures) made of wire cloth.

HURTADO: Asked whether hatching success determined for the nests made during the arribadas or by nests made by solitary turtles?

SCHULZ: Replied that it was in both ways.

MARQUEZ: Stated that there was no doubt whatsoever that the catches made by prawn trawlers are partly responsible for this problem.

The Chairman requested nesting reports from Guatemala and Honduras.

ROSALES: Stated that the presence of L. olivacea had not been confirmed in eastern Guatemala and the recordings of Honduras and Haiti were questioned. The National Representative of Haiti confirmed that said information was also erroneous.

SCHULZ: Asked about the egg transplants made in Guatemala.

RAMBOUX: Reported that an egg transplant experiment has been started in shaded corrals and that they have had up to a 97.4% hatching rate (average for 1981).

CHAIR: Stated that one must be careful with these transplants, since it is probable that only males are being obtained, thus affecting the respective population.

Following the order of the agenda the pending tasks were defined and priorities were set.

Critical Areas:

(1) Implementation of surveys of nesting beaches;

(2) Defining foraging areas;

(3) Investigating the location of juveniles;

(4) Determination of the migratory routes.

Future Actions:

(1) To start nesting surveys on the beaches of: Honduras, Guatemala, Cuba, Venezuela, and Guyana.

(2) To promote the use of equipment to exclude the turtles from prawn trawlers (turtle excluding devices), in the western Atlantic countries.

4.5 Hawksbill Turtle

4.5.1 Biological Synopsis of the Hawksbill Turtle (*Eretmochelys imbricata*) (Anne Meylan)

The hawksbill turtle (*Eretmochelys imbricata*) occurs in tropical and subtropical waters of the Atlantic, Pacific, and Indian Oceans. It is widely distributed in the Caribbean and western Atlantic, normally ranging from southern Florida southward along the Central American mainland to Brazil, and throughout the Bahamas and the Greater and Lesser Antilles. The diagnostic features of the species are two pairs of prefrontal scales; thick, posteriorly overlapping scutes on the carapace; four pairs of costal scutes, the anteriormost not in contact with the nuchal scute; two claws on each flipper; and a beak-like mouth. Two subspecies of *E. imbricata* (*E. i. imbricata* in the Atlantic Ocean, *E. i. squamata* in the Pacific Ocean) have been described, on the basis of differences in coloration and carapace shape. The criteria have proven to be unreliable in distinguishing the two forms, however, and subspecific designations are rarely used. The affinities of *Eretmochelys* with other sea turtle genera are not well established. Osteological evidence (Carr, 1942) and serum protein analysis (Frair, 1979) suggest closer affinities with the loggerhead (*Caretta*) and ridley (*Lepidochelys*) than with *Chelonia*.

The hawksbill is a small to medium-sized marine turtle; adult females in the Caribbean range from 62.5-91.4 cm straight carapace length. This is similar to sizes reported elsewhere in the world, except for turtles nesting in the Sudan, Yemen, and Oman, which are significantly smaller. Caribbean hawksbills also tend to be larger than those in the East Pacific. Mature female and male hawksbills caught off eastern Nicaragua by Nietschmann (1981) ranged in weight from 27.2-86.2 kg. Adults are sexually dimorphic; males have longer, thicker tails than do females and the proximal claws on the front flippers are more developed. The minimum size at which this dimorphism becomes evident is not established, nor is it known, for either sex, at what age sexual maturity is reached. Only two growth records for wild hawksbills have been published, both from Australian waters: 1.62 cm/yr for a 81 cm female, and 1.76 cm/yr for a subadult 67 cm in length (Limpus, 1979).

Many aspects of life history of the hawksbill are poorly known. From the time hatchlings leave the nesting beach until they reach approximately 18-20 cm in carapace length, they are rarely seen in coastal waters. There is limited evidence that this period may be spent drifting passively in the open sea in weedlines or shearlines, as is postulated for young *Caretta* and *Chelonia*. Small hawksbills have been sighted in weedlines in a few widely separate localities, and the stomachs of three small hawksbills that stranded independently in Florida contained fragments of the pelagk the alga *Sargassum fluitans* and other weedline-associated debris (Meylan and Carr, 1982). An alternative theory is that they take up residence on reefs near their natal shores. Evidence to support this latter theory is equally fragmentary (Uchida, 1979; Witzell and Banner, 1980).

Hawksbills greater than 20 cm in carapace length typically inhabit coral reefs and other hard-bottom habitats such as old limestone banks and volcanic outcrops. There is evidence that in the east Pacific hawksbills live in mangrove-fringed bays and estuaries. Repeated captures of tagged turtles suggest that individuals may remain in the same foraging areas for extended periods.

The hawksbill is omnivorous in its feeding habits, consuming primarily reef-associated benthic organisms, such as sponges, tunicates, sea anemones, and algae. In the Caribbean, choristid and hadromerid demosponges are particularly important food items (Meylan, unpublished data). As large, mobile predators, they are important members of the reef community.

Throughout its range, the hawksbill is characteristically a diffuse nester. Nesting occurs on a wide variety of beach types, including mainland shores and beaches on oceanic and continental islands. Although hawksbills frequently nest on beaches used by green turtles, they show much wider tolerance of beach type. Nesting occurs on small, isolated cays, on rocky cove-head beaches and on beaches fronted by coral reefs. Small size and agility enable them to negotiate offshore obstacles.

Mating takes place in the vicinity of the nesting beach, as is the general pattern for marine turtles. The nesting season extends for a longer period than for any other sea turtle in the Caribbean. May through October are the peak months, but occasional nesting probably occurs year round.

Locality	Nesting Season	Peak Months	Source
U.S. Virgin Islands	May-Nov	----	Boulon and Olsen, 1982
Dominican Republic	May-Dec	Aug-Oct	Ottenwalder, 1981
Nicaragua	May-Nov	Jul-Aug	Nietschmann, 1981
Costa Rica	May-Nov	May-Jun	Carr, Hirth and Ogren, 1966
Panama	Apr-Dec	----	Meylan, unpublished data
Guyana	----	Jul-Aug	Pritchard, 1969
Suriname	Feb-Aug	Apr-Jul	Schulz, 1975

In the Caribbean, hawksbills nest almost exclusively at night. This is the norm throughout the world, although turtles nesting at localities in the Seychelles, China, and northern Australia have been reported to be partly or completely diurnal. Nests are usually placed near or under vegetation at the back of the beach platform. Nesting behavior generally follows the pattern exhibited by other marine turtles.

Eggs are smaller (40 mm) than those of green turtles, and are most similar in size to those of the ridley. Clutch size is directly correlated with carapace length (Hirth, 1980). It varies markedly throughout the range of the species. Hawksbills nesting in the Sudan, Yemen, and Oman, lay significantly fewer normal-sized eggs than turtles elsewhere. Clutches at these localities usually include a substantial number of undersized, yolkless eggs. Mean clutch size in the Caribbean ranges from 101-161 eggs.

Locality	Clutch Size Average	Clutch Size Range	Sample Size	Source
U.S. Virgin Islands	142	51-211	39	Small, 1982
Tortuguero, Costa Rica	161	53-206	57	Carr, Hirth and Ogren, 1966
Suriname	146	112-179	13	Schulz, 1975
Shell Beach, Guyana	158	139-176	7	Pritchard, 1969
Carriacou, Grenadines	101	54-155	22	Goodwin, 1981

Hatchlings emerge from the nest after 58-64 days. They are 4.0-4.2 cm in length, and are usually dark brown dorsally with nearly black plastrons. The influence of incubation temperature on sex determination has not been studied. However, 62 of 69 embryos examined from a single clutch in Florida which developed during cool temperatures were male, suggesting the same pattern of temperature influence as has been demonstrated for Chelonia and Caretta (Dalrymple and Hampp, 1983).

Few data are available on the average number of nests laid by an individual hawksbill per season. At Cousin Island, Seychelles, where surveillance of the nesting beach is nearly complete, hawksbills nest an average of 2.76 times per season (de L. Brooke and Garnett, 1983). Turtles that have nested at Cousin Island in previous years nest more times per season than new arrivals, 3.68 versus 2.50. Of 240 hawksbills that have been observed from 1955 through 1982 at Tortuguero, Costa Rica, 212 nested once during a season, 26 nested twice, one nested three times and one, four times (Carr and Stancyk, 1975; Carr, unpublished data). The beach is not patrolled throughout the entire season, however, and the number of renestings is therefore conservative. The average internesting interval for Eretmochelys is slightly longer than two weeks.

Locality	Internesting Intervals (days) Average	Number of Intervals	Source
Tortuguero, Costa Rica	19.8	11	Carr and Stancyk, 1975
Eastern Nicaragua	18.5	5	Nietschmann, 1981
Maziwi Island, Tanzania	16-19 (range)	5	Frazier, 1981
Campbell Island, Australia	14.7	27	Limpus et al., 1983

Not all emergences or nesting attempts result in eggs being laid. Percentages of successful emergences of 47 and 60% in two different seasons (Diamond, 1975) and 77% (Limpus et al., 1983) have been reported.

Few remigration intervals have been recorded for Eretmochelys. At Cousin Island, Seychelles, 25-30% of tagged hawksbills are seen in later seasons;

two- and three-year remigration intervals are predominant (de L. Brooke and Garnett, 1983). As of September 1982, only 9 of 240 hawksbills (3.75%) tagged at Tortuguero, have been seen in later years; three and four years are the most common intervals (Carr and Stancyk, 1975; Carr, unpublished data).

Locality	Remigration Interval (No. Observations)	Source
Tortuguero, Costa Rica	2 years (1) 3 years (4) 4 years (3) 6 years (1)	Carr and Stancyk, 1975 and Carr, unpublished data
Eastern Nicaragua	3 years (1)	Nietschmann, 1981
Cousin Island, Seychelles	2 years (14) 3 years (12) 4 years (4)	de L. Brooke and Garnett, 1983
Masirah Island, Oman	1 year (1)	Ross, 1981
Sabah, Malaysia	2 years (1) 3 years (3)	de Silva, 1982

There is evidence that hawksbills are capable of homing to specific subsections of the shore to nest, both within the same season and in subsequent seasons (Carr and Stancyk, 1975; Diamond, 1976). The degree to which site fixity is expressed within a population, however, is not known.

It is not known whether the hawksbill is migratory. Tag recoveries indicate that some long-distance travel does occur. Evidence to support the commonly held theory that hawksbills nest on beaches adjacent to their feeding grounds is inconclusive.

Place Tagged	Place Recovered	Distance Traveled (km)	Source
Tortuguero, Costa Rica (7 turtles)	Miskito Cays, Nicaragua	385-463	Carr and Stancyk, 1975
Tortuguero, Costa Rica	Colon, Panama	480	Carr, unpublished data
Eastern Nicaragua	Pedro Cays, Jamaica	628	Nietschmann, 1981
Eastern Nicaragua	Almirante Bay, Panama	443	Nietschmann, 1981
Sabah, Malaysia	Philippines	713	de Silva, 1982
Solomon Islands	Papua New Guinea	1400	Vaughan and Spring, 1980
Torres Strait, Australia	Solomon Islands	1650	Parmenter, 1983

Hawksbills are endangered throughout their circumtropical range. Precipitous declines are evident in Caribbean populations. International trade in tortoise shell has been identified as the single greatest threat to the species (Groombridge, 1983).

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Other references: Appendix 6, Bibliography.

4.5.2 Rapporteur Report of the Hawksbill Turtle Species Synopsis Panel Session

CHAIR: Jack Woody, Fish and Wildlife Service, USA

RAPPORTEUR: Larry Ogren, National Marine Fisheries Service, USA

BIOLOGIST: Anne Meylan, University of Florida, Gainesville, USA

PANEL: Dalva Arosemeña, National Representative, Panama

Jack Dammanñ, St. John, U.S. Virgin Islands

James Finlay, National Representative, Grenada

Jacques Fretey, National Representative, Guadeloupe and Martinique

Maurice Hanshell, National Representative, Turks and Caicos Islands

Harold Hirth, University of Utah, USA

Jaime Incer, National Representative, Nicaragua

Rhema Kerr, Natural Resource Conservation Department, Jamaica

Bernard Nietschmann, Department of Geography, University of California, USA

Jorge Picon, Department of Interior, USA

Eustace Royer, National Representative, Jamaica

Rosa Argelis Ruiz, Smithsonian Tropical Research Institute, Panama

Horace Walters, Steering Committee, WATS

Wayne Witzell, National Marine Fisheries Service, USA

The Chairman introduced the biologist who presented an overview of the biology of *Eretmochelys imbricata*. The Chair then introduced panel members and initiated brief discussion of the gaps in our knowledge of this species.

NIETSCHMANN: Stated that small, 10-12 cm long hawksbills are found on patch and fringing reefs of eastern Nicaragua by fishermen.

MEYLAN: Noted this record, which was just the sort of information that we need.

PICON: Reported that 80% of confiscated hawksbills in Puerto Rico are about 12-20 cm long. They all bore the holes from being speared by divers in the surrounding waters.

DAMMANN: Thought that the main problem in making reliable population estimates from nest/track surveys is that there are too many small obscure beaches and islands throughout the hawksbill's range. It is not possible to visit every one of these potential nesting sites and costs would be prohibitive. Therefore, current population estimates for numbers of nesting females are low.

MEYLAN: Agreed completely, but thought that given the current high prices paid for the scutes (tortoise shell), most beaches are watched closely. The turtle hunters report that the number of nesting turtles has decreased. In conclusion, she agreed that more turtles are nesting that are not observed/reported--but that number may not be as high as some think.

DAMMANN: Stated that typical beaches with extensive sandy upland area are not necessary; hawksbills frequently nest on small obscure beaches and other shoreline types fronted by a rocky beach and on heavily vegetated dunes.

FINLAY: Talked about getting information from knowledgeable fishermen. Divers also enjoy catching turtles. Unusual nesting habits were discussed.

CHAIR: Agreed the problems with making estimates from beach surveys are manifold, and asked whether former important nesting beaches known for the hawksbill had gone? Could the panel answer that?

MEYLAN: Agreed that many populations of former abundance have been depleted.

CHAIR: Asked for any more comments from the panel.

FRETEY: Thought there was great need to educate the tourist to protect the hawksbill. Jewelry and other items made from tortoise shell are widely sold throughout the islands. Education programs on conservation need to be made available to the public through the media. He said he would attempt to get Air France to show films of this nature that deal with endangered species on flights to the Caribbean (and other areas).

CHAIR: The next subject to be discussed will be key research needs. Meylan has highlighted them in her overview; Witzell has reviewed them in his synopsis of the species (hawksbill). Comments were requested from the panel.

DAMMANN: Read key sections from Witzell's synopsis dealing with the subject of problem areas, i.e., lack of information.

- Lost year - early life history
- Population size
- Sex identification
- Age at maturity
- Life span
- Metabolic characteristics
- Distribution and abundance
- Captive culture
- etc., etc. (plus many more areas)

CHAIR: Agreed this was true for all species, just a matter of degree.

MEYLAN: Discussed the consequences of hawksbill reproductive behavior, diffuse nesting, and an extended nesting season, and the constraints these factors place on conducting a tagging program.

CHAIR: Requested comments from National Representatives.

INCER: Described an important hawksbill beach in southeast Nicaragua between Monkey Point and Greytown. This beach might provide just what one requires to carry on an effective tagging program.

NIETSCHMANN: Stated that the name of this beach is Cocal and has a copra processing "plant" nearby. Workers would walk the beach, nearby, hunting turtles and eggs. However, civil unrest in area now makes walking the beaches a dangerous activity. Soldiers are actively searching for "contras" in this area. This situation is beneficial to the nesting population and the immediate future of the hawksbills has improved here and elsewhere. The Navy is actively patrolling traditional fishing areas for resource pirates from other countries harvesting lobster, fish, and turtles. The economic situation makes shrimp trawling difficult to continue. Vessels are tied up at the docks in disrepair. Also, Miskito Indian refugees are hijacking large fishing vessels, like trawlers, to escape to neighboring countries. However, some hawksbills are being killed to supply the curio trade with all the eastern Europeans present in the country.

RUIZ: Stated that the San Blas area of Panama is a good feeding ground for hawksbills. Recent aerial survey has revealed the presence of a single track. No protection for the species in San Blas; indians sometimes capture turtles when they dive for groupers and lobsters. Export trade exists, especially for small turtles.

HIRTH: Reported sightings of small hawksbills by divers in the South Pacific. Minimum size at maturity not known. One cannot make estimates of all adult turtles from observations on feeding grounds.

ROYER: Thought because of the difficulty in counting number of hawksbill nests, problems with the Jamaican population estimate existed (Rhema Kerr will discuss this later). Eggs are protected from being taken by law. Therefore, hunters take females before they nest. Morant Cays has a rocky beach with small pockets of sand; therefore, nesting goes unobserved because no tracks can be detected. Hurricane Allen may have temporarily disrupted nesting activities and eroded beaches, but it also destroyed fishermen's turtle nets, an expensive piece of equipment that cannot be readily replaced. He concluded by saying the population estimate for Jamaica's hawksbills is too high. Rhema Kerr will explain how that figure was derived.

CHAIR: Requested comments on the WATS data base.

KERR: Stated that more research effort and research support is needed to obtain population estimates in Jamaica. Emphasis should be put on:

- Interview surveys of fishermen
- Improved interview forms
- Mobilization of youths to help obtain information

Increased funding will be required to implement this project. A request for guidance and technical advice in planning research and conducting surveys was made.

HANSHELL: Stated that hawksbills occur throughout the Turks and Caicos. Former exports of turtles and turtle products to U.S. were banned after the Endangered Species Act in the U.S. was passed. We need to look into this matter and also regulate inter-island trade.

FINLAY: Expressed the need for more information in the many small islands of Grenada. Divers and fishermen are a good source of information. Fish nets catch turtles incidentally. Turtles caught in surrounding waters have eggs. Where will they nest? Fishermen are reluctant to give information on their turtle catches--afraid of possible trouble. There is need to provide assurances to informants that they will be not be prosecuted.

CHAIR: Commented that economic constraints in small countries are prevalent and adversely impact enforcement efforts.

FRETEY: Mentioned the existence of several vernacular or common names for one species of turtles. This can decrease the validity of interview data obtained from fishermen if not corrected.

CHAIR: Agreed.

RUIZ: Thought one should get familiar with the customs and attitudes of the local fishermen when interviewing. Convey the idea you respect their knowledge of their livelihood. Learn their terminology. Give them proper credit for sharing this information with you. Encourage them not to rob nests. Good communication procedures will give you good data.

FRETEY: Stated that in Martinique and Guadeloupe many nesting beaches are located close to cities. Many females are taken from nesting beaches close to population centers. It is difficult to patrol all beaches on an island. Legislation protecting turtles is minimal and enforcement is limited.

AROSEMENA: Reported that Panamanian law protects the hawksbill but enforcement is inadequate. A proclamation to declare this turtle an endangered species is pending legislative action. Colombian vessels trade with San Blas Indians; tortoise shell is possibly involved in this activity. Negotiations with the San Blas Indians have been undertaken. The Caribbean coastal area is remote and difficulties experienced in traveling throughout this region would be lessened if they allowed us to conduct research from their reserve or territory. Tourists to the region have expressed a keen interest in observing sea turtles. This potential renewal and labor source could be capitalized upon.

CHAIR: Thought more studies were needed to make the WATS data base population estimates reflect real number of turtles.

JOSEPH: Thought that more research was needed to determine population size. Obtaining information about the hawksbill should be given first priority. Hawksbills outnumber green turtles about two to one. Hawksbill population levels are believed to be increasing, while the green turtle is decreasing in abundance. He asked whether A. Meylan could explain this.

MEYLAN: Replied that Barbuda is a good place for hawksbills.

JOSEPH: Asked was this typical of the Antilles or not. What about Antigua?

MEYLAN: Agreed. Antigua is not as good as Barbuda. But neither island has lots of hawksbills.

MARIN: Stated that Honduras needs much more survey effort; that is why its presentation was rather limited. Turtle research was just initiated and they knew the data was weak. That is why it was not included. Hawksbills are caught and exported, but better statistics are necessary for proper management and protection of the species.

KAVANAUGH: Thought the Panel needed to discuss the data base more and research techniques less. He wanted more information on life history and behavior of the hawksbill. Fifty five percent of the shells in Haiti's market places are hawksbills. The hawksbill is more important than the green - what are their population sizes?

AROSEMENA: Pointed out that the data base figure for nesting of hawksbills in Panama is too high.

KERR: Pointed out that the interview data collected from fishermen is exaggerated. Perhaps about 300 females is a better estimate. Recent aerial surveys of the south coast revealed that only three turtles had crawled up to nest. This underscored problems discussed in locating nests.

INCHAUSTEGUI: Reported that an error exists in the data base. 420 turtles, not 1,000, were recorded from the Dominican Republic.

MEYLAN: Agreed that confusion does exist over whether figures refer to total female population or seasonal nesting frequency.

BOULON: Corrected an error in U.S. Virgin Island figures in the data base. Less than 100 nesting females was the estimate, not 10,000.

POLANCO: Asked the Panel to correct Mexico's estimate for the northern Gulf of Mexico. It is not 480.

FINLAY: Noted that fishermen catch turtles with eggs in their nets. Where do they nest? This is the data source for their estimates of nesting turtles.

FULLER: Objected to the term validate. His estimate was conservative but needed better documenation. We need to be conservative unless we have the data to document our figures.

CHAIR: Noted that the use of the term validate has in reality caused much discussion among members of the Panel. He suggested asking Harvey Bullis to define this term again at the end of this session.

MARIN: Agreed that the data are preliminary, that is the primary intention. Instructions for more precise estimates of populations need to be made more clear before future work is done. It may be best to collect new data.

CHAIR: Confirmed this and said it was intended that these data be treated as estimations, very preliminary and possibly containing some errors.

Summary of the Session:

The session have covered the known biology of these species and noted the faults in the information in various areas which make population estimation difficult. The problems to be solved and the required investigatory work needed were discussed. The characteristics of reproduction in the hawksbill, diffuse nesting and prolonged ovulation, make it difficult to conduct investigations on nesting. Other species and populations, without doubt, present similar problems.

4.5.3 Audience Response

Comment by P. Fairbairn:

In Jamaica's continual search for scarce transport and manpower to aid in the protection as well as the study of our sea turtle resources, the country's Coast Guard and Air Wing have proven very helpful, providing inexpensive access to remote islands as well as the main coast, and at times the support of personnel and equipment. Where there exists a body of well-disciplined men and machines commanded by sympathetic officers, much can be done for conservation. It is suggested that such an institutional resource be included as a routine target of national conservation education programs, with a view to more fully realizing the potential of the militia for invaluable peacetime public service.

Response:

General agreement.

Comment by W. Leonard:

There were two comments:

(1) Nesting season. Hawksbills lay about five times during the nesting season. They lay five less eggs on each laying.

(2) It is believed that hawksbills tend to lay in areas where no one seems to traffic.

Response:

None.

4.6 Leatherback Turtle

4.6.1 Leatherback Turtle Overview of Biology (Peter Pritchard)

The leatherback turtle (*Dermochelys coriacea*) is a species of superlatives. It is easily the world's largest turtle reaching weights of over 600 kg, as well as being the most distinctive. Bearing a shell totally lacking horny scutes, no claws or scales on the limbs, a series of strong longitudinal ridges along the carapace, free ribs, remarkable anatomical and physiological adaptations to life in very cold waters, it barely qualifies as a reptile, let alone a turtle. Taxonomically it is considered the only living representative of the family Dermochelidae. It is the most widely distributed of all reptiles, with nesting in many tropical localities, including French Guiana, Suriname, Trinidad, Panama, Costa Rica, and certain of the islands such as St. Croix and Hispaniola. Extralimitally, there are major nesting grounds in the east Pacific mainland coast (especially Costa Rica and Mexico), northwestern New Guinea, Malaysia, and elsewhere.

When not nesting, the leatherback wanders widely and is frequently seen as far north as British Columbia, Newfoundland, Japan, and even Scandinavia and Siberia; to the south, it is known from southern Chile, the southern tip of New Zealand, Tasmania, and South Africa.

The leatherback feeds entirely upon extremely soft prey, primarily jellyfish, and shows anatomical adaptations, including the massive hyoid and throat structures and a two-meter long esophagus, that allow it to capture and ingest large volumes of this prey. The species appears to have the capacity for extremely rapid growth. The skeleton remains essentially embryonic throughout life and the cartilage, uniquely among living reptiles, is extensively vascularized. Recent estimates suggest that maturity may be reached in as little as two to three years. This hypothesis is compatible with the initial growth rates observed in the Miami Seaquarium, though these individuals sickened and died within about 18 months. Indeed, the leatherback is extremely difficult to raise in captivity, not only because of its specialized diet and intolerance of most substitute foods, but also because of its habit of swimming endlessly into the walls of its tanks, causing severe abrasion and infection. Indeed, as the old Costa Rican proverb says, "you can't keep a *baula* in a *jaula*."

The leatherback has numerous vernacular names. These include leathery turtle, luth, trunk, trunkback, and variations thereof, and in Spanish, not only baula, but tortuga tora, canal, siete filos, chalupa, cardon, and others. One name, tinglar or tinglada, has extremely widespread use in territories as separate as Puerto Rico and Peru.

The leatherback is a migrant - or at least wandering - species that is known to travel enormous distances in a short time. Females I have tagged, when they were nesting in French Guiana, have been recaptured within a few months as far away as West Africa, New Jersey, the Carolinas, and Texas. Whether the movements are directed migrations or are simply the result of individuals following drifting jellyfish flotillas is not yet clear. However, unlike other turtles, it can be said that leatherbacks are water-column rather than bottom-feeders, and indeed their delicate integument renders them singularly liable to serious injury if they encounter rocks, reefs, or other obstacles.

Because of their size and delicate integument, leatherbacks are constrained to nest upon beaches that offer an unobstructed and preferably deep-water approach. This is demonstrated dramatically by analysis of the east Pacific nesting range, where the species assembles in numbers at the southwest tip of Baja California, the Mexican coast from Jalisco to Oaxaca, and the most exposed beaches of the great peninsulas of Nicoya, Osa, and Azuero. All of these sites offer an unusual proximity to deep water. In South America, the coasts of the Guianas offer a muddy rather than rocky approach, and because of this major nesting grounds exist even though they are fronted by rather shallow waters. In the east Pacific, the leatherback nests in the winter (October-January) rather than in the summer as in the west Atlantic.

The leatherback shows moderate philopatry, but is known to wander 100 km or more between nestings in the Guianas, and it is probable that small islands on which a handful of leatherbacks nest annually do not have intrinsic populations, but rather a share of a regional archipelagic population.

The population estimates for the leatherback have been subject to upward revision in recent years. In 1961, it was estimated that there were only about 1,000 pairs in the world. However, at that time the only large colony known was in Malaysia. Since then colonies in French Guiana, Suriname, Mexico, Irian Jaya, and elsewhere have been documented. In 1971 I estimated a world population of 29,000 to 40,000 females. More recently, following discovery of important beaches in Mexico, I have revised this to somewhat over 100,000 females. Mrosovsky, using a different equation, calculates 75,000, which is reassuringly close.

Regional variation in leatherbacks is minimal. However, they are smaller at maturity in the east Pacific, and may have a different intensity of spotting. The latter may be correlated with size and thus be invalid as a taxonomic character. Another possible character lies in the form of the carapacial keels, which are wavy in the Atlantic, but often adorned with vertical tooth-like studs in the east Pacific. However, the subspecific name schlegeli, based upon an ancient engraving of a Japanese specimen that seemed to have a narrow head, should not be used.

4.6.2 Rapporteur Report of the Leatherback Turtle Species Synopsis Panel Session

CHAIR: N. Mrosovsky, University of Toronto, Canada

RAPPORTEUR: K. Bjorndal, University of Florida, Gainesville, Florida, USA

BIOLOGIST: P. Pritchard, Florida Audubon Society, USA

PANEL: R. Boulon, Jr., National Representative, U.S. Virgin Islands

J. Fretey, National Representative, Guadeloupe and Martinique

S. Inchaustegui, National Representative, Dominican Republic

C. Lugenbuhl, Lugenbuhl Research Institute, USA

K. Morris, National Representative, St. Vincent and Grenadines

A. Ruiz, Smithsonian Tropical Research Station, Panama

R. Shoop, University of Rhode Island, USA

R. Wilkins, National Representative, St. Kitts-Nevis

The Chair introduced the panel members and gave a brief overview of past and present population estimates. The biologist gave a brief review of the basic biology and population status of the leatherback.

The Chair corrected the French Guiana figures in Table E3 and the WATS data base for estimated number of nesting females. They should be: 1977-6792; 1978-7607; 1979-5197.

BJORNDAL: Listed the corrected values for the "number of nesting females inferred" column in the summarized data base table. Dominican Republic > 750; Panama > 1,000; Puerto Rico > 30; Trinidad and Tobago > 250. The value for Costa Rica was questioned as too high.

BERRY: Agreed that the value should be reassessed.

CHAIR: Agreed that the value should be adjusted following the session. (Based on 17 flights by A. Carr, between 1956 and 1982 for which the number of tracks varied between 90 and 120, and two flights in 1983 by F. Berry for which the numbers were 702 and 596, an estimate of > 600 for total number of females in the population was derived. Most of the tracks counted were noted as "old" or "age unknown").

CHAIR: Invited comments on leatherbacks at sea.

SHOOP: Population estimates for leatherbacks are easier to make from aircraft than for other species because they spend much more time at the surface feeding and perhaps basking. They are often seen close to shore and are fairly evenly distributed from Florida to Canada during summer months. Long-line fishermen off Canada report numerous leatherbacks are attracted to their "cold light," cyalume bait.

CHAIR: Stated that work similar to that of Jane Frick with green turtles could be done, but nothing else is possible at this time.

FRETEY: Reported that dead leatherbacks at the nesting beach in French Guiana have empty guts, and one can assume they are not feeding.

PRITCHARD: Noted that the few stomachs he has examined from nesting females were empty, but jellyfish quickly become amorphous in the gut, so perhaps we can not assume they are not feeding. Biggest questions concern the juvenile leatherbacks and where they go. They may grow rapidly and disperse widely in the deep open ocean.

CHAIR: Stated that leatherbacks may follow patchy food sources which change from year to year, there might not be very clearly defined migratory pathways in this species. The possible role of the many yolkless eggs laid at the end of each clutch should be investigated. In Suriname, clutches with and without these eggs showed no difference in mortality, but mortality was high in both sets. The work needs to be repeated. Another problem is high tag loss in this species.

INCHAUSTEGUI: Reported that for three years, clutches have been hatched in boxes in the Dominican Republic. The small eggs were discarded; the hatching percent is 80%.

BOULON: Said there was a low rate of tag loss within a season in the U.S. Virgin Islands. Turtles nest from one to nine times per season, the average number of nestings being five. In 1979, six turtles were tagged; in 1980 - none; in 1981 - 26 turtles, three with tags from 1979; in 1982 - 19, none had tags; in 1983 - 19, one had a tag from 1979 and 1981, five had tags from 1981. Some with possible scars from tag loss were present, and comparisons with previous turtles may identify individuals. This rate of tag return indicates a high level of nest-site fidelity within a nesting season and some degree of between season nest-site fidelity.

FRETEY: Reported that ten thousand (10,000) plastic tags had been used in French Guiana, none had been recovered. Magnetic button tags embedded under the skin are now being used, but it has not been possible to use these on large numbers of turtles.

CHAIR: Summarized from the literature some percentages on poorly laid eggs: 40% on Suriname beaches, with higher values for particular beaches; 39% in French Guiana; 31% in Virgin Islands; 30% in South Africa; 22% in Mexico (Tierra Colorado); and less than 2.5% in Malaysia.

FRETEY: Said that only 3.5% of the eggs laid in French Guiana result in hatchlings.

LUGENBUHL: Discussed his 30-second television spot describing the dangers of plastic bags in the ocean to leatherbacks that mistake them for jellyfish. The spot will be translated into Spanish and will be available in both languages to all interested countries, as a donation from his foundation.

CHAIR: Stated that 44% of leatherbacks autopsied and reported in the literature have had plastic in their digestive tracts.

RUIZ: Reported on nest mortality in Panama: 60% of nests were laid high on the beach, 39% of nests were laid in the middle of the beach, and 1% of the nests were laid low on the beach. High mortality in upper nests was due to vines that entangled hatchlings. High tides flooded the beach for two weeks - many of the nests in the middle of the beach were lost.

INCHAUSTEGUI: Asked Pritchard if color pattern of hatchlings could be recorded and used for later identification.

PRITCHARD: Replied that the color patterns are not very different among hatchlings, and they change with age; so the technique would probably not be successful.

FRETEY: Reported that along the metropolitan coast of France, leatherbacks feed on jellyfish that are there from August to September. They also eat plastic bags and some die. In French Guiana the army is clearing the beach of logs and debris that trap and kill nesting leatherbacks.

CHAIR: Opened the session to questions from the floor:

BURNETT-HERKES: Asked if anyone had examined the lungs of leatherbacks to see if they are adapted to diving to great depths?

PRITCHARD: Stated that he was unaware of any such study. There are hypotheses that the great amount of oil in leatherback tissue is an adaptation for diving.

BURNETT-HERKES: Suggested they are feeding in deep boundary layers.

JOSEPH: Asked whether the leatherback was using its oil tissues as food stores to get through periods of little food.

CHAIR: Thought this was a plausible possibility.

FULLER: Reported that one leatherback nested last year on Antigua, when there were no jellyfish around the island. The day before the hatchlings emerged, the jellyfish arrived.

FRETEY: Showed slides of French Guiana and discussed the problems of beach erosion, village dogs, offshore mud banks, and beach debris to the survival of leatherbacks. For two to three years, 12% of nesting females died from being trapped by beach debris.

CHAIR: Closed the session.

4.6.3 Audience Response Session

Comment by J. Ross:

It has been suggested that *Dermochelys coriacea* may grow to maturity more rapidly than other sea turtles. This interesting conjecture requires verification. However, the linear extrapolation of captive growth rates has been shown to produce grossly underestimated time to maturity in three other species. A critical appraisal of leatherback growth is needed.

Response:

Agreed.

Comment by B. Brenes:

A lot of generalities have been said about hatchling orientation on their way to the water (*Dermochelys*, *Eretmochelys*, and *Caretta*). What do you believe are the factors that influence hatchling orientation?

Response by Mrosovsky:

Although there may be a number of minor back-up mechanisms, the key factor is visual orientation. This has been demonstrated in a number of studies.

Comment by D. Ehrenfeld:

This question is directed to all synopsis panel members or other symposium participants. Does anyone know of any new nesting colony of any species, consisting of five or more nesting females, established in any place where turtles were known not to be nesting before, at any time in recent years?

Response:

The Chair suggested this had been done in the 38 National Reports submitted to WATS.

Comment by C. R. Shoop:

High concentrations of any species of nesting turtles (if they return to natal beaches) may reflect the qualities of the beaches 20, 30, or 40 years ago. Since females nest on the average of every one or two seasons, we are simply observing year classes (size classes?) from those hatches several decades ago. We should not judge nesting beach quality from observations of present concentrations. Doug Robinson touched on this topic when he suggested studying low density nesting beaches.

Response:

None.

Comment by C. R. Shoop:

Regarding sizes of individuals in different populations. As in many reptiles, adult size in a local population is a parameter subject to selection for many reasons, e.g., energy storage, reproductive output, predator avoidance, nest depth (flipper size), thermal considerations, etc. are important. All play a role in determining average size of adults. Consequently, age at sexual maturity is affected by the above factors.

Response:

None.

4.7 Research Techniques and Planning

4.7.1 Rapporteur Report of the Research Techniques and Planning Panel Session

CHAIR: Frederick Berry, National Marine Fisheries Service, USA

RAPPORTEUR: Wayne Witzell, National Marine Fisheries Service, USA

PANEL:

Jack Frazier, National Zoological Park, Washington, USA

John Hendrickson, University of Arizona, USA

Sally Hopkins, South Carolina Wildlife and Marine Resources Department, USA

Andrew Kemmerer, National Marine Fisheries Service, USA

Herman Kumpf, National Marine Fisheries Service, USA

Colin Limpus, Queensland Turtle Research, Australia

Rene Marquez, Technical Team, WATS

Robert Menzies, Nova University, Florida, USA

Thomas Murphy, Poco Sobo Plantation, South Carolina, USA

Larry Ogren, National Marine Fisheries Service, USA

David Owens, Texas A&M University, USA

Douglas Robinson, Universidad de Costa Rica, San Pedro, Costa Rica

Robert Shoop, University of Rhode Island, USA

Edward Standora, State University College, New York, USA

Jack Woody, Fish and Wildlife Service, USA

The Chair introduced the panel members, and stressed the need for improved research techniques, particularly in those areas of research dealing with surveys, applied biology, and statistics. Selected panel members led the presentations and discussions of each topic.

Surveys

ROBINSON, WOODY, MARQUEZ, HOPKINS: Beach Surveys: The three major types of surveys on the beach are tagging nesting females at night, determining nesting success during the day, and ground truthing aerial surveys during the day. It is difficult to do all three types of beach surveys, and factors such as available money, manpower, and desired results must be considered before beginning work. Questions such as, "why surveys?," and "what problems are to be addressed?" are critically important. It was noted that both high and low density beaches should be surveyed. Researchers were warned that observer accuracy should be determined.

HOPKINS: Aerial Surveys: Shoreline aerial surveys are used to determine the presence of turtles and suitable nesting habitat. These are low intensity flights and are usually done before more intense turtle work is initiated. More intense flight coverage is done to determine the species present, the number of turtles, and the seasonality of nesting activity. The most intense aerial surveys determine the total number of nests present, and are used for estimating the population size of nesting females. These intense surveys are performed daily using the tidal regime to make sure that observations of the tracks and nests are fresh. Ground truthing must be performed on each beach type to avoid errors such as determining old from new tracks, missed tracks, and identifying whether the turtle actually nested or made a false crawl.

SHOOP: Pelagic Aerial Surveys: These are the most intense and costly types of surveys and are used for estimating population sizes. Planning is essential and all environmental factors must be considered, such as season, temperature, sea conditions, and sun glare. Best results were found by using an aircraft that affords a downward view. An altitude of 500 feet at a speed of 120 knots enables the two observers to view effectively a 0.334 mile swath of ocean surface. About 750 nautical miles of survey can be flown per day but planning must account for bad conditions, since only one out of three days is usually suitable for spotting turtles. Random or stratified flight patterns must be determined before the survey begins and an automated (computer) data collection system on board the aircraft is useful to expedite data collection and subsequent statistical analyses. Identification of turtles by species works best on loggerheads and leatherbacks. Behavioral studies, to determine the amount of time spent at the surface, are needed by species and by season. The determination of reliable population estimates by these surveys is disputed, due to too many unaccountable variables. However, it was stated that it was essential to have some measurement, particularly since turtle populations consist of juveniles, subadults, and males that are never seen on the beach.

CHAIR: Vessel Surveys: Shrimping vessels and gear can be used to collect turtles for biological sampling and for making seasonal density estimates. The incidental catch of turtles by other fisheries needs to be determined.

LIMPUS: Trapping: The capture of turtles for biological studies can be done by using fish trawls and nets, by scuba and snorkeling, and by chasing swimming turtles down with speed boats.

Underwater: Non-catching techniques (observations), as by SCUBA or snorkel, are used for identification of species and for estimating size ranges. Observers towed behind boats can determine abundance estimates and whether the turtles have been previously tagged.

OGREN, HENDRICKSON, LIMPUS: Tagging: The metal flipper tags currently in use (Monel) are generally unsatisfactory due to improper application, mechanical failure, and corrosion. The new titanium tags, and perhaps certain plastic tags, recently available for testing appear promising. A new technique of grafting light to dark tissue on hatchlings results in a recognizable, life-long tag. These are termed "living tags."

KEMMERER, MURPHY, STANDORA: Tracking: Radio tracking is useful for short-term activities, up to 45 days, and the signal can be picked up in an airplane up to 50 km away. These work best on smaller turtles, because they spend more time on the surface than large turtles. Acoustic tags have shorter life expectancies and shorter signal ranges due to the usual underwater noises. Satellite tracking is long term, up to three years, and requires significant funds and sophisticated equipment. The use of these various tracking systems depends on the types of information the researcher wishes to collect, i.e., movements, surface behavior, temperature and heart beat.

MENZIES: Biochemical: Sophisticated techniques such as electrophoresis, sero-immunological, and DNA sequencing are currently being developed to identify pieces of meat and shell by species. It is hoped that refinement of these techniques will enable researchers to identify individual breeding stocks of turtles.

FRAZIER: Age: Determining the age of turtles, particularly age at maturity, is necessary for understanding population dynamics. This is needed for formulating rational management policies for turtle resources. The use of hard parts, bone and eye lenses, for determining growth layers is currently being researched. The determination of growth layers into chronologically (yearly, monthly, etc.) identifiable sequences is difficult, and possibly bone staining via tetracycline will solve this.

OWENS, LIMPUS: Sex: The determination of natural sex ratios is very important for understanding population dynamics. The sex determination of young turtles is done through histological examination (on sacrificed specimens) or by using testosterone titer in live specimens. The use of the surgical laparoscope also holds promise for determining the sex of sub-adult turtles.

CHAIR: Physiology: Research techniques must be developed to determine hibernation, diving, and stress factors.

"Medical": Turtle diseases, parasites, necropsy, and nutritional requirements need more study.

KEMMERER: Protection: The development of the turtle excluder device (TED) is a major breakthrough in eliminating turtle mortality in shrimp trawls. It is hoped that this device will be used in all areas where shrimp and fish trawls often capture and drown turtles. Other methods to protect turtles from incidental and direct take and mortality need study.

Statistics

CHAIR: Data base: Communication between turtle researchers and governments of the various countries is critical. Possibly the centralization of data bases is necessary to avoid duplication of effort and confusion. The publication of results is encouraged, as well as public education programs.

Future Research Needs (not in order of priority)

1. Develop a technique, preferably simple and inexpensive, to age turtles.

2. Determine size of individual turtle stocks.

3. Refine quantitative methods to develop absolute population estimates from pelagic aerial surveys. Photographic methodology to identify and size turtles during these surveys is also needed.

4. Develop reliable, relatively inexpensive, easy to apply, and long lasting tag for all turtle sizes.

5. Form a regional tagging center to coordinate, control quality of, monitor, and manage tagging data.

6. Form an ad hoc task force to evaluate and coordinate long-term tracking studies.

7. Develop parameters and criteria for definition of critical habitat.

8. Determine which turtles are most productive, young-mature or old-mature.

9. Form a team of experienced technicians skilled in turtle field studies and make them available for assisting those countries requesting assistance. This includes biological research, resource assessment, hatchery management, etc.

10. Determine mechanisms of sex differentiation in sea turtles (endocrine, genetic, and environmental).

11. Study reproductive physiology of sea turtles.

12. Study physiological ecology of diving, hibernation, nesting, and mating.

13. Study population genetics and work to clarify systematics.

14. Study normal histology and functional anatomy.

15. Collect, through multichannel telemetry, baseline data on body temperature, swimming speed, and diving depth.

16. Continue turtle censusing efforts to update the WATS data base regarding population estimates.

17. Survey subadult turtles on foraging grounds.

18. Search for and determine the habitat and requirements of post-hatchling or juvenile sea turtles (also known as the "lost year" class).

4.7.2 Audience Response Session

Comment by J. Frazier:

Effective management is dependent on good biological information, which in turn is dependent on the availability of basic information and scientific material. Included in the latter are specimens that are collected with data in reputable museums and available to scientists for studies of taxonomy, morphology, distribution, and other basic biological investigation. Will this organization appeal to National Representatives and field biologists to salvage available specimens and deposit them with data in museums?

Response:

Agreed.

Comment by R. Juhl:

Some speakers noted that often turtles swim long distances against prevailing currents. This may not be the case since often currents moving in one direction on the surface may be coupled with an inshore or subsurface countercurrent. These currents may be used by turtles advantageously. More information is needed on this to determine relationships, if any.

Response:

None.

Comment by S. Cornelius:

Tag loss is a serious problem at the major arribada beaches in Costa Rica. It may be as high as 50% after one year and 90% after two. This applies to both plastic and monel. This is not due to corrosion in the case of monel, however, but to some mechanical damage probably resulting from tag biting by the turtles themselves or possibly predatory fish.

Response:

None.

4.8 Habitat Alteration Impacts

4.8.1 Rapporteur Report of the Habitat Alteration Impacts Panel Session

CHAIR: Llewellyn Ehrhart, University of Central Florida, USA

RAPPORTEUR: John Fletemeyer, Nova University, Florida, USA

PANEL: Karen Bjorndal, University of Florida, Gainesville, Florida, USA
David Bowman, Fish and Wildlife Service, USA
Lori Chu-Cheong, National Representative, Trinidad and Tobago
Wendell Clarke, National Representative, Bahamas
Manuel Hernandez, University of Puerto Rico, Puerto Rico
Daven Joseph, National Representative, Antigua
Herman Kumpf, National Marine Fisheries Service, USA
Peter Murray, National Representative, St. Lucia
James O'Hara, South Carolina, USA
Frank Schwartz, North Carolina, USA
Ross Wilcox, Florida Power and Light Company, USA
Ross Witham, Florida Department of Natural Resources, USA

The Chair opened with the following comment: Habitat alteration has many real and potential impacts on marine turtles and may be divided into two categories: impacts on nesting success and impacts on turtles in the water.

JOSEPH: I. Problems associated with small islands:

A. Erosion: Natural problems associated with wind and tides result in significant loss of sand, especially on the Atlantic side of the islands.

1. High energy beaches are characteristically the most affected.

2. Mostly impacts leatherback nesting, but also creates problems for green turtle and hawksbill turtle nesting.

B. Hotels, bars, and condominiums:

1. Problems associated with increased beach illumination.

2. Problems associated with increased human traffic.

3. Problems related to waste dumping in the water.

C. Protective nets (for protecting bathers from sharks):

1. Presents obstacle to nesting turtles.

2. Sometimes result in incidental drownings.

KUMPF: Discussed nesting success and oil spills.

I. Nesting success:

A. To evaluate nesting success it is necessary to use an interdisciplinary approach.

B. It is necessary to develop indices for each species.

II. Oil spills:

A. Development of contingency plan for nesting and foraging habitats which have been identified (i.e., using aerial survey data).

B. The value of using national WATS reports to help identify key nesting beaches.

O'HARA: Commented that we may develop a ranking system which ignores other less important nesting beaches. Therefore, caution should be used.

WITHAM: Commented on the problem with long-term oil pollution, i.e., tar balls which may remain afloat for over a year.

MURRAY: There are problems related to sand mining in the Caribbean:

A. Reduces nesting habitat and sometimes completely destroys a nesting beach.

B. Believed that pumice may be used as a substitute or an alternative to sand mining, thereby eliminating this impact on nesting beaches.

SCHWARTZ: Noted that not only does sand mining impact nesting beaches, but also the manipulation of a beach by bulldozing.

CHU-CHEONG: Stated that sand mining also was a major problem in Trinidad and Tobago. On these two islands sand mining is only permitted during the months of June, July, and August. This is the same time when leatherbacks nest.

HERNANDEZ: Stated that Puerto Rico also experiences problems involving offshore dredging, resulting in the destruction of grass beds.

MARIN: Thought it was necessary to consider alternatives to sand mining on important nesting beaches, i.e., obtaining from rivers.

SCHWARTZ: Noted the use of synthetic vegetation to induce the accumulation of sand in certain areas affected by erosion.

WILKINS: Said we should consider ocean currents when considering areas for sand mining.

WILCOX: Discussed impacts involving the Florida Power and Light Company.

I. Results of turtle monitoring on Hutchinson Island over the last 10 years:

A. During 10-year period, development has increased dramatically.

B. Florida Power and Light owns about 10% of the island and has set this area aside for a turtle sanctuary.

C. One impact investigated was the result of construction beyond the surf zone.

1. Initial impact resulted in a reduction in nesting; however, when construction was finished in the beach area, nesting returned to normal.

II. Other management measures taken by the Florida Power and Light Company:

A. Planting of vegetation to provide a light deflector to help reduce hatchling disorientation.

B. Developing method to keep turtles from entering intake pipe at electrical generating plant.

1. Use of electrical fields not successful because of expense and lack of long-term reliability.

2. Use of acoustic methods is most satisfactory in keeping turtles out of the intake pipe. May be used elsewhere.

CLARKE: Discussed problems associated with the Bahamas. Difficult to assess problems because of lack of manpower and funds.

I. Major problems include the following:

A. Use of bleach for lobster fishing has destroyed many reefs and has reduced turtle foraging habitat.

B. Tourists have seriously impacted turtles by illegally killing turtles and molesting them. Both foraging habitats and nesting beaches are impacted by this problem.

C. The recent construction boom has also affected nesting beaches in the Bahama Islands.

D. Foreign fishermen also take turtles illegally.

SCHWARTZ: Noted that bulkhead construction seriously impacts many nesting beaches in the USA and should be eliminated.

O'HARA: Added comments on nest monitoring on Hutchinson Island: presently 50% of island is developed whereas in the past less than 10% of the island was. Results of development indicate a higher level in aborted nesting attempts or false crawls; however, no significant drop or increase in the level of nesting has been observed.

WITHAM: Stated that aborted nesting attempts may not be due to construction but may reflect a higher level of pedestrian traffic. He discussed the impact of humans in Florida. Impacts are many and varied and include:

(1) Litter and garbage and associated beach cleaning.

(2) Problems related to extensive erosion reducing suitable nesting beaches.

(3) Dredging and beach renourishment projects.

(4) Use of off-the-road vehicles.

HERNANDEZ: Said that whenever possible, problems relating to human impact should be mitigated using natural processes. In Puerto Rico one problem is the necessary funds to help mitigate these problems.

BJORNDAL: Pointed out that in addition to the problems already cited, one must consider impacts on the drift line (i.e., pollution, tarballs, plastic bags, etc.). Investigation of this subject is required and should be considered important because of the "lost year," and the observations of juvenile turtles, which apparently associate with the drift line.

FLETEMEYER: Discussed impacts associated with extensive coastal zone development. Problems include:

(1) Artificial lights and hatchling disorientation - even very low levels of artificial lights result in disorientation.

(2) Beach cleaning operations - usually do not physically destroy nests but compaction results in a reduction of gas exchange within the nest environment. This sometimes results in a high level of CO_2 and results in a premature pipping of eggs in affected nests.

(3) Dredging and renourishment - sometimes causes increased sand compaction and results in the following changes in nesting behavior:

   a. Nest construction closer to shore.

   b. Shallower nest construction.

   c. Increase in aborted nesting attempts.

(4) Boat runovers.

(5) Pedestrian traffic.

CHAIR: There are some engineering and design solutions to certain, but probably not all, turtle habitat alteration problems. Human cleverness may devise others. We must always remember the inevitability of the natural processes often involved ("mother nature bats last") and "design with nature."

4.8.2 Audience Response

Comment by D. Owens

It is becoming increasingly obvious that oil pollution is having potentially serious impacts on sea turtle populations in the United States. Documentation comes from Florida by Ross Witham, and from Texas and Mexico by the Joint Mexico-U.S. Kemp's Ridley Recovery Team. To what extent is oil pollution, i.e., tar on beaches, fresh spills, etc., a problem in the central and southern portions of the WATS area?

Response:

R. Marquez, Mexico: This is difficult to answer; research is necessary.

M. Murillo, IOCARIBE: IOCARIBE has a program to coordinate data and monitor oil and tar problems in this area. Close communication is needed between respective countries on this important question.

Comment by H. Kumpf:

With the tremendous influx of oil from the PEMEX IXTOC-1 spill in the marine environment, was there verifiable evidence of impacts on turtle nesting beaches or on individual turtles?

Response:

J. Carranza, Mexico: This was monitored very closely in Mexico by many agencies and groups. At this time there has been no detectable impact on the fishery resource. In the case of *kempi*, we have not found any known adverse impacts. However, with *kempi* it may be much longer before we can really say.

Comment by J. Incer:

Is there any information on the effects of pesticides on hatchlings, juveniles, or adults leaving or approaching the beach?

Response by Chair:

This potential problem is recognized, but no work is in progress and there are no hard answers presently available. Some work has been published on heavy metals in adults.

Comment by R. Boulon:

The U.S. Virgin Islands, British Virgin Islands, and other developing Caribbean islands share a form of habitat alteration due to the ever increasing numbers of charter and private yachts. The presence of these vessels damages seagrass beds and coral reefs. It may also inhibit nesting by sea turtles on the beaches within bays where the boats anchor. A study in cooperation with the National Park Service is being initiated to quantify these effects.

Response:

None.

Comment by J. P. Ross:

Several workers (Ross, Stancyk, Martinez) have shown that, within broad limits, grain size of sand on nesting beaches is of minor importance to nesting turtles. Sand grain size is, therefore, of low priority in assessing and evaluating nesting beaches. Factors of turtle use and nest success should be the major determinants of turtle nesting beaches.

Response:

Agreed.

Comment by G. A. Canessa:

Recently an interoceanic oil pipeline has been installed in upper Panama and it is proposed to install another one in Costa Rica. What effect is possible from the passage of supertankers in the Caribbean area on the migration of turtles, and also on their feeding and nesting habitats? What recommendations should be given to minimize possible negative impacts on the populations of the various sea turtles?

Response:

The long-term impacts are unknown.

4.9 Utilization

4.9.1 Rapporteur Report of the Utilization Panel Session

CHAIR: Bernard Nietschmann, University of California, Berkeley, California, USA

RAPPORTEUR: Henry Reichart, Steering Committee and Technical Team, WATS

PANEL:

Kiddy Blandford, Fisherman, Nicaragua

Jorge Carranza-Fraser, Instituto Nacional de Pesca de la Secretaria de Pesca, Mexico

David Ehrenfeld, Rutgers, State University of New Jersey, USA

James Finlay, National Representative, Grenada

Felix Gregoire, Forestry and Wildlife Division, Ministry of Agriculture, Lands, and Fishery, Dominica

Rory Kavanaght, National Representative, Haiti

Winston Leonard, Fish Market Operator, Virgin Islands

Roderick Mast, National Marine Fisheries Service, USA

Nicolas Mrosovsky, University of Toronto, Canada

Freddy Pacheco, Universidad Nacional, Costa Rica

Edith Polanco, Directoria General de Administracion Pesquera, Mexico

Emily Roet, Sea Turtle Rescue Fund, USA

Argelis Ruiz, Smithsonian Tropical Research Institute/WNIU of Panama

Louis Walters, Ministry of Natural Resources and the Environment, British Virgin Islands

Ralph Wilkins, Fisheries Officer, St. Kitts

Chairman described the format of this session and the sequence of subject discussion.

CHAIR: Introduction of panel members. Outline the historical and present uses. Summary of National Report data. Identify critical problem areas. Examine potential directions for future actions. Discussion of data by each species, country, sub-region and region:

(a) Life history/stage
(b) Specific products - food, shell, skin, etc.
(c) Subsistence/commerce
(d) Domestic trade/international trade
(e) Comparison of WATS data with TRAFFIC estimates
(f) Assessment of WATS data base

The Chairman outlined historical and present uses of turtles in the Caribbean region:

(1) Sea turtles have long been exploited by people in the Caribbean. Products include: meat, eggs, shell, calipee, skins, oil, and more recently, stuffed turtles, polished shells, and cosmetics.

(2) Pre-European Period. Prior to the arrival of Europeans to the Caribbean, the area contained a large human population. For example, Hispaniola is estimated to have had one to eight million people. Panama had two million people.

Sea turtles were important resources for coastal people. Archeological evidence and early description of European explorers indicates the island Arawak, Ciboney, and other groups along the Caribbean mainland margin exploited sea turtles for food and useful products.

(3) Amerindian Holocaust. European intervention led to massive loss of the indigenous population. One hundred percent in many islands as "Arawak Holocaust"; Bahamas 1513, Hispaniola 1648, followed by the rest of Greater Antilles. The island Arawak, Lesser Antilles, put up some resistance but they too were destroyed - small population survived. The mainland was depopulated in many areas, with survivals in some areas. Millions of people, many of whom used sea turtles and their products, were gone in less than two centuries. We have very little understanding of the status of sea turtle stocks that were exploited by former populations of indigenous people, or the methods of utilization employed.

(4) European Period. Many green turtles were exploited by European explorers to supply ships on return voyages, and to provide food for colonists and slaves brought from Africa.

Shell, calipee, live turtles, and dried meat became important items in regional and European commerce. A smaller number of people than in the pre-European period greatly reduced the stocks of green and hawksbill turtles; foraging and nesting aggregations declined. The Bahamas, Cayman Islands, south coast of Cuba, and elsewhere suffered rapid loss of the once large populations of green turtles.

(5) Nicaraguan Example. Coastal Miskito long depended on turtles. The exploitation of large foraging populations of green turtles centered on Miskito's Cays and lower cays to Set-Net Point.

Exploitation was regulated by many controls including village tenure over sea territory (customary sea tenure is a widespread but little investigated method of resource management).

Commercialization of the turtle resource base began with the Cayman Island turtle voyages in the 19th century and intensified with the opening up of turtle processing companies in late 1960's and early 1970's. Up to 10,000 turtles a year were exported. Miskito Indians were paid a small amount of money for turtles they caught; then consumption of turtles declined as did the turtles; local control of the resource was largely replaced by the demands for international trade. To save the threatened green turtle population, commercial turtling was stopped in 1977.

Subsistence exploitation has been further reduced as a result of the state of war between Indians and the Sandinistas who now occupy the coast and control the resources.

Utilization of green turtles and hawksbills has been affected by culture, cash economy, markets, and increasingly, by politics.

The Chairman requested the panel to discuss the WATS computerized data base and to provide comments.

ROET: Reviewed the Caribbean turtle trade figures and supplied further information to update the WATS data base. This is appended to this panel session report.

EHRENFELD: Thought there were two reasons why the data base is not useful in its present form to develop policies of utilization, indeed why it can be very misleading:

(1) As has been amply demonstrated here, the data for all species are incomplete, inaccurate, and based on unproven assumptions; much of it is little better than guesswork. In short, it has not been verified.

(2) Even if the data were verified (validated), it is largely static, not dynamic data: the number of mature turtles (usually nesting females) reflects events that happened one to five decades ago, except perhaps in the case of *Dermochelys*.

Unlike traditional fishery species such as herring, flounder, mackerel, and sardines (but with the exception of the slowly maturing sturgeon), this very long maturation time for sea turtles introduces a new and very difficult variable into the kind of models normally used in determining management approaches and utilization. Looking at green turtle population data, for example, is like looking at the light from a star 25 light years away: it appears to be shining now, but in fact, you are looking at history, and there is no way of telling whether, during the past 25 light years, that star has increased in brightness, or perhaps has gone out altogether. Furthermore, with sea turtles, because of the discrete nature of the different year classes, it will not suffice to examine data for three or four years to find trends. Projection of trends is invalid for sea turtles because of the biological, environmental, and historical separation of different age classes. What happens to the age class of a certain year does not necessarily tell you anything about the fate of the age class of two years before, or one year after, or 10 years after. This is borne out by the year-to-year fluctuations in the numbers of nesting females.

Although it is important to begin to gather population data, it is equally important to recognize that neither the quality of our numbers, nor our interpretation of the numbers, permits us to use these data to assign utilization quotas, with very few exceptions.

ROET: Agreed with Ehrenfeld's comments. We do not know how long this utilization has been going on and for which year, class, or sex. Referred to utilization for tourist trade and commercial markets, major export to Japan and Europe. There also appears to be international trade between Caribbean countries, primarily directed at tourists. There may be some import in the region of Asian turtle products for that trade. International trade may not be visible in your country, but it still exists.

There is considerable Japanese trade in hawksbill products but oftentimes the country of origin is not given.

WALTERS: Heard that the hawksbill is most endangered, but data base does not indicate a large Caribbean trade. He asked if this meant that Caribbean fishermen unload the turtles on the "high seas" to others (for instance, to non-CITES countries).

ROET: Stated that a lot of trade goes on in a country which its government may not be aware of.

CHAIR: Requested Roet for non-WATS sources of information.

ROET: Gave a synopsis of trade data.

MROSOVSKY: Asked whether the Netherlands are shown to be a major exporter. If so, trade figures are untrustworthy because there are no sea turtles there.

GREGOIRE: Asked, if small islands are exporting and the numbers are assumed to be true, how could WATS curtail trade from these small islands?

DAMMANN: Pointed out that the Netherlands are not a party to CITES and are a leading transit shipper for turtle products, also from Asia.

CHAIR: Asked what kind of turtle parts are in trade.

ROET: Stated that they were mostly hawksbill shells, some green turtle shells, meat in wider Caribbean trade, loggerheads in curio shops, leatherback oil and skins. One strange record: Japan shows more import from Cayman turtle farm than the Cayman Islands show as being exported.

CHAIR: Moved discussion on to regional trade in turtles and products.

KAVANAGHT: Said that in Haiti turtle fishing is not an important activity. The animal has limited market value. The fishermen prefer to take shrimp or lobster. Green turtle is used for meat and wall decoration. Meat is used locally: from fishermen to consumer, no middleman. Green turtles are often left alone on the beach by people who live there; too large and too much meat all at once. Hawksbill meat is good; special efforts are made to catch them. Carapace is used locally for domestic market or tourists. Scutes for rings, etc. Whole small hawksbills are used for wall decorations. One pound of lobster costs $5.00; one pound of turtle costs $3.00. In addition, it is more trouble to catch a turtle.

MAST: Asked what methods were used to catch turtles in Haiti.

KAVANAGHT: Replied that different types of nets with decoys, are used to attract and catch the turtles. Also, sometimes they are shot with a gun, but this damages the shell, so this method is not often used--only for sport fishery. Japan import figures for turtle from Haiti are greater than the number of animals present in Haiti.

ROET: Asked for import-into-Haiti data.

KAVANAGHT: Replied that some turtle shells are imported as raw material which is processed and then exported. Only one exporter to Japan.

LEONARD: Said the Virgin Islands produce products, but are not set up for export. They sell to whomever passes by.

CHAIR: Suggested that large quantities of turtle products are stored somewhere until a need arises. Therefore, the trade data do not necessarily reflect when the turtles were actually caught.

RUIZ: Stated that the greatest export from Panama to Japan was hawksbill. There was inadequate legislation and it is still possible to get an export permit for hawksbills. San Blas has its own municipal legislature and may be receiving hawksbills from Colombia. There are many merchants in Puerto Obaldia for turtle trade.

CARRANZA-FRASER: Said it was difficult to get official information on turtle catch for self consumption. There is a need for inclusion of data on non-commercial consumption. This is difficult to control. He asked how much was being caught in the Caribbean for local or regional consumption.

PACHECO: Noted that trade in turtle products puts pressure on conservation. The international scene is not fair to local situations. Costa Rica has legal harvest for local consumption. According to the WATS data base there is heavy trade from here, but Costa Rica is not necessarily involved in this.

ROET: Thought that contrary to what has been said, trade has decreased. Japanese trade has decreased slightly.

LEONARD: Noted that on the small islands there are only part-time turtle fisheries. The young fishermen are not interested in catching turtles, nor eating the meat.

RUIZ: Stated that in Panama older fishermen, as well as young ones, fish for turtles for local use.

CHAIR: Made a comment on WATS data base. If Jamaica is deleted from Table 1, there are only about 260 turtle fishermen in the Caribbean. This seemed to be too low a number as far as he could judge.

RUIZ: Said that in Panama it was mainly the Indians and Afro-Antilleans who fished for turtles, eggs and guts for their own use. Some people used the meat and eggs of the canal turtle. Meat was not sent elsewhere: it is used locally and in just a few restaurants (canal turtle - leatherback).

CHAIR: Defined subsistence to mean for food only. Subsistence also provides meat for exchange with friends and neighbors. Subsistence hunting also has cultural aspects.

BLANDFORD: Said that in his village people lived from the turtle. They didn't have much money so had to look after themselves. Turtles helped them a great deal.

GREGOIRE: Noted that in Dominica subsistence turtle hunting had declined because there were fewer turtles. Closed season June-September but was difficult to enforce. There was pressure on the poor people to break the law, because they have to eat. He did not believe that subsistence hunting hurts the turtles, but he was not sure.

POLANCO: Reported that in the Gulf of Mexico and the Caribbean two species are fully protected. Turtle consumption tradition not strong, may be in Vera Cruz.

FINLEY: Added that in Grenada the young men do go turtling (as opposed to Virgin Islands).

BLANDFORD: Said that in his village it is mostly older men who did the turtling. But he taught his boys so they could feed their families when they grew to be men.

MARIN: Stated that incidental catches of turtles were only by shrimp fishermen. Eggs were used more than meat. Eggs were used in restaurants. Believed to be an aphrodisiac. Sold in bars as such. In closed season as much as $1.00 per egg. Shrimpers used meat of incidental turtle catch for food. Meat not popular in Honduras, but eggs were.

POLANCO: Said the situation in Mexico was similar to Honduras.

CHAIR: Asked the panel how they could improve data base.

PACHECO: Said that turtles move, nest, and feed in different places. Greater international cooperation was needed. For instance, greater cooperation between Costa Rica and Nicaragua on their shared green turtle population. Costa Rica protects its turtles, while Nicaragua kills 15,000. Cooperation was needed to maintain the populations.

CHAIR: Stated that more long-term data collection is needed, as in fisheries management. Maybe use students for thesis projects in this.

WILKINS: Suggested we should be careful when getting information from fishermen, as it may be unreliable.

RUIZ: Said you could work with fishermen and get reliable data. It depended on your approach. Do not only look at research problems, look also at their problems. They test you on what you know about turtles. This will get their trust.

CHAIR: Closed the session.

4.9.2 Audience Response

Comment by S. Inchaustegui:

Should the turtle's penis be considered as a turtle product? This is used in alcoholic beverages as an aphrodisiac (wide distribution) in the Dominican Republic and other islands. The dry penis has a cost of $20.00 (U.S. dollars). Should this aspect be considered as part of the education program?

Response:

None.

4.9.3 Annex to Management Options Panel Session

INTERNATIONAL SEA TURTLE TRADE IN THE WIDER CARIBBEAN

Prepared by Emily Roet
Sea Turtle Rescue Fund
Center for Environmental Education
Washington, D.C. USA

Sea Turtle Species Predominately Harvested for International Trade

Hawksbill:

Status: Hawksbill turtles are listed in Appendix I of the Convention on International Trade in Endangered Species (CITES) which includes species threatened with extinction and which are or may be affected by trade.

Primary Threats to Survival: Harvest of adults and juveniles for the "tortoise shell" trade.

Primary Products: Adult hawksbills are harvested for their shells which are manufactured into "tortoise shell" jewelry and carvings. Juvenile hawksbills are harvested to be manufactured into stuffed turtles and carapace wallhangings.

Green Turtle:

Status: Green turtles are listed in Appendix I of CITES, and the Annex to the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere.

Primary Threats to Survival: Commercial exploitation of eggs and adults. Incidental catch in fisheries.

Primary Products: Meat (fresh, frozen, and canned), calipee, calipash, oil (used in cosmetics), skins, manufactured leather articles, carapace wallhangings, stuffed specimens, and "tortoise shell" jewelry.

Olive Ridley:

Status: Olive ridley turtles are listed in Appendix I of CITES.

Primary Threats to Survival: Commercial harvest of adults for skin and meat. Harvest of eggs from nesting beaches. Incidental catch in fisheries.

Primary Products: Skin and manufactured leather articles.

Types of International Trade in Sea Turtle Products in the Wider Caribbean Region

Commercial Trade:

Exports of sea turtle products (primarily unprocessed products) to markets in Japan and Europe.

Trade in sea turtle products (both unprocessed and manufactured) between countries in the wider Caribbean for the tourist trade, for re-export to markets in Japan and Europe, and to a lesser extent, for national consumption in the country of import.

Tourist Trade:

Export of sea turtle products by tourists. Products are generally, but not exclusively, manufactured.

Deficiencies in Trade Statistics

The following tables and graphs are derived from the Japanese Ministry of Finance statistics. Japan, the largest importing nation for raw hawksbill shell, and a major importing nation for other sea turtle products, has recorded imports by country of origin for hawksbill shell and "other tortoise shell" since 1965, and for turtle skin and leather since 1976. It must be emphasized, however, that these statistics reflect only a portion of the actual international trade in sea turtle products occurring in the wider Caribbean for the following reasons:

(1) Other countries outside the wider Caribbean region import commercial quantities of sea turtle products from this region. Generally, data are not available on this trade.

(2) A large tourist trade in sea turtle products exists in many countries in the wider Caribbean. This trade is substantial, but statistics are not currently available.

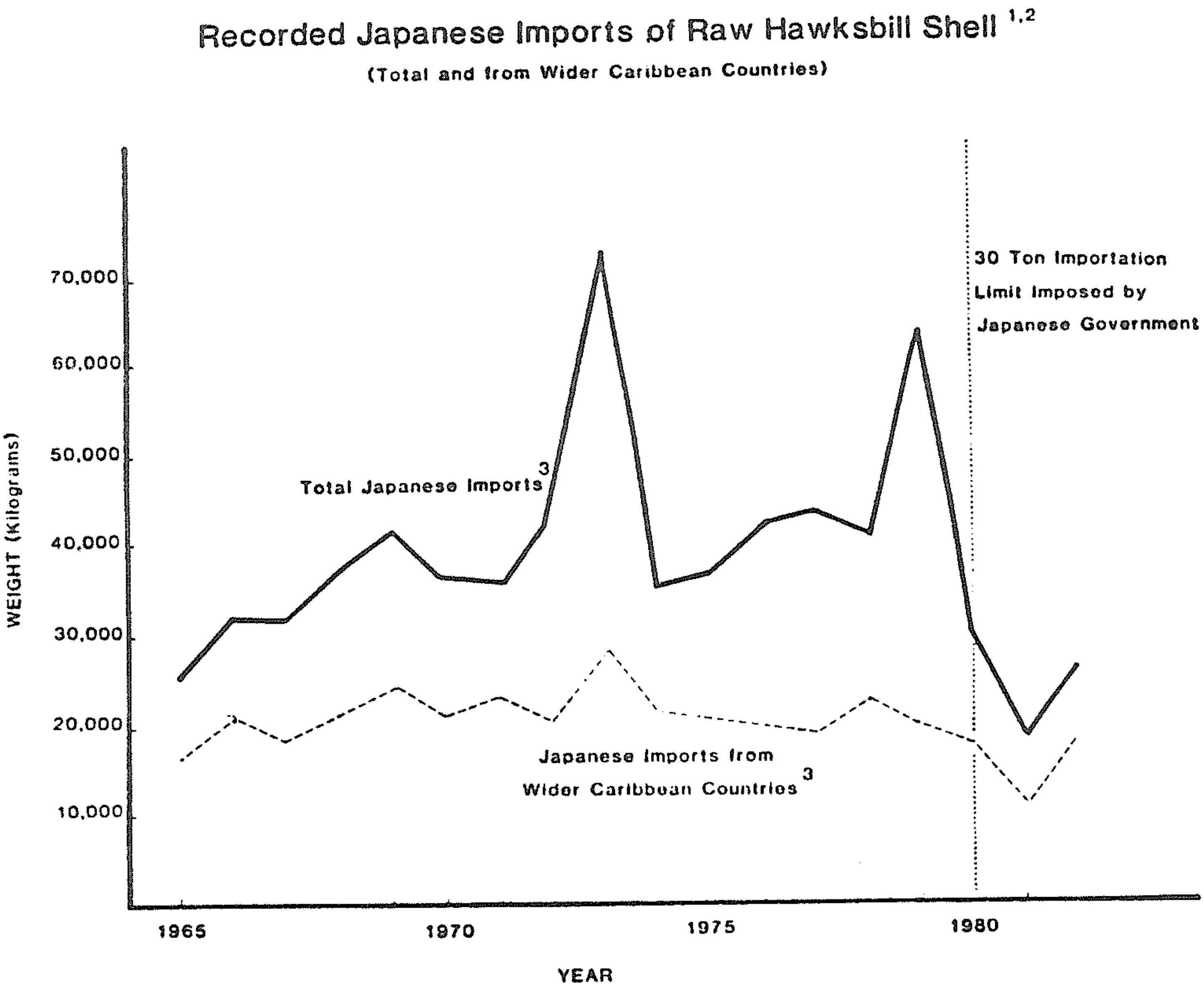
(3) Many wider Caribbean countries export sea turtle products to other wider Caribbean countries. Some of these products are then consumed locally, some are sold to tourists, and some are commercially re-exported. Data are generally not available on this trade.

(4) The records of imports into Japan probably are incomplete due to difficulties associated with reporting imports. In addition, the Japanese government imposed a 30 ton (30,000 kg) import restriction on hawksbill shell in 1980; therefore, any imports above that limit, being illegal, are likely to go unreported.

(5) Japanese trade statistics do not distinguish between country of origin and country of export. Therefore, these statistics do not necessarily include all countries from which turtles have been harvested to supply

the Japanese market, nor do quantities shown for countries necessarily reflect harvests that have occurred solely in those countries. In some cases, countries without native sea turtle populations (e.g., the Netherlands) and countries without large hawksbill populations (e.g., Cayman Islands) have been identified as major suppliers of hawksbill shell to Japan.

Figure 1



[1]Source - Boeki Geppyo, Ministry of Finance, Japan.

[2]Estimates of the weight of the shell (carapace, marginal scales and plastron) from an adult hawksbill range from 1.5 to 2.5 kilograms (kg). Thus, 10,000 kg of raw hawksbill shell represents 4,000 to 6,000 adult hawksbills. However, these estimates are conservative as not all parts of the shell are always traded. Using the above conservative estimates, approximately 7,250 to 12,084 hawksbills were killed to provide the 18,126 kg of shell which was recorded as imported by Japan from the wider Caribbean countries in 1982.

[3]"Total Japanese Imports" includes 20,563 kg of raw hawksbill shell recorded as originating from the Netherlands. It is likely that these imports are actually from the Netherland Antilles. However, these imports are not included in the category "Japanese Imports from the Wider Caribbean Countries" due to this uncertainty.

Table 1

Overview of Recorded Japanese Raw Hawksbill Shell Imports (1978-1982)

Wider Caribbean Countries from which Japan Reported Importing Over 10,000 Kilograms of Hawksbill Shell

Country	Total Quantity (kg) 1978-1982
Cayman Islands	20,216
Cuba	27,246
Panama	19,929

Wider Caribbean Countries from which Japan Reported Importing Between 1,000 and 10,000 Kilograms of Hawksbill Shell

Country	Total Quantity (kg) 1978-1982
Bahamas	4,428
Belize	1,274
Dominican Republic	1,982
F.W. Indies	1,041
Haiti	5,748
Honduras	2,267
Jamaica	3,300
Nicaragua	2,862
St. Lucia	1,181
Netherlands (= Netherlands Antilles?)	6,590

Wider Caribbean Countries from which Japan Reported Importing Less than 1,000 Kilograms of Hawksbill Shell

Country	Total Quantity (kg) 1978-1982
Barbados	43
Costa Rica	449
Dominica	303
Grenada	16
Puerto Rico	18
St. Vincent	180

Table 2

Wider Caribbean Countries from which Japan Reported Importing Substantially Larger Quantities of Hawksbill Shell in 1982 than in the Previous Four Years

	Quantity (kg)				
Country	1978	1979	1980	1981	1982
Belize	0	314	258	0	702
Dominican Republic	0	219	534	357	872
Jamaica	128	559	695	419	1,499

Table 3

Wider Caribbean Countries from which Japan Reported Importing Substantially Larger Quantities of Hawksbill Shell between 1977-1982 than in the Two Preceeding Six Year Periods

	Quantity (kg)			
Country	1965-1970	1971-1976	1977-1982	Total
Bahamas	2,349	3,362	5,350	11,061
Belize	771	398	1,314	2,483
Cayman Islands	0	6,156	24,079	30,235
Dominica	0	132	303	435
F.W. Indies	427	274	1,239	1,940
Honduras	283	354	2,338	2,975
St. Lucia	0	965	1,670	2,635

Table 4

Recorded Japanese Imports of Raw Hawksbill Shell from Wider Caribbean Countries (1965-1982)

Country	Quantity (kg) 1965-1970	1971-1976	1977-1982	Total
Bahamas	2,349	3,362	5,350	11,061
Barbados	690	1,373	43	2,106
Belize	771	398	1,314	2,483
Cayman Islands	0	6,156	24,079	30,235
Colombia	862	166	0	1,028
Costa Rica	2,383	1,701	709	4,793
Cuba	27,009	38,466	31,230	96,795
Dominica	0	132	303	435
Dominican Republic	5,899	221	2,489	8,609
F.W. Indies	427	274	1,239	1,940
Grenada	0	631	75	706
Guyana	27	0	0	27
Haiti	6,836	7,711	6,921	21,468
Honduras	283	354	2,338	2,975
Jamaica	5,062	6,167	3,983	15,212
Leeward Windward Is.	1,583	0	0	1,583
Mexico	0	8	0	8
Nicaragua	1,998	9,094	4,435	15,527
North West Indies	68	0	0	68
Panama	64,030*	53,908	24,379	142,317
Puerto Rico	2,059	2,011	282	4,352
St. Lucia	0	965	1,670	2,635
St. Vincent	0	814	410	1,224
Turks and Caicos Is.	2,111	85	0	2,196
United States	150	159	0	309
Venezuela	0	171	0	171
Total	124,687	134,327	111,249	370,263
Netherland (= Netherland Antilles?)	7,910	5,046	7,607	20,563
Total	132,597	139,373	118,856	390,826
Total Worldwide To Japan	206,308	262,196	225,124	693,628
Percentage from Wider Caribbean (not including the Netherlands)	60.4%	51.2%	52.8%	53.4%

*Includes imports from Panama (62,413 kg) and from the Canal Zone (1,617 kg).

Table 5

Recorded Japanese Imports of Raw Hawksbill Shell from Wider Caribbean Countries (January - April 1983)

Country	Quantity (kg)				
	Jan.	Feb.	Mar.	Apr.	Total
Belize	0	0	72	0	72
Costa Rica	0	5	0	0	5
Cuba	519	2,901	0	570	3,990
Dom. Republic	0	0	42	49	91
Haiti	249	0	90	22	361
Honduras	0	14	154	466	634
Jamaica	0	180	41	0	221
Panama	725	302	22	269	1,318
St. Lucia	0	19	0	137	156
Trinidad	0	0	0	108	108
United States	0	0	0	22	22
Total	1,493	3,421	421	1,643	6,978

Table 6

Recorded Japanese Imports of Raw Other Tortoise Shell from Wider Caribbean Countries (January - April 1983)

Country	Quantity (kg)				
	Jan.	Feb.	Mar.	Apr.	Total
Cayman Islands	39	0	0	9	48
Total	39	0	0	9	48

Table 7

Recorded Japanese Imports of Other Tortoise Shell from Wider Caribbean Countries (1978-1982)

Country	Quantity (kg)					
	1978	1979	1980	1981	1982	Total
Cayman Islands	1,179	1,577	535	434	1,904	5,629
Cuba	0	750	225	0	950	1,925
Domin. Republic	62	0	0	44	0	106
Haiti	45	0	0	0	0	45
Jamaica	0	0	997	0	0	997
Panama	0	0	452	362	0	814
Puerto Rico	25	0	0	0	0	25
St. Lucia	0	339	95	0	0	434
Total	1,311	2,666	2,304	840	2,854	9,975

Table 8

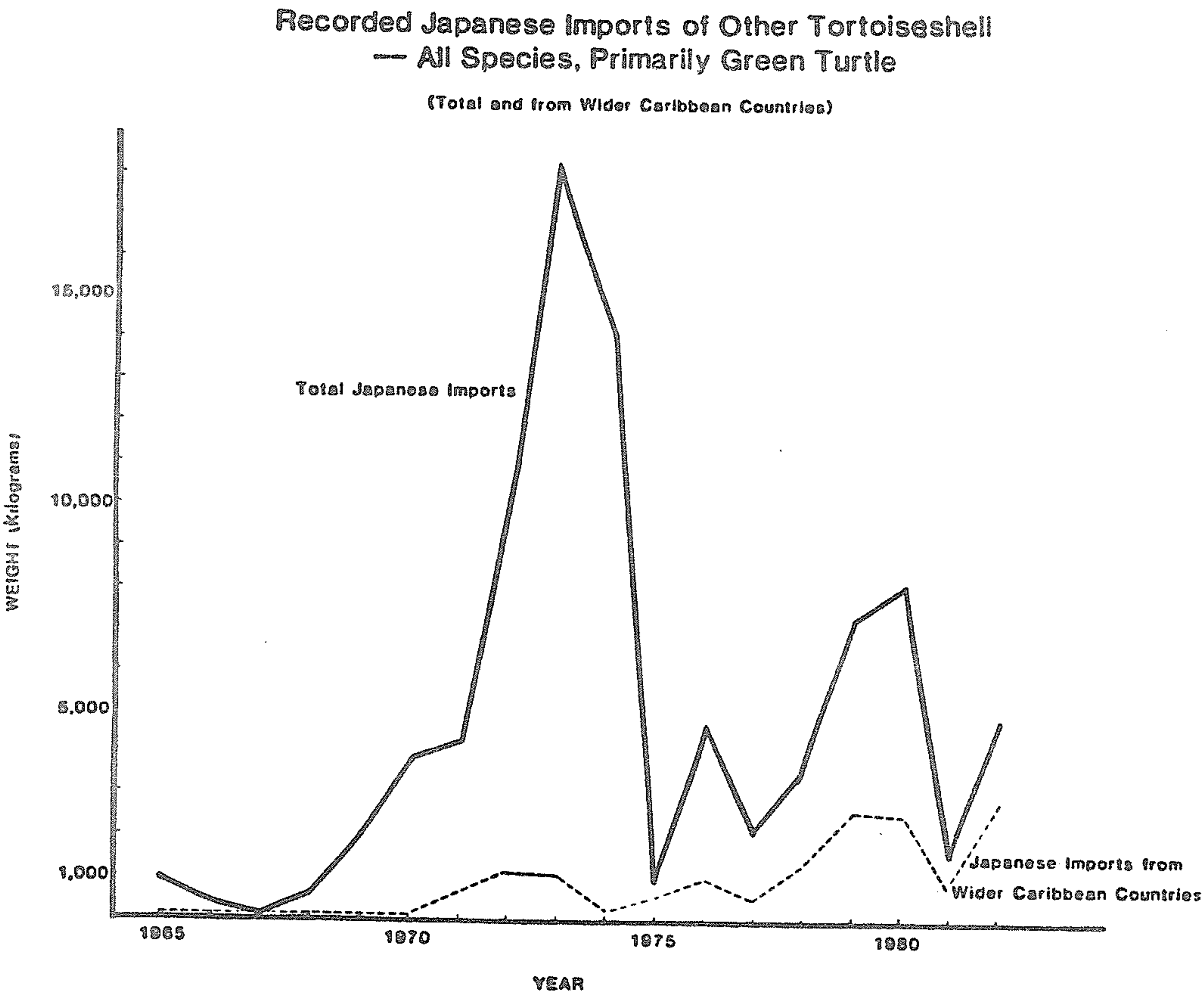
Recorded Japanese Imports of Sea Turtle Skins and Leathers from Wider Caribbean Countries (1978-1982)

Country	Quantity (kg)					
	1978	1979	1980	1981	1982	Total
Belize	0	0	168	0	0	168
Cayman Islands	23,514	14,336	14,778	6,687[2]	0	59,315
Mexico[1]	12,707	31,849	11,506	10,536	8,007	74,605
Nicaragua[1]	640	0	0	0	0	640
Panama[1]	2,546	0	0	0	0	2,546
Total	39,407	46,185	24,452	17,223	8,007	137,274

[1]Quantities can include skins obtained from sea turtle hunts on the Pacific coast.

[2]Imports of skins from the Cayman Islands into Japan exceed recorded exports by the Cayman Turtle Farm (650 lbs).

Figure 2



*Source - Boeki Geppyo, Ministry of Finance, Japan.

How Countries Can Protect Sea Turtles From Impacts of Trade

(1) Ratify the Convention on International Trade in Endangered Species (CITES).

All species of sea turtles are listed in Appendix I (species threatened with extinction which are or may be affected by trade).

Under CITES, international trade (import, export, and re-export) of Appendix I species is subject to particularly strict regulation in order not to further jeopardize their continued existence; with very limited exception, commercial and tourist trade is prohibited.

(2) Adopt national legislation protecting sea turtles from trade including controls on:

a. Harvest

b. Sale

c. Import

d. Export

(3) Enforce CITES and national legislation protecting sea turtles.

(4) Assess stiff penalties for illegal activities concerning sea turtles.

(5) Educate citizens and tourists concerning:

a. Detrimental effects of harvest and trade on sea turtle populations.

b. Laws protecting sea turtles and enforcement of these laws.

(6) Take measures concerning other factors that affect sea turtles such as:

a. Protection of nesting beaches,

b. Protection of primary foraging areas, and

c. Reduction of incidental capture.

4.10 Conservation

4.10.1 Rapporteur Report of the Conservation Panel Session

CHAIR: Peter Bacon, University of the West Indies, Jamaica

RAPPORTEUR: J. Perran Ross, Museum of Comparative Zoology, Harvard, USA

PANEL: George Balazs, National Marine Fisheries Service, USA
Lori ChuCheong, National Representative, Trinidad and Tobago
Gilberto Cintron Molero, National Representative, Puerto Rico
Mario Hurtado, Ecuador
Milton Kaufmann, Monitor International, USA
Andrew Kemmerer, National Marine Fisheries Service, USA
Anne Meylan, University of Florida, Gainesville, Florida, USA
Peter Murray, National Representative, St. Lucia
Herbert Nanne, Ministry of Agriculture, Costa Rica
Chuck Oravetz, National Marine Fisheries Service, USA
Leslie Richardson, National Representative, Anguilla
Horace Walters, WATS Steering Committee
Mike Weber, Center for Environmental Education, USA

Chairman's opening remarks: The conservation panel is convened to discuss and assess present data on conservation activities. The data are:

(1) Table 13 from the National Reports - Estimated Incidental Catch.

(2) Table 18 from the National Reports - Public and Private Institutions Concerned with Sea Turtle Conservation/Management/Utilization.

(3) Table 19 from the National Reports - Sanctuaries and Refuges.

The Panel will:

(1) Discuss and amend National Reports and the data tables.

(2) Discuss techniques and conservation activities including:

- Reduction of incidental catch
- Marine parks and reserves
- Techniques
- Predator control
- Conservation education
- Critical problems and potential directions

Topics on legislation and enforcement were deferred to another panel.

Summary of Data in National Reports and WATS Data Base

Table 13 - Estimated Incidental Turtle Catch:

(1) Fourteen (14) countries presented information: Anguilla, Antigua, Brazil, British Virgin Islands, Cuba, Honduras, Jamaica, Martinique, Mexico, Montserrat, Netherlands Antilles, Nicaragua, Turks and Caicos, and the United States.

(2) Only five (5) gave numerical data: Jamaica, Martinique, Mexico (Gulf), Nicaragua, and the United States.

(3) Methods of incidental catch included: shrimp nets, fish weirs, spear fishermen, gill nets, pound nets, longlining (tuna), power plant water cooling intakes, channel dredging, and boat collision.

A. Kemmerer and C. Oravetz presented slides and a 10 mm film showing the objectives, development, and results of a Turtle Excluder Device (TED) for shrimp trawls.

The TED is a conservation technique available to reduce incidental catch and mortality of turtles. NMFS is actively encouraging the use of TED in the U.S., South Atlantic, and Gulf of Mexico. The device was developed in a cooperative effort with the shrimp industry, environmental community, and Sea Grant marine extension agents.

The goal of the TED Program was to both conserve turtles and make the shrimp industry more efficient. The major thrust is now to encourage the use of TED and continue fisherman education. Feedback from fishermen will allow improvement of the device. Instruction booklets on TED are available. In conjunction with development of TED other research results were a quantification of incidental mortality, calculation of mortality with length of tow time, and development of resuscitation techniques. Currently between 22% and 40% of turtles caught in trawls die. This value ranges from 5.4% after 90 minute tows to 47% after 270 minute tows. Turtle catch is greatly decreased and shrimp catch maintained or increased when TED is used.

BALAZS: Asked what were the terms of reference for the definition of the category "foreign incidental catch" in National Reports.

CHAIR: Replied that almost no information was submitted. The intention was to quantify the incidental catch of the non-regional fishing fleets, but this is not reported to be a problem.

MEYLAN: Reported that a Japanese long-line fleet is based in St. Maarten and ranges widely throughout the region. No data are available on catch of turtles, but data from other regions suggest this should not be of concern.

WEBER: Thought there was a continuing need for education of fishermen in the U.S. and elsewhere. Additional causes of incidental catch include pound nets that catch juvenile loggerheads in Chesapeake Bay and drift nets set for sturgeon in the southeast. More information is required.

ORAVETZ: Complimented M. Weber and the Center for Environmental Education on cooperative education efforts.

Table 18 - Public and Private Institutions Concerned with Turtle Conservation:

(1) Twenty six (26) countries provided information.

(2) United States listed 403 people in 137 agencies in 12 states, 169 research activities, 88 protective activities, and 39 educational activities.

(3) Balance of region listed twenty one (21) governmental agencies, 25 non-governmental agencies involved in 17 research activities, 8 protective activities, and 9 educational activities.

WEBER: Amended the data: add to the U.S. report several NGO's conducting conservation programs including the Sea Turtle Rescue Fund, International Fund for Animal Welfare, Greenpeace, and Monitor International.

Table 19 - Sanctuaries and Refuges:

(1) Twenty (20) countries provided information.

(2) Sixteen (16) had one or more sanctuaries or refuges.

(3) One hundred and five (105) sanctuaries or refuges give primary or incidental protection to sea turtles. These are variously designated as State or National Parks, Wildlife Refuges, Sea Turtle Refuges, Marine Parks, etc.

WEBER: Amended the data. Add: Key Largo and Looe Key National Marine Sanctuaries. Eliminate: St. Thomas (U.S. Virgin Islands) National Marine Sanctuary proposal as no longer under consideration.

MEYLAN: Asked whether Tobago Keys in St. Vincent were still under consideration for a refuge.

K. MORRIS: (National Representative, St. Vincent). Stated that, due to disputed ownership, the refuge proposal is stalled.

ORAVETZ: Amended the data. Add: St. Croix's critical habitat area for *Dermochelys coriacea* which is effectively a refuge.

ROSS: Commented on critical turtle areas and protected areas. From comparisons of Table C and Table 19, the following data are extracted: of 22 major nesting beaches, only nine receive any formal protection, and some of these are inadequately patrolled. Notable nesting areas that apparently lack any formal protection are:

Nicaragua	Ei	
Dominican Republic	Ei	Dc
Grenada	Ei	
Jamaica	Ei	
Panama	Ei	Dc
Costa Rica		Dc
Trinidad		Dc

All the large nesting grounds for *C. mydas*, *L. olivacea*, and *L. kempi* appear to receive some protection.

There are additionally 14 protected areas that offer protection to small nesting or foraging populations of *Eretmochelys*, *Chelonia*, and *Dermochelys* (Table 19).

Most small nesting areas and nearly all foraging habitat are not protected. There is a clear lack of congruence between protected areas and important areas for turtles.

WEBER: Made a statement on sanctuaries and refuges. Several types of areas have been identified as critical for sea turtles: nesting beaches, breeding waters, foraging areas, and internesting habitat. Given appropriate protection of these areas, sea turtles can carry on critical stages of their life history.

Protection of the habitat is important for the long-term health of a species. Parks, reserves, or sanctuaries which place conservation of an area's resources as a top priority can help achieve this.

The U.S. has over the years developed programs for terrestrial and marine parks, reserves, and refuges.

The National Marine Sanctuary (NMS) Program began in 1972. There are now six NMS's, of which three protect areas used by sea turtles. These NMS's seek to conserve identifiable ecosystems and their constituent elements from intrusive human activities. While conservation of an area's resources is the primary goal, non-damaging human activities are allowed and, in some cases, encouraged. The NMS's provide a focus for research as well, regarding the dynamics of ecosystems, the influence of human activities, and resource inventories. Finally, these sanctuaries provide a focus for educational efforts. It is critical that any sanctuary, park, or reserve protect an entire ecosystem. Thus, it is critical that parks protecting nesting sea turtles also protect the offshore waters where the males and females aggregate.

Secondly, resources must be devoted to implementing parks, reserves, and sanctuaries. It is of very little benefit to establish a protected area, particularly if it is easily accessible, unless enforcement can be carried out.

While it is important that sanctuaries be established in areas critical to the health of sea turtle populations, more than sea turtles must be conserved in such areas. Sea turtles depend upon the health and presence of food sources and refuge areas. He would be happy to provide anyone who is interested with additional information about marine sanctuaries.

HURTADO: Commented that establishing refuges in developing countries has many problems not yet discussed.

(1) It requires legislative action for establishment and maintenance that is complicated by jurisdictional conflicts between different government agencies.

(2) There is a lack of confidence in refuge management activities by local inhabitants who perceive these activities as harrassment and coercion by officials. There is a great need for education in fishing communities to overcome this resistance.

ROSS: Suggested that in view of the small size and dispersed nature of turtle resources in much of the region, small refuges located at the key locations may be more feasible and economical than large park systems. These should be located on nesting beaches and foraging areas most utilized by turtles. Enforcement could be restricted to peak nesting seasons and enhanced by community participation by volunteers, students, boy scouts, etc.

Destructive activities like sand mining, spearfishing, and turtle poaching could be controlled on small refuges.

CHAIR: Asked the panel to comment on specific problems concerning use of hatcheries and moving eggs.

BALAZS: Recalled the opening sentence of WATS Conservational Manual "The key to conservation is the protection of stocks by the most natural means possible." This also reflects the Washington, D.C. Turtle Conservation Strategy.

CHAIR: Invited Dr. N. Mrosovsky to make a comment.

MROSOVSKY: (University of Toronto, Canada). Suggested that the utilization of doomed eggs - those that would be destroyed by high tides - can be a valid conservation method. If eggs saved are divided into two lots, not necessarily equal, and one lot is sold for consumption and the other is reburied on the beach, it has the advantages of: (1) putting food in people's mouths, (2) augmenting reproductive output, and (3) putting supervisory personnel on the beach which also assists enforcement.

We should take a positive attitude toward utilization. Instead of always telling people what not to do, we should refine and improve harvesting of doomed eggs, as done in Suriname.

Where egg loss is great due to predators or as a result of turtles digging up each other's nests (e.g., west coast of Costa Rica), similar advantages could be derived from saving some eggs and using others.

CHAIR: Asked Dr. Mrosovsky to define a "doomed egg".

MROSOVSKY: He replied that doom is a matter of opinion and human predictions can be fallible, but eggs laid below the last high tide mark are almost certainly doomed.

HURTADO: Suggested that best protection may be protection of habitat, but for practical reasons we should examine other alternatives, especially those that are acceptable to local people.

MEYLAN: Responded to the "doomed egg" comment of N. Mrosovsky:

(1) "Doomed egg" management policy is not relevant in most of the wider Caribbean. Suriname and French Guiana represent an unusual situation with respect to the number of eggs available and erosion problems (and thus number of available doomed eggs).

(2) She challenged the notion that these doomed eggs can be reliably identified, even when they do exist.

(3) The quota of "doomed eggs" is easily affected by industry demand, and hence could be difficult to enforce.

MROSOVSKY: Asked Dr. Schulz or Dr. Reichart to respond to techniques of identifying doomed eggs.

SCHULZ: Said that in Suriname they utilized people who used to be egg poachers. These people had many years of experience and a reliable ability to identify doomed eggs.

FRETEY: (National Representative, Guadeloupe and Martinique). Reported that in 1980, a hatchery was started in French Guiana and, recognizing the problems associated with temperature-dependent sex determination, they developed a system of solar heating to duplicate natural nest temperatures. The average natural nest temperature was 29°C.

CHAIR: Pointed out that the data base for the topic of predator control was very small. Comments were requested from the panel but there were none.

CHAIR: Stated that the topic of education and information exchange encompassed a wide variety of activities. He suggested the panel discuss: (1) what activities are most effective, (2) what information should be offered, and (3) what is the target population?

WEBER: Thought the conservation equation had two basic factors: animals and people. Where a species was depleted, we must try to improve both factors.

Enforcement of conservation laws is one way to influence human activities. However, because of a variety of factors, the effectiveness of enforcement will always be limited.

Education of the public can supplement enforcement. Education can take many forms:

(1) Educational materials for schools

- Poster session
- Caribbean package

(2) Materials for general public

- Beach brochure
- "Tracks and Facts" brochure
- Tourist trade brochure

(3) Television programs

- Features
- Public service announcements: e.g., Chris Lugenbuhl's spot (see leatherback turtle panel session).

(4) Direct involvement

- Student volunteers on beach patrols, hatcheries; these attract the interest of the public

(5) Art - posters

(6) Essays, art contests

(7) National day of the turtle

The conservation problems of sea turtles are quite dramatic. Education about sea turtles can develop concern about other conservation problems, and indeed about our own future.

Conservation education must reflect local conditions as much as possible. For this reason, organizations such as the Sea Turtle Rescue Fund look to everyone present for help in developing and distributing materials which will meet the needs in their own country.

MURRAY: Stated that the eastern Caribbean was short on resources; therefore, the following priority for education was proposed.

(1) Politicians
(2) School children
(3) Coastal inhabitants

For school children, the conservation messages can be included in material for other subjects like reading, languages, and literature.

BALAZS: Thought that the primary target should be four to seven year olds who pass information to their parents - some of whom are politicians!

HURTADO: Added that a continuing problem is to finance the development and introduction of suitable educational material.

WEBER: Reported that the C.E.E. can develop and provide materials without charge.

HURTADO: Thought that non-government organization can assist, but the primary responsibility for environmental education should lie with governments who have an obligation to include it in regular programs.

MURRAY: Described the distribution of C.E.E. materials to St. Lucian schools as part of a public education program on conservation.

CHAIR: Asked for a panel member to open discussion on the topic of problem areas and potential directions.

ROSS: Stated that a position had been reached in the Symposium where everyone had sufficient information and knowledge to assess needs and problems. There was need to synthesize the information and provide concrete direction to National Representatives.

RICHARDSON: Stated that Anguilla recognized the need for conservation; however, for conservation of turtles and other marine life in the area, there must be similar conservation methods in neighboring islands.

NANNE: Stressed the need for joint efforts at the regional level, although this presents administrative problems.

CHAIR: Asked panel members to identify the problems that impede regional cooperation.

WALTERS: Stressed the importance of CITES as a framework and tool for regional cooperation. Also described an initial attempt to negotiate fisheries regulations in the Antillean region.

BALAZS: Reminded the Symposium that a problem for regional cooperation was hunger. Until immediate practical problems are solved, conservation and cooperation is limited.

KAUFMANN: Pointed out that CITES only functions for international trade. A recent treaty for protection and development of the marine environment in the wider Caribbean has been signed by 12 nations and has a provision for cooperative action on endangered species.

CHAIR: Invited Jaime Incer to address the Symposium.

INCER: (National Representative, Nicaragua). Issued the following statement of readiness of Nicaragua to participate in cooperative research and management of the turtle resource of Miskito Cays that is shared with Costa Rica:

"Nicaragua takes advantage of the Western Atlantic Turtle Symposium (WATS) to make a statement regarding its firm support for the efforts of the international scientific community here convened to protect and conserve the marine turtles of the region.

"It also expresses its desire to request the technical and economic support of those interested institutions so that the Miskito Cays can be established and managed as a protected area, it being the area where the largest concentration of green turtles (*Chelonia mydas*) occurs and the richest extension of submarine forage for the development of the species in the Caribbean.

"It declares the recognition given to the green turtle as a natural resource which is also part of the regional patrimony and expects that the proposed area will be considered, in the near future, a research area for the conservation of the species, which will be opened to international scientific research as a contribution of the country for the national protection and management of the marine resources of the Caribbean."

This statement was followed by applause and vigorous approval from National Representatives and audience.

CLARKE: (National Representative, Bahamas). Described a program for training young fishermen and providing summer employment in government ministries for exceptional high school students.

He addressed the problem in the Bahamas of foreign visitors unaware of Bahamas restrictions on underwater spearfishing. He requested assistance from U.S. to enforce these restrictions on pleasure boaters.

KAUFMANN: Described the Wider Caribbean Sea Turtle Recovery Team Network. Called for a continuation of WATS/IOCARIBE activity. Emphasized the usefulness of a NGO activity parallel to government action in the region.

CHAIR: Announced the end of the time period, and adjourned the panel with thanks to members.

4.10.2 Audience Response

Comment by R. A. Seigel:

I represent a conservation group known as the International Fund for Animal Welfare (IFAW). One of the major problems we hoped would be addressed during this vital conference was the need for increased cooperation among nations which "share" populations of sea turtles, e.g., Nicaragua and Costa Rica. We have been delighted by the sentiments expressed by the various National Representatives supporting such cooperation. In so far as possible, I am sure that IFAW would be more than willing to do what it can to actively encourage such international cooperation in the future.

Response:

Thanks were expressed.

Comment by G. Guagni dei Marcovaldi:

I wish to draw to your attention the program of marking, quantitative and qualitative evaluation, and management of eggs on the principal nesting beaches of Brazil. This program of the Departamento de Parques Nacionales, Ministerio da Agricultura, was outlined in a brief slide show.

4.11 Culture

4.11.1 Rapporteur Report of the Culture Panel Session

CHAIR: Harold Hirth, University of Utah, USA

RAPPORTEUR: Juan Gonzalez, University of Puerto Rico, USA

PANEL: Karen Bjorndal, University of Florida, USA
David Ehrenfeld, Rutgers, State University of New Jersey, USA
James Finlay, National Representative, Grenada
Wayne Hunte, National Representative, Barbados
Herb Kumpf, National Marine Fisheries Service, USA
Herbert Nanne, Aquaculture Department, Costa Rica
Joe Parsons, National Representative, Cayman Islands
Henry Reichart, Steering Committee, WATS
Leslie Richardson, National Representative, Anguilla
Eustace Royer, National Representative, Jamaica
James Spotila, State College at Buffalo, New York, USA
James Wood, Research Manager, Grand Cayman Turtle Farm, Cayman Islands

The Chairman opened the session and introduced all the members of the panel. Immediately, he proceeded to give an overview of the matters to be considered. These were defined and outlined as follows: Culture, movement of eggs from one place to another, incubation, the formulation of controlled egg hatcheries, release of hatchlings, head-starting, broodstocking, and the ranching and farming of sea turtles. He quoted the WATS Manual for Sea Turtle Research and Conservation stating that "the key to management and conservation is protecting the remaining sea turtle stocks under conditions which are as natural as possible." However, he pointed out that, under certain circumstances, it may be advisable to intervene with one or more culture techniques, some of which could prove to be controversial. He further indicated that there are few solid answers to the questions and that the panel's mission was not to provide all answers, rather to present culture options, describe trustworthy culture techniques, and discuss the pros and cons associated with them.

After stating that culture of sea turtles involves anything from dealing with improving the hatching rate of individual eggs to the formulation of high technology turtle farms, the Chairman proceeded to start the discussions with the simpler techniques.

SPOTILA: Initiated the panel discussions by giving a brief report of his work on sex determination of sea turtles by the temperature of incubation. His presentation was supported by slides depicting data from his work (and that of his associates) reported recently in Science, Vol. 216:1245-1247. In essence this research showed that eggs incubated at higher than normal temperatures result in high female to male hatchling ratios. On the other hand, if incubation proceeds at a lower temperature then the male to female ratio of the hatchlings is larger. His word of caution was that uncontrolled incubation (in nature or in styrofoam boxes) may produce all males or all females, thus altering the natural sex ratios. He suggested the use of temperature-controlled equipment to avoid problems.

EHRENFELD: Pointed out that we do not know what the natural population sex ratio is. He suggested to try not to manipulate sex ratios until we know more about this matter.

HUNTE: Question. How much do we know about the mating behavior of turtles in order to calculate an optimal sex ratio?

WOOD: Said we cannot tell. In the farm they got better results with a three female to one male ratio.

SPOTILA: Stated that in work done in Tortuguero the primary sex ratio observed was 68% females. He could not say if that was true for the adult population. Evidence points to population differences. He suggested we should avoid excessive manipulation.

REICHART: Noted that the discussion was about primitive areas where there are usually no good facilities. Use of styrofoam boxes: we should simulate natural conditions or use styrofoam boxes. He was concerned that sex ratios change from year to year and we cannot make a sex ratio judgement on one year's data. Long-term information was needed before deciding that artificial hatching was bad.

CHAIR: Repeated what the WATS Manual said about handling eggs: if it is necessary to rebury eggs do it as soon as possible after the female lays the eggs, within six hours. Do not rotate because of interruption of embryological development.

Discussed the second category: Head-starting. Now we have the hatchlings. What do we do now? Where should they be released? How are they marked so we recognize them later?

KUMPF: Through a presentation backed with data using overhead transparencies, Kumpf reviewed the research and progress of the ridley head-starting program, and informed the panel of an 80% survival.

EHRENFELD: Considered the head-starting program still experimental, although extremely valuable. He believed one cannot make any judgement of its success until it is known if head-started animals can produce viable offspring. Some day this could be an important technique in conservation. He did not agree with the idea of using "doomed eggs" for head-starting. Might as well relocate them in the same beach.

ROYER: Believed costly head-start programs were hard to justify. If the objective was to bring about increases in the number of turtles that will live relative to pre-exploitation of the turtle resource - how long would it take to get that resource to the hungry people? That gets to be expensive.

KUMPF: Said it often costs $95.00 per hatchling in his head-start program.

BJORNDAL: Underscored the statement of E. Royer, because these expenditures are beyond the scope of some nations. She suggested other programs less expensive than head-starting. Moving eggs is simple and inexpensive, for example.

EHRENFELD: Thought the main reason to move eggs was to avoid predation or poaching.

BJORNDAL: Said that moving eggs even a short distance protects them from raccoons or dogs.

REICHART: Agreed that leaving the nest as it was would help rather than cause any disruption by moving it. They camouflage the actual nest and disturb an area a few feet away, to make it look like the nest has already been dug up. For good measure they often scattered old egg shells about. This thwarts poachers and predators.

SPOTILA: Thought it important to educate people: telling people who need food to be concerned about losing that resource should help reduce the poaching on eggs.

CHAIR: Turned to third category: Broodstocking. How many centers should there be? What about crossbreeding? How to identify the best animals?

WOOD: Said there were two different approaches in regard to broodstocking: using captive adults or growing captive-reared until they become reproductively active.

EHRENFELD: Thought the idea of broodstocking appealing. But suggested one should beware of the pitfalls. What about preserving genetic variability? Not easy. Suggested also collecting animals for broodstocking before there are a few left (no less than 100-200). Otherwise one could be accused of bringing the species to the very margin of extinction during the broodstocking experimentation.

KUMPF: Thought the panel should note the commendable experiments in the Miami Seaquarium with ridleys obtained from Galveston.

PARSONS: Asked what sex ratios were being used at the University of Miami.

KUMPF: Replied it was three females to one male. Mainly based on availability.

CHAIR: Introduced the fourth category: Turtle Ranching. He Defined the term as raising of sea turtles in semi or complete captivity for a period of time after which they are slaughtered or sacrificed for their products. The source of stock is from wild populations (eggs, hatchlings). He then proceeded to talk about parameters to be considered. What was their purpose? Would the ranch benefit people and turtles, or international trade? What were the socioeconomic implications? How many ranches should there be?

PARSONS: Stated that if every Caribbean country had a turtle ranch, then that would solve the problem of exploitation.

REICHART: Believed that international trade and conservation need not be mutually exclusive, in spite of many statements to that effect. There are no hard data to prove that trade in ranched or farmed turtles is detrimental to world populations; and ranching could be a conservation tool.

BJORNDAL: Believed that the situation in each locale has to be considered. The engineering and other tasks involved are substantial leading to the creation of a very expensive product. The market, then, could be limited. The marketing situation has to be considered.

PARSONS: Said it was important to get countries to work on a small scale and not worry about marketing (export).

ROYER: Considered the practice a risk. He said that it was expensive to feed protein to livestock. He went further to say that it was a wrong practice when this happens in a protein deficient country. Suggested having the ranch develop where the hatchlings normally develop, foraging on natural feeds even if it means slow growth.

PARSONS: Thought it better to produce something that was more acceptable in the market.

WOOD: Said that maintaining sea turtles in captivity was difficult because of disease. Turtle ranching could become a gigantic welfare scheme.

BJORNDAL: Agreed with Jamaica's representative to have something not requiring high technology, but warned of the small growth rates of turtles in the Caribbean (1 cm/yr) if they were to depend on natural foraging. This was not going to produce as much meat as needed.

FINLAY: Said one should think economics. No need to have ranches in all the islands.

WOOD: Said that ranching could be highly capital intensive. Everything will depend on why it was started anyway. Ultimately should be self supporting.

CHAIR: Introduced the fifth category: Farming. Most complex. It is a self sustained population in a closed system encompassing more biology and engineering than a turtle ranch. CITES defines "bred in captivity" by sustained production of F_2. He went on to ask the following questions: Are sea turtles (appropriate) good candidates for farming? Are certain species better than others? What is the benefit of farming to the Caribbean people... to the world? Would this increase international trade in wild turtles? How does one identify farm from wild products? What about future technology: gene splicing, artificial insemination, etc?

EHRENFELD: Questioned the existence of turtle farming by saying that there are no turtle farms by the reasonable definition of CITES, nor have there been, nor are there likely to be. He was aware of the Cayman operation and that it has had some good side effects. He believed that the proponents of farming have not confronted the serious problems of mariculture; they have not confronted the declining or erratic fertility of captive wild and farm raised animals. He went on to mention the problems of mortality (hatchling), citing the figure for 1977-1981 survival as varying between 1 and 4%. He listed other problems such as the high cost of facilities, high cost of high-protein diet, and stimulation of world trade. He concluded that turtle farms are and will remain a subsidized venture, an enormous drain on the proprietor's finances. He referred to the slow growth rate of turtles even in farm conditions. Then, because of their inefficiency in feeding, they actually are taking food from the mouths of protein starved poor people. The end product is an unnecessary luxury item for the rich. He elaborated on the problem of mariculture stimulation of trade. Suggested poaching of wild stocks is inevitable because this activity does not involve the expenditure of money. He continued by saying that the profit margin for poachers will be higher than for farms. He stated that if mariculture makes sea turtles valuable enough to return a profit on its enormous investment, then poachers will pick up wild animals and sell them at slightly less than the prevailing prices. He closed by saying that turtle farms will remain a threat to sea turtle survival.

FINLAY: Asked what would happen if mariculture is increased? He agreed that no one should feel guilty for feeding corn to chickens, in reference to feeding high protein to sea turtles, thus taking food from hungry mouths.

EHRENFELD: Replied that chickens are different protein converters.

WOOD: Thought the problems encountered with chicken farming were not solved immediately at the beginning. Even though sea turtles require the protein feed for rapid growth - the amount consumed is small compared to similar food produced elsewhere. Facilities are at a high cost. Turtle farms have not made a profit.

PARSONS: Believed that turtle farming will give poachers an alternative.

NANNE: Agreed that depending on wild eggs of Chelonia mydas for the project outlined above could be dangerously negative for the species. He believed that the country, poor as it was, should develop alternate ways of producing the proteins needed. He indicated that the discussions ensued during the panel session offer a word of warning against any projects involving the turtles as a source of protein.

CHAIR: Concluded that culture is a complex process. Turtle culture in any form involves a lot of biology. He then closed the session.

4.12 Enforcement and Regulations

4.12.1 Rapporteur Report of the Enforcement and Regulations Panel Session

CHAIR: Jorge Picon, Department of Interior, USA

RAPPORTEUR: Jorge Carranza, Instituto Nacional de Pesca, Mexico

PANEL: David Bowman, U.S. Fish and Wildlife Service, USA
Enoc Burgos, Honduras
Gilberto Cintron, National Representative, Puerto Rico
Milton Kaufmann, Monitor International, USA
Rhema Kerr, Jamaica
Mirna Marin, National Representative, Honduras
Edith Polanco, National Representative, Mexico
Fernando Viquez, Costa Rica
Horace Walters, Steering Committee, WATS

The Chairman introduced the members of the panel and presented the theme mentioning the importance of and what adequate enforcement and regulations mean for the protection and recovery of the sea turtle populations.

BOWMAN: Referred to U.S. legislation included in the Endangered Species Act that covers all threatened and endangered species. This law specifies the mechanism used to declare a species as threatened, how to take it off the list if it has recovered, collaboration between the states and the federal government, penalties for violating the Act, etc.

POLANCO: Summarized the Mexican legislation that covers the following aspects: The capture of three of the five species in the Gulf of Mexico and the Mexican Caribbean is permanently banned; the other two can only be captured for subsistence and with a permit from the Secretariat of Fishing. In the present year, no permits have been issued. When permits for subsistence are extended, minimum sizes and sex percentages are regulated.

Stated regulations are quite effective, especially in the case of the Kemp's ridley turtle, since during the reproductive season Marines are used to patrol the beaches. In some cases a boat from the Mexican Navy has been commissioned to ensure that shrimp are not caught in front of the nesting beach during this period.

MARIN: Made a summary of the legislation in the Central American countries and the following aspects were emphasized: All of the countries, except Nicaragua, have laws that protect turtles to different degrees; Guatemala has a permanent and total prohibition on the capture of adults and eggs; Costa Rica regulates fishing and permits a regulated commercial exploitation. It also has an intense conservation program on the beaches.

KERR: Made the following summary of the northwest Antilles that include Bahamas, Cuba, the Cayman Islands, Jamaica, Haiti, the Dominican Republic, and the Turks and Caicos Islands.

(1) All of the countries have laws that regulate utilization of sea turtles;

(2) Most of them have laws that only prohibit the capture of turtles and their eggs on the beaches. In addition, the Cayman Islands and Haiti forbid capture in their territorial waters. The Dominican Republic protects the turtles only in its territorial waters. Jamaica protects them entirely, on land as well as at sea. Most of these laws were passed in the 1970's, but in the case of Jamaica, the Turks and Caicos Islands, and the Bahamas, they are from the 1940's and 1950's. With respect to regulations, they are deficient or non-existent in many cases.

WALTERS: Explained the situation of the eastern Antilles, where protection laws exist that include partial banning (from April to August) or regulations for egg or adult capture. These laws have existed for a long time but enforcement is seldom accomplished.

CINTRON: Made a summary of the situation that exists in the northern South American countries in which regulation can be divided into four categories:

(1) total or partial bans on some or all the species;

(2) habitat protection;

(3) laws that protect all wildlife and consequently include sea turtles;

(4) commercial and exploitation control.

CHAIR: Referred to the importance of CITES as a mechanism to control importation, exportation, or commercialization of sea turtles and their products, and asked for the point of view of the other members of the panel on the different regulation and monitoring problems.

KAUFMANN: Explained the existence of regional mechanisms that manage the resource under discussion. He emphasized the Cartagena Covention where countries of the WATS region were present and the fact that they have committed themselves to the regulation, protection, and improvement of all marine resources of the Caribbean basin.

Discussion was active and the following relevant aspects can be mentioned:

(1) A mechanism that would make the laws of one country congruent with those of others is needed, since it is not convenient or fair that while some actively protect the resource, others exploit it without making useful contributions for its conservation.

(2) It is necessary to differentiate between regional legislation and regional agreements. Both terms were used but the first one does not exist since agreements can exist between countries but not laws that cover all of them.

(3) Natural or ecological areas with similar biological problems can be identified in the Caribbean, and an intent could be made to draw up bilateral or multilateral agreements for turtle conservation.

(4) There are still many unknowns in turtle biology that must be investigated in order to make more firmly based decisions.

Future Actions. Options for future actions were widely discussed and several possibilities were mentioned without the panel approving any specifically. The Chairman, Jorge Picon, emphasized the undeniable difficulties that are encountered due to the geography of the area and the complexity of the resource whose protection is desired. Before the discussion ended, he asked those present to submit their comments in order to bring Table 20 of their National Reports up to date.

4.12.2 Audience Response

Comment by J. Frazier:

During the verbal presentations of the National Reports no less than five countries (Bahamas, Barbados, Belize, St. Lucia, and Dominica) mentioned a minimum legal size for turtles of various species. Five countries are ex-British colonies. Are large (adult) turtles more expendable than small? If these laws are not ecologically sound, will the National Representatives be able to appeal for a change in legislation?

Response:

If laws are not ecologically sound and data are presented to support a change, the countries involved will attempt to revise their laws or regulations.

Comments by B. Morera Brenes:

I request that the participants of this symposium ask the government of Costa Rica, who, through the Ministry of Agriculture had promised to protect sea turtles at the opening of this symposium, that they withdraw the decree which gave permission to capture the green turtle in Costa Rica. This decree gives permission to capture *Chelonia mydas*. Furthermore, I suggest that international cooperation be applied in the Caribbean region to stimulate the conservation and protection of sea turtles. If many scientists from different countries make a petition, whether through institutions or personally, this type of legislation will be established. They could force any government to respond positively.

Reponse (unidentified person from Limon):

I am from Limon. Limon is a province in Costa Rica. I agree firmly with the government's position because the government knows the socio-economic problems, the problems of many people from Limon that make their living based on the capture of *Chelonia mydas*. The government decided to give partial permission, so that the capture of *Chelonia mydas* will be done in a rational way. Does this person who wants the protection of *Chelonia mydas* and wants the people who base their subsistance on their capture, whether eating or commercializing in the turtle, to die? I am sure that if he accepts my invitation to visit the area, he would probably withdraw his proposal.

I am aware that all the coastal countries that share this species also live from it. Therefore, we should think carefully so we will not affect interests, because the ship that tries to sail and has no equilibrium, would wreck, and we do not want that. We want to preserve the turtle.

Response by B. Morera Brenes:

I am the person who made the comment, and I would like now to talk about the comment made by the compatriot who just talked. I agree with him when he talked about the national exploitation of the turtles. What I want to add to his opinion about this particular decree made by our government, is that it covers the poaching of eggs and killing of turtles that already existed. I am not saying that the inhabitants in the area shouldn't use *Chelonia mydas* for subsistence. I disagree with the fact that in addition to the permission given by the government in the decree, there is a great piracy because the rural guards do not enforce the law. I am saying this based on personal experience. I want to make very clear my point: sea turtles must be preserved for rational human use.

4.13 Status of Species

4.13.1 Rapporteur Report of the Status of Species Panel Session

CHAIR: Peter Pritchard, Florida Audubon Society, USA

RAPPORTEUR: John Fletemeyer, Nova University, USA

PANEL:
Dalva Arosemena, National Representative, Panama
John Beddington, England
James Burnett-Herkes, National Representative, Bermuda
Felix Gregoire, National Representative, Dominica
Colin Higgs, Steering Committee, WATS
Mirna Marin, National Representative, Honduras
Rene Marquez, Technical Team, WATS
Anne Meylan, Technical Team, WATS
Peter Murray, National Representative, St. Lucia
Larry Ogren, Technical Team, WATS
Joe Powers, NOAA/NMFS, USA
Jim Richardson, University of Georgia, USA
J. Perrin Ross, Ocean Research and Education Society, USA
Louis Walters, National Representative, British Virgin Islands

CHAIR: Stated that the major task of this panel was to define the status of species in this region. Other status determinations have been made previous to this symposium. The United States, under the Endangered Species Act of 1973, listed the hawksbill, leatherback and Kemp's ridley as endangered and the olive ridley, green turtle, and loggerhead as threatened. Certain populations of the olive ridley in Mexico and the green turtle in Florida were listed as endangered. However, the Convention on International Trade in Endangered Species listed all the species on Appendix I, which corresponds to endangered status and prohibits them from trade between signatory countries. The IUCN has categories of endangered and vulnerable for sea turtles. These listings are contained in that organization's Species Survival Commission's Red Data Book of Amphibians and Reptiles. These classifications should be re-evaluated over the years and a mechanism should exist for making any changes where and when appropriate. However, one does not want to suggest that a species is suddenly out of danger if a new colony is discovered. One of the inherent difficulties of classifying sea turtles' status is related to their long maturation time. As David Ehrenfeld mentioned yesterday, the adult turtles that are counted on the nesting beach today may, in a sense, be more a reflection of their status twenty years ago when they hatched and crawled to the sea, rather than their current status. The adult population, also, if it is large and allowed to reproduce, should ensure that a generation from now there will be a lot of survivors that reach maturity. Regardless, we don't want to just count adults. We also need to estimate how many young turtles, how many are in the pipeline and what we could expect the recruitment rate to be in future years. This will be a difficult task. In many cases we know the hatching success and whether large numbers of hatchlings have or have not entered the system. But their subsequent history remains almost totally unknown.

This symposium has the potential to improve on previous classifications because we have just the western Atlantic to consider and we are represented by many men and women from throughout the region. Also, we have a great amount of current population data available to us in the National Reports despite the fact that they are not absolutely complete. It is suggested the panel fit the various species and populations into a slightly more complex matrix of categories than has been used previously. It is suggested we evaluate status and trends separately and then recombine these elements (see Tables on pages 204-206). The first matrix element pertaining to their status would range from: (1) the most abundant - species in which there will be no evidence of decline or at carrying capacity, (2) the second status element will be somewhat depleted, (3) the third status will be threatened, (4) the fourth status will be endangered, (5) the fifth will be marginal or naturally rare, (6) the sixth status will be extinct and/or absent. These categories should be linked to an item in the second matrix element relating to trends in population size that would range from category: (A) increasing fast, (B) increasing, (C) stable, (D) decreasing, and (E) decreasing fast. Beyond that we should also note whether populations are vulnerable or not as a third matrix element. Some populations may be currently abundant or have not yet exhibited serious declines, but have such ominous trends or foreseeable mortality increases, that we may decide to call them vulnerable. This classification approach will lead some to say that exploitation was tolerable for populations that were at carrying capacity and stable or somewhat depleted, but increasing fast. Conversely, populations known to be decreasing fast, whether abundant or somewhat depleted, threatened, or endangered, need protection until the trend is stabilized and reversed. The sixth status category, extinct or absent, in the second matrix element, would make any management decision inapplicable except for perhaps reintroduction attempts on a case-by-case basis.

The species synopsis panelists will be asked how many populations or assemblages for a particular species he or she will identify in the western Atlantic region. One, as in the case of Kemp's ridley, or several, as might be considered for the green turtle or leatherback. In the latter species complexes, a separate classification matrix should be given. The Chair, recognizing his personal opinion, expressed his hope that the panelists would not endorse anything incompatible with CITES and avoid discussing issues dealing with international trade. However, some may want to identify populations which are amenable to some level of subsistence and local utilization.

OGREN: Thought most everyone was familiar with the history of the green turtle in the Caribbean - so much had been written about it. In the western North Atlantic in historic times large colonies or rookeries were being exploited in Bermuda, the Tortugas, Cuba, and the Caymans. Other large colonies, such as Tortuguero and in Suriname, were also present and provided recruits for the region. However, today, only about half of those large colonies are still in existence and most likely are only depleted remnants or at lower levels of their former abundance. Only three significantly large assemblages of nesting green turtles occur today. The one located at Tortuguero, Costa Rica, is by far the most important and largest, followed by Suriname. A third one, located at Aves Island, Venezuela, where less than 800 females.have been reported to nest is important not because of its size but simply because it is one of the few sites of aggregated nesting. We don't have enough information or recent survey numbers to give estimates for all the diffuse and occasional nesting that occurs elsewhere throughout the region except for one or two areas. These are in Mexico and Florida. In northwestern Yucatan and especially on the adjacent coastal islands, Rene Marquez has reported that 200 or 300 females are in the breeding population. A similar number are reported to nest along Florida's east coast between Cape Canaveral and Miami. This latter population may be increasing slightly; however, some believe increased survey efforts and better reporting coverage may be the reason for the higher numbers.

For the rest of the Caribbean area, the nesting effort for the green turtle is apparently too scattered and low to make any estimates of numbers of females. The numbers of immature turtles in their development habitats and foraging areas is likewise almost totally unknown. Tagging studies have fairly recently been initiated in the U.S. Virgin Islands and in the lagoonal systems of eastern Florida. An earlier study was done at Cedar Key, Florida, but that particular commercial fishery was closed a decade ago.

He turned to the main objective of this panel - to assess the status and trends of green turtle populations, albeit geographical but probably discrete, for the few localities with sufficient information. First, he made some changes in the data base on Table 6 in the printout sheet. For the Tortuguero population, under "nesting females," if we can assume that refers to annual nesting, then the estimated average is 15,000. But at the same time we should include the range, which fluctuates widely from 5,000 one year, followed by 50,000 the next, and back down to 8,000 the next - and so on. This does not mean that the recruitment and mortality rate is fluctuating, but that individual breeding adults are on different remigratory schedules. Under the column "Inferred Total" population, for an average of the estimated total female population over a period of several seasons, the figure should be 23,000 females in the breeding population.

Joop Schulz has reported for Suriname that an average of 1,500 females nest annually and the total breeding population of females is 4,500. With regard to their status and trend and the classification we are to assign these populations, L. Ogren asked Schulz to present this if he was prepared to do so. It should be mentioned that these figures are calculated from either total nest counts per season or, in the case of Tortuguero and Suriname, from tagging studies where the numbers of remigrants and recruits have been observed. These methods, including the various standard reproductive rates used for clutch size and the renesting frequencies, have been discussed earlier.

From the data available, we are only able to classify the status of the populations that nest at Tortuguero and Suriname and include some evaluation of the Aves Island aggregation. The latter population may now be receiving protection by a permanent research station established there by Venezuela, but the threats from severe erosion by hurricanes and rising sea levels are serious. Loss of nests and beach, both potential and real, would place this population in the vulnerable category. Analysis of the demography for the Tortuguero population by Carr indicates that this population has not stabilized and Karen Bjorndal's study indicates that the cohort survivorship curves are decreasing, which supports this statement. Therefore, if it is not stable and decreasing, he would categorize it as threatened - some would say endangered, considering all the unknown mortality, potential and real, that occurs throughout its entire range in the wider Caribbean - and needs continuing protection. Joop Schulz will give his classification of the Suriname population when he is ready to comment on his data.

RICHARDSON: Stated that Llewelyn Ehrhart, in his synopsis of Caretta biology stated, "the loggerhead exhibits a curious discontinuity of nesting on the eastern and western rims of the Caribbean." This may reflect fragments of a historical distribution about which we may never know the facts. He selected eight geographical areas, and whether this represents stocks and the relationship of one stock to another at the moment is completely unknown. He started with Brazil, which, in its initial stages of a stock assessment, WATS reports at least 2,000 nesting per year, and there are probably more. We have no current information on historical stocks, or even current population trends, so he deferred that status until there was more information from Brazil. A second area, Colombia and Venezuela, is listed as common in Peter Bacon's WECAF Report No. 7, but is not evidenced by WATS surveys, only seven years later. He understood there is serious and uncontrolled poaching of eggs in this regionally important nesting population. I would say that the status, using Pritchard's new listing, is definitely endangered. The population trend is decreasing fast.

The third area, Central America, Panama and north of Belize, is an area which Pritchard calls marginal, and there is very little information to develop a status on this. The fourth area is Mexico, and this includes for brevity, both the Gulf of Mexico and the Caribbean portions. This is another important regional nesting population with at least 400 nesting females per season listed in WATS. He understood from Rene Marquez that there is uncontrolled poaching in the southeast areas, so he would say that the status is definitely threatened at least, perhaps endangered, but he would assume that Mexico, with its environmental programs, was moving into that area very soon. The fifth area, the Lesser Antilles, is marginal again. There appear to be very few loggerheads. One most unusual exception is Grenada, which has reported a curious occurrence of a fishery of Caretta caretta, also a nesting population of loggerheads there. This very interesting observation needs to be further explored. The sixth area, Greater Antilles, includes a very broad region of Cuba, Haiti, Dominican Republic, Jamaica, and perhaps Puerto Rico. We know very little from Cuba, except that there is a strong conservation effort there to protect the turtles by a moratorium. The status throughout that area in general is probably threatened. It appears that there is very little control in most areas. The population is probably decreasing, but again we know very little about Cuba. There has been very little time to fit it to Pritchard's new framework. The seventh area, Bahamas and Turks and Caicos, and we might include Bermuda, is a very common foraging area for loggerheads. The current stocks appear up, relative to historical stocks. Current trends appear stable and for at least the foraging area, there is no evidence of decline, and perhaps the trends are increasing. As a nesting area there appears to be occasional nesting in the southern islands and it appears that there is continuing poaching in those very remote islands. The remaining nesting habitat is definitely threatened.

Finally, the southeastern United States region includes 28,000 nesting females. This number is changed almost annually as we've done a better job of assessing the density of nesting on small areas of beaches.

He cautioned that large, focused assemblages of nesting animals are deceptively robust. They are in fact highly susceptible to natural and man-induced impacts precisely because of their focused nature.

The loggerhead as a species is secure in the southeast United States, but those large assemblages of the loggerhead are certainly not secure and perhaps very vulnerable. He broke the southeast United States into two portions: (1) south Florida, which runs north to Cape Canaveral, and (2) the vicinity of

Georgia, South Carolina, north to Cape Hatteras. In the south Florida portion perhaps 20,000 are nesting, and from the small area of Palm Beach County to Volusia County, roughly 200 miles, there is intensive beach front development planned and under construction, and sea walls are very obvious here. We must not assume that these turtles would automatically move north to the Cape Canaveral protected area, at which there is greater than 90% predation of sea turtle nests. Current stocks are high relative to the historic stocks because of our recent population estimates, but we really don't know what they were a few years ago.

High loss of beach front cautions us to suspect that the current population trends are down and this population is threatened under the definition of the U.S. Endangered Species Act. Pritchard's format would say that they are somewhat depleted and stable, and certainly very vulnerable.

And finally, the last section is the area in Georgia and the Carolinas. The same can be said of these 6,000-8,000 nesting females. Development, erosion, incidental catch, and mortality is still reducing our current numbers and this nesting assemblage is threatened according to the definition of the U.S. Endangered Species Act. In his opinion, they are somewhat depleted and are stable or slowly decreasing, and they are very vulnerable, perhaps less vulnerable than the huge assemblages in Florida.

<u>MARQUEZ</u>: Reported that the Atlantic ridley is found totally within the Gulf of Mexico, and therefore, its evaluation is easier than the other species. Approximately 600 nesting females appear each season, depending on the composition of the population, and whether or not two or three stocks exist, because the average nesting cycle is 1.8 years. There are animals which nest each year, and the majority of population nests every two years. The smaller population nests on a three-year cycle. This implies a mixture of stocks within the same population. We believe there are approximately 2,000 adult female turtles within the mixture of the aforementioned three stocks. With the extra population which we have made through the release of hatchlings from protected eggs, and the theoretical sexual maturity of from eight to 10 years, we arrive at an average of 4,000 turtles of both sexes. We can say that the status of this species is quite unstable, in danger of extinction, but with a population size which increases slightly each year. We have observed new recruits on the beach, very young and small, that five years ago we had not observed with the frequency which there actually is. Protection is necessary at all levels within the Gulf of Mexico. Also, it is difficult to evaluate the juveniles which have left the area of the Gulf. The cause of total mortality within the population, whether from fishing or natural causes, is incompletely known. A large scale investigation is necessary stressing the new areas that we have discovered which possess small populations of several dozen animals. These are located,

for example, in the state of Veracruz, and some which are found to the north of Rancho Nuevo. With this information we can think there is a slight recuperation of the species, but it is necessary to pay much attention to protection on an international level.

HIGGS: Stated that there was only one nesting colony of olive ridleys of any significant size and this colony nests primarily on the coast of Suriname. A few nest on the coast of French Guiana. Between nesting seasons these turtles forage along the nesting coast. That is, they primarily feed off the coast of Suriname and French Guiana with a few stragglers going as far as the Gulf of Venezuela, in the northwest and Natal, Brazil in the south.

The number of turtles in this population is declining and there was a drastic decline in this population during the early 1970's from about 1,200 nesting females to 750 nesting females. The nesting females are spread out now; they are not concentrated in Suriname, but there is a spreading out of nesting females to neighboring beaches, particularly the nearby beaches in French Guiana. Unknown, but appreciable numbers, nest in Honduras; however, very little is known about this population. Reports about olive ridley nesting in the south of Brazil have been recently validated by Brazilian scientists. The range of this population, however, is unknown, and again, there is very little that is known about this nesting colony.

Next to the Kemp's ridley, it is the rarest turtle in the western Atlantic region and the main factor for decline is the incidental catch by shrimp trawlers in the turtle foraging area. The area in which these turtles forage is the productive shrimp grounds off Suriname and French Guiana, where many shrimp vessels operate. There is full protection of nesting turtles in Suriname. They have an active conservation program to ensure relatively little poaching of eggs and taking of nesting turtles. But with the spreading out of this population to other nearby beaches, particularly French Guiana, there is extensive poaching of the eggs by people and predation by dogs. Although the population is protected in French Guiana, there is very little enforcement of the regulations. In the matrix of the classification, the olive ridley is endangered and declining.

MEYLAN: Thought it was not possible at the present time to delineate populations of hawksbills within the wider Caribbean area. There are no nesting aggregations which we can treat as entities and we know virtually nothing about migratory patterns. There are areas in the Caribbean which seem to report relatively higher numbers of hawksbills than others. But, for the reasons above, we can't really consider these separately. We have to present a regional evaluation of the status. We have to discuss the unique censusing problems which hawksbills present. They nest diffusely, the nesting season is longer than for any other species, and they nest on a wide range of beach types, that include small isolated patches of sand that are difficult to monitor. These factors undoubtedly contribute to underestimation. Even taking these factors into account, however, it is impossible to ignore the alarming low reports which our National Representatives have presented in their reports. With corrections that have been made in the data during the week, the total number of females reported to be nesting annually throughout the entire Caribbean region is less than 2,000 individuals. At this time, with some countries not reporting and without complete coverage at any specific geographic locality, can only be used as an indicator of the order of magnitude of nesting rather than a concrete value. It tells us rather clearly, however, that the continued survival of Eretmochelys in the region is in jeopardy.

To put it in historical perspective, we should note that hawksbills have had a long history of exploitation in the Caribbean. When early mariners were raiding green turtle rookeries for meat, they were also buying turtle shell from coastal peoples. Because of their diffuse nesting distribution, however, it has been difficult to detect depletion over the years. We see evidence of decline quite clearly now both on nesting beaches and in foraging habitats and the pressures are accelerating. International trade and local tourist trade are putting a price on the hawksbill's head that populations cannot bear. Raw turtle shell prices of 50 to 70 U.S. dollars per pound are not uncommon in parts of the Caribbean, particularly in Panama and Nicaragua. A single capture of a hawksbill can bring more income to an indian in Panama than his entire year's effort in farming. In many parts of the Caribbean the tortoise shell trade is only one of the pressures on the species. There is, in addition, a very lucrative tourist market in polished carapaces and stuffed juveniles, and there is the traditional subsistence use of both eggs and meat. There is pressure too on the coral reefs where the hawksbills live. This is almost directly correlated to the increase in tourism in the region. Another consideration when we evaluate the status of the hawksbill is the difficulty in protecting it. Nesting on beaches throughout the region, with no real aggregations, protection of the nesting females and eggs is a monumental task. Habitat protection has some possibilities, but this is costly and labor intensive. The single most important threat to the species is international trade in tortoise shell. Without a drastic decline in this trade, the future of the hawksbill in the Caribbean is indeed gloomy at the moment. In summary, the hawksbill is clearly endangered in the Caribbean region. It is rapidly declining and it deserves maximum protection to promote its recovery.

ROSS: Noted that the statement of status has got to reflect the need for conservation and the vulnerability to both natural and manmade impacts on turtle populations. It has to reflect the size and the trends of the populations and it will hopefully indicate whether a population can sustain exploitation. It is extraordinarily difficult, as we've heard, to assign a single word to these many tasks, and yet we have to do so, even though the basic information that any wild-life manager would ask for is information on population size and the distribution of stocks. Survival by age class recruitment and reproductive potential is all incompletely known. We apply this to Dermochelys coriacea, the leatherback turtle. There are only five populations reported which are large enough to include here. He stressed that these are estimated to be larger than 250 nesting females per year. The population which occurs in French Guiana and Suriname, considered to be a single population, is the largest. Of the remainder of the reported nesting grounds there are eight of small size, around the order of 50 nesting females a year, and 12 characterized as being present as traces, up to three or four single nesting females per year. We do not have enough information to extrapolate any of these figures to total number of nesting females. He, therefore, declined to do so, and recommended that this information in the WATS data base be removed certainly for this species and probably for the other species.

Dr. Pritchard had indicated that the total number of individuals in these populations is not a particularly useful tool for managing them. The populations occur discretely and the total number is not particularly relevant to this purpose. As an example, 40 years ago the population of Kemp's ridley must have been at least 50,000 individuals. It was probably much larger, but at least 50,000 individuals 40 years ago. At that time, it was highly endangered as is evidenced by its current decline virtually to extinction. Numbers are not particularly useful. If we go through the populations of Dermochelys that we know about, the French Guiana-Suriname population may be stable. The apparent changes in the nesting females could be interpreted as shifts between the two jurisdictions. It is certainly vulnerable; the described mortality of adults and the extremely low success of the eggs for this population suggest that currently it is not receiving the protection which it has received in the past. The political turmoil, particularly in Suriname, must make us wonder about the protected status of that population. In Colombia, an estimated 1,000 individuals are nesting. He grouped the Colombia and Panama populations as one for this purpose. It is certainly declining due to the heavy exploitation for meat and is completely unprotected. It must be considered vulnerable.

In Costa Rica we have no evidence for decline basically because we have no evidence at all. It is assumed that the status for this is a stable population. It would be nice to test that. It is not currently protected in any meaningful way and, therefore, it is vulnerable.

The Trinidad population (a relatively small one - no more than 250 nesting females), is greatly depleted, strongly threatened by the continued exploitation of meat and eggs, and highly vulnerable.

The population in the Dominican Republic, from what Ross had estimated, is smaller than the estimated 750 in the data base. Nevertheless, if we accept the 750 number, it is extremely endangered and certainly depleted. There are reports that mortality of nesting females on the beaches and the take of eggs approaches 100% in all the area except for a small portion where there is a conservation program. That population is highly endangered.

Of the remaining medium size populations, probably by virtue of their size, they deserve complete protection. You are never going to get very much value from them anyway. Their contribution to the recruitment into the general area is unknown but may be useful, so it is suggested that they all deserve full protection and their trace nesting grounds also require complete protection mainly because there is not much else to do with them. Therefore, on the balance, we can conclude that there is absolutely no other category that could be applied to the species in this region than endangered.

CHAIR: Thanked the speakers and commented that if the last few days had lulled us into a feeling of security that there are a lot of turtles in a lot of countries, perhaps we have that confidence rudely shaken by the experts who have put the data together for us, combined it with really all the available information, and come up with pretty sad stories for virtually all the species in the region.

The Chair introduced a visiting expert, John Beddington. He had come from the British Isles and experts are often classified as to how far they come, but even if he lived next door he would be an expert. He would like to give us some insights on population models and how you determine status of species and convert that to management options.

BEDDINGTON: Stated that most of his work tended to involve fish populations and indeed whale populations, and one of the reasons people asked him to come here was that there must be some analogy between the whale population management and the turtles. They live for a very long time, they grow very slowy, and their reproductive capacity is relatively low. The sort of problems we need to address in turtle ecology and management are rather similar to the sort of problems that we have had to address and we have addressed in management of whale populations. There has been a number of comments on the status of the stocks, and trends of the stocks in all the various species of turtles in this area. But some of the essential questions have not been posed, because the really critical question that has to be posed of a turtle population is really what proportion of it can be lost either due to direct exploitation by man for subsistence, or other reasons, for incidental catch, or perhaps by the ingestion of plastic bags causing extra natural mortality.

What proportion of this extra mortality which is being induced can that turtle population sustain? Is it 1%? Is it 0.1%? Is it .01%? It's not likely to be 10%. That we know by analogy and we can do the rough calculations on the demography, but it's absolutely critical that this question is posed and answered by the research that can be done if you are going to be able to assess the trends and what is likely to happen to the turtle populations. You can notice quite clear declines in nesting females. That can be observed, but very often there are going to be situations where it is not going to be possible to actually monitor and detect changes, whether they be increases or decreases. By the very necessity of actually monitoring them you are going to need more research effort than may be possible, so one has to be able to answer this question, "what is the proportion of extra mortality, whether it be from harvesting or incidental catch, that these populations can sustain?" The only way that these questions can be answered is by looking rather carefully at the demography. There are tremendous problems about dealing with the demography of pre-adult turtles, but that is the critical area of ignorance perceived in the knowledge that has actually been attained from turtles. We don't know what is the proportion of the survival from when they first enter the water to when they actually reach sexual maturity and start to breed. Until that question is answered, at least approximately, we're not going to be able to answer the questions about what is going to happen to turtles under different situations.

CHAIR: Asked Beddington to give his thoughts on one other point, since this was a group of very practical men who have to manage resources often on very limited budgets.

Which of the "taking eggs" or "taking turtle" strategies might be more compatible with the preservation of the species, and what about protecting eggs to justify take of turtles?

BEDDINGTON: Replied that there was not one answer to the question posed. Some species, because of their life history characteristics, may be better exploited by taking, let us say, nesting females. Other species may be better exploited by taking pre-sexually mature, and others may be better exploited by taking eggs. There will not be a unique answer because the species differ so greatly in their life history characteristics. For something like the green turtle, which appears to reach sexual maturity at a very late age (20-30 years) compared to other turtles which apparently reach sexual maturity at a much younger age, means, therefore, that there will be no single answer. There will be different answers for the two. One of the key things that one has to ensure is that the rate of exploitation is going to be lower than the rate of recruitment. That will mean substantially lower, so taking a small proportion of the estimated recruitment is one way that you can at least ensure that there will not be drastic declines in the population. That is the one thing that has to be taken into account. If there are situations where the entire recruitment is being taken each year, then you don't need mathematics to show that that species is going to decline massively. To give you some sort of ideas of the figures that have been done with whales, one finds if we take between 5 and 10% of the annual recruitment, that is the sort of level that whales can withstand.

Turtles may be able to sustain far less. That is possible, but this is why there is the need to look at the demography of the early life stages. One final comment: there is a great opportunity for some historical studies. If it is at all possible to estimate for turtle populations we know to have gone extinct, or to have been severely depleted, what proportion of the population was being taken, then it may be possible to assess the upper limits of the exploitable levels and you certainly should not exceed those with current populations.

PRITCHARD: Opened the question of status of stocks to the panel and to anyone who had comments they would like to present on any of the species.

RICHARDSON: Said that for those who dabbled in population models, the comments by John Beddington brought some very important points home which he wanted to mention. Fisheries management decisions, the ones that John has been saying that we need, are based on solid population models. Having personally been studying the population model of a loggerhead nesting assemblage in Georgia for 20 years now, he had still not even started to understand what's happening. One of the things that all of our population models in their very primitive and exploratory nature keep telling us is that these sea turtles take 20 or 30 years perhaps to reach maturity and then nest once and disappear. That particular finding would indicate to a fisheries management person that we should take the adult nesting females following the end of the first nesting season. However, there is the danger that if our models are wrong and we don't have any idea how good our sampling is at this moment, then we could destroy the only breeding nesting assemblage of turtles that we have.

SCHULZ: The only data that Schulz had available was the counts of nests that had been laid from 1967 up to 1982. He did not have the demographic data, as they apparently have for another beach. As it is well known that there is a very great fluctuation between the years, he did not dare to draw a trend line through those annual figures. If one tries to do that, there is a certain slight upward tendency in the number of females that nest in Suriname. There still exists an opportunity to study demography, especially of the sub-adults, because it is a very simple straight line migration between Suriname and the feeding grounds in Brazil. This has been started and we hope that sometime in the future this can be continued.

The only thing he would say was that there was a slight upward trend in the numbers of females nesting there. When asked whether this was endangered or threatened, he said threatened.

CHAIR: Asked Dr. Schulz if there was historical evidence of decline from early times in Suriname.

SCHULZ: Replied that he did not know and added that 250,000 eggs had been taken every year since 1967. This should be included in the overall picture.

CHAIR: Asked if a category of increasing, but vulnerable would be compatible. He would hate to call it threatened if we don't have a basis.

SCHULZ: Agreed with increasing, but vulnerable. That would be at this moment with the knowledge we have the best description.

MARQUEZ: Returned to the population dynamics of sea turtles, stating it was important to define total mortality. Actually, we don't know the extent of mortality due to fishing, as the majority of captures are clandestine. He thought that the metal tags used to mark the turtles have many defects, they fall off and they corrode. We can make some statistical arrangements in order to eliminate the maximum amount of deviation, which can exist. For example, we know how many turtles there are in the case of the Kemp's ridley in Mexico. Every year we tag around 300 turtles. After the first year, 50 tagged turtles returned. In the following years, the number of turtles with their original tags diminishes. Therefore, with this inference, we can determine, up to a certain point, a rate of mortality that is sustained by an annual class.

We can also infer approximately what the total mortality of adult females is. Also, we can estimate the mortality of eggs on a determined beach and the total number of hatchlings released per season. We can estimate the mortality between eggs and released hatchlings and the mortality of adult females. Of course, this represents a series of approximate estimations, but it is the only tool which we can actually count on for obtaining population estimates. We do an extrapolation with the greatest possible caution between hatchling mortality which we have already determined and adult mortality. And at this moment, we can estimate approximately the potential or the quantity of animals each year.

A definite problem in this case is what is the age of maturity. In this case we can incur grave errors if we underestimate the age of maturity. Regardless, we must make a series of models, i.e., beginning from eight years, the minimum age of sexual maturity, up to 20, 25, 30, 50 or more years. In this manner we can estimate the number of animals in the population. According to the number of adult females that are arriving every year, we can have an approximate idea about the number of animals currently existing in the population.

BURNETT-HERKES: Thought the remarks by Jim Richardson and certainly the information that we have on green turtle populations from Tortuguero, both very long term studies of nesting populations, point to the fact that we need more than information from nesting populations to decide what the status of stocks is.

He thought this was obvious to everybody, but we seem to limit our research, at least in the past, only to these convenient centers. He thought that we would be kidding ourselves if we think that we can improve our information by more studies of nesting sites. We need to study the non-breeding populations, not only to find out the status of the stocks, but also to learn more about growth rates, distribution, and migration patterns. It's perhaps an expensive type of research, relative to research on nesting stocks, but it is the type of research that can be done by low technology methods. It can be done in many different areas of the region so you will be able to use a diverse number of people from diverse countries to do it. It will need a huge amount of coordination, and this is the very thing that the WATS group and IOCARIBE might be looking at in the future.

MURRAY: Had several questions. Based on discussions so far on the status of species and also considering the limited information we have on the turtle stocks in the WATS area, one of the things that comes to mind is whether or not we can determine whether the stocks can tolerate even a slight amount of subsistence usage. Perhaps someone from the panel could comment.

ROSS: Said that, given the economics and political realities in the region, that is one of the key questions and he was glad it had been asked. He thought what we come down to was an appreciation of some of John Beddington's comments where he suggested that we can't really manage these populations right now, unless we restrict our take to a small proportion of our best estimate of what recruitment is. Then, if we are doing the wrong thing, that if we are in fact driving these animals to extinction, we will do so slowly enough that hopefully the improved research that we generate will catch up. Then we can change our minds in five or 10 years time and not have done irreparable damage. What those sustainable yields are, and what is meant by sustainable yields, needs to be clarified. The utilization panel discussed in some detail the fact that people who rely either on an annual basis or on a significant dietary basis on sea turtles are relatively few in the region. That a great deal of alleged subsistence catch in fact goes to trinkets and turtle steaks for tourists and others. This is a cash-earner for the region and not to be dismissed trivially. There may be no clear answer, but there are a lot of restraints on what the answer must be. All of the regional managers should keep all those constraints in mind and make their own conservative estimates that hopefuly we won't do too much damage.

MEYLAN: Said she did not think that in the eastern Caribbean the hawksbill could withstand subsistence take at all. She thought it could not withstand anything right now and a moratorium of some sort was in order at least for a short time to let stocks recover.

This isn't just in the interest of the hawksbill. It's in the interest of the people who would rely on it in the future as a subsistence resource. If the hawskbill is extirpated further down the line, there will be nothing to replace green turtles as a food source when they become depleted. At one point it might be an important subsistence element and if it's sold off as souvenirs, e.g., polished carapaces for France and Italy, it won't be there to call on when you need it.

HIGGS: Asked a question, as he was somewhat confused. Yesterday and on previous days of the symposium there were a number of people who said that foraging juveniles and sub-adults were on the increase in the foraging areas, and today we get a very gloomy story that the nesting female populations are declining for most of the species. Perhaps someone on the panel can give some information as to what would acount for this. Are these estimates of increase of foraging juveniles and sub-adults wrong? Hawksbill and green turtle.

CHAIR: Thought we tend to agree that the Florida green turtle population, as an example, seems to be increasing from a very low level to a less lower level. It appears to be documented that the Suriname green turtle population is undergoing a modest increase, so we are not portraying pessimism on principle here, but he asked Colin Higgs to be specific and ask about specific populations.

One particular case was Barney Neitschmann who mentioned a resurgence of immature green turtles in Nicaragua, but then we heard from a turtle fisherman in the area that he regarded them as getting fewer and smaller, so we heard conflicting data from that panel.

BEDDINGTON: Was reticent to take the floor again to comment on turtle ecology, but thought that to clarify the position we should recognize that when you have a very long lived population, different sectors of the population can show different trends, so it's quite feasible that the breeding females of the population might be actually showing the same decline because that is, after all, a decline that might have been produced by a decline in recruitment some 20 or 30 years previously. Whereas young animals might show an increase because the recruitment has increased 10 years previously. So this is not incompatible with the population dynamics. Also, to take up the point of the level of subsistence take, and developing Perran Ross' point, if you are going to actually exploit a population, and you are going to do it conservatively because you recognize you're ignorant, you don't then have to improve your scientific knowledge. The important point is to work out what are the consequences if you are very wrong. If you're actually working on a subsistence take on an extremely small population, let us say, maybe 200 or 300 individuals, then the problems if you're very wrong can come to you very quickly. If you're working on a small take on a population, that is, an order of magnitude larger, say 20-30,000 individuals, and you're taking a portion of the recruitment, the time scale to a disaster is really rather long. It is possible to actually give some guidelines, depending first on the level of recruitment and secondly on the level of the size of the population, about the sort of takes that will not bring disaster.

<u>BURNETT-HERKES</u>: In answering Colin Higg's question, was reminded that he was one of the people who said that a population of young turtles has been on the increase. We have a somewhat artificial situation in Bermuda in that we stopped our fishery 10 years ago and this is the reason why we have more juvenile turtles around. Unfortunately for Bermuda, they seem to be ending up in Nicaragua, when they get a bit older, as we learned, from our tag returns, and, possibly even back to Tortuguero. It looks like we're replenishing the beaches from which we did get turtle eggs some time ago.

<u>WALTERS</u>: Referred also to Colin's question and thought that Ralf Boulon mentioned some days ago that juvenile turtles and turtles on the whole are on the increase in United States Virgin Islands. This is due, presumably, to the conservation measures employed in the United States Virgin Islands Park Service. On the British Virgin Islands side, he cannot exactly say whether there is an increase or there is a decrease. His own guess was that in the British Virgin Islands there are a number of fishermen. The coastline consists of a number of inlets, coves, beaches, etc; the method of fishing was that fishermen would have their turtle nets put across these inlets and coves in order to catch the turtles when they're foraging and feeding in the different habitats. Because of recent developments in the tourist business, and especially marine activity, where you have boats, yachting, water skiing, etc., it has become extremely difficult for fishermen to capture turtles simply because they cannot risk losing their nets when they are set across these inlets and coves. Now this may contribute really to the increase of turtles in that part of the world.

Whether or not the boating activity has caused the turtles to move away from the area is something which has to be studied and researched.

<u>ROSS</u>: Thought the question of apparent increases, particularly in <u>Chelonia mydas</u>, was interesting and possibly explainable. Our division of all the species into stocks has been somewhat arbitrary and perhaps is unrealistic. It is conceivable and quite likely that most of the juvenile <u>Chelonia mydas</u> in the region originated on the large nesting beaches, most likely

Tortuguero. If we look at the history of that population, we can see that 30 and 40 years ago that population was exposed to very heavy female mortality on the beach. That mortality was halted by the enlightened activities of the Costa Rican government. That was about 20 or 30 years ago, but perhaps that is a little too long. One would, therefore, expect an increase in recruitment now many years later, as a result of that enlightened action. Perhaps the light at the end of the tunnel, the little glimmer of promise here is that some of the things that we are doing and perhaps the reduction in take at the foraging grounds do slowly have an effect. Asking for the Chairman's indulgence, Perran Ross suggested the one person who had information on an apparently increasing population was George Hughes from South Africa and perhaps it would be appropriate for him to briefly comment on the effects of protection and the fact that you do seem to get a result after a while.

CHAIR: Agreed that this was an important point. He thought it would be negative if we were to reject evidence to the contrary that perhaps sometimes our conservation efforts have worked or could have worked, and to feel that nothing has increased despite our efforts. I think we need to look around and objectively evaluate positions and sometimes find things better than they were as well as sometimes finding things worse. The Chair would welcome a quick word or two from George if he is able to do so on the populations in South Africa.

HUGHES: Said it would be a little unfair to expect anything too dramatic from South Africa because the populations of leatherbacks and loggerheads down there are very modest in comparison to populations in other parts of the world. They had now been protecting for two decades and the actual number of females handled had more or less doubled in the loggerheads and leatherbacks have gone from an all time low of five females in one season in 1966 to over 83 tagged in one season, so it's very difficult in such a short time to say that this apparent increase is directly due to the protection we've given the beaches, but it is nevertheless encouraging because the trend is certainly upward.

OGREN: Said he would like to respond briefly about the Tortuguero situation and why, after all these years of varying levels of protection, the breeding population has not stabilized. We need to clarify that, and as John Beddington and David Ehrenfeld discussed earlier, the age of maturity is an important factor to consider because the effects of earlier exploitation are not evident for many years. In the case of Tortuguero, full protection was not provided to the entire 20 miles of the rookery until the National Park was established in 1975. The turtle freezing plants in Nicaragua, where the foraging population was heavily exploited in the late 1960's and early 1970's, did not close down until 1976. Heavy egg loss by man, feral dogs and erosion on the nesting beach continued at the same time, as well as an intensive trade in calipee where large numbers of breeding turtles were killed just for their plastrons. The consequences of all this mortality will not be evident in this population today or tomorrow, but years hence.

CHAIR: Closed the session after expressing thanks to the panel.

EXAMPLE

SEA TURTLE CLASSIFICATION MATRIX FOR SPECIES SUMMARIES

ELEMENTS/STATUS CATEGORIES TREND

Element I	1. No Evidence of Decline	2. Somewhat Depleted	3. Threatened	4. Endangered	5. Naturally Rare	6. Extinct or Absent
Element II						
A. Increasing Fast						
B. Increasing						
C. Stable						
D. Decreasing						
E. Decreasing Fast						
Element III						
Vulnerable						

MANAGEMENT DECISIONS OR OPTIONS

Some Level of Exploitation Tolerable:	1A, 1B, 1C
Subsistence or Local Use Tolerable:	2A, 2B, 2C, 3A
Protection Needed*:	2D, 2E, Vulnerable
Reintroduction to be Considered:	6

*All Element I categories 3, 4, 5 included in matrix classification (except 3A). 1 and 6 not included.

STATUS OF SPECIES MATRIX CLASSIFICATION - SUMMARIES

Species	Geographic Populations	Matrix Classification	Management Decisions/Options
Green Turtle	Aves Island, Venezuela	Threatened, decreasing 3D	Protection needed
Green Turtle	Tortuguero, Costa Rica	Threatened, decreasing 3D	Protection needed
Green Turtle	Suriname	Increasing, vulnerable B III	Protection needed
Loggerhead	Colombia and Venezuela	Endangered, decreasing 4D	Protection needed
Loggerhead	Mexico	Threatened, vulnerable 3 III	Protection needed
Loggerhead	Greater Antilles (not including Cuba)	Threatened, decreasing 3D	Protection needed
Loggerhead	Bahamas, Turks and Caicos, Bermuda	a) No evidence of decline, stable-increasing 1C-B (foraging population)	a) Some level of exploitation tolerable
		b) Threatened (nesting population) 3	b) Protection needed
Loggerhead	Southeastern United States	Threatened, stable-decreasing, vulnerable 3C-D III	Protection needed
Kemp's ridley	Mexico	Endangered, increasing, vulnerable 4B III	Protection needed (reintroduction continuing)
Olive ridley	Suriname, French Guiana	Endangered, decreasing 4D	Protection needed

STATUS OF SPECIES MATRIX CLASSIFICATION - SUMMARIES (Continued)

Species	Geographic Populations	Matrix Classification	Management Decisions/Options
Hawksbill	Wider Caribbean region	Endangered, decreasing fast 4E	Protection needed
Leatherback	Suriname, French Guiana	Endangered, stable, vulnerable 4C III	Protection needed
Leatherback	Colombia, Panama	Endangered, decreasing, vulnerable 4D III	Protection needed
Leatherback	Costa Rica	Endangered, stable, vulnerable 4C III	Protection needed
Leatherback	Trinidad	Endangered, decreasing, vulnerable 4D III	Protection needed
Leatherback	Dominican Republic	Endangered, decreasing, vulnerable 4D III	Protection needed

Synonymies: Declining = decreasing
Unstable = vulnerable

4.13.2 Audience Response

Comment from C. Webster:

What utilization can or has been made to enlist status counts from SCUBA and dive organizations and personnel.

Response from K. Bjorndal:

I don't know of many efforts, we do know of Norine Rouse's work on the Atlantic coast of Florida. She gave us a short presentation of some of her observations in the first audience response panel. Are there any other National Representatives here, or other people who know of such programs?

Response from J. Wood:

I don't know if this particularly answers your question but in Grand Cayman we have a very large diving industry. As a portion of our survey, trying to determine sea turtles in Cayman waters, we have an arrangement with the local dive boat operators. When they go out and see a turtle they fill in a form which they send us once a month. In this way we are able to get a whole lot of people-hours in the water and get a relatively large number of reports of turtles in various parts of the island.

Response from K. Bjorndal:

I think Mr. Webster's point is well taken, that there is a source of manpower there, that perhaps is overlooked in some areas, and we could be making better use of these organizations.

Comment from D. Metton and A. Myketuk:

We have described eight pre-Colombian turtle traps located near the Manuel Antonio National Park of Costa Rica. Implied from the traps is that there has been a substantial reduction in the sea turtle population of approximately 1,000 years ago.

Response:

None.

4.14 Management Options Panel Session

4.14.1 Rapporteur Report of the Management Options Panel Session

CHAIR: William Fox, University of Miami, USA

RAPPORTEUR: Anne Meylan, University of Florida, USA

PANEL: George Balazs, National Marine Fisheries Service, Honolulu, Hawaii, USA

John Beddington, International Institute for Environment and Development, England

Ralf Boulon, Jr., National Representative, U.S. Virgin Islands

Jorge Carranza-Fraser, Director, Institute National Pesca, Mexico

Jorge Csirke, FAO, Rome, Italy

David Ehrenfeld, Rutgers University, USA

George Hughes, National Park Service, South Africa

Wayne Hunte, National Representative, Barbados

Rory Kavanaght, National Representative, Haiti

Herb Kumpf, National Marine Fisheries Service, Miami, Florida, USA

Fernando Rosales Loessener, National Representative, Guatemala

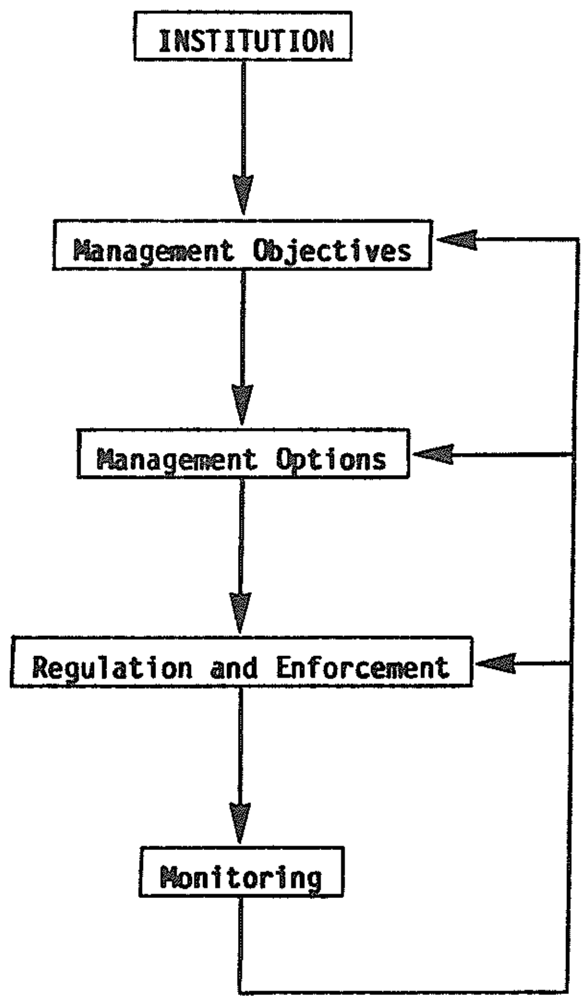
Edith Polanco, National Representative, Mexico

The Chairman explained that comprehensive management designed to control all the factors that may improve sea turtle populations, or reduce the factors affecting their viability, is nearly impossible given the unknowns concerning sea turtle biology and the limitations of resources available for carrying out management programs. Management options must, therefore, be selected to serve the most critical needs and objectives, and to offer the best chances of success. These options should be selected and based on: (1) the limitations imposed by the biological attributes of the species and its particular natural history characteristics, (2) the resources available to carry out management programs, and (3) a careful consideration of the effects a particular management plan may have on the various facets of the life history of the species to be managed, especially those that are not the direct target of the management plan, other species that interact with the managed species, and the ecosystem in general.

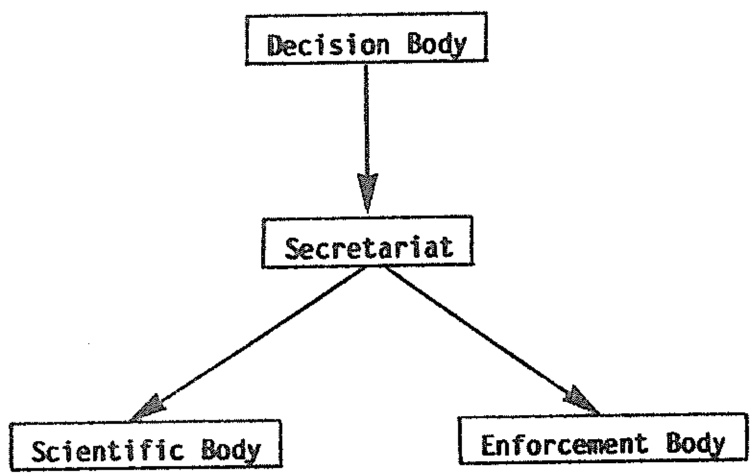
A sample of options, based on sea turtle life history stages, follows:

I. Eggs
   A. Protect entire nesting beach, or a portion of the beach.
   B. Protect site of nest (wire circle, etc.).
   C. Move eggs short distance (to avoid high tides; to trick human and non-human predators).

MANAGEMENT SYSTEM



<u>INSTITUTION</u>



D. Move eggs to protected hatchery.
E. Incubate oviducal eggs from slaughtered females.
F. Predator control.
G. Harvest of eggs regulated by percentage or number of eggs allowed, geographic area, or open/closed seasons.
H. Prohibit international commerce; limit harvest to subsistence take, or local sale or national markets.

II. Hatchlings
A. Predator control.
B. Removal to safe habitat (e.g., airlift beyond oil spill).
C. Release hatchery hatchlings immediately.
D. Retain hatchlings for head-starting.

III. Sub-Adults
A. Protect feeding and developmental habitats.
B. Control harvest by upper or lower size limits, open/closed seasons, or geographic areas.
C. Ranching or farming.
D. Prohibit sale of specific product, such as stuffed souvenirs, tortoise shell or leather.
E. Prohibit international commerce; limit harvest to subsistence take, or local sale or national markets.
F. Limit incidental catch by closed seasons or protecting areas of high turtle concentrations (e.g., off nesting beach).

IV. Adults
A. Protect feeding, migratory, nesting and/or internesting habitats.
B. Control harvest by size limits, sex, or open/closed seasons.
C. Ranching or farming.
D. Prohibit specific product/use, such as leather, tortoise shell or stuffed souvenirs.
E. Prohibit international commerce; limit harvest to subsistence take, or local sale or national markets.
F. Limit incidental catch by closed seasons or protecting areas of high turtle concentrations (e.g., off nesting beach).

The Chair presented a management matrix and invited each panel member to complete this and comment upon it.

MANAGEMENT OPTIONS MATRIX CATEGORIES

Life History Stages

Eggs (nest)
Hatchlings
Subadults   species
Adults   specific sizes
  Males
    Breeding season
    Non-breeding
  Females
    Breeding season
    Nesting season
    Non-breeding
    Non-nesting

Habitats

Nesting beaches
Off nesting beaches (nesting seasons)
Forage grounds
Migratory routes
Hibernacula

Actions

Laws, regulations
Enforcement
Education
Population surveys

Species

Green Turtle
Loggerhead
Kemp's Ridley
Olive Ridley
Hawksbill
Leatherback
All species
Unidentified species

Uses

Subsistence
Trade
  Local
  National
  International

Sources

Wild stocks
  Farming/Ranching
  Wild stock
  Captive stock

Products

Food
  Meat, eggs, oil, calipee
Salable products
  Shells, skulls, tortoise shell
  Leather, stuffed turtles

(This introductory address was illustrated with slides.) The objectives of management are:

(1) To achieve population stability or persistence;

(2) To optimize utilization;

(3) To achieve an equitable allocation of the benefits of management.

BALAZS: Stated that in the unlikely event that international agreements can be made quickly, we need to define management units in national boundaries. Major points in the matrix are specific legislation, limit of habitat alteration and control of specific uses. Reduction in incidental catch is very important, as this is wasted catch of no benefit to people. We need to define human need for subsistence and if there is compelling need to take greater risks in management. We need also a valid population model on which to base exploitation. This was an important resolution from the World Conference in Washington.

BEDDINGTON: Noted that management will require cooperation between countries and sharing of information on exploitation. This is necessary to predict trends. It is important to ask which life history stages should be exploited, although this will vary with species. It may be better to exploit what you can control.

BOULON: Stated that many countries have general legislation but need very specific legislation in some cases. He suggested a category of nest protection be added to the matrix. For hawksbills a very important management option is control of international trade. As far as habitat alteration is concerned, we cannot worry about natural changes, but could give attention to beach clean-up techniques. Nest relocation is a valuable tool in preventing loss from predators and erosion. Head-starting may be useful but we do not know the outcome of this option.

CARRANZA: Stressed that we must regulate turtle catch. He believed the only way was to give fishermen alternative income--not just for subsistence--they need money too. The pressure on turtles has increased greatly. He insisted that fishermen need fishing gear, boats, etc. and someone to tell them what resources they can fish, and to give them a market for alternative products.

CSIRKE: Noted it was important to identify the juvenile phase, the stage we know least about. We must ask whether it is feasible to protect various life history stages, and include economic considerations in this decision. If feasible, is it effective and will it ultimately contribute to an increase in population. Who will be negatively affected by these measures and who will benefit? A great deal has been said at this conference about conservation, but very little about fishermen. Some of the management measures suggested won't benefit anyone until 20 years later, so you cannot expect cooperation.

EHRENFELD: Was not sure how valuable this matrix was. He believed it was important to deviate as little as possible from what turtles are doing, given their evolutionary success. He was impressed with Reichart's suggestion that false nests can be used in deterring predators and poachers. If we must move nests, move them to similar habitats at similar depth. It is unknown if individual sea turtles, through genetic variation, have different temperature regulation mechanisms and select certain habitats for nesting, or if they nest randomly. He did not know whether protection of migration routes was necessary, but it would be difficult to achieve.

HUGHES: Stated that the management necessities (not options) were: (1) protect and monitor nesting beaches, on whatever scale is feasible, (2) specific legislation for specific situations, (3) limit habitat alteration. The last is not as important as stock evaluation. Small, consistent efforts are better than none.

KUMPF: Pointed out that there was a plethora of legislation existing in the region, but enforcement is necessary. Two major areas to address are habitat alteration and reduction in incidental catch. It is important to differentiate between international trade and subsistence use, which are very different categories. Kumpf noted that previous panels had given a number of explanations for increases in some juvenile turtles; these are probably a result of conservation measures, but the numbers are valid and should be accepted. Furthermore, it is important to determine how much removal is tolerable, if known, so that management options can more wisely be described.

LOESSENER: Referred only to Guatemala. Specific legislation is an essential measure for eggs of species nesting on the Atlantic coast of Guatemala because of high human predation. Laws need to be balanced, not radical, and legislation must impose punishment for violations. Legislation regarding adults is not so important because meat is not used, except in one community. This is traditional, but a law was passed in 1981 banning capture and trade in mature turtles. Loessener suggested that the fisheries department could give special licenses to ethnic groups. Beach patrols are important for protection of eggs and females, but are very difficult in Guatemala because of lack of access to some beaches. Currently there is no inspection of markets, although this is important. There should also be inspection at the sites where eggs are consumed. He considered that there were no significant changes in habitat in Guatemala. Head-starting is a luxury and he inferred that the net effect of this option is not established. Incidental catch was not considered as it is not relevant to Guatemala. Protection of foraging areas is important for greens and hawksbills on the Atlantic side; this, and protection of migration routes requires regional cooperation.

POLANCO: Said that two points in the matrix applied to Mexico; the need for special legislation and beach patrol. Two species are totally protected in Mexico -- Kemp's ridley and the leatherback. The main problem with beach patrols is the extensiveness of areas where control is necessary. There is need for a mechanism to make patrols easier, and she suggested the use of surveillance activities of various marine agencies. Market inspection is routine in Mexico; the problem is that market distribution is widespread (most of the turtle products are sold in baskets all over town, not in public markets), which presents difficulties for inspection. Limiting habitat alteration is important. There are feasibility problems and it can be costly, so we need to concentrate on the bigger problems, especially of Kemp's ridley and hawskbills. Hatchery work is being done systematically at Rancho Nuevo; other hatcheries are being set up as are complimentary activities with other species. There is insufficient information from Mexico about incidental catch and other categories on the matrix. We should consider also the high price for green turtle products and the traditional use of shell for jewelry.

KAVANAGHT: Had completed the matrix for three species from Haiti. Special legislation is essential for hawksbill and loggerhead as these are the ones most used and there is no way to control beaches because they are not accessible. The hawksbill is one of the main export species so there is need to exercise great control and to survey areas where they occur. Kavanaght was concerned about the green turtle, which is consumed most, as there is great need for protein in Haiti. Caretta is the primary species for export to Japan; the meat is not eaten in Haiti but sale of carapace provides money. The exploiters have a big effect on the resource and in Haiti they do not have data to support legislation. It is difficult to convince people about the need for conservation. He was concerned about the sale of loggerhead shells which sell for $40 each. The fishermen do not get the big profit from exports but if an increase in traditional utilization continues, these species will continue to be endangered for a long time.

HUNTE: Chose management options geared to small islands. Specific legislation is clearly required. In Barbados there is no protection of adults or sub-adults except less than 100 m from the beaches. A closed season is desirable for Barbados. The biology of reproductive females is important and we need to know the probability of survival of the eggs. We are in the early stages of management in the rehabilitation phase; the ultimate need is for an optimum utilization strategy. The lack of information on demography is disturbing, e.g., population models; so the gathering of demographic data is a primary need. The second priority for research is to determine stock discreteness; by electrophoretic methods, and to redouble efforts to study migratory routes. The latter would tell us who we should collaborate with in management. Beach control is essential and ideal, but needs public awareness and manpower. Market inspection is essential also, but in islands with many possible landing sites this can be ineffective. There is a need to quantify landings. Control of habitat alteration is essential, because while turtles nested formerly on all coasts of Barbados, they are now restricted to the east coast, presumably because of development. Hunte was not sure that hatcheries were necessary in the eastern Caribbean, but thought research into headstarting should be continued. He congratulated the developers of TED, and noted that spear fishermen take turtles incidentally to lobsters and fish. Protection of foraging areas is not a priority management option in Barbados but we should be cautious as coral reefs have little resilience. Pollution has caused deterioration on west coast reefs of Barbados. Specific items for the tourist trade are a driving force in the Barbados fishery. Hunte stated that the most exciting development in the Symposium for him has been the information on temperature effects and sex determination, both scientifically and as a management tool.

CHAIR: Chairman Fox, in opening the subject to general discussion, stated that he had picked out from the session the need for an international regime in sea turtle management.

CARRANZA: Noted that a widely distributed resource requires a coordinated system for legislation and management. The important question is how to do it with more than 30 countries involved in WATS, each with its own peculiar needs. He was speaking as a member of the Steering Committee and a panel member. We need to establish terms of reference.

POLANCO: Thought we should clarify the idea of an international regime through harmonization of laws, multinational agreements, and consideration of economic issues and sovereignty.

CSIRKE: Drew attention to the law of the sea upon which one could elaborate special items about turtles; turtles should qualify as a shared resource under Article 62. This gives the frame of reference for regional, bilateral, or multilateral agreements. However, the individual countries must have clear objectives first. The turtle resource is evidently shared; how to manage it internationally is open to discussion, but the main voice is that of the countries with the resource.

BEDDINGTON: Agreed that the key question had been asked by Jorge Carranza, i.e., the terms of reference. The meeting has defined some of these: (1) to assess the status and trends of the populations, and (2) to develop a wide sharing of information, especially on harvest rates of all categories.

CHAIR: Noted that we can provide focused management on some species, while others need to have diffuse management schemes. Some species have to be managed everywhere, i.e., hawksbills. The green turtle, loggerhead, olive ridley, and Kemp's ridley have foci of large nesting beaches, so could be amenable to focused management. On the third item for discussion, specific uses, the Chair noted that the dollar value of products like shell is lost to the Caribbean region. One method of international cooperation would be to band together to prohibit raw exports. Allowing export only of finished products would keep value in the region.

EHRENFELD: Stated that as tortoise shell from hawksbills is the main turtle product from the region, considering its endangered status, it would be premature to consider building an industry on it.

KUMPF: Thought the Chairman had implied that as sale of shell happens anyway, we might as well take advantage of it. From trade records, trade has obviously been large for 18 years.

CHAIR: Agreed that once trade is regionalized, it is easier to manage.

EHRENFELD: Reiterated that no level of exploitation is supportable for hawksbills, which makes the problem more serious. A minor point is that we cannot satisfy demands of the traditional Japanese market in terms of quality. Any sanctioning of utilization would bring the hawksbill closer to extinction.

CARR: (New York Zoological Society) Stated that since the panel had recognized the International Bonn Convention of 1981, he question why this was not well utilized.

CHAIR: Introduced a fourth area of discussion. Previous panels have mentioned the "lost year" and juveniles. He proposed that we have information on nesting beaches, and can count eggs, hatchlings, recruits, and remigrants. The only thing missing is the time period from hatchlings to recruits, but there is sufficient data to proceed with management advice.

BEDDINGTON: Disagreed. We have not studied long enough to predict the future of turtle populations. At Tortuguero we don't know the size of stocks that produced what we see now. Therefore, there is insufficient data, and a need for mortality rates on hatchlings through maturity. We should also look at other species with shorter maturation times. Currently, data is not available, and will take many years to accumulate. A short cut is to get an indication of the mortality that occurs between hatchlings and sexual maturity. The day of intensive study of nesting beaches is over. If money and research effort is available, it should be directed at this phase.

CHAIR: Thought that the key parameter was time from hatchling to adult recruit, which gives the pre-adult mortality rate for the long history of green turtles at Tortuguero. He agreed that we should try to develop predictive capability if we could randomly sample age distribution of pre-adults.

JOSEPH: (National Representative, Antigua) Stated that those countries with high frequency of foraging hawksbills would like to see the Lesser Antilles form a joint management strategy to analyze trends and get a comprehensive view.

CHAIR: Agreed that we need a heavy focus soon on hawksbills.

BURNETT-HERKES: (National Representative, Bermuda) Referring to the export of turtle products, noted the need under CITES to control turtle shell. Concerning the diffuse versus focused management proposals, a green turtle focused plan may work for turtles but not for the human population. It is an oversimplification socio-economically. The world looks to Costa Rica to protect green turtles, but why should they? Why can't Costa Rica have equal access to the resource?

CHAIR: Noted that the optimum management plan will not be intrinsically equitable, i.e., Costa Rica needs to allocate benefits to all concerned, if taking was only allowed in that country. The reverse is also true: if Costa Rica sacrifices, then it needs a return from the regional community for its sacrifice.

GORDON: (National Representative, USA) Reported that there was continued pressure to allow imports of farmed products; plus the search for an identification mechanism. Keeping value in the area deserves consideration and sharing benefits with non-harvesting nations is feasible. One successful example is fur seals, and the reallocation of the benefits.

EHRENFELD: Agreed that the fur seal example is one end of a spectrum, involving only three nations. Another example was the International Whaling Convention, which has not had the same success. The danger of international organizations is the separation of biology and bureaucracy. We may end up with pressure to increase take, or create a bureaucracy that would need to be supported by funds gained from sale of turtle products.

FRETEY: (National Representative, Guadeloupe and Martinique) Did not agree that management should be left to individual countries, as turtles are an international asset. Individuals are going to kill off the wealth and trade. He disagreed also with ranching, as the products are poorly identified and create confusion.

AROSEMENA: (National Representative, Panama) Thought that in general, fisheries management is more complicated than it appears in the case of sea turtles. All countries here are interested, but they have to be considered on a national level first, then regional. Many countries are signatories to conventions without knowing how well they can comply; we lack infrastructure. There is a lack of communication with other agencies, i.e., the hawksbill shell trade in Panama. These agencies may not be aware of convention stipulations.

CHAIR: Agreed with the importance of national coordination concerning management objectives and treaties.

CINTRON: (National Representative, Puerto Rico) Urged the development of population models, and the need to consider ontogenetic differences in habitat occupation. Models cannot be confined to one geographical area. There is need to develop a tag with good longevity, as tag loss is a big problem.

BALAZS: Noted that there were two types of recruitment: (1) to nesting beaches, and (2) to foraging grounds. The "lost year" concerns only hatchling to foraging stages, but requires clarification. Juveniles can be captured, and are subjects currently of several studies by Balazs, Limpus and others. We should also clarify that there has been 26 to 28 years of monitoring at Tortuguero, so that calculating the size of stock from which recruits are drawn now may not be far away.

The Chairman closed the panel session at this point.

Announcement

On behalf of the National Representatives of Anguilla, Antigua, Bahamas, Barbados, Bermuda, British Virgin Islands, Dominica, Grenada, Guyana, Haiti, Jamaica, St. Kitts/Nevis, St. Lucia, St. Vincent, and Trinidad and Tobago, we wish to inform the Symposium that because of the active participation of a South African national on the very important panel on Management Options and because of our collective governments' anti-apartheid policy, we were forced to withdraw our participation in the above session. The participant in question has, however, considerately agreed to withdraw his participation and the group is now prepared to rejoin the proceedings. We regret any embarrassment or inconvenience this has caused the WATS Steering Committee and IOCARIBE. (Note: Several other countries associated themselves with this statement and Dr. Hughes withdrew from the Panel.)

Addendum to Management Options Matrix

Twelve members of the Management Options Panel Session recorded their personal/professional opinions on Vu-foils of the matrix table. These were individually projected and discussed during the session.

The Editors have summarized these 12 opinions in the following two Summary Tables (A and B).

In Summary Table A, the sums of the votes (or opinions) in each block are shown. In each block, the sum for "essential, critical" is in the upper left, "very important" is in the center, and "needed" is in the lower right. Where a panel member (in three tables) marked all four categories under Life History Stage for one or more species, the vote was recorded only under "all."

In Summary Table B, the numbers in each block were simplistically weighted (4, 2, 1) and summed. Row, column, and species totals are recorded for the blocks.

A simple ranking of the totals for Options in Summary Table B indicates a summary opinion for this exercise:

1.	Beach Patrol	250
2.	Specific Legislation	202
3.	Limit Habitat Alteration	161
4.	Reduction in Incidental Catch	120
5.	Market Inspection	99
6.	Control of Specific Uses	89
7.	Protection of Foraging Areas	47
8.	Establish Hatcheries	28
9.	Protection of Migration Routes	24
10.	Headstarting	15

The ranking for species totals is:

1.	Green	207
2.	Kemp's Ridley	197
3.	Loggerhead	174
4.	Hawksbill	165
5.	Leatherback	155
6.	Olive Ridley	133

This perhaps gives an indication of a priority ranking for management of the species, based on the emphasis given by panel members. Furthermore, considering all life history stages by species and by option, the largest set of totals is for Beach Patrol of Greens with Loggerheads second; no totals were recorded for Headstarting of Loggerheads, Greens, or Leatherbacks.

These simplistic summary rankings are imperfect and based in part on individual subjectivity. However, they afford a relatively comprehensive perspective of a complex international problem.

The Editors, 8 March 1984

MANAGEMENT OPTIONS MATRIX

Summary Table A: Sums of Individual Opinions.

SPECIES:	Loggerhead				Green				Leatherback				Hawskbill				Kemp's Ridley				Olive Ridley			
OPTIONS / LIFE HISTORY STAGE	EGGS	NESTING	ADULTS	ALL	EGGS	NESTING	ADULTS	ALL	EGGS	NESTING	ADULTS	ALL	EGGS	NESTING	ADULTS	ALL	EGGS	NESTING	ADULTS	ALL	EGGS	NESTING	ADULTS	ALL
SPECIFIC LEGISLATION	$^{2}-_{-}$	$^{-}-_{-}$	$^{-}1_{-}$	$^{5}-_{-}$	$^{-}-_{-}$	$^{-}-_{1}$	$^{-}2_{-}$	$^{7}1_{1}$	$^{2}-_{-}$	$^{1}-_{-}$	$^{-}1_{-}$	$^{6}1_{1}$	$^{1}-_{-}$	$^{-}1_{1}$	$^{-}2_{-}$	$^{6}1_{1}$	$^{-}-_{-}$	$^{-}-_{-}$	$^{-}-_{-}$	$^{6}-_{1}$	$^{1}-_{-}$	$^{1}-_{-}$	$^{-}-_{-}$	$^{5}-_{1}$
BEACH PATROL	$^{2}2_{3}$	$^{2}2_{3}$	$^{1}-_{2}$	$^{2}-_{1}$	$^{3}3_{2}$	$^{3}4_{1}$	$^{1}-_{-}$	$^{4}-_{-}$	$^{2}-_{-}$	$^{3}2_{1}$	$^{1}-_{-}$	$^{3}-_{-}$	$^{2}2_{1}$	$^{2}3_{1}$	$^{-}-_{-}$	$^{-}-_{-}$	$^{3}1_{1}$	$^{3}1_{1}$	$^{-}-_{-}$	$^{2}-_{-}$	$^{3}1_{2}$	$^{3}1_{2}$	$^{-}-_{-}$	$^{1}-_{-}$
MARKET INSPECTION	$^{1}-_{1}$		$^{-}-_{2}$	$^{1}-_{1}$	$^{-}-_{2}$		$^{1}-_{2}$	$^{1}2_{-}$	$^{1}-_{2}$		$^{-}-_{1}$	$^{1}-_{1}$	$^{2}-_{1}$		$^{3}-_{-}$	$^{2}2_{-}$	$^{1}-_{-}$		$^{-}-_{-}$	$^{3}1_{-}$	$^{-}-_{1}$		$^{-}-_{-}$	$^{1}1_{1}$
LIMIT HABITAT ALTERATION	$^{2}-_{1}$	$^{2}2_{1}$	$^{-}-_{1}$	$^{3}-_{-}$	$^{1}-_{2}$	$^{1}3_{2}$	$^{-}-_{1}$	$^{3}-_{-}$	$^{1}-_{2}$	$^{1}1_{2}$	$^{-}-_{1}$	$^{3}-_{-}$	$^{1}1_{2}$	$^{1}2_{1}$	$^{-}1_{1}$	$^{2}-_{-}$	$^{1}-_{1}$	$^{1}-_{1}$	$^{2}-_{1}$	$^{2}-_{-}$	$^{1}-_{1}$	$^{1}-_{1}$	$^{-}-_{-}$	$^{2}-_{-}$
ESTABLISH HATCHERIES	$^{1}-_{1}$				$^{1}1_{-}$				$^{-}1_{-}$				$^{-}2_{1}$				$^{2}-_{-}$				$^{-}1_{-}$			
HEADSTARTING	$^{-}-_{-}$				$^{-}-_{-}$				$^{-}-_{-}$				$^{-}1_{-}$				$^{2}-_{1}$			$^{1}-_{-}$	$^{1}-_{-}$			
REDUCTION IN INCIDENTAL CATCH			$^{2}3_{2}$	$^{1}1_{1}$			$^{1}3_{2}$	$^{1}1_{-}$			$^{-}1_{3}$	$^{1}1_{-}$			$^{1}2_{1}$	$^{1}1_{-}$			$^{4}-_{1}$	$^{3}1_{-}$			$^{1}2_{1}$	$^{2}1_{-}$
PROTECTION OF FORAGING AREAS			$^{-}3_{3}$	$^{-}-_{1}$			$^{2}3_{1}$	$^{-}-_{1}$			$^{1}-_{1}$	$^{-}-_{1}$			$^{-}-_{-}$	$^{-}-_{2}$			$^{2}-_{-}$	$^{-}-_{1}$			$^{-}-_{1}$	$^{1}-_{1}$
PROTECTION OF MIGRATION ROUTES			$^{-}-_{1}$	$^{-}-_{1}$			$^{-}2_{2}$	$^{-}-_{-}$			$^{-}-_{4}$	$^{-}-_{-}$			$^{-}1_{1}$	$^{-}-_{1}$			$^{1}-_{-}$	$^{-}-_{-}$			$^{-}-_{1}$	$^{-}-_{1}$
CONTROL OF SPECIAL USES	$^{1}-_{-}$		$^{-}-_{-}$	$^{1}-_{1}$	$^{1}-_{-}$		$^{1}-_{2}$	$^{1}1_{1}$	$^{1}1_{-}$		$^{-}1_{1}$	$^{-}-_{1}$	$^{1}-_{-}$		$^{1}-_{-}$	$^{3}1_{1}$	$^{2}-_{-}$		$^{1}-_{-}$	$^{3}-_{-}$	$^{-}-_{-}$		$^{1}-_{-}$	$^{2}-_{1}$

Legend: Essential, Critical = upper left; Very Important = Center; Needed = lower right.

MANAGEMENT OPTIONS MATRIX

Summary Table B: Weighted Sums of Opinions.

SPECIES:	Loggerhead				Green				Leatherback				Hawskbill				Kemp's Ridley				Olive Ridley				
OPTIONS / LIFE HISTORY STAGE	EGGS	NESTING	ADULTS	ALL	EGGS	NESTING	ADULTS	ALL	EGGS	NESTING	ADULTS	ALL	EGGS	NESTING	ADULTS	ALL	EGGS	NESTING	ADULTS	ALL	EGGS	NESTING	ADULTS	ALL	TOTALS
SPECIFIC LEGISLATION	8	0	2	23	0	1	4	31	8	4	2	27	4	3	4	27	0	0	0	25	4	4	0	21	202
BEACH PATROL	15	15	6	9	20	21	4	16	10	16	4	12	13	15	0	0	15	15	0	8	16	16	0	4	250
MARKET INSPECTION	5		2	5	2		6	8	6		1	5	9		12	12	4		0	14	1		0	7	99
LIMIT HABITAT ALTERATION	9	13	1	12	6	12	1	12	6	8	1	12	8	9	3	3	5	5	9	8	5	5	0	8	161
ESTABLISH HATCHERIES	5				6				2				5				8				2				28
HEADSTARTING	0				0				0				2				9			4	0				15
REDUCTION IN INCIDENTAL CATCH			16	7			12	6			5	6			9	9			17	14			9	10	120
PROTECTION OF FORAGING AREAS			9	1			15	1			5	1			0	0			8	1			1	5	47
PROTECTION OF MIGRATION ROUTES			1	1			6	0			4	0			3	3			4	0			1	1	24
CONTROL OF SPECIFIC USES	4		0	5	4		6	7	6		3	1	4		4	4	8		4	12	0		4	9	89
TOTALS:	46	28	37	63	38	34	54	81	38	28	25	64	45	27	35	58	49	20	42	86	28	25	15	65	
	174				207				155				165				197				133				

4.14.2 Audience Response

Comment by E. Roet:

Hawksbills are being exploited. We do not know all of the routes for trade, but Japan figures prominently in this trade. We need more data on the status of stocks and the degree of exploitation. We also need international cooperation and cooperation in the wider Caribbean region.

Response:

None.

Comment by R. Kennedy:

I am aware of decreases in sea turtle populations, but we must still consider man's needs. Therefore, more emphasis should be placed on turtle culture, rather than protecting and transplanting eggs and headstarting. We must help man as well as conserve turtles.

Response:

None.

Comment by N. Mrosovsky:

I would like to ask John Beddington what he thinks about the utilization of "doomed eggs" (eggs that are laid below the high tide line)? Also, does he think it would be safe or relatively safe to harvest some eggs from arribadas where many eggs are either dug up by other turtles, or rot in the ground later?

Response:

Beddington was not present.

Comment by J. Fretey:

Many people on different panels have talked about the sex-temperature relation. I would like the Chairman of this panel to give recognition to Claude Pieau, a French scientist who discovered the relation sex-temperature more than 10 years ago, in swamps where turtles are found. We all are grateful.

Response:

Yes.

Comment by F. Pacheco:

At the Management Options panel some possibilities of turtle egg management were discussed in reproduction projects. In the Symposium some people have talked against the possibility of projects involving nest manipulation, stating this procedure was a threat to the natural stocks. In view of the not very consistent opposition supporting this last statement, we would like to ask Ross Witham for his opinion of the repopulation and experimental culture of green turtles in the Tortuguero area, now being considered by the Universidad Nacional (UNA-Costa Rica) and JAPDEVA (governmental institution). Will it be possible to conduct these activities without negatively affecting the natural stocks?

Response by R. Witham:

Headstarting is a positive program in turtle management. Our Florida headstarting program has been in operation for about 13 years and we believe the larger numbers of green turtles nesting off southeastern Florida now may be due to our work, although no headstarted turtle has ever been found nesting. I believe temperatures of nests are not adversely affecting sex ratio.

5. FUTURE ACTIONS

5.1 Rapporteur Report of the Future Actions Session

CHAIR: Manuel M. Murillo

PANEL: National Representatives

The Chairman opened the session by acknowledging recommendations that had already come from the previous Chairpersons and National Representatives. He stated the objective of this session was to discuss and point out action for the future based on previous Symposium sessions and discussions.

Robert Lankford, Administrator to the WATS, was called upon to outline the procedures to be followed for discussion in this Future Actions Session, which were as follows:

(1) The session was directed at National Representatives.

(2) Decisions and recommendations made would be limited to those made by National Representatives;

(3) The document entitled, "Western Atlantic Reef Resources," was only an information document to stimulate discussion and would not be dealt with during this session (the document is annexed to this report).

The Chairman outlined the agenda for discussion which was as follows:

1. Suggestions for Future Options

   a. Critical Areas.
      i. Research extension/expansion/coordination.
         - Continuation of WATS data base, in support of regional, sub-regional and national activities.
         - Selected future surveys.
      ii. Training activities under IOCARIBE-sponsored TEMA.

   b. Development of a specialized data base synopses, based on the national reports.

   c. WATS Newsletter on IOCARIBE letterhead.

   d. Follow-through for WATS in 1987.

   e. Formation of Steering Committee for WATS continuation.

2. Evaluation and Potentials

   a. Formation of a IOCARIBE-sponsored permanent entity, WATS-Commission, for the promotion of research and related activities on a regional basis.

   b. Possibilities for the utilization of the WATS format for other pan-Caribbean species problems.

The Chairman then opened discussion to the National Representatives.

GORDON: (National Representative of the USA). Opened the discussion stating that he believed that the WATS Symposium had succeeded in establishing a strong interest within the countries represented in the management and conservation of marine turtles in the western Atlantic region. He stressed the need to continue to carry out further research and collect data. In order to carry out the commitment to continue data acquisition and to address the need to improve the quality and quantity of data, he said that the United States National Marine Fisheries Service offers to maintain the data base, acting as an intermediary until a more permanent body is formed or in operation, in the following manner:

(1) Maintain and receive additions to the sea turtle data base that has been developed from the national reports;

(2) Develop and distribute the results of an annual canvas of National Representatives to attendees at WATS;

(3) On an annual basis act as a clearing house for related information such as research techniques, management actions, and lists of research workers and interests;

(4) Offer advice and technical help in developing up-dated national reports.

JOSEPH: (National Representative of Antigua). Stressed the necessity for more research and of the need for developing countries to receive external funding to carry out such research. He strongly recommended that WATS institute a training program whereby persons from countries in the region can get technical training at institutions where sea turtle research is being undertaken.

HUNTE: (National Representative of Barbados). Recommended that efforts be made to improve the WATS data base and that countries strive to continue sea turtle surveys. He emphasized that in many countries manpower may be a limiting factor in carrying out such surveys and called upon countries represented to indicate if this is a problem. He made a plea for countries where the infrastructure exists for fishery data collection that efforts be made to collect as detailed data on turtles as possible.

FINLAY: (National Representative of Grenada). Stated that in many of the smaller Caribbean countries collecting landing data is difficult. Manpower is limited and turtles seldom enter the market, but are usually sold at the landing site. He recommended development of objective surveys which may be conducted to determine the status of the turtle populations in such countries. He also stressed the need for direction and guidance from qualified persons who can advise on what data should be collected and how to analyze such data.

BURNETT-HERKES: (National Representative of Bermuda). Supported the comments of the representative of Grenada. He agreed that WATS should continue with improvement of the WATS data base. He stressed the need for training of biologists and fishery managers in the region and the need to standardize data collection. The data base should contain information on who the workers are in various fields of turtle research and stock assessment and what type of information they would be interested in obtaining. Also, research should place emphasis on foraging areas to learn more about sub-adult animals using tag-release programs, census of reefs by diving, etc. He stressed the need to make educational materials available on sea turtles' life histories and conservation to continue throughout the region.

RICHARDSON: (National Representative of Anguilla). Supported the recommendation made for training of officers in research methods and data collection. Also the need to standardize the data collection system.

INCER: (National Representative of Nicaragua). Made the following contribution to the discussion: We should;

(1) Develop strategies for national, sub-regional and regional policies for the conservation of sea turtles in the Caribbean,

(2) Explore each country's interests, capacities to act, and limitations, and

(3) Explore regional and international interests in cooperation.

Diagnose the needs for research, management capacity, training of personnel, and the exchange of information. Categorize cooperation and projects based on:

(1) Confirmed regional interest,

(2) Confirmed sub-regional interest by two or more countries' national interest,

(3) Status of the resource with its recovery in view,

(4) No duplication of efforts. Trend to assign projects to the best "interests" of the turtles and not of the countries,

(5) Identification of critical nesting and foraging areas in order to save them,

(6) The need for personnel training in order to follow-up on projects' demands.

POLANCO: (National Representative of Mexico). Commented as follows:

Statistical Information (Item 1.a.i from the WATS data base)

Information exchange would be limited by the difference in statistical nomenclature, for example:

(1) Species identification,

(2) Weight concepts (for example, landing weight or fishery catch), and

(3) Statistical integration units (for example, number of animals, kilograms or pounds, number of skins, weight of skins, etc.).

Training (Item 1.a.ii)

Make an effort to summarize and synthesize information for training purposes. Mexico requires this be done and offers the regional organizations (WATS-IOCARIBE) the contribution of the above.

Research Expansion (Item 2.a)

Synthesis is required to suggest those fields of research which are more profitable and effective. For example, in the field of enforcement and regulations we are in need of more scientific information in order to be more effective.

AROSEMENA: (National Representative of Panama). Expressed concern for funding of turtle research and data collection. The government of Panama is interested in turtle management and conservation but funding to collect data and conduct necessary research is a problem. She proposed the possibility of developing countries submitting research proposals to international organizations for funding.

MURRAY: (National Representative of St. Lucia). Suggested the setting up of national management areas for the WATS area under a WATS Commission to maximize the use of turtle resources and pool these resources both in terms of man-power and "hardware" resources. Recommended that one selected survey be done on subsistence utilization of turtle stocks to enable a determination of whether or not stocks can tolerate this compromise between total protection and existing utilization.

GREGOIRE: (National Representative of Dominica). Pointed out that trade in turtle products encourages fishing effort on these species. Recommended a regional network be developed to control and discourage trade in turtle products.

MARIN: (National Representative of Honduras). Emphasized the need for more information on incidental catch of turtles. Recommended

WATS develop a special questionnaire for distribution to fishermen. She also pointed out the difficulties of getting reliable information from fishermen if they think such information is wanted by the government of the countries concerned.

MORRIS: (National Representative of St. Vincent). Supported the recommendations made by the other representatives concerning the need for training of personnel within the region. Recommended information in the WATS data base be made available to the Lesser Antilles this year in Antigua. This meeting will be dealing with harmonization of fisheries legislation within the Lesser Antilles region, particularly in light of the recent passing of the Law of the Sea Treaty.

CLARKE: (National Representative of Bahamas). Agreed with the Honduras representative on the difficulty of collecting data from fishermen and stressed the need for more trained manpower in the field to collect data.

FINLAY: (National Representative of Grenada). Suggested that perhaps countries within the region should be encouraged to enforce their regulations covering sea turtles. Protect the turtles until we have the necessary data to develop proper management plans. He stressed the need for a region-wide effort to collect simple data from fishermen and other field work.

ROYER: (National Representative of Jamaica). Suggested that WATS look into whether or not questionnaires developed asked for all the information that is felt necessary. Also recommended a survey be carried out in the region to determine what impact, if any, spearfishing had on turtle populations. Jamaica will use their field workers, about 20, to collect specific turtle data.

INCHAUSTEGUI: (National Representative of the Dominican Republic). Suggested that WATS send a summary of the information in the data base and recommendations made at this Symposium directly to the respective country government officials.

CHAIR: Stated that WATS works with the governments of the countries in the region and the information is channeled through the National Representatives.

KAVANAGHT: (National Representative of Haiti). Recommended that a Scientific Team be established to supervise and work in the countries. During the years between WATS I and WATS II members of this team could visit countries to provide assistance with research and data collection. Also, recommended that a questionnaire be developed and sent out to National Representatives on an annual basis for their completion. The purpose of the questionnaire is to enable each country to add new information to the data base annually.

The Chairman briefly summarized the recommendations for future actions as follows:

(1) Strengthen the WATS data base,

(2) Encourage training in countries where training is needed,

(3) Maintain coordinating organization of the WATS, and

(4) Accept proposal made by the USA delegate for NMFS to act as a clearing house for information generated by countries in the region on turtles.

The National Representatives agreed that a specialized data base synopsis, based on the national reports, needs to be developed and supported by the Chairman's recommendation that the proposal made by the USA National Representative in respect to the NMFS offer of assistance in this regard be approved.

The Chairman recommended and the National Representatives endorsed that the existing WATS Steering Committee continue into WATS II. It was pointed out that the present Steering Committee and Technical Team had done an outstanding job in putting together WATS I and there was no reason to form new committees.

The National Representatives agreed with the Chairman's recommendation that it would be desirable to have a WATS newsletter on IOCARIBE letterhead. The National Representative of Barbados requested details on type of newsletter proposed. It was pointed out by Bob Lankford that production of newsletters, particularly in two languages, is a time consuming job and in producing a newsletter you first require finance and then some person to do the work. The Steering Committee is to look into development of a suitable WATS newsletter.

The National Representatives agreed that there should be a follow-up WATS II meeting. The Chairman charged the present Steering Committee to continue their work and begin organizing a WATS II meeting to be held in 1987.

As an introduction to item 2(a) on the agenda, Bob Lankford gave a brief history of IOC and IOCARIBE and their respective mandates. The National Representatives, based on Bob Lankford's remarks, recommended to the Chairman that the formation of a WATS Commission be put on the agenda of the Fourth IOC Meeting.

The Chairman then introduced item 2(b) on the agenda which is the document entitled "Western Atlantic Reef Resources." He directed the National Representatives to comment on the format of WATS and the applicability of this format to other resources. Also, which resources should be subject to this approach if it is deemed appropriate. Comments were as follows:

<u>GORDON</u>: (National Representative of the USA). Endorsed concept of 2(b); however, felt that funding of such a symposium may be a problem. He offered to send the National Representatives a copy of the U.S. Spiny Lobster Management Plan.

POLANCO: (National Representative of Mexico). Felt it was important to develop this scheme for other resources; however, not in a position to express comments on this item because it has not previously been considered by the Mexican government prior to this meeting.

BURNETT-HERKES: (National Representative of Bermuda). Welcomed other species symposia and recommended that lobsters would be a good starting point. He felt that success of such a symposium as WALS depended to a large degree on support from the U.S. National Marine Fisheries Service as we have had for WATS.

MARIN: (National Representative of Honduras). Supported extrapolating the WATS format to other resources such as lobsters.

INCER: (National Representative of Nicaragua). Believed the WATS format could be applied to other resources and recommended that we begin developing such programs for other resources, in particular, sea mammals and the reef community.

AROSEMENA: (National Representative of Panama). Supported utilization of WATS format for other resources, in particular, the spiny lobster.

MURRAY, JOSEPH, CLARKE: (National Representatives of St. Lucia, Antigua, and Bahamas). Strongly endorsed remarks made by other National Representatives and recommended that we begin to develop such programs.

On this issue the National Representatives recommended that Bob Lankford and Manuel Murillo have this item put on the agenda of the Fourth IOC meeting. There being no more to discuss, the session was adjourned.

5.2 Annex I to Future Actions Session

Western Atlantic Reef Resources (April 1, 1983)

Phase 1: Western Atlantic Lobster Symposium (WALS)

Introduction:

The spiny lobster resource of the Greater Caribbean Basin is one of great value and greater potential. Annual landings for spiny lobster in the basin (including Brazil) are about 30,000 metric tons (FAO, 1980) with an estimated potential of 40,000 tons (FAO, 1981).

Throughout the Caribbean Basin, including the Central and South American seacoasts, one of the major ecosystems supporting harvestable marine resources is the reef complex. The best known and most valuable species groups are the lobsters and the snapper/grouper complex. Biological and economic overfishing in areas of the Caribbean have caused economic hardships on resource users as well as biological problems with lobster populations.

Because of ocean currents and the extended planktonic larval stage of the spiny lobster, recruitment, and harvestability of this species are uniquely pan-Caribbean conservation and management issues. Of major concern is biological overfishing and the unavailability of conclusive data regarding exchange between various geographic spawning areas within the species range.

Much more extensive biological and socio-economic data bases are necessary to effectively manage the spiny lobster resource. Only very preliminary fishery management decisions can be made on the basis of present data (Caribbean Fishery Management Council, 1982). What is needed now is local population data and knowledge of factors that affect recruitment. A Western Atlantic Lobster Symposium (WALS) could address these problems.

Scope of WALS:

(1) Develop and apply research framework that will provide a coordinating mechanism for scientific research and training dealing with reef resources in the IOCARIBE sphere, with particular emphasis on spiny lobsters.

(2) Secure official participation and support of the potentially 38 countries that will benefit from the outcome of WALS.

(3) Conduct a symposium sponsored by IOCARIBE to be held within four years. The symposium will cover both basic and applied fisheries research and would emphasize pan-Caribbean activities in conservation, utilization, culture, environmental dependence, and management regimes.

Structure:

A standing Steering Committee and Technical Team will be formed at the initial scoping meeting held under the auspices of the IOCARIBE secretariat. It is expected that additional membership will be appointed and institutions conducting pertinent research, as well as participating agencies, would be considered for committee or team membership. The two standing groups may well form subcommittees to address specific issues (standardization of research techniques, data base standards, training needs, and symposium format).

Objectives:

(1) Develop a Country Assessment Report dealing with discrete population and environmental parameters.

(2) Assemble data and information on spiny lobster biology, populations, socio-economic factors, and pertinent oceanographic and environmental parameters to form a regional data base.

(3) Prepare a report on the status of lobster stocks in the region.

(4) Evaluate and recommend future research requirements.

(5) Identify and review spiny lobster conservation and management options.

(6) Seek methods to promote international cooperation and mutual assistance in the scientific research and management of the spiny lobster resource.

(7) Conduct the symposium and distribute the results.

6. RAPPORTEUR REPORT AND SUMMARY OF THE SYMPOSIUM

CHAIR: Robert Lankford

CHAIR: Introduced the last session of the WATS, which for him was a great pleasure because this was the culmination of not only the Symposium, but also a number of years of hard work and dedication on the part of many people. He congratulated the rapporteurs and the chairmen, as well as the panels, who had done a fine job of compiling a complex body of information. Regarding the closing ceremonies, certain logistic problems of getting reports from the rapporteurs approved, edited, typed, and translated had been overcome. A number of these have been approved and could now be presented, as follows: He asked each panel chairman to affirm the validity of his report and then the National Representatives to approve its contents.

BACON: Reported that all reports have been approved by the panel chairmen.

CHAIR: Noted the session was a little bit ahead of time. The first report, which had been circulated, was the green turtle species synopsis. The Chair asked for comments or objections from the floor, if not, he would take this report as approved. Green turtle species synopsis, distributed and approved. Loggerhead turtle species synopsis, approved. Kemp's ridley turtle species synopsis, approved. The next is the olive ridley turtle species synopsis.

There were several questions from the floor concerning details of these reports and how delegates were expected to approve reports they had just received.

CHAIR: Stated that the hawksbill biological report was still with the translator. The next report was the leatherback species synopsis, which was presently only a rapporteur's report. The biological data was still with the translator. The Chairman promised to get everything cleaned up and mailed within the next 10 days, in English or Spanish. He asked members to be aware that the material which will be presented, will be the same material which will go to the editorial committee headed by Dr. Bacon, which will then modify certain phrasing, etc. for the publication in the final transactions. Everyone gets a copy of the transactions, that is, all registered participants.

MARIN: Proposed that in view of the fact that the reports had been handed out very rapidly, and representatives had not reviewed them, they could not be approved. She suggested they be approved provisionally. However, each one can do a more meticulous review later and hand any comments to the panel chairs, so that the changes can be corrected.

CHAIR: Thanked the delegate from Honduras for this very, very pleasant intervention.

INCER: Nicaragua supports totally the suggestion from the Honduranian representative and thinks this is the most practical exit from these complications. APPLAUSE!

CHAIR: Agreed that, as had been suggested to the floor, representatives be asked to approve in principal the reports as they presently stood and in the future, upon distribution, if there are particular objections, communicate directly with the panel chairman. This applies also to the remaining reports. We have all the reports and all have been approved by the panel chairmen: conservation panel chairman, culture panel chairman, and enforcement and regulation panel chairman. Status of species report, management options.

JOSEPH: In regard to corrections to the rapporteurs reports and all the panel sessions, suggested that the National Representatives take three to four hours that evening and reviewed them and then present the corrections afterwards if that was at all possible.

CHAIR: State this would not be possible because there were logistic problems. This would be done by mail within the next two weeks. The Chair said he would entertain a motion from the floor to accept the report as it has been presented with the conditions stated.

MARIN: Asked to make a comment. Congratulations to the floor and the Steering Committee for the way they had concluded this Symposium which she considered to be a total success and was happy to have been there.

CHAIR: The Chairman thanked her very much. On behalf of all the workers, he appreciated the comment.

MURRAY: Agreed to move the motion.

HUNTE: Asked for an opportunity, assured that he could confidently speak on behalf of the National Representatives to thank IOCARIBE and WATS for giving the opportunity to attend this Symposium. He probably also spoke for everyone when he said that we have gained tremendous information and insights in the past week and asked for a round of applause from the National Representatives as a gesture of appreciation. APPLAUSE!

MURILLO: Stated that in first place, important events always end in simple, but meaningful actions. He wanted to take a moment to give thanks for the collaboration, the compromise, and the interest with which all have participated in this Symposium. The success, if one could speak of success up to this point of WATS, will be precisely the reception received from all, the contributions from each one of the participating countries, the elaboration of the national reports, the seriousness of scientific contributions, and the environment of harmony in which the panel sessions of the symposium developed. Even though there was not agreement over some of the critical aspects, as expected, investigation and recent data have been received. To IOCARIBE, to the Steering Committee of WATS, to the Technical Team and to the local Costa Rican Committee, it has been an honor to receive this responsibility to organize this event. The effort done has been returned with all contributions and comments. IOCARIBE hopes to have contributed with the organization of this Symposium to establish a communication base, which was badly needed for the Caribbean region, and hopes to receive from representations and the countries they represent, also ,rom the scientific community and the general community, suggestions and recommendations for future work. He expressed thanks to the participants of the committees that have worked here, to the Steering Committee for its commitment, to the Scientific Committee for the assistance given to the elaboration of the national reports, to the Local Committee because it has made possible and simplified the work concerning logistics, and to the management supporting team, the group of secretaries, translators, and students that have been working intensively for the success of this Symposium. IOCARIBE wished to reaffirm commitment to the regional countries in order to make an efficient organism that works to promote science and human resources for science in the region. It is hope that the tasks given in the future can be accomplished as successfully as this WATS I, and that the harmony and friendship that have been built during these days allow us to interchange information to the benefit of the conservation and adequate management of a resource that is critical for all the countries within the region.

The Chairman expressed his thanks and closed the Symposium.

APPENDIX 1: A Glossary of Terms*

Prepared by C. Kenneth Dodd, Jr.

ADULT: A member of the population that has reached sexual maturity. Sea turtles may reach sexual maturity at different sizes rather than after a certain number of years; hence, the age at sexual maturity may be quite variable and dependent on a number of factors, such as amount and quality of food sources.

ALVEOLAR: Pertaining to the functional, or biting, part of the jaw.

AQUACULTURE: The process of raising aquatic organisms in a controlled environment for commercial purposes. See: farming and ranching.

ARRIBADA: The emergence of an aggregation of ridley turtles onto nesting beaches. Copulating pairs congregate in large numbers followed by mass nesting of females, generally over a period of several days. The function of arribadas and the cues by which they are formed are a matter of much speculation. Terms such as arribazons, morrinas, and flotas are synonyms.

AXILLARY NOTCH: The notch in the front part of the shell into which the front leg fits.

BEACH RENOURISHMENT: The process of replenishing sand on a beach due to loss from erosion. Since the new sand may have characteristics (compaction, grain size, etc.) different from the natural sand, renourished beaches may not be as attractive to nesting turtles as natural beaches.

BEAK: The horny covering of the jaws, in turtles consisting of a single plate over each jaw surface. Also known as rhamphotheca or tomium.

BICUSPID: Having two cusps.

BIFURCATE: Having two branches.

BODY PIT: The depression dug by the female turtle during nesting. Body pits are characteristic of different species and range

*This glossary contains terms that were used during the Symposium which may not be familiar to some attendees. Further explanation of many of them is contained in the IOCARIBE/WATS Sea Turtle Manual of Conservation and Research Techniques.

from shallow (ridleys) to rather deep (leatherbacks) and may persist for months under certain conditions. The center of the body pit usually does not indicate the position of the eggs.

BREEDING: The process of copulation or the physiological conditions of taking part in or being ready to take part in the process of producing offspring. Breeding is thought to usually take place off the nesting beach although it occasionally has been recorded along migration routes and in areas far from suitable beaches. The term breeding is sometimes used interchangeably with "nesting" or with "mating" (i.e., copulation).

BRIDGE: The part of the shell of a turtle that connects the carapace and the plastron.

CALIPASH: The dorsal layer of gelatinous fat in the body and that of the flippers, generally greenish in color. Used in making soup.

CALIPEE: The cartiladge from the ventral surface of the body, primarily from the plastron. Also used in soup making. The word "calipee" is often used today to include calipash.

CALLOSITY: A roughened area of skin, sometimes with superficial, sculptured bone exposed or just below the surface.

CARAPACE: The dorsal shell of a turtle.

CARUNCLE: The horny tubercle on the snout of a baby turtle used to cut through the eggshell.

CAUDAL: Pertaining to the tail.

CITES: An acronym for Convention on International Trade in Endangered Species of Wild Fauna and Flora. CITES is an international trade agreement to monitor and control trade in species listed on its appendices. All sea turtles are listed on Appendix I, the most restrictive appendix. As such, unless reservations are taken, commercial trade in wild specimens or products is prohibited among member countries.

CLUTCH SIZE: The number of eggs deposited in a nest.

COMMENSAL: An organism in a symbiotic relationship with another organism in which one member of the association (the commensal) derives an advantage and the other derives neither an advantage nor disadvantage. Barnacles are common commensals on sea turtles.

CONSERVATION: A careful preservation and protection of something, especially with regard to planned management of a natural resource to prevent destruction, neglect, or unwise exploitation.

COSTAL BONES: The bones of the carapace lying between the neural and the peripheral bones. The lateral (also called pleural or costal) scutes roughly overlie these bones.

CRAWL: The tracks of a turtle on the beach. "Track" is used synonymously with crawl. See: false crawl.

CUSP: A sharp projection, typically from the edge of the jaw.

DEVELOPMENTAL HABITAT: The place where immature turtles feed and grow prior to reaching adult size. The developmental habitat of sea turtles may or may not correspond to the adult habitat and thus may require special conservation and management measures.

DISORIENTATION: The result of using inappropriate cues for moving in a particular direction. For instance, hatchling sea turtles will move inland toward street lights instead of correctly toward the sea, and are thus said to be disoriented.

DOOMED EGGS: Eggs in natural nests which are likely to be destroyed during the course of incubation by natural, predictable causes, particularly beach erosion or extended tidal flooding.

EFFECTIVE POPULATION SIZE: The number of reproducing individuals in an ideal (i.e., Mendelian) population. See also: population.

ELECTROPHORESIS: A technique for separating molecules based on their differential mobility in an electric field. Each type of molecule has a specific electrical charge, a specific attraction to the solution in which it is kept and a specific molecular weight. All of these characteristics "finger print" the compounds in a solution so that they can be separated (here, largely on the basis of electrical charge) from other molecules.

EMERGENCE:

a. female. The action of the female turtle leaving the water and coming onto land to nest.

b. hatchling. The hatchlings leaving the nest cavity on their way to the sea. This may not necessarily occur immediately after hatching from the egg.

EMERGENCE TIME: The amount of time it takes the female to leave the water and begin nesting, or the time between hatching and the emergence of the hatchlings from the nest.

ENDANGERED: Any taxa likely to become extinct within the forseeable future if those factors responsible for their status continue operating.

ENZYME: A protein complex produced in living cells which, even in very low concentration, speeds up certain chemical reactions but is not used up in the reaction. See also: protein.

EVOLUTION: See "natural selection" first. A cumulative change in the inherited characteristics of groups of organisms which occurs in the course of successive generations related by descent. Evolution, a process, is defined as the result of "natural selection," and has no predetermined endpoint. As natural selection determines the composition of a population over time, it results in a shift of population characteristics. This shift is usually in the direction favored by the "environment" during each contributing generation. The descendant organism may carry any degree of resemblance to its ancestor depending upon the nature and intensity of natural selection and the span of time (or generations) between them. In its extreme case, the descendant may bear only a very subtle resemblance to the ancestor, or may be very similar.

EXTINCT: A species, subspecies, or population that no longer exists is extinct.

EXTINCTION: The man-induced or natural process whereby a species or subspecies ceases to exist. May be used to describe the same process at the population or other levels.

FALSE CRAWL: The track left by a sea turtle that has ascended a beach but returned to the sea without laying eggs.

FARMING: The practice of culturing sea turtles in a closed-cycle system for commercial purposes. Farming does not rely on wild populations except initially, and later occasionally, to maintain genetic diversity and avoid problems with inbreeding.

FERTILIZATION: The fusion of two gametes of opposite sex to form a zygote.

FORAGING: The process of looking for food. Areas where turtles feed are referred to as foraging habitat.

GAMETE: A mature reproductive cell capable of fusing with another similar cell of the opposite sex to produce a zygote (i.e., a sex cell).

GENE: The unit of heredity (or inheritance) located in the chromosome. Interacting with other genes, it controls the development of hereditary characters. The gene is a small segment of the DNA (deoxyribonucleic acid) molecule that bears the information specifying the amino acid sequence for a particular protein or a major peptide chain (molecule made up of amino acid chains).

GENE POOL: The sum total of genes in a breeding population. See also: gene and population.

GROUND TRUTH: Correlation between aerial surveys and beach surveys on a particular section of beach to obtain an estimate of the numbers of nests and false crawls. The number of nests and false crawls from beach surveys (ground truth) is then compared with the numbers from aerial surveys to gain an index of the accuracy of aerial surveys on sections of beach where beach surveys are not possible or too time consuming.

GULAR SCUTE: The frontmost (paired, occasionally single) scute of the plastron, except in sea turtle species where the paired gular scutes are separated by an intergular scute.

HABITAT: The specific place in the natural environment where an animal or plant lives.

HALF-MOON TRACK: A semicircular or similar shaped track made by a turtle that emerged from the sea but turned around and returned almost immediately without nesting.

HATCHERY: A man-made structure or enclosed area constructed for the incubation of eggs. Hatcheries may be relatively simple (i.e., a fence built around an area to which many nests have been moved) to complex (i.e., a building constructed to hold styrofoam boxes of incubating eggs).

HATCHING: The process of leaving the egg after development is completed. See: emergence, hatchling.

HATCHLING: A turtle that has recently emerged from the egg.

HEAD-STARTING: The experimental practice of raising hatchling turtles in captivity for the first months of life which may give them a better chance of survival when released.

HYBRID: An offspring of a cross between two genetically dissimilar individuals. Such an individual will exhibit a mixture of characteristics of both parents. The resemblance may be stronger to one parent than the other depending upon the influence of a variety of allelic interactions.

HYBRID INVIABILITY: The loss or reduction in vigor/fitness of hybrids.

HYBRID STERILITY: The sterility of hybrids.

HYBRID VIGOR: The increased behavioral or biological success and fitness of hybrids. A synonym for heterosis.

IMBRICATE: Overlapping, as the shingles of a roof or the scutes of the carapace of a hawksbill turtle.

IMMATURE: An animal that has not reached sexual maturity.

IMPRINTING: The hypothetical process by which a hatchling turtle receives a lifelong impression of its natal beach that enables it to recognize appropriate cues and relocate the beach when it has become an adult.

INBREEDING: The mating of closely related individuals.

INCIDENTAL CATCH: The capture of a species (such as a sea turtle) while fishing for another species (such as shrimp).

INCUBATION: The process of development between egg laying and hatching. In sea turtles, incubation may last up to 50-75 days depending on the temperature and species involved.

INFRAMARGINAL PORES: Pores located near the rear of the inframarginal scutes. These pores are only found in the ridleys. The pores conduct secretory products to the surface, but the function of these products is unknown.

INGUINAL NOTCH: The notch behind the bridge and in front of the hind limb of a turtle.

INTERNESTING INTERVAL: The amount of time between successful nestings within a nesting season. This period is usually 10-17 days for most species, but up to 28 days for ridleys.

INTERSEX: Abnormal individual which is intermediate between the two sexes in characteristics, having all its cells of identical genetical composition. This may occur through failure of the sex determining mechanism of genes, or through hormonal or other influences during development.

JUVENILE: A turtle past the yearling stage but a long way from adulthood. Inasmuch as wild sea turtles may take up to 50 years to reach sexual maturity, and that different species and even populations within a species have different growth rates, the distinction between a juvenile and subadult is not well defined. This distinction is further complicated in that there may be no correlation between size and age.

KARYOTYPE: The chromosome complement within the nucleus of a cell or organism, characterized by the number, size, and configuration of the chromosomes, usually described during mitotic metaphase of cell division. When these are described in the literature, the author has photographed a cell in mitotic metaphase, cut out and lined up (usually in decreasing size) the outlines of the chromosomes. The number and shape for these is species specific.

KRAAL: An enclosure. With regard to sea turtles, a protected enclosure around nests on a beach. See: hatchery. Traditionally, the term kraal means a pen in the water used for holding turtles for a few days to several months before slaughter.

LIVING TAGS: Grafts of tissue transferred from one part of the body to another. This is an experimental technique of marking hatchling sea turtles in a manner in which they may be recognized years later as juveniles and adults. The technique involves grafting tissue from one part of the turtle (for instance, a disk from the plastron) to another part (for instance, a particular section of the carapace). In theory, the grafted tissue will grow normally in the new location and thus provide a conspicuous marker of living tissue. Experiments to date have involved gouge, disk, pocket, and reversed-plug grafts. While the results have been promising, it is still too early to determine if the technique will prove successful.

"LOST YEAR": The period of time between hatching and attainment of a carapace length of 20-30 cm during which sea turtles are epipelagic in habits and rarely encountered. May not actually be a period of one year.

MANAGEMENT: The science of working with the characteristics and interactions of habitats, wild animal populations, and humans to achieve specific goals.

MARGINALS: The scutes lying around the margins of the carapace. These more or less overlie the peripheral bones.

MENDELIAN POPULATION: An interbreeding group of organisms sharing a common gene pool. See also: population and gene pool.

MIGRATION: The directed movement of animals from one place to another. Sea turtle migrations usually involve feeding and nesting activities and are particularly striking in the greens and leatherback. The cues of orientation are still largely a mystery.

NATURAL SELECTION: The natural process by which organisms leave differentially more/less offspring than other individuals because they possess certain inherited advantages/disadvantages. Individuals of a species which possess certain inherited advantages which allow them to survive, reproduce and produce more offspring (i.e., are more "fit") than individuals without these advantages. On the other hand, individuals which have inherited disadvantages die too early to leave offspring or they are sterile or their offspring are less likely to survive than offspring of individuals with such disadvantages. That which is an advantage during one time, may at a later time become a disadvantage, because of changes in habitat, climate or other critical parameters. Species which have developed as a result of natural selection and have later become extinct, in the natural course of events, are examples of organisms whose advantages had transient value, being at first favored and then disfavored by natural selection.

NECROSIS: Death of tissues.

NEONATE: A recently hatched individual.

NESTING: The process of depositing eggs in a nest cavity on a beach. This is often used interchangeably with "breeding."

OLFACTION: Pertaining to the sense of smell. Olfaction may be involved in nest site selection, imprinting, and migration.

ORIENTATION CIRCLE: A circular pattern in the track made by a sea turtle, especially the leatherback, when the adult female is crawling up the beach to nest or moving down the beach towards the sea, or by hatchlings as they crawl to the sea. Thought to be related to direction-finding behavior.

OVIPOSITION: The process of depositing eggs.

PERIPHERAL BONES: The bones around the edge of a turtle's carapace that lie beneath the marginal scutes.

PHALANGES: The elongate finger or toe bones in the flippers.

PHENOTYPE: The visible properties of an individual that are produced by the interaction of the genotype and the environment. If a sea turtle carries characteristics in its genotype for several variations of shell color pattern, the phenotype of the turtle is only the specific color pattern which the turtle expresses. Contrasts with "genotype."

PHYLOGENY: The evolutionary history or geneology of a group of organisms.

PIVOTAL TEMPERATURE: The narrow range of temperature during the incubation of eggs at which there is an abrupt change in sex ratio of hatchlings from nearly all males to all females. The sex ratio at a particular temperature is a property of both the position and abruptness of the pivotal temperature. Synonymous with "threshold temperature" of some authors.

PLASTRON: The ventral shell covering the underside of a turtle.

POPULATION: A group of organisms belonging to the same species that occupy a fairly well defined locality and exhibit reproductive continuity from generation to generation. Genetic and ecological interactions are generally more common between members of a population than between members of different populations of the same species. See also: species.

PROTEIN: A molecule composed of a chain of amino acids which possesses a characteristic three-dimensional shape imposed by the sequence of its component amino acids.

RACE: (equivalent to subspecies). Generally meant to describe a set of populations which have a defined locality and are different in one or several characteristics from other populations of the same species. See also: subspecies, population, and species.

RAFTING: Refers to passive drifting, usually on another object. This term is sometimes employed in relation to green turtle hatchlings drifting in floating sargassum.

RANCHING: The process of raising sea turtles from eggs or hatchlings to some set market size for commercial purposes. This is not a closed-cycle system as it continuously relies on wild populations as a source for either eggs or hatchlings.

RARE: Taxa with small world populations that, while neither endangered nor threatened, are at risk.

RELICT: A persistent remnant of an otherwise extinct flora or fauna or kind of organism.

REMIGRATION: The return of adult turtles to a particular breeding area in succeeding years. Depending on the species involved, remigration usually occurs on a one (ridley), two, three, or four (most other species) year cycle. However, there are exceptions: Hawaiian male green turtles remigrate on a one-year cycle.

ROOKERY: The nesting location of populations of sea turtles. Rookery may refer to one species (for example, the green turtle rookery at Tortuguero) or to a general area of sea turtle nesting (for example, the Florida sea turtle rookeries).

SALVAGE: The retrieval of dead parts or whole animals for scientific information or record keeping.

SCUTES: The horny scales covering the bony carapace and plastron, except in the leatherback. The shape of the scutes does not mirror the shape of the underlying bones and they are named differently from the bones. Both are of taxonomic importance.

SEA-FINDING BEHAVIOR: The procedure whereby hatchling sea turtles correctly orient towards the sea upon emergence from the nest. The cues involved in this behavior are not well understood, although light is clearly important.

SEMISPECIES: Populations or subspecies which differ significantly but are not entirely reproductively isolated biologically (i.e., they may be still able to reproduce and bear fertile offspring). The genetically controlled mechanisms of behavior, physiology, or anatomy which control reproductive success are not entirely incompatible. See also: population, race, and species.

SERRATED: Having a saw-toothed edge.

SEX RATIO: The number of males divided by the number of females (sometimes expressed in percent) at fertilizaton (primary sex ratio), at birth (secondary sex ratio) and at sexual maturity (tertiary sex ratio).

SPECIATION: The process of species formation. See also: species.

SPECIES: A taxonomic term to describe a type of plant or animal which can interbreed successfully with members of the same type; these are reproductively isolated from members of all other types (or species). They may mate with similar organisms which are in the same genus and bear considerable resemblance to them but either cannot produce offspring as a result, or the offspring are sterile, or the offspring have distinct survival disadvantages. In some cases, they simply cannot mate because of morphological, behavioral, or physiological differences. See also: taxon and taxonomy.

STATUS OF STOCKS: The evaluation of the abundance of a particular harvestable species, and its potential for harvest. See stock.

STOCK: A management term which refers to a harvestable portion of a species living within a certain geographical area. A stock may include a portion of a biological population or several populations.

SUBADULT: A turtle approaching sexual maturity. See: juvenile.

SUBSISTENCE CAPTURE: Capture of sea turtles by peoples living in close contact with the sea when such capture is customary, traditional, and necessary for the sustenance of such individuals and their families or immediate kin groups. Such taking is not considered a part of external market-oriented commerce. Prior to the 1970's, the Miskito Indians of Nicaragua formed one of the best examples of a society based on subsistence capture of sea turtles.

SUBSPECIES: A named geographic race or a set of populations of a species that share one or more distinctive features and occupy a different geographic area from other subspecies. While breeding is possible and in many cases occurs between members of different subspecies of the same species, it is not as frequent as among members of a single subspecies. This is because of incomplete reproductive isolation. The edges of subspecies ranges frequently overlap and show gradual shifting from one subspecies to the other. The mixing which does not occur is prevented by their occupying different geographic locations and slightly different niches. Some subspecies are at an early stage of speciation. See also: species and population.

SURVIVAL RATE: The percentage of individuals surviving from one developmental stage, year class, or life stage to the next stage, or succeeding period.

SWIMMING FRENZY: The period of heightened activity or rapid swimming of hatchlings out to sea following the emergence from the nest. The swimming frenzy lasts up to several days depending on species or population involved and may aid the hatchlings in clearing the surf and reaching developmental habitat.

SYMPATRIC: Describing two or more populations of the same or different species that overlap in geographic distribution. See also population.

SYSTEMATICS: The study of evolutionary, including historic and genetic and phenotypic, relationships among organisms.

TAG: A metal or plastic marker, typically bearing a specific number of the turtle and address of the tagging individual or institution, which is attached to the turtle for future identification. Most tags are placed on the right front flipper, although the left front flipper, rear flippers, or even the rear margin of the carapace are also used. Most tags are either metal (inconel, monel, or titanium) or plastic. Returns of tags by fishermen and others provide clues to the movements of sea turtles.

TAGGING: Placing a metal or plastic marker on a turtle, usually on the front flipper, to aid in recognition when finding the animal on a subsequent occasion.

TAKE: Means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect a particular species or animal, or to attempt to engage in such activity.

TAXON: (pl. taxa). A unit of classification (e.g., a kingdom, phylum, class, order, family, genus, or species--includes subcategories of these as well).

TAXONOMY: The science of classification, of describing, naming and assigning organisms to taxa. Ideally, the classification is based upon systematic relationships, i.e., of inherited characteristics of behavior, morphology, physiology, or tissue and blood chemistry. Usually a combination of measurements and/or characteristics are used.

T.E.D.: An acronym for Turtle Excluder Device. A structure fitted to a trawl specifically designed to reduce incidental catch, specifically of sea turtles, and other non-target objects while maintaining normal levels of shrimp catch.

The U.S. National Marine Fisheries Service has developed a TED that is effective in reducing mortality of turtles while maintaining or actually increasing the catch of shrimp.

<u>TELEMETRY:</u> The use of electronic equipment to monitor the movements of animals. With regard to sea turtles, sonar and radio telemetry are most often employed, although satellite telemetry holds much hope for long distance tracking. Typically, an electronic device which emits a signal at a characteristic frequency is attached to the turtle's carapace. By tuning a receiver to that frequency, the turtle can be tracked from land, sea, air, or space. Unfortunately, most telemetry tracking requires the signal to be airborne to be transmitted, which restricts the amount of time it can be received.

<u>TEMPERATURE PROFILE:</u> Refers to the various temperatures encountered on a beach at different times of the day. Temperature profiles of the sand may be considered in both horizontal and vertical dimensions. The temperature profile may influence nest site selection and surely affects sex ratios and duration of incubation of eggs.

<u>THREATENED:</u> Taxa likely to become endangered within the foreseeable future. This is basically the same as the "vulnerable" category used by the International Union for the Conservation of Nature and Natural Resources.

<u>TORTOISE SHELL:</u> The scutes of the hawksbill turtle used in the manufacture of various items, particularly in jewelry. Green turtle scutes are sometimes also used but are harder to work, thin and generally do not have the same beauty of genuine tortoise shell.

<u>TUBERCLE:</u> A small lump or knotlike projection.

<u>VERTEBRALS:</u> The scutes of the carapace which overlie the backbone of the turtle (absent in the leatherback). May also be called central or neural scutes.

<u>YEAR CLASS:</u> All the animals in a population that hatched during a particular nesting season. The sizes of a particular year class can vary substantially after a few years depending on quantity and quality of food sources.

<u>YEARLING:</u> A turtle that has survived one year from the time of hatching. Depending on amount and quality of food, and the species involved, yearlings may vary in size.

<u>ZYGOTE:</u> The diploid cell formed by the union of egg and sperm cells. Also known as a fertilized egg.

APPENDIX 2: Abstracts of Poster Presentations

Braddon, Sylvia A. and Carol Furman

Sea Turtle Species Identification by Isoelectric Focusing Methods

USDC, NOAA, NMFS
Southeast Fisheries Center
Charleston Laboratory
Charleston, South Carolina USA

Six species of sea turtles are protected under provisions of the USA Endangered Species Act of 1973. These species are Eretmochelys imbricata, Lepidochelys kempi, Chelonia mydas, Dermochelys coriacea, Caretta caretta, and Lepidochelys olivacea. In spite of the act, however, continued importation and sale of sea turtle meat prompted law enforcement agents from the National Marine Fisheries Service, as well as other federal agencies, to request technical assistance. Without the usual gross anatomical features, pieces of meat could not be positively identified as sea turtle, let alone by species. A method was developed to distinguish pieces of uncooked meat by turtle species. This method utilizes isoelectric focusing (IEF) in conjunction with a general protein stain to produce "fingerprint" banding patterns unique to each species. Isoelectric focusing is a method which utilizes the electrical charge character of proteins to separate individual proteins into discrete bands. This charge character determines the isoelectric point of the protein; that is, the pH at which there are equal numbers of positive and negative charges on the protein. A protein residing at its isoelectric point can no longer migrate due to its neutral character (lack of net charge). Thus, proteins applied to an IEF gel will all migrate under the influence of high voltage until they each reach the pH equivalent to their isoelectric points. Each protein will form a band at its isoelectric point. Therefore, the total protein extract will yield a series of bands in a column over the width of the gel which is unique to each species. Recently, additional methods have been investigated for applicability in distinguishing sea turtle populations. Standard enzyme staining methods normally used in conjunction with starch gel electrophoresis are being adapted to the isoelectric focusing system. Two of the many enzyme stains that are being tested are compared to that of a general protein stain in the poster. The stains are lactate dehydrogenase and acid phosphatase; each of these stains yield well-defined banding patterns for turtle samples.

Burnett-Herkes, James, H. Clay Frick, Donald C. Barwick, and Nicholas Chitty

Juvenile Green Turtles (*Chelonia mydas*) in Bermuda: Movements, Growth and Maturity

Department of Agriculture and Fisheries
P.O. Box 834 - Hamilton 5, Bermuda

Four hundred and sixty four juvenile green turtles (Chelonia mydas) were tagged and released in Bermuda between 1968 and 1982. Twenty-five have been held in captivity for varying lengths of time in aquaria and fish ponds, 174 were pen reared from eggs imported from Costa Rica and hatched on Bermuda beaches, and 265 were caught wild either by fishermen (1968-73) or later by the authors with a large nylon seine (550 m long, 20 m deep, 25 cm stretch mesh). Wild turtles were taken from areas near shore and from reefs 15 km offshore.

Eighty of these turtles have been captured twice, and 14 have been captured a third time. Time at liberty for turtles caught more than once varied from several hours to just under seven years (2,542 days). Ninety-two percent of wild turtles recaptured in Bermuda waters were found at their initial capture sites. The remaining 8% were recaptured within a radius of 4 km of their original capture sites. One turtle weighing 57.7 kg when tagged was recaptured off the eastern coast of Nicaragua some 3,500 km away after being at large for 918 days.

Growth rates (calculated as a percent of weight gained per year for wild green turtles free for more than 30 days after tagging) were variable, ranging from 2.7%-99.1% per year with a mean of 27.1% per year. Weight gains decreased as turtles grew larger. Turtles of < 5 kg grew at 42% per year, while turtles of > 35 kg grew at 14% per year (Table 1). If we assume that Bermuda turtles mature at about 100 kg, then based on the weight increase data we can estimate that it may take about 27 years for green turtles to mature in Bermuda (Figure 1).

Table 1. Relative Growth Rates of Juvenile Green Turtles (Chelonia mydas) Tagged at Bermuda.

Weight Class (kg)	Number	Average Annual % Weight Gain
0-5	9	42.0
6-10	11	30.8
11-15	11	25.1
16-20	3	23.2
21-25	4	23.9
26-30	1	(18.0)
31-35	2	12.0
36-40	3	16.8
41-45	2	14.2

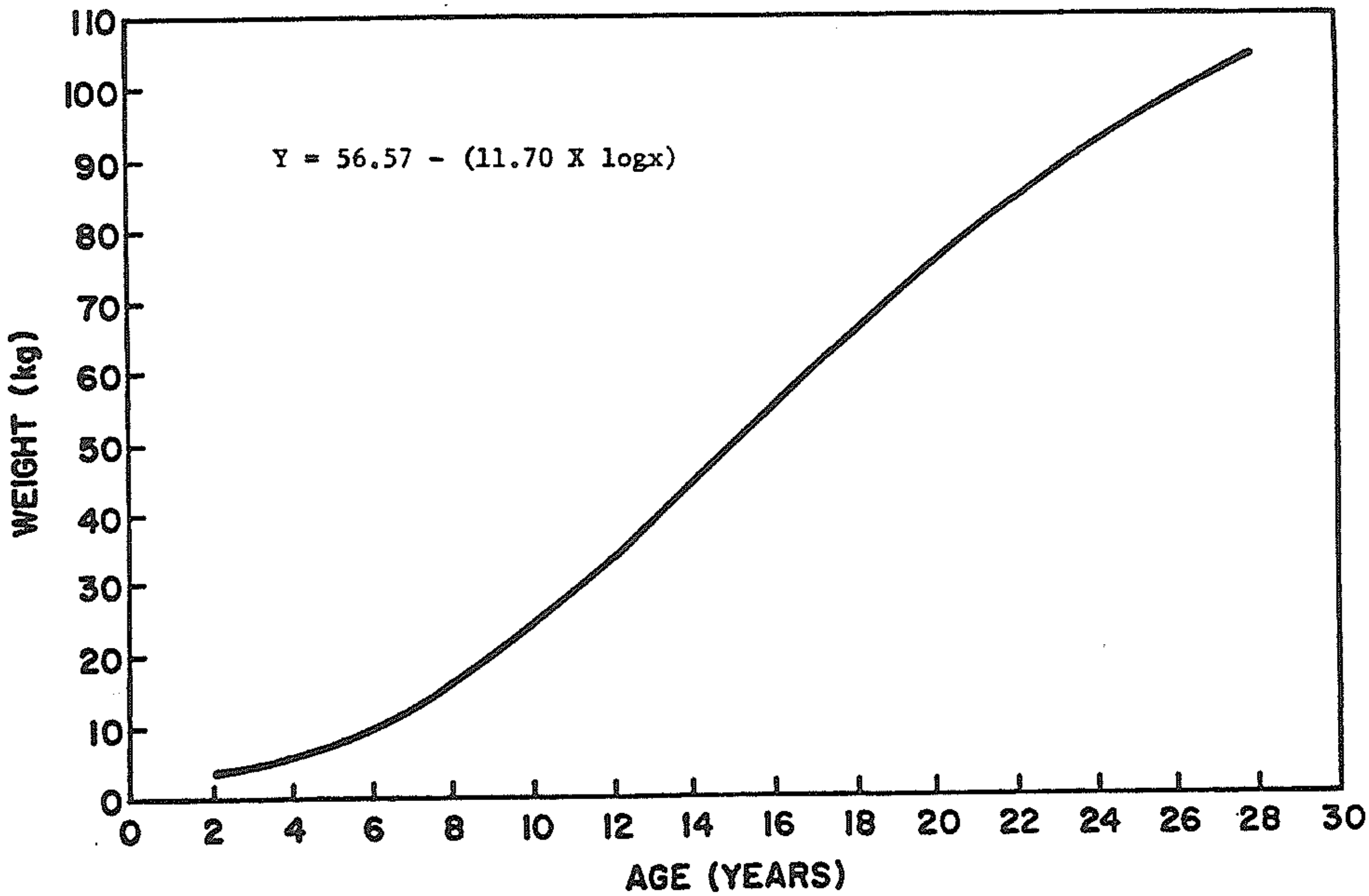


Figure 1. Growth curve for wild green turtles (*Chelonia mydas*) from tag and recapture data in Bermuda.

Brongersma, Leo D.

Atlantic Ocean Crossing and Sighting of Sea Turtles

Rijksmuseum van Natuurlijke Historie
Leiden, The Netherlands

Definite proof of turtles crossing the Atlantic Ocean from west to east was obtained by the recovery of five tagged turtles, of these four were headstarted in Florida waters, viz., two *Chelonia mydas* (L.) found in the Azores, one *Caretta caretta* (L.) off Madeira, one *Lepidochelys kempi* (Garman) near Biarritz, France, and one adult *Dermochelys coriacea* (L.), which travelled from Suriname to Ghana. In the past it was usual to consider turtles appearing in European Atlantic waters to be flotsam driven to Europe by gales and drifting with the Gulf Stream. However, when tracing records of turtle sightings in the open ocean, it was found that large numbers of them occurred in the Azores area and around Madeira. By far the greater number of them were fairly young, less than half grown to two thirds grown. This led me to suggest that their presence in the open sea might well be part of their normal life. If young turtles from the western Atlantic move to the eastern Atlantic, the question arises whether, when nearing the adult stage, they will return to the west by using the westward directed current of the north Atlantic gyre. As yet, no sightings have been reported from that current. There is also a possibility that part of the Azores turtles come from the Mediterranean. A more extensive note on these crossings will be published by G. A. Maul, R. Witham, and L. D. Brongersma.

It will be of interest to tag turtles in the Azores area (some tagging is already being done there by Mr. Dalberto Teixeira Pombo, of Santa Maria) to see where they go. Also, it will be of interest to tag turtles off the west coast of Africa to check whether they sometimes cross the South Atlantic from east to west.

Carr, Archie F.

Tortuguero Visitors Center

Department of Zoology
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The exhibit of the Caribbean Conservation Corporation (CCC) is a series of nine colored posters about 2 by 1.8 meters in size, with accompanying explanatory text in Spanish and English. Another set of these posters, mounted in clear fiberglass, is being installed in a visitors information center in Tortuguero Village, two miles south of the Green Turtle Station of the CCC.

The aim of the exhibit is to orient the rapidly growing numbers of Costa Rican and foreign tourists who are going to Tortuguero over the newly completed intra-coastal waterway. While the CCC has not been involved in promoting tourism, its members believe that the hosts of visitors now coming in with a desire to see green turtles on the beach have economic potential for Costa Rica, and may in the long run be the most effective factor in preventing destruction of the turtle colony by over-exploitation.

When tourists arrive and are put ashore at the Village, they find simple accommodations but no way of satisfying their curiosity about the green turtles, the town, Tortuguero National Park, or the work at the John H. Phipps Green Turtle Research Station of the CCC. The function of the information center will be to explain the history and interactions of all of these. This will not only help the visitors to feel less lost when they go ashore, alleviating the embarassment of the villagers over the sparse amenities of the community, but will also prevent disturbance to nesting turtles by visitors untutored in turtle watching, and relieve our over-worked tagging teams of the obligation to double as tourist guides.

Funds for erection of the center were made available by an award from the Tinker Foundation to the Caribbean Conservation Corporation in honor of the Foundation President, Joshua B. Powers.

Charboneau, Richard and Elias Sanchez Montero

Sea Turtle Conservation Project at Quepos, Costa Rica

Costa Rican Nature Conservation Association (ASCONA)
Quepos, Costa Rica

Considering that the threat (mainly human activity) to the sea turtles which nest on the beaches near Quepos, Costa Rica, has truly intensified, an enthusiastic group of volunteers has established a sea turtle conservation project with the ASCONA branch in Quepos for these chelonians. The project, in its third year, has three major components: environmental education, development of egg hatcheries, and beach surveillance by the regional police force.

The poster is part of a four-poster display which serves as an environmental education tool during community and school exhibitions. This particular poster is a historical account through photographs of the project in its first year, showing the birth of the project's first transplanted nest, and the expressions of the children who witnessed the event. The presentation of this exhibit, slide shows, films, and talks about sea turtles to students and community members has been a crucial part of the program.

The second component of the program is to establish egg hatcheries, located on coastal properties where the residents play an important management role. The major goal is to relocate the doomed natural nests to the hatcheries located on the same beach in such a way as to assure maximum offspring production. In 1982, 4,492 hatchlings reached the ocean from these hatcheries.

Lastly, the region's police force has played an active role in beach surveillance by relocating confiscated illegally collected eggs to the hatcheries. Therefore, an integrated conservation program has been established, based on the principals of environmental education.

Chateau, D.

Estimation of the Production of Green Turtle Hatchlings on Europa and Tromelin Islands (Indian Ocean)

Institut Scientifique et Technique des Peches Maritimes
B.P. 60 - 97420 Le Port, Ile de la Reunion

The study conducted by the Institut Scientifique et Technique des Peches Maritimes (ISTPM) concerns two major green turtle (*Chelonia mydas*) nesting sites in the Indian Ocean: the islands of Europa (22°21'S, 40°21'E) and Tromelin (15°33'S, 54°31'E).

The efforts of observers on these islands during the principal nesting season (November through February) enables us to:

(1) Determine the number of tracks on the beaches,

(2) Tag and continuously follow individual female adults on their nocturnal remigrations, and

(3) Continuously study the individual nests, number of eggs, incubation time, rate of hatching, and rate of emergence.

The different observations have been carried out for five years in order to estimate the yearly production of hatchlings on these islands: for the 1982-83 season this estimation is about 4,000,000 for Europa and 500,000 for Tromelin.

Among the parameters utilized for that estimation, some are still poorly known: rate of fertility of the laying, numbers of nests destroyed by the turtles, rate of diurnal emergence, level of predation, etc. They will be especially studied during the next missions.

Lastly it is suggested that future to research be conducted to ascertain connections between the of the laying process and some of the parameters of the hydroclimatic environment to enable us to predict the yearly production of hatchlings.

Ehrhart, Llewellyn M.

Structure, Status and Ecology of Loggerhead and Green Turtle Populations in Developmental Habitats of the Indian River Lagoon System, Florida

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Three well-defined estuaries (Indian River, Mosquito Lagoon, Banana River) comprise the 125 km-long Indian River lagoon system on the Florida Atlantic coast. Prior to 1900, several thousand green turtles and (presumably) loggerheads occurred in this system. A fishery for green turtles flourished after 1875 and appears to have decimated the population by about 1900. Although there has been little commercial or other take for nearly 75 years, these populations were ignored by biologists until the present studies began. After Ehrhart and Yoder (1978) showed that Chelonia and Caretta were still present in Mosquito Lagoon, further studies (Mendonca and Ehrhart, 1982; Ehrhart, 1983) began to define the structures of the populations. Turtles were captured alive in large-mesh nets between 1976 and 1981, and much information was gathered when many of both species were stunned by low water temperatures in 1977 and 1981. The loggerhead turtles of Mosquito Lagoon are about twice as large (weight $\bar{x}$:43.7 kg, range:13-111 kg; CLSL $\bar{x}$:65.8 cm, range:44-93 cm) as green turtles (weight $\bar{x}$:18.8 kg, range:2-59 kg; CLSL $\bar{x}$:48.2 cm, range:25-74 cm). Weight class distributions for both species are given in Figure 1. Virtually all green turtles and 95% or more of the loggerheads are immature. Clearly, the Indian River lagoons are "developmental habitats," in the sense of Carr et al. (1978). In summer 1982, pilot studies of turtle populations in the "central region" of the Indian River near Sebastian Inlet, 60 km south of Mosquito Lagoon, were begun. Capture rates for loggerheads were five times as great as those seen previously, in Mosquito Lagoon, and suggest that there is a genuine abundance of immature loggerheads in this part of the system. Green turtles comprise about 30% of the captured turtles (but the status of C. mydas remains relatively unclear). Preliminary results indicate that although adult female loggerheads occasionally enter Indian River during the nesting season, the populations of both species resemble those of Mosquito Lagoon: virtually 100% of the turtles are juveniles/subadults. Research involving modified net deployment strategies and mesh sizes is continuing in an effort to further characterize these populations.

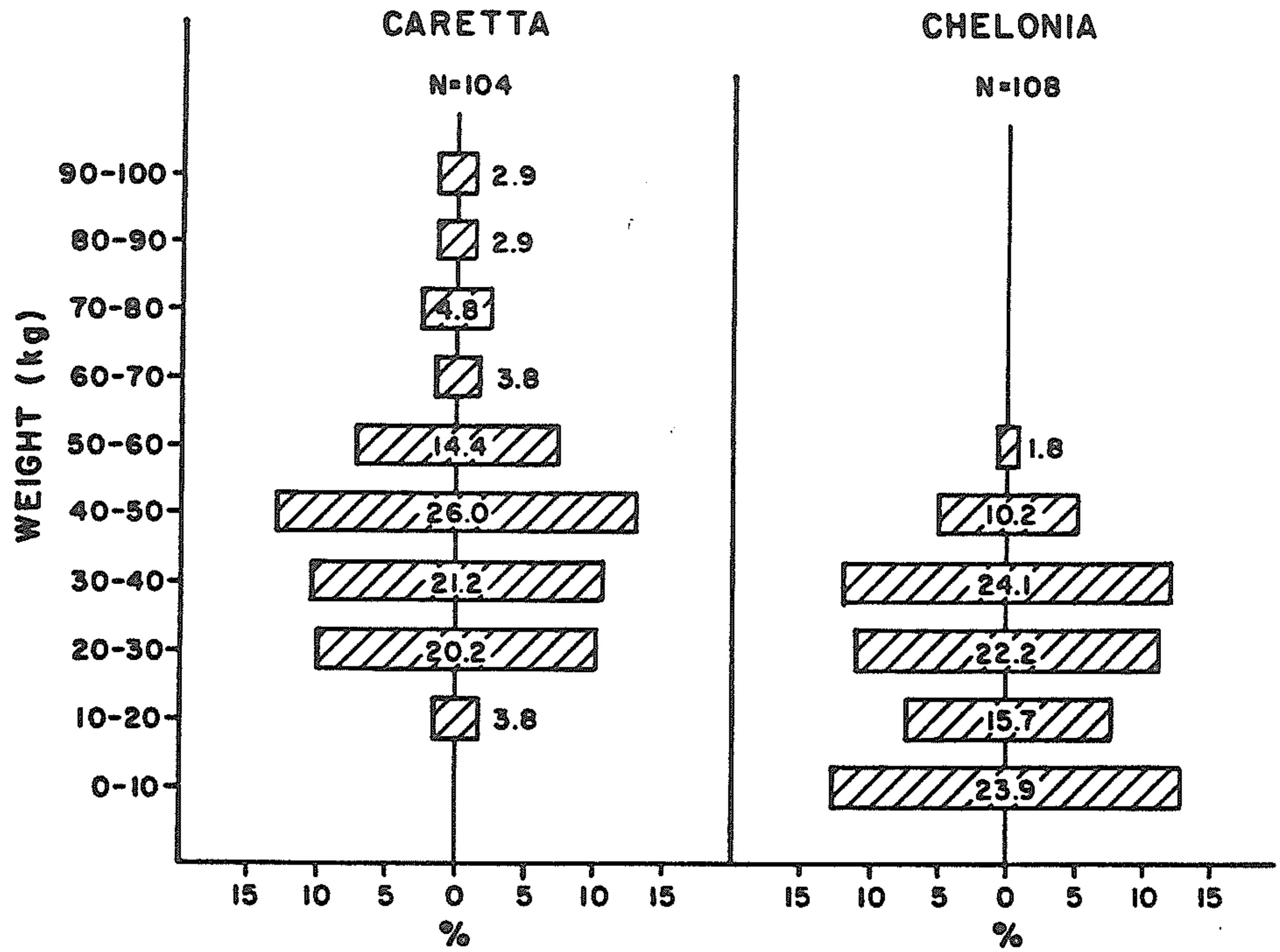

Figure 1. Weight-class distributions of lagoonal populations of loggerhead turtles (Caretta caretta) and green turtles (Chelonia mydas), 1976-81.

Fontaine, Clark T., Jorge K. Leong, and Richard M. Harris

Headstarting the Kemp's Ridley Sea Turtle

Galveston Laboratory
Southeast Fisheries Center
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

The Galveston Laboratory of the National Marine Fisheries Service (NMFS), Southeast Fisheries Center (SEFC), has conducted headstart research on Kemp's ridley sea turtles, *Lepidochelys kempi*, since 1978. The headstart research project is part of an international effort to protect and increase nesting populations of this endangered species. This experimental project is (1) increasing survival of hatchlings during their first year of life by headstarting them in captivity, (2) tagging and releasing headstarted turtles in hopes that they will later return to nest on any beach, and (3) testing the imprinting hypothesis by tagging and releasing headstarted turtles in hopes that they will return to nest on the beach where they were imprinted. It is also directed toward (1) refining the rearing techniques, (2) optimizing survival and growth in captivity, and (3) obtaining information on early life history, general biology, physiology and pathology, of Kemp's ridleys.

Kemp's ridley sea turtle eggs are transported each summer to the Padre Island National Seashore (PINS) near Corpus Christi, Texas, from the beach at Rancho Nuevo, Mexico, through cooperation with the Instituto Nacional de Pesca of Mexico, the U.S. Fish and Wildlife Service (USFWS), the National Park Service (NPS), and the Texas Parks and Wildlife Department (TPWD). The eggs are incubated and hatched, and the hatchlings are "imprinted" in the beach sand and surf at PINS by the NPS. Each year, more than 1,500 "imprinted" hatchlings are air-transported to the NMFS Galveston Laboratory where they are reared for 10-12 months. Survivors in healthy condition are tagged with numbered, monel, flipper tags, and later released off PINS by NMFS personnel from a U.S. Coast Guard vessel operating out of Corpus Christi.

Methods of headstarting Kemp's ridleys have improved considerably since 1978. Since 1980, survival rate from hatchling size to release has been between 88 and 95%. The young sea turtles are fed a highly nutritious, commercial diet, developed especially for sea turtles. To prevent aggressive behavior and associated injury, the turtles are kept separated in individual containers placed in semi-closed raceways. Techniques also have been developed to diagnose and treat diseases and injuries.

Information obtained when tagged turtles are recaptured or sighted indicates that the turtles survive and migrate long distances, and that their growth is good in the wild. For example, one headstarted turtle has been recaptured near the coast of Biarritz, France. It is uncertain at what age Kemp's ridleys mature and return to the nesting beaches, but it is thought to be in excess of 10 years. Therefore, the major objective of increasing nesting populations of Kemp's ridley turtles may not be realized for several more years. However, this experimental project has been successful so far in that headstarted turtles do survive and grow in the wild.

Frazier, J.

Marine Turtles in the Southwestern Atlantic

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National Zoological Park
Smithsonian Institution
Washington, D.C. 20008 USA

Visiting museums and institutions in Argentina and Uruguay, one finds records and specimens of marine turtles of four species; in order of abundance they are: *Caretta caretta* (L.), *Chelonia mydas* (L.), *Dermochelys coriacea* (L.), and *Lepidochelys olivacea* (Eschscholtz). The last species is reported for the first time in the region. The oldest record is a specimen of *C. mydas* captured in Rio de la Plata in 1898. In total there are 98 records or specimens from Argentina and 92 from Uruguay. The number of specimens or records with locality data is few: 34 *C. mydas*, 36 *C. caretta*, and 20 *D. coriacea*. Captures of the three species are concentrated on the Atlantic coast of Uruguay, especially in the department of Rocha, and the eastern coast of the province of Buenos Aires, especially near the city of Mar del Plata; both places are the sites of important fisheries. *C. mydas* and *D. coriacea* are commonly found in Rio de la Plata, but there are few specimens of *C. caretta* from within the river. All species are recorded most frequently during the summer (December-February). Curved length of carapace of *C. mydas* varies from 27.0 to 50.0 cm and 82% of the measurements fall between 32.5 and 42.4 cm. The *C. caretta* vary from 50.0 to 115.0 with 69% between 58.5 and 87.4 cm. The *D. coriacea* are all greater than 120.0 cm; 72% are between 183.5 and 252.4 cm. There is no nesting in the region and the source of the animals is unknown; distances from Rio de la Plata to the closest known nesting beaches are thousands of km. Nevertheless, the Rio Plata area seems to be an important foraging area, and it is essential to include Argentina and Uruguay in international plans for rational management of these resources.

Joseph, Jeanne, Gloria Seaborn, and Frances Van Dolah

Identification of Sea Turtle Oils

NOAA/NMFS Laboratory
Charleston, South Carolina USA

Cosmetic products containing sea turtle oils are manufactured in a number of foreign countries and are available in domestic markets from time to time, despite U.S. law prohibiting importation of products from endangered species. Our objective has been to provide assistance to law enforcement personnel of the Office of Customs and NMFS by developing methods for isolation and identification of turtle oils in cosmetics.

Briefly, the methodology involves isolation of triacylglycerols from authenticated turtle oils and cosmetics by column chromatography, followed by analysis of the component fatty acids of the triacylglycerols by gas-liquid chromatography (GLC) using highly efficient capillary columns.

Fatty acids were selected for analysis because they are transferred through the food chain and thereby provide information on the diet and environment of the animal under investigation. Fats of terrestrial and freshwater animals contain linoleic acid (18:2w6)* as a major fatty acid (> 10%). In contrast, fats of marine animals rarely contain more than 1-2% 18:2w6. Instead, long-chained polyunsaturated fatty acids (PUFA) such as 20:5w3 and 22:6w3, minor components in freshwater animals, are characteristic of most marine animals, and it is these fatty acids which have been the major focus of our investigation.

Turtle oils we have analyzed to date include depot fats of the loggerhead (three turtles), yellow bellied slider (three individuals), one Mexican river turtle, one Pacific ridley, one Kemp's "head-start" ridley and an albino, aquarium-reared green turtle. In addition, we have analyzed rendered oils of green, hawksbill and, loggerhead turtles. Cosmetics which have been analyzed include several products with Spanish-language labels, a product of France, and one from India.

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*A simplified nomenclature for the fatty acids defines their chemical structure. As an example, 20:5w3 denotes a fatty acid with 20 carbon atoms and 5 double bonds in the molecule. The number following the Greek letter "w" indicates the position of the double bond nearest the hydrocarbon end of the molecule.

Kemmerer, Andrew J., Walter R. Nelson, and Walter F. Gandy

Sea Turtle Tracking Technology

Mississippi Laboratories
Southeast Fisheries Center
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

In the late 1970's, the Mississippi Laboratories of the Southeast Fisheries Center, National Marine Fisheries Service, initiated a series of engineering studies to develop and apply tracking technologies to selected marine turtle problems. The first of these studies was to develop a technique to assist in the evaluation of releases of headstarted Kemp's ridley (*Lepidochelys kempi*) turtles. Initial efforts focused on traditional radio tracking approaches with special attention given to methods of attachment and behavioral responses. These efforts involved extensive laboratory and controlled field tests with headstarted loggerhead (*Caretta caretta*) and Kemp's ridley turtles. No significant effects on animal behavior were noted when the transmitters were trailed behind the turtles on lanyards roughly 2/3 the carapace length. Commercially available 8 gm transmitters were enclosed in pyramid wooden floats with a total air weight of 28 gm. An advantage of the lanyard attachment was that it allowed full exposure of the transmitter every time the turtle surfaced. Radiated power of the transmitters averaged -7 dbm with a capability of 45 days of continuous operation.

Three demonstrations of the radio tracking system were conducted before the technology was considered operational. One was with headstarted loggerhead turtles, and two were with headstarted Kemp's ridley turtles. All tracking was done from an aircraft equipped with a high-gain receiver. The receiver was designed to differentiate and receive signals from up to 100 turtles. Three element yagi antennas were mounted on the wings and a dipole quarter-wave antenna was installed on the underside of the aircraft. Detection range was about 50 km. Selected turtles were tracked for periods of up to 30 days following release, with some of them travelling as far as 240 km offshore.

The radio tracking capability was expanded in 1981 and 1982 and combined with sonic tags to monitor movements and surfacing behavior of adult loggerhead turtles near the Canaveral Channel, Florida. Two experiments were conducted, one in September (summer) and one in early March (spring). Twenty turtles were tagged during each experiment with radio beacons and acoustical pingers. An aircraft was used for the radio tracking, and a vessel equipped with a directional hydrophone was used for acoustical tracking. Neither of these techniques, however, provided very satisfactory results. The radio tracking was limited by infrequent and brief periods spent by the turtles at the surface and the acoustic tracking was limited by a detection range of about 0.5 km. A very successful portion of each experiment, however, was continuous monitoring of the radio tags with a shore-based, computer controlled spectrum analyzer. This system permitted continuous monitoring of the absence, presence, duration, and amplitude of signals from the tagged turtles. These parameters were used to determine surfacing behavior. During the summer experiment, which lasted 20 days, average time spent by a turtle during a surfacing was 2.2 minutes and the turtles averaged 1.0 surfacings per hour. The turtles spent 3.8% of their time at the surface and a diurnal periodicity was indicated in surfacing behavior. Changes were noted in surfacing behavior during the spring experiment, which lasted 35 days, where turtles spent an average of 2.9 minutes during a surfacing, surfaced 1.3 times an hour, and spent 6.0% of their time at the surface.

Initial attempts at tracking turtles with satellites were made with modified transmitters originally developed for tracking polar bears. These transmitters operated through the Nimbus-6 satellite. They were designed to operate for one year with a duty cycle of an eight-hour transmission period every four days. Total weight of the transmitter package, which included a secondary radio beacon, was 3.2 kg with a buoyancy of 1.8 kg. After a series of lagoon tests, a 96 kg female loggerhead turtle was outfitted with a transmitter. She was successfully tracked for eight months over a distance exceeding 2,200 km. Accuracy of satellite locations was about 5 km. Several other tracking experiments were conducted with the Nimbus-6 transmitters and all were relatively successful except for one involving a 67-cm carapace length, female Kemp's ridley tagged at Rancho Nuevo, Mexico. The turtle apparently was captured a few days after release by a local fisherman presumably because of difficulty the turtle was having with the large transmitter package.

Partly because of the presumed failure with satellite tracking of the Kemp's ridley turtle, but also because of a phasing down of the Nimbus-6 system, engineering efforts shifted to a new satellite system -- TIROS/ARGOS. The ARGOS tracking and data communication capability is proposed to be operational on all NOAA series satellites and is currently operating on NOAA-6 and 7. Two prototype transmitters were developed and are 41% of the air weight, 22% of the displacement volume, and 13% of the buoyancy of the Nimbus-6 tansmitters. These transmitters have undergone extensive laboratory tests and one controlled field test attached to a captive loggerhead. One release of a tagged loggerhead was attempted in 1982, but the transmitter failed for unknown reasons. Additional tests of the one remaining prototype transmitter have been conducted without failure and a long-term captive animal test is planned for the fall of 1983 to try to determine why the first prototype failed.

Kochinsky, Lyle and Robert A. Menzies

Possible Genetic Differences between Florida and Costa Rican Atlantic Green Turtles

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It has been suggested by many investigators that sea turtles return to their natal beaches for breeding. If so, one would expect genetic differentiation between populations sufficiently separate geographically such as Caribbean Costa Rica and Florida. This laboratory has begun a study to test this hypothesis. This report is a preliminary comparison of alloenzyme loci between the two populations.

Sixteen enzyme loci have been examined in over 50 animals. Four loci appeared more polymorphic than the rest and were studied in greater depth. These were lactic dehydrogenose-1, lactic dehydrogenose-2 (C.1.1.1.27), phosphoglucomutose (2.7.5.1), and phosphohexose isomerase (5.3.1.9).

One locus, PGM, showed highly significant genotypic and allelic frequency differences between the two populations. The other three loci did not show significant differences. However, when the cumulative "G" was calculated (see Menzies, 1981, Proc. Gulf and Carib. Fish Inst., 33, 230) for all four loci, the "G" was significant.

While these results appear to agree with the outcome of Smith *et al.* (1976, Trans. 41st North. Am. Wildlife Nat. Res. Conf., p. 119), *with the* exception of PGM, we did not find the same loci-specific population differences. This may be a result of different sources of turtles (Smith) whereas our Caribbean sample was strictly from Atlantic Costa Rica and their's a Caribbean mixture. The differences observed may reflect pan-Caribbean population differences. However, because of the small number of animals and loci examined in both studies to date, we can't be sure that the differences observed are not a statistical anomaly.

[1]Van der Heiden, A. M., R. Briseno-Duenas[1], and D. Rios-Olmeda[2]

Description of a Labor- and Cost Saving Method for the Determination of Sex in Hatchling Sea Turtles

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[2]Instituto Nacional de Pesca. Secretaria de Pesca, Playas las Hadas y Prolongacion Carnaval s/n. Mazatlan, Sin., Mexico.

A method to process gonads of hatchling sea turtles preserved in formalin using glycerin as a clearing agent is described. Essentially, the technique consists in placing the gonads in a formalin-glycerin solution and then bringing them to pure glycerin by slow evaporation in an oven at about 40°C. Clearing by processing to glycerin allows researchers to distinguish between sexes when the gonads are viewed under a stereomicroscope by transmitted light, even at low magnifications. For this study, we used the gonads of three-day old hatchlings of the olive ridley (*Lepidochelys olivacea*).

Our observations of the (*Chelonia mydas agassizi*) gonads preserved in formalin of the black turtle have shown that sometimes a positive sex determination is possible and thus no need for further processing is necessary. Observing this, we discuss the strategy to be followed in the determination of sex in sea turtles by means of the main existing techniques.

Witham, Ross

The Florida Headstart Program

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The Florida Department of Natural Resources (FDNR), Bureau of Marine Research, began a marine turtle stock enhancement (headstart) program in the mid-1950's. Martin County Historical Society provided facilities at the House of Refuge Museum to headstart *Caretta caretta*. By 1959, *Chelonia mydas* was the target species for FDNR's headstart program.

Tagging, to assess the program's effectiveness, was begun in 1964 when 99 tagged yearling *C. mydas* were released. Tagged releases were continued in 1967 (N = 91) and 1968 (N = 42). Initial tag returns indicated dispersal and survival of headstarted *C. mydas*.

Annual tagged release of *C. mydas* since 1972 (N = 1000+/year, approximately 15,000 to date) have resulted in 127 tag returns. Four of the turtles represent multiple returns. Tag returns, demonstrate distribution to New York, Portugal, Brazil, Mexico, and south Florida. These are depicted on an accompanying poster.

Lutcavage, M., P. Lutz, T. Bentley, A. Bergey, and P. McMahon

Physiological Research on Sea Turtles at the University of Miami

University of Miami
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On-going research projects involving the regulatory biology and physiological ecology of sea turtles at the University of Miami (P. Lutz, principal investigator) include aspects of diving physiology and the effects of temperature. Based on ventilatory measurements and blood and lung gas composition, we have found that voluntary dives are routinely aerobic. However, the extraordinary ability of the loggerhead to survive prolonged anoxia has been documented in forced dives as well as in-vivo preparations. In a related study using the red eared pond slider we are examining the relationships of brain electrical, ionic and metabolic activities in the absence of oxygen. Responses of turtles while breathing hypoxic gas mixtures and elevated levels of carbon dioxide were studied to determine respiratory control as well as the involvement of anaerobic metabolism in extended dives. The functional morphology of the sea turtle's uniquely structured, low-residual volume lung and its role in gas delivery is also under investigation.

Metabolic strategies and dive patterns of sea turtles may be directly influenced by environmental temperatures. In a study of loggerheads trawled from the Cape Canaveral ship channel from 1979-1982, blood chemistry, including ionic composition, and osmotic pressure was analyzed. This study will help determine changes in blood characteristics with respect to seasonal versus temperature effects, and their possible significance in defining a hibernation state.

Other on-going research projects at our laboratory include a study of kidney function and osmoregulation in green turtles and loggerheads. In addition, we are currently interested in the potential effects of oil on eggs, hatchlings, and subadults. Our research facilities consist of fully equipped laboratories for metabolic and respiratory studies and a flow-through sea water system of 3 x 8 ft, 1100 gallon tanks.

Mack, David

International Trade in Sea Turtle Products

World Wildlife Fund
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Sea turtles have long been exploited for their products. For centuries, subsistence hunters have collected turtles for meat and eggs. Since at least the early-1960's, however, large volumes of turtles have been collected for their meat, skin, and tortoise shell to supply international demands and the growing tourist industry.

The shell of marine turtles is carved into jewelry and ornaments. Japan alone has imported tortoise shell from between 400,000 and 800,000 hawksbills over the last 20 years.

Since the 1970's, large volumes of sea turtle skins have been used by the leather industry to manufacture shoes, boots, handbags, wallets, and belts. To supply this trade, at least 1.8 million olive ridleys were taken from the Pacific coast of Mexico and Ecuador. In the past, the meat of these turtles was also exported, mainly to the United States.

The sale of stuffed juvenile and sub-adult sea turtles is rapidly gaining popularity and provides an additional threat to wild sea turtle populations. Up to 750,000 stuffed hawksbill turtles have been imported by Japan alone since the early 1960's, and many species of marine turtles are taken in tropical countries for stuffing and sale in their tourist markets.

The implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1975 established regulations for international trade in many endangered and threatened wildlife species, including sea turtles. All seven species of sea turtles are listed on CITES Appendix I, essentially prohibiting commercial trade in these species. CITES, which now includes 81 member countries, has helped curb international trade in wild sea turtle products, but many countries, both CITES and non-CITES members, continue trading in them despite CITES regulations. This trade is still a threat to the remaining populations of marine turtles.

Matlack, P. A.

Impacts of Artificial Beach Renourishment and the Development of Erosional Scarps on Nesting Sea Turtles

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Artificial beach renourishment is becoming a hazard for sea turtles nesting on southeastern Florida shores. Many coastal segments from Miami to Palm Beach have been renourished over the past 15 years with adverse consequences for sea turtles. The impact of this management practice has been largely overlooked. John U. Lloyd Beach, Broward County, Florida, attracts one of the largest nesting populations of green turtles in south Florida. Studies on this beach indicate that oversteepened slopes (often in excess of 80°) produced by winter storms prevent nesting turtles from reaching backshore nesting sites. Because of this cliff-like scarp, turtles often abandon attempts to nest and move to more accessible parts of the beach. Segments lacking a scarp become over-crowded, with turtles digging up nests previously laid. Still other turtles lay their eggs on the foreshore in front of the barrier scarps where the nests can be washed out by the next high tide, unless removed by field investigators.

An additional problem is created when park officials attempt to lessen hazards to beach-goers by dragging a steel I-beam behind a tractor to reduce the slope of the scarp. When the slope is reduced the nests may be exposed or more deeply buried, jeopardizing successful hatching of the eggs.

As beach renourishment becomes a more extensive management practice along eroding coasts, scarped shorelines become common coastal features. Such beach scarps adversely affect the nesting habits of sea turtles, creating an additional stress on species already experiencing declines. Attempts by the Florida Department of Natural Resources to restrict beach renourishment projects to months when turtles are not nesting, although beneficial, will not eliminate the formation of beach scarps after renourishment.

Menzies, Robert A., Lyle Kochinsky, and J. Michael Kerrigan

Techniques for Muscle Biopsy and Blood Sampling from Sea Turtles

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With the development in recent years of micro assays for a variety of biologically important compounds, it has become advantageous to develop non-injurious methods of collecting tissue and blood. This paper is a review of muscle biopsy and blood sampling techniques that have proven successful for a number of investigators. Details with photographic illustrations will be presented in the poster session.

Muscle biopsy. Animals are turned on their dorsal surface and one hind flipper is retracted and held by an associate. The area between the "knee" and "heel" is cleaned. A longitudinal incision, 2-3 cm, is made on the mid-ventral line of the flipper midway between the knee and the ankle in the region over the plantaris muscle. The incision is made by first penetrating the epidermis and dermis in a groove between two scutes down to the facia covering the muscle bundles. After the facia has been carefully penetrated without entering the muscle, the scalpel is reversed and facia freed by blunt dissection. When sufficient muscle has been exposed the center of the biopsy portion is gripped with curved hemostats. A piece of muscle 100 mg to one gram (depending upon the size of the turtle) is removed with curved scissors. The wound is painted with gentian violet to reduce risk of infection. The biopsy is frozen as soon as possible.

Blood samples. Blood is obtained from two locations: the paravertebral sinus on the back of the neck and the "Axillary plexus" (this name is offered to avoid confusion with the brachioplexus). The paravertebral sinus is located on either side of the midline between the posterior scutes (above the supraoccipital bone) on the skull and the nuchal scute on the carapace. Blood can be obtained by inserting the needle at a steep posterior angle just off the midline about half way between the supraoccipital and the carapace with the neck fully extended. On turtles in excess of 25 pounds an 18 gauge needle and a 5 or 10 ml syringe is adequate. On very large animals under field conditions it is often difficult to maintain the neck in an extended position. In this case it is possible to obtain a blood sample while the animal is on its back during the muscle biopsy procedure. In this position the neck is naturally extended and since the head is slightly lower than the rest of the body, this venous sinus is filled with blood. A sample can easily be obtained using the same anatomical markers as above but entering the neck from the side with the needle. The axillary plexus is a collection of blood vessels in the vicinity of the axilla. With the animal on its back, blood can be obtained by inserting the needle centrally in the axilla. The depth of penetration depends on the size of the turtle. Care should be exercized with this technique to avoid multiple penetrations since there are major arterial supplies in this area as well as innervation pathways for the anterior flipper.

Blood cells should be separated from plasma or serum as soon as possible and both stored frozen. This work was supported in part by the National Science Foundation (DAR 8009353), the Institute of Medical and Marine Research, and the Academy of Marine Sciences (Miami).

Menzies, Robert A. and Lyle Kochinsky

Biochemical Systematics of Sea Turtles: Preliminary Alloenzyme Results

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Although the present results are too preliminary for definitive conclusions, it is appropriate for the purpose of this Symposium to summarize our progress and anticipated directions. We have examined 23 enzyme loci in five species of sea turtles and 13 loci in Dermochelys coriacea, the leatherback. The first group consists of Chelonia mydas (Florida and Atlantic Costa Rica), Eretmochelys imbricata (Florida), Caretta caretta (Florida), Lepidochelys kempi (Galveston, NMFS), and L. olivacea (Pacific Mexico). Data were derived from as many as 60 animals (green turtles) to as few as one to three (leatherbacks). Each species can be definitively distinguished from any other by selection of the currently studied genetic markers. Allele frequencies were computed from putative genotype assignments. From these, Nei genetic identities, distances, and heterozygosities were calculated.

Heterozygosities ranged from about 10% for loggerheads and leatherbacks to 25% for ridleys and hawksbills and 20% for greens. The unusually high heterozygosities were undoubtedly a bias from our concentrating on polymorphic loci. A parallel study in which intraspecific and interpopulation genetic variability is being assessed depends on analysis of polymorphic loci.

Of greater interest are the relationships between species that the calculated genetic distances reflect. As expected, C. mydas, E. imbricata and C. caretta form a group roughly equally spaced from L. olivacea. The genetic distances are 0.28, 0.23, and 0.27 respectively. With respect to Chelonia, L. olivacea appears to be the closest with Eretmochelys and Caretta following with genetic distances of 0.34 and 0.52. Interestingly, D. coriacea is placed just outside of this group with genetic distances of the order of 0.35 to 0.47. Among several interpretations of the latter observation are (1) the obvious behavioral, morphological, and physiological differences between this marine turtle and the rest are specializations which overshadow a not so divergent genome, or (2) leatherbacks are truly divergent ancestrally and the present alloenzyme data reflects convergence. Frair (Comp. Biochem. and Physiol. 72B [1982] 1) has also noted similarities in serum electrophoretic patterns between Chelonia and Dermochelys.

Another surprise is the apparent divergence of L. kempi. This species is roughly equally divergent from L. olivacea, C. caretta, and E. imbricata (genetic distances: 0.42, 0.47, 0.49) and quite distant from both C. mydas (0.72) and D. coriacea (0.82). Phylogentic analysis does not produce a Wagner tree that is easily reconciled with previous data and thought concerning the evolution of this group. However, if the leatherback is for the present deleted, one interpretation of the remaining data is that Lepidochelys is most closely related to a common ancestor with L. kempi diverging at an earlier time than the rest. It will be extremely interesting to see if these patterns persist as more loci and individuals are added to the study. Perhaps of equal importance will be the inclusion of data from several populations of each species taking into consideration the apparent high degree of genetic variability.

Nuitja, I. Njoman S.

Notes on the Nesting Sites of the Leatherback Turtle,

Dermochelys coriacea Linn. in Indonesia

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The leatherback turtle, Dermochelys coricea Linn., which inhabits the Indonesian Archipelago is an endangered species due to the incessant hunting for its meat and collection of its eggs. Since May 29, 1978, this species has been fully protected in all Indonesian waters by the government to enable the leatherback turtle populations to recover from the impacts of fishing. The last record of the total length was between 176.0 to 192.2 cm. The leatherback's nesting season is from May to August on the Sukomade beaches. The largest diameter of sand grains are between 0.29 to 0.50 mm.

This paper is a preliminary report of the research on the leatherback turtle in Indonesia and attempts to give the state of knowledge at present on the distribution of nesting sites and the situation of the leatherback turtle population in Indonesian waters as based on a study of results on this species. Further information may be obtained from the Directorate of Management and Wildlife and the Fisheries Service.

Ogden, John C.

Acoustical Tracking of Sub-Adult Green Turtles (*Chelonia mydas* L.)

Foraging in Seagrass Beds in St. Croix, U.S. Virgin Islands

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Foraging sub-adult green turtles (Chelonia mydas) were captured on their feeding sites in Thalassia beds. An acoustical tag transmitting a 75 KHz pulse of characteristic interval was sub-dermally implanted in a fold of skin on the posterior ventral surface and the animals were immediately released at the capture site. Several animals were followed daily for several months and one turtle was tracked for over six months. The tracking confirmed a regular daily pattern of foraging involving a characteristic nocturnal resting location, and regular diurnal visitation of a feeding site in a Thalassia bed. The feeding site, used by several tagged and untagged turtles, consisted of three grazing plots of about 100 m^2 in area, and numerous small plots of several m^2 in size. Turtles were active in these plots from January 1982 to January 1983 at which time grazing decreased and the tracking signals were lost. Chronic grazing by turtles in plots stresses Thalassia principally by interrupting the input of detrital-based nitrogen essential for seagrass growth into the sediments. This study establishes potential limits of this grazing strategy of green turtles and opens new questions to study which are of importance to the management of green turtle populations on their feeding ground.

Ogden, John C. and Susan Williams

Foraging Ecology of the Green Turtle (*Chelonia mydas* L.) in St. Croix U.S. Virgin Islands

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Populations of green turtles (Chelonia mydas L.) ranging in size from approximately 8 kg in shallow water (< 10 m) to in excess of 150 kg in deeper water (10-20 m), forage on the seagrass meadows dominated principally by turtle grass (Thalassia testudinum) and manatee grass (Syringodium filiforme) surrounding the island of St. Croix. Since 1978 the West Indies Laboratory of Fairleigh Dickinson University has conducted investigations on the foraging patterns of green turtles and on their interrelationships with their seagrass food source, supported by the U.S. National Science Foundation and the National Geographic Society. The principal techniques used have been direct observation of green turtles by diving, acoustical tracking, and studies of the physiology and productivity of the seagrass within areas grazed by turtles compared to ungrazed control areas. Understanding of the foraging ecology of green turtles is important for their conservation, as seagrass feeding areas are vulnerable to man-induced disturbances and the natural growth rate and sexual maturation of turtles are limited by nutritional factors.

Green turtles create and maintain grazing scars in shallow Thalassia beds. The scars are initiated by grazing in small areas which fuse into larger areas of approximately 100 m^2 in area. Once the scars attain this approximate size, their borders remain unchanged over long periods of time. Scars are maintained by regular grazing by green turtles for periods of more than one year. Thalassia grows from a basal meristem at the sediment surface, and the turtles take the new growth during each bout of grazing. Individual grass blades marked within permanent 10 x 20 cm quadrats within the scars are cropped on the average every four to six days. Maximum growth between grazing bouts based on productivity estimates of Thalassia is approximately 1 cm.

Green turtles spend many hours each day on the scars often taking only one seagrass blade tip per bite. Up to three turtles have been observed feeding on a single scar. Daily food intake, assuming this is the only feeding, is estimated to be low. The new growth, however, is relatively high in protein and low in lignin compared to ungrazed blades, perhaps permitting the grazing turtle to maximize energy intake (Bjorndal, 1980). Non-feeding periods (mostly at night) are spent in characteristic resting locations on the coral reef, usually within 0.5 km of the feeding site.

Chronic grazing by green turtles in the grazing scars stresses Thalassia resulting in lower productivity (measured by a trend to lower daily blade elongation) and significantly more narrow blades in grazing scar areas compared with ungrazed control areas. We suggest that stress in Thalassia is produced by the interruption of portions of the nitrogen cycle in seagrass beds within the grazing scar. Detrital Thalassia no longer falls to the sediment surface. Preliminary measures show a small nitrogen reserve of three to six days in the sediments. In order for the *Thalassia* within the scars to remain productive, other sources of nitrogen such as sedimentation, ammonification, nitrogen fixation, turtles, feces, and translocation of nitrogen along the rhizomes must be important. Of these, translocation along rhizomes from portions of plants outside the grazed area to the scar may be of major importance. In order for this pathway to be effective there would be a theoretical maximum size for a grazing scar related to the size of an individual *Thalassia* plant. The relationship of scar size, plant size, grazing intensity, and productivity of seagrasses is being investigated.

Bjorndal, K. A., 1980. Nutrition and grazing behavior of the green turtle *Chelonia mydas*. Marine Biology, 56:147-154.

O'Hara, James and J. Ross Wilcox

Electrical and Acoustical Barriers to Protect Sea Turtles

Environmental and Chemical Sciences, Inc.
Florida Power and Light Company USA

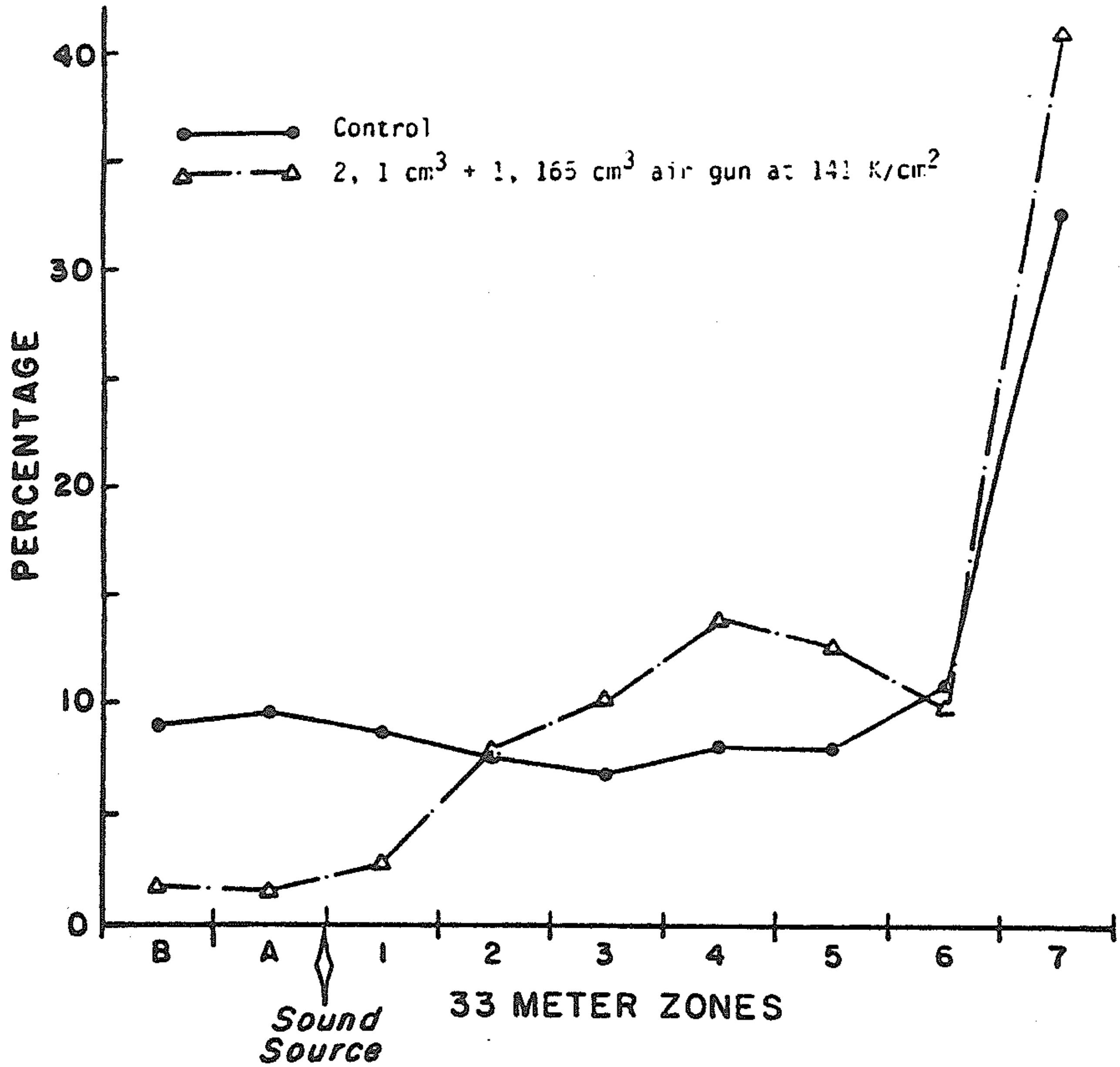
Sea turtles can become entrained into power plant cooling water intakes when seeking dark, cave-like areas for resting. Our studies showed both electrical and acoustical barriers to be effective in altering the behavior of sub-adult loggerhead turtles.

Both AC and pulsed DC electrical fields blocked juvenile and sub-adult turtles from one end of a test channel. Electrical currents of approximately 20 volts AC and 25 volts DC were sufficient to cause 100 percent of the sub-adult turtles tested to turn away from the field. Higher voltages were required to influence the juvenile turtles to the same extent.

A safe and effective barrier across a 300 meter long canal was formed using seismic profiling air guns. To test an acoustical barrier, sub-adult loggerhead sea turtles with a float attached by cord to the carapace were allowed to swim freely in a 300 meter test canal. The location of the turtle was monitored by television recording every seven minutes.

Turtles strongly avoided the noise and near-field pressure waves generated by a 165 cm^3 air gun at 141 kg/cm^2 fired every 15 seconds. The behavior of the turtles was influenced to a lesser extent when 70 kg/cm^2 was used. The air guns were effective deterrents up to 30 meters from the sound source.

The acoustic barrier appears to have strong potential as a deterrent to sea turtles entering dangerous industrialized areas. An array of air guns could cause avoidance of a larger area.



Percentage of total time spent by turtles in each zone during different sound tests.

Oravetz, Charles A.

Trawling Efficiency Device (Turtle Excluder Device)

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The trawling efficiency device A.K.A. turtle excluder device (TED) was developed in 1980 by the National Marine Fisheries Service (NMFS). The TED was developed principally to exclude sea turtles from shrimp trawls where they are incidentally captured and sometimes drown. NMFS estimates that each year in the southeastern United States about 33,000 sea turtles are captured in shrimp trawls and about 12,000 of these turtles die. Most of the sea turtles captured are loggerheads, listed as a threatened species under the U.S. Endangered Species Act, but some are Kemp's ridleys and greens, which may indicate small populations of these species in U.S. waters.

If the TED is used properly, it excludes about 97% of sea turtles which enter the trawl. The TED excludes other bycatch such as horseshoe crabs, jellyfish, skates, rays, sharks, sponges, and large fish. Finfish separators can be added to the TED which eliminate smaller finfish. The TED also increases the shrimp catch up to 7% and reduces trawl drag due to improved water flow which may result in fuel savings. Because of these ancillary benefits to shrimp trawling, the NMFS believes the TED will be used voluntarily by shrimp fishermen and is actively encouraging its use.

NMFS estimates about 200 TED's are currently in full or part-time use in the southeastern U.S. shrimp fishery. NMFS is continuing its research on the TED to test and develop lighter, less cumbersome, and more efficient models.

Owens, David W., Yuki A. Morris, and Thane Wibbles

Sex Ratio of a Sea Turtle Population: Techniques and Observations

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Marine turtles, like many other reptiles, exhibit a temperature dependent component in their sex differentiation physiology. In laboratory studies and under hatchery conditions, markedly skewed sex ratios have been observed. However, we still do not know if skewed sex ratios occur in natural populations, or for that matter, what the ecologically effective sex ratio of natural populations might be. Furthermore, sex ratios based on hatchlings from a given year or from adults seen at the nesting beach might not be completely representative due to inherent sex distribution biases. On the other hand, the sexes of a sample of large immature animals while at a feeding ground should overcome bias problems and accurately represent the effective sex ratio. With National Marine Fisheries Service support, a natural population of loggerheads at Cape Canaveral, Florida, and a captive reared sample of Kemp's ridleys at Galveston, Texas, have been studied. Since sex can not be determined by external observations, the relative circulating levels of testosterone were used to predict sex from a sample of 172 loggerheads (Figure 1) and 10 ridleys (Figure 2). This endocrine method of evaluating sex was verified to be completely accurate by conducting laparoscopic examination of the gonads in 24 individuals. The technique was also found to be accurate in each season of the year at ambient water temperature between 19° and 27°C. A method of predicting sex by use of careful tail measurement was not accurate in the loggerheads but was accurate in the ridleys. The 67 male and 102 female loggerheads indicates a sex ratio of 1 male:1.57 females, which is significantly different from the commonly assumed 1:1 ratio seen in some species.

We conclude:

(1) That the testosterone based sex determination technique is valid for conservation use on natural and captive sea turtle populations, and

(2) That the loggerhead sea turtle population studied may have a need for significantly more females than males.

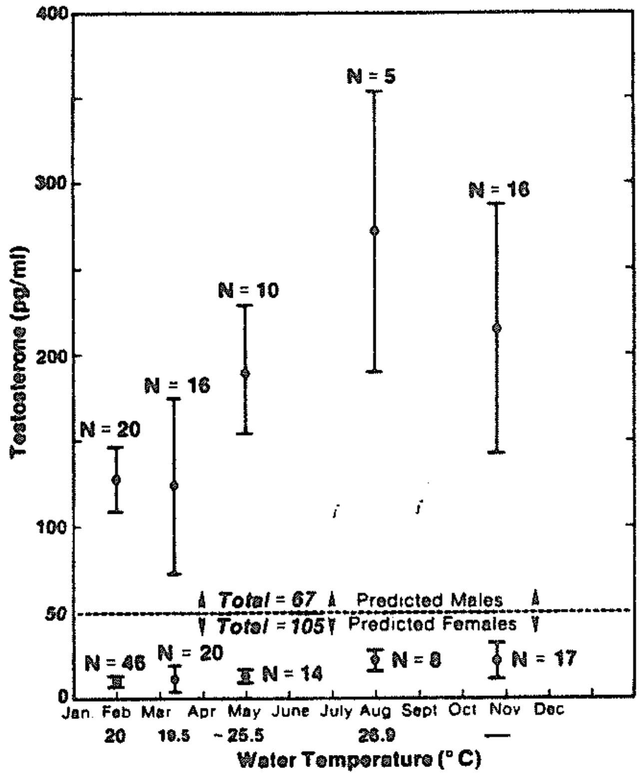

Figure 1. Testosterone levels in the serum of loggerhead turtles compared to time of year and ambient sea water temperature. Males are easily distinguished from females in this immature-wild population.

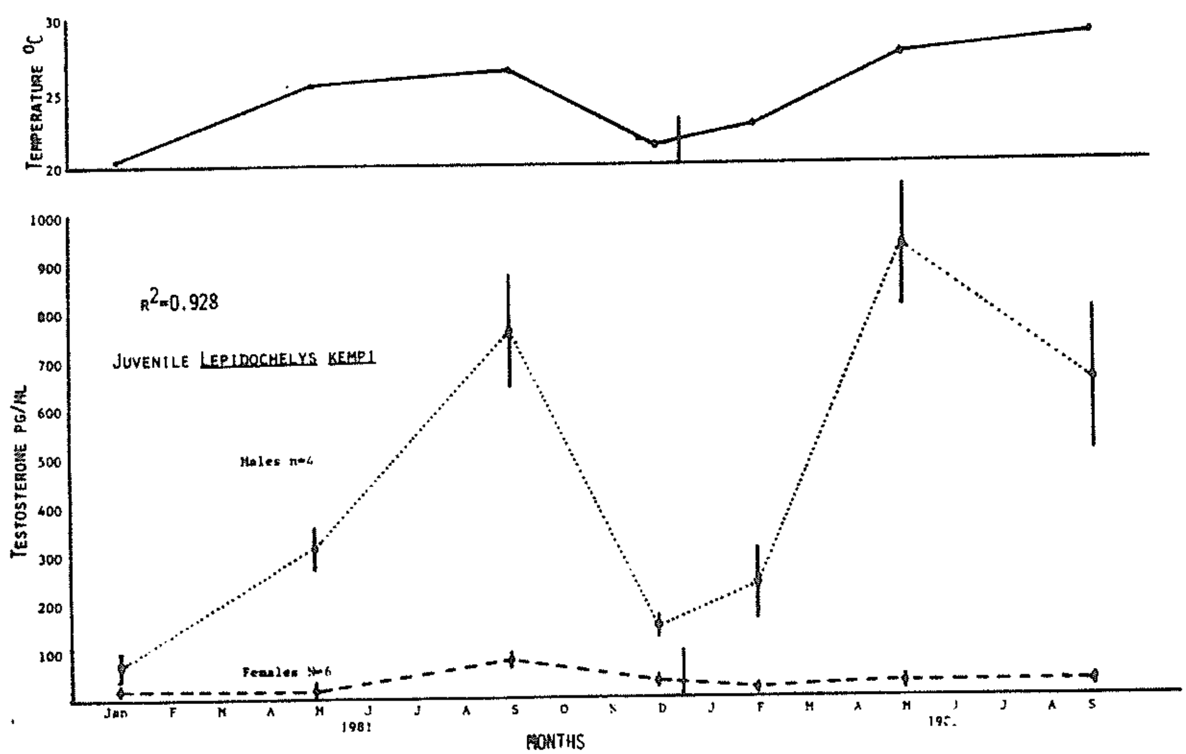

Figure 2. Similar data for head-started Kemp's ridleys hatched in 1978 as part of the joint Mexico-U.S. ridley recovery program.

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International Trade in Sea Turtle Products in the Wider Caribbean

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Of the seven species of sea turtles, three species, hawksbill, green, and olive ridley have been heavily exploited to supply international markets with sea turtle products. Products in trade include both raw parts of turtles (e.g., shell, skin, oil), and manufactured items (e.g., "tortoise shell" jewelry and carvings, stuffed turtle specimens, polished whole carapaces, leather articles, oil-based cosmetics). All species of sea turtles are listed on Appendix I of the Convention on International Trade in Endangered Species (CITES) which 81 nations have ratified. International trade in Appendix I species is subject to particularly strict regulations in order to protect these species; with very limited exceptions international trade is prohibited.

In the wider Caribbean region there is substantial tourist trade and commercial trade in sea turtle products. Commercial trade includes: (1) direct exports of products from countries where the turtles were harvested to markets in Japan and Europe; (2) trade in products between countries in the wider Caribbean region for tourist markets, for re-export to Japan and Europe, and to a lesser extent for national consumption in the country of import; and (3) imports of products from Asia and Europe for the tourist trade.

This report focuses solely on Japanese import statistics. The data presented represent only a portion of the actual international trade in sea turtle products occurring in the wider Caribbean region. Japan, the largest importing nation for raw hawksbill shell, and a major importing nation for other sea turtle products, has recorded imports by country of origin for hawksbill shell and "other tortoise shell" since 1965 and for turtle skins and leather since 1976.

During the last 18 years (1965-1982), the Japanese imported a minimum of 370,000 kg of hawskbill shell from a minimum of 26 different countries or other geopolitical units in the wider Caribbean region. Based on a very conservative estimate, this represents between 148,000 and 247,000 adult hawksbill turtles. Major exporting (or re-exporting) countries include Panama (142,000 kg), Cuba (97,000 kg), Cayman Islands (30,000 kg), Haiti (21,000 kg), Jamaica (15,000 kg), and the Bahamas (11,000 kg).

In this 18 year period, annual imports into Japan from the wider Caribbean region have averaged 21,000 kg with a high of 27,000 kg in 1973 and a low of 12,000 kg in 1981. In general, hawksbill imports to Japan from the wider Caribbean decreased in the period 1977-1982 relative to the preceeding 12 year period. However, while imports to Japan from certain countries decreased (e.g., Panama) or ended (e.g., Turks and Caicos Islands), imports from at least seven countries - Bahamas, Belize, Cayman Islands, Dominica, French West Indies, Honduras, and St. Lucia - increased. In addition, Japan imported greater quantities of hawskbill shell in 1982 than in the previous four years from Belize, Dominican Republic, and Jamaica.

During the last five years (1978-1982) other imports into Japan from countries in the wider Caribbean region have included 10,000 kg of "other tortoise shell" (probably primarily green turtle shell) from eight countries and 137,000 kg of turtle skins and leather from five countries. Skins exported from Mexico, Nicaragua, and Panama probably originated primarily from sea turtles harvested on the Pacific coast.

Countries can protect sea turtles from impacts of trade by: (1) ratifying and enforcing CITES; (2) adopting and enforcing national legislation protecting sea turtles from trade including controls on harvest, sale, import, and export; (3) assessing stiff penalties for violations of these laws; (4) educating citizens and tourists concerning both the detrimental effects of harvest and trade on sea turtle populations and about laws protecting sea turtles; and (5) taking other measures such as protection of nesting beaches and primary foraging areas and reducing incidental capture of sea turtles.

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Sex Ratio of Adult Green Turtles

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Adult green turtles, *Chelonia mydas*, are reported to have an excess of females on feeding grounds in the Caribbean. Values of the proportion of females in samples range from 0.59 (Mortimer, 1981) to 0.68-0.91 (Caldwell, 1962) and 0.71 (Carr and Giovanolli, 1957). A similar estimate of 0.56 (Hirth and Carr, 1970) was obtained from a feeding ground in Arabia. However, these reports are based on fishermen's catches that may be biased.

A study of adult green turtles on a feeding ground in Oman (Arabia) showed 114 females in a sample of 242, a female proportion of 0.47 (not significantly different from 0.5). Examination of subsamples within this sample reveals three sources of bias that affect the estimate of sex ratio (Table 1).

(1) Samples with sex ratios different from 1:1 can be drawn with a high probability from a population in which males and females are equally represented (Table 2). Sex ratios estimated from samples must be tested against binominal probabilities to determine their significance.

(2) Males and females segregated in some feeding areas. Similar segregation was reported in Australia by Booth and Peters (1972).

(3) In Oman, fishermen selected adult female turtles even when they were the less abundant sex in some areas. As a result, the fishermen's sample over estimated the abundance of females on this feeding ground.

Stratified sampling of sub areas within the feeding ground by an unbiased method revealed segregation of sexes and resulted in the estimate of a sex ratio not significantly different from 1:1.

Estimates of sex ratio in the Caribbean region may have been subject to biases similar to those described in Oman. It is therefore prudent to assume, for management purposes, that the sexes are equally represented in adult green turtles until adequate, unbiased sampling and appropriate analysis yield evidence to the contrary.

Table 1. Numbers of male and female green turtles *Chelonia mydas* from feeding grounds at Masirah Island. Local names of locations in parentheses.

Sample	Males	Females	Proportion Female	x^2
I. Natural deaths	7	21	0.75*	6.03
II. Killed for food	22	35	0.61	2.52
III. Captured by hand				
Loc. 1 (Dawwah)	2	6	0.75	1.13
Loc. 2 (Al Ager)	25	35	0.58	1.34
Loc. 3 (Shagaf)	66	16	0.20*	29.20
Loc. 4 (Bayd)	6	1	0.14	2.29
Total	128	114	0.47	0.70

*Significantly different from 0.5 (x^2 greater than 3.84, P = 0.05, df = 1)

Table 2. Probable number of females in samples drawn from a population with equal numbers of males-females.

Number in Sample	a) Number of Females	b) Proportion of Females
5	1 - 4	0.20 - 0.80
10	3 - 7	0.30 - 0.70
20	5 - 15	0.25 - 0.75
25	9 - 16	0.36 - 0.64
30	11 - 19	0.37 - 0.63
40	16 - 24	0.40 - 0.60
49	19 - 30	0.36 - 0.64
100	40 - 60	0.40 - 0.60
200	86 - 114	0.43 - 0.57
400	184 - 216	0.46 - 0.54
500	230 - 270	0.46 - 0.54
1000	470 - 530	0.47 - 0.57

Only values outside this range indicate significant deviation from equal sex ratio in the population.

The values indicated in a and b occur with probabilities of greater than 0.05.

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The Uses of *Eretmochelys imbricata* in Panama

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The hawksbill turtle (E. imbricata) has been utilized in Panama as a nutritional product since pre-Colombian epochs. During the nineteenth century, this product was the object of exportation. Now, on the Caribbean coast of Panama, the exploitation of this species is threatening the survival of this resource.

Eretmochelys is captured all year round, but during its nesting period the capture is increased. The fishermen utilize the hawksbill turtle as an important source of protein. They utilize the meat, the internal organs of the body, and the eggs. Curiously, the male sex organ is sold as an aphrodisiac. The carapace is sold in Colon and Panama City to the local artisans. The craftsmen use it to make different jewelry: bracelets, necklaces, earrings, etc. Other special articles that are made from the scutes include spurs for rooster fights and ornamental combs used with our national dress. All these ornamental articles can be bought directly from the artisan, local retailers, jewelry stores, artisanal stores, hotels, etc.

Unfortunately, the hawksbill is not protected by law. It is only listed as one more endangered species. We must mention that Panama is a signature country of CITES. For this reason it is necessary to take some urgent measures in order to protect this resource. At the same time, some international and national institutions could help to control more effectively the capture and commercialization of this species. The hawksbill is a valuable, renewable natural resource. No reason exists why this resource can not be utilized and managed rationally in order to feed the people and increase their revenues.

APPENDIX 3: Manual of Sea Turtle Research and Conservation Techniques (Announcement)

The SEA TURTLE MANUAL was conceived, written, published, and distributed to support the research efforts of the National Representatives to WATS, the WATS Technical Team, and any sea turtle research workers who cared to use this publication. Another purpose of the MANUAL was to promote standardization of terms and techniques.

The SEA TURTLE MANUAL was first distributed during 1981 as xerox copies. The MANUAL was published in June 1982 by the Tico Times in San Jose, Costa Rica, as separate English and Spanish versions. The printed versions were distributed by IOCARIBE.

The first printed versions were the product of 12 authors: Peter C. H. Pritchard, Peter R. Bacon, Frederick H. Berry, John Fletemeyer, Archie Carr, Robert M. Gallagher, Robert R. Lankford, Rene Marquez M., Larry H. Ogren, William G. Pringle, Jr., Henry M. Reichart, and Ross Witham. The English version contained 95 pages, the Spanish version 99 pages, and each contained 20 figures, and an annex of four colored plates of 32 plate-figures. The supplies of these first versions were distributed, and the issue was declared out-of-print in July 1983.

The Second Edition of the MANUAL was started in early 1983, also to be issued in English and Spanish. One author was added, Sally R. Hopkins, who collaborated with Fred Berry on a significant revision of the Section on Aerial Surveys. The title was slightly altered. The Second Edition was edited by Karen A. Bjorndal and George H. Balazs.

The English version of the Second Edition was published in November 1983 by the Center of Environmental Education, Washington, D.C. It contains 126 pages, 19 figures, and an annex of five colored plates of 40 plate-figures.

Copies of the Second Edition of the MANUAL, English or Spanish, at $10.00 U.S. per copy, can be obtained from:

Center for Environmental Education
624 9th Street, N.W.
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San Jose, Costa Rica, July 1983

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APPENDIX 5: Eastern Pacific Sea Turtle Research

Ad Hoc Session

The meeting was held on July 23, 1983, at the School of Biology, University of Costa Rica, beginning at 0830 and terminating at approximately 1830. Seventy persons signed the roster and were distributed as follows:

Australia - 1	Mexico - 5
Brazil - 2	Netherlands - 1
Costa Rica - 41	Nicaragua - 3
Ecuador - 1	Panama - 2
France - 1	United States - 7
Guatemala - 1	Venezuela - 1
Honduras -3	

An agenda was followed and completed, and a steering committee formed with the charge of looking for funds to organize a formal regional meeting with the goal of starting a regional program and electing a directorship. The following persons form this committee:

Guillermo Canessa	Costa Rica
Mario Hurtado	Ecuador
Rene Marquez	Mexico
Ricardo Miser	Mexico
Stephen Cornelius	United States (Assessor)
Dalva Arosemena	Panama

The following papers were presented:

1. The great arribadas. Survival or suicide? By Douglas C. Robinson.
2. Cooperative conservation. By Ricardo Mier.
3. Possibilities of starting a coordinated program on Pacific Ocean sea turtles. By Stephen Cornelius.

The following unofficial National Reports were presented:

Nicaragua	Myriam Zeledon M.
Honduras	Mirna Marin
Panama	Argelis Ruiz
Costa Rica	Steve Cornelius
Guatemala	Anne Ramboux
Peru	Jack Frazier
Chile	Jack Frazier
Ecuador	Mario Hurtado
Mexico	Rene Marquez

The papers and reports will be published in Ecuador, under the supervision of Mario Hurtado, and will be distributed to interested parties.

It was generally agreed by the participants that a comprehensive regional program was desirable. Specific actions which might be considered were as follows:

1. Maintain a sufficient supply of tags in a single location for distribution to cooperating national programs as needed.

2. Establish a central data bank for marking studies.

3. Offer computational facilities to those investigators without access to a computer.

4. Agree to reciprocal payment of rewards.

5. Establish a reward fund to cover those programs that exhaust their resources.

6. Prepare a generalized reward poster for distribution throughout the region.

7. Prepare a regional Spanish-language newsletter to inform on research, conservation and management activities.

8. Hold seminars and workshops to promote compatible research methodologies and to discuss management policies.

9. Establish a centralized library which would include reports and theses as well as published works and staff it with a person competent to respond to the specific needs of regional investigators and administrators.

10. Maintain a registry of projects in progress or in planning so to eliminate duplication of effort and establish contact between researchers with related studies.

11. Cooperate in the dissemination of conservation-oriented material such as films, pamphlets, posters, etc.

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The Symposium ended 27 July 1983. Now, 226 days later, the final draft of the PROCEEDINGS OF WATS is ready for printing, with the exception of some minor editorial details.

The editors conscientiously and voluntarily assumed the responsibility of assembling this production for printing and distribution. We also assume responsibility for any flaws or errors that may exist.

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