Caribbean Environment Programme
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Sea Turtle Recovery Action Plan for Suriname

Prepared by:

WIDECAST
Wider Caribbean Sea Turtle Recovery Team and Conservation Network

CEP Technical Report No. 24

1993

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For bibliographic purposes this document may be cited as:

Reichart, H. A. and J. Fretey. 1993. WIDECAST Sea Turtle Recovery Action Plan for Suriname (Karen L. Eckert, Editor). CEP Technical Report No. 24 UNEP Caribbean Environment Programme, Kingston, Jamaica. xiv + 65 pp.

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Sea Turtle Recovery Action Plan for Suriname

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PREFACE

Sea turtle stocks are declining throughout most of the Wider Caribbean region; in some areas the trends are dramatic and are likely to be irreversible during our lifetimes. According to the IUCN Conservation Monitoring Centre's *Red Data Book*, persistent over-exploitation, especially of adult females on the nesting beach, and the widespread collection of eggs are largely responsible for the Endangered status of five sea turtle species occurring in the region and the Vulnerable status of a sixth. In addition to direct harvest, sea turtles are accidentally captured in active or abandoned fishing gear, resulting in death to tens of thousands of turtles annually. Coral reef and seagrass degradation, oil spills, chemical waste, persistent plastic and other marine debris, high density coastal development, and an increase in ocean-based tourism have damaged or eliminated nesting beaches and feeding grounds.

Population declines are complicated by the fact that causal factors are not always entirely indigenous. Because sea turtles are among the most migratory of all Caribbean fauna, what appears as a decline in a local population may be a direct consequence of the activities of peoples many hundreds of kilometers distant. Thus, while local conservation is crucial, action is also called for at the regional level.

In order to adequately protect migratory sea turtles and achieve the objectives of CEP's Regional Programme for Specially Protected Areas and Wildlife (SPAW), *The Strategy for the Development of the Caribbean Environment Programme (1990-1995)* calls for "the development of specific management plans for economically and ecologically important species", making particular reference to endangered, threatened, or vulnerable species of sea turtle. This is consistent with Article 10 of the Cartagena Convention (1983), which states that Contracting Parties shall "individually or jointly take all appropriate measures to protect ... the habitat of depleted, threatened or endangered species in the Convention area." Article 10 of the 1991 Protocol to the Cartagena Convention concerning Specially Protected Areas and Wildlife (SPAW Protocol) specifies that Parties "carry out recovery, management, planning and other measures to effect the survival of [endangered or threatened] species" and regulate or prohibit activities having "adverse effects on such species or their habitats." Article 11 of the SPAW Protocol declares that each Party "shall ensure total protection and recovery to the species of fauna listed in Annex II." All six species of Caribbean-occurring sea turtles were included in Annex II in 1991.

This CEP Technical Report is the seventh in a series of Sea Turtle Recovery Action Plans prepared by the Wider Caribbean Sea Turtle Recovery Team and Conservation Network (WIDECAST), an organization comprised of a regional team of sea turtle experts, local Country Co-ordinators, and an extensive network of interested citizens. The objective of the recovery action plan series is to assist Caribbean governments in the discharge of their obligations under the SPAW Protocol, and to promote a regional capability to implement scientifically sound sea turtle conservation programs by developing a technical understanding of sea turtle biology and management among local individuals and institutions. Each recovery action plan summarizes the distribution of sea turtles, discusses major causes of mortality, evaluates the effectiveness of existing conservation laws, and prioritizes implementing measures for stock recovery.

WIDECAST was founded in 1981 by Monitor International, in response to a recommendation by the IUCN/CCA Meeting of Non-Governmental Caribbean Organizations on Living Resources Conservation for Sustainable Development in the Wider Caribbean (Santo Domingo, 26-29 August 1981) that a "Wider Caribbean Sea Turtle Recovery Action Plan should be prepared ... consistent with the Action Plan for the Caribbean Environment Programme." WIDECAST is an autonomous NGO, partially supported by the Caribbean Environment Programme.

AKNOWLEDGEMENTS

The basic framework for sea turtle conservation in Suriname was laid down in the late 1940's, and to give proper recognition to all the people who have since then, directly or indirectly, contributed to this Sea Turtle Recovery Action Plan for Suriname would be an impossible task. Suffice to say that I (HAR) can express my gratitude and appreciation only to those people that I am, or have been, in close contact with during my work in Suriname over the past 20 years. First of all I want to acknowledge the contribution of Joop Schulz. He has been the major force behind the development of the country's sea turtle conservation program. The information derived from his pioneering work can be found throughout this document.

Then there are the field workers, those all-too-often forgotten and unsung heroes who go plodding along the beaches night after night, collecting data for us. Without their dedication and hard work (under often deplorable field conditions) much of the information presented in this Action Plan would not have become available. First among these is Louis Autar, for many years the coordinator of all marine turtle field work in Suriname -- and still going strong. I also want to thank his assistants Eddie Moesé, Katidjo Loor, the Karamantanas, Takoer, Tedjo, Kiba, and many other field workers with whom I have had the pleasure to work on the beaches over the years. Finally, I must not forget the foreign researchers who have made perhaps indirect, but nevertheless significant contributions to this Action Plan through their field work in Suriname. To name just a few: Derek Green, Richard Hill, Peter Dutton, Nicholas Mrosovsky, Peter Pritchard, and Clare Whitmore.

The Foundation for Nature Preservation in Suriname (STINASU) is the Government-designated agency charged with implementing the marine turtle conservation program. I want to thank its former Director, Kris Mohadin and its current Director, Muriel Held for their help and steadfast support in the program. I also want to express my appreciation to Ferdinand Baal, Head of the Nature Conservation Department of the Surinam Forest Service for the work he has done on behalf of marine turtle conservation in Suriname. For many years, the World Wildlife Fund-The Netherlands has been a major supporter of the marine turtle program in Suriname, including facilitating the developing of this Recovery Action Plan by permitting the senior author the time and freedom to work on it. For this, our sincere gratitude.

1/ The WIDECAST regional Recovery Team provided impetus for this document and critiqued earlier drafts. These persons are the following: Lic. Ana Cecilia Chaves (Costa Rica), Dr. Karen L. Eckert (USA), Jacques Fretey (France), Lic. Hedelvy Guada (Venezuela), Dr. Julia A. Horrocks (Barbados), Dr. Peter C. H. Pritchard (USA), Dr. James I. Richardson (USA), and Dr. Georgita Ruiz (Mexico). The IUCN/SSC MTSG (Dr. Karen A. Bjorndal, Chair) and UNEP-CAR/RCU (Dr. Richard Meganck, Co-ordinator) reviewed an earlier draft. Major financial support for WIDECAST has come from the UNEP Caribbean Environment Programme, the U. S. National Marine Fisheries Service (Office of Protected Resources), and the U. S. State Department (Bureau of Oceans and Intl. Environmental and Scientific Affairs/Office of Ocean Affairs). The Chelonia Institute provided travel assistance to Dr. K. L. Eckert and Dr. J. I. Richardson in 1993. Special appreciation is due Milton Kaufmann (President of Monitor International and Founder of WIDECAST) for his unwavering personal commitment to the project.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

CEP ……..... UNEP Caribbean Environment Programme
CITES …….. Convention on International Trade in Endangered Species
EEZ …… Exclusive Economic Zone
IUCN …… World Conservation Union
LBB ……..….. Dienst's Lands Bosbeheer (Surinam Forest Service)
SAIL ……. Surinam American Industries, Ltd.
SSC …… IUCN Species Survival Commission
SPAW Protocol ……..... Protocol concerning Specially Protected Areas and Wildlife
STINASU …….. Stichting Natuurbehoud Suriname
(Foundation for Nature Preservation in Suriname)
TED …… Turtle Excluder Device
UNEP ……. United Nations Environment Programme
U.S. FWS …….. United States Fish and Wildlife Service
WATS …… Western Atlantic Turtle Symposium
WIDECAST ……... Wider Caribbean Sea Turtle Conservation Network

LIST OF TABLES AND FIGURES

ABSTRACT

Suriname is the centermost of the three Guianas, which are located along the Atlantic coast of northern South America. The four species of sea turtle nesting in Suriname are the leatherback (Dermochelys coriacea), the green (Chelonia mydas), the olive ridley (Lepidochelys olivacea), and the hawksbill (Eretmochelys imbricata). Only once has a loggerhead sea turtle (Caretta caretta) been seen on a Surinam beach and for all practical purposes the loggerhead can be ignored as a species nesting in Suriname. The most common species nesting are the leatherback and the green turtle. Olive ridley nesting was relatively abundant in the 1960's and 1970's, but the Surinam nesting population (the most important in the Western Atlantic) now appears to be in danger of extinction. Hawksbills nest only occasionally, rarely more than 30 nests per year. The nesting season is generally from February through August, with peak season varying slightly depending on the species. The leatherback and green turtle populations appear to be healthy and stable. They may even be increasing, although this could be caused by a shift from French Guiana, where some nesting beaches are eroding. Local foraging is most likely limited to the olive ridley. Tagging studies show that green turtles migrate to distant foraging pastures, primarily in Brazil, and leatherbacks return to temperate latitudes after nesting.

Presently, the only exploitation of sea turtles in Suriname is the use of eggs. Except for an occasional incident, no adults are slaughtered for food. The Government has set strict limits on the egg harvest, and the collecting is to be done only in the Galibi Nature Reserve by local Amerindians under supervision of the semi-Government foundation STINASU (Foundation for Nature Preservation in Suriname). Each year STINASU is given a permit to collect 200,000 - 250,000 eggs for sale on local markets. Only eggs from "doomed nests" (those nests otherwise expected to be lost to shoreline erosion) are collected for sale. STINASU engages egg collectors from the local Amerindian communities. A portion of the income STINASU derives from the sale of the eggs is deposited in the Amerindian village treasury, and STINASU uses its share to hire extra guards to protect the other nesting beaches. Because of conservation measures in place for several decades, only one local species is seriously threatened and that is the olive ridley. The reasons for the decrease could be several, most prominent among these are (a) the over-harvesting by local Amerindians up to about 1969 and (b) the lack of enforcement in using turtle excluder devices (TEDs) on shrimp vessels operating off the coast of the Guianas. Incidental catch and drowning in shrimp trawls and driftnets is the most severe and unresolved sea turtle conservation issue in Suriname.

Suriname has an excellent set of nature protection legislation dating back nearly a half century. Nevertheless, there is room for improvement in the regulatory framework; specifically, provisions for the full protection of sea turtles at sea (to the edge of the country's 200 mile economic zone) are vague in current legislation and penalties (including fines) are inadequate to act as reasonable deterrents to illegal activity. In addition, enforcement is marginal because of lack of personnel. A critical need exists to build up the infrastructure of the various agencies concerned with marine turtle protection and management. Equipment is lacking for even the few guards or field workers to perform their tasks satisfactorily. Recent armed rebellion in the interior and the illegal occupation by Amerindians of the Galibi Nature Reserve (both peacefully settled in 1993) have been serious setbacks to population monitoring and conservation efforts

formerly directed toward sea turtles. Several recent reports, including this one, recommend greater participation and economic benefit for Amerindians living near the Galibi Nature Reserve. In addition, we have recommended that an infusion of conservation funds be secured and used to hire and train additional personnel, develop educational materials, and compose a bilingual (Dutch/English) manual entitled: Sea Turtle Conservation Techniques and Procedures in Suriname.

It is abundantly clear that marine turtle populations nesting throughout the Guianas should be protected through a framework of regional regulations. This will require unequivocal cooperation between Suriname, Guyana, French Guiana, Brazil, and Venezuela. To attain this cooperation through country-to-country negotiations would be difficult, but here is where WIDECAST could play an essential role in bringing it about. Each country should have its national policy, of course, but for marine turtle conservation they should also work with a comprehensive set of regional regulations. Also to this end, we recommend that the Cartagena Convention with its Protocol concerning Specially Protected Areas and Wildlife (SPAW Protocol) be ratified as soon as possible.

SAMENVATTING

Suriname is het middelste land van de drie Guiana's en ligt langs de Atlantische kust in het noorden van Zuid Amerika. De vier soorten zeeschildpadden die op de stranden van Suriname hun eieren leggen zijn de lederschildpad, die in de Surinaamse volkstaal Sranan Tongo *aitkanti* of soms *siksikanti* genoemd wordt, (Dermochelys coriacea); de soepschildpad, *krapé*, (Chelonia mydas); *warana* (Lepidochelys olivacea) en de karetschildpad, *karèt* (Eretmochelys imbricata). Er is slechts éénmaal een dikkop, *onechte karèt* (Caretta caretta) op een Surinaams strand waargenomen en deze zeeschildpad moet derhalve niet als een in Suriname nestende soort beschouwd worden. De meest voorkomende zeeschildpadden die in Suriname hun nesten maken zijn de aitkanti en de krapé. Gedurende de jaren zestig en zeventig waren er nog redelijk veel warana's in de in Suriname nestende populatie (de belangrijkste in de West Atlantische Oceaan), maar deze populatie blijkt nu met uitroeiïng bedreigd te zijn. Er komen maar weinig Karèt's naar Surinaamse stranden, er worden zelden meer dan 30 nesten per jaar gelegd. Het algemene legseizoen voor de vier soorten is van februari tot en met augustus, met hoogtepunten van nestactiviteiten die per soort iets van elkaar verschillen. De aitkanti en krapé populaties blijken gezond en stabiel te zijn. Het is zelfs mogelijk dat hun aantallen nog toenemen maar dit kan veroorzaakt worden door de verplaatsing van aitkanti's en krapé's uit Frans Guiana waar enkele legstranden aan erosie onderhevig zijn. Studies door middel van het merken van zeeschildpadden ("tagging studies") hebben aangetoond dat, na in Suriname hun eieren gelegd te hebben, krapé's naar ver afgelegen zeegrasvelden, die vooral langs de kust van Brazilië liggen, migreren om daar te foerageren. Aitkanti's reizen naar de gematigde breedtegraden in de Atlantische Oceaan na op Surinaamse stranden eieren gelegd te hebben. Warana's foerageren voornamelijk langs de kusten van de Guiana's en Venezuela.

De enige vorm van exploitatie van zeeschildpadden in Suriname is de consumptie van eieren. Behoudens een incidenteel voorkomend geval, worden volwassen zeeschildpadden niet geslacht voor gebruik als voedsel. De Overheid heeft strenge beperkingen gezet voor het rapen van eieren. In het Galibi Natuurreservaat mag dit alleen door ter plaatse wonende indianen gedaan worden, onder toezicht van de parastatale Stichting Natuurbehoud Suriname, STINASU. STINASU krijgt elk jaar een vergunning om zo'n 200.000-250.000 eieren te verzamelen voor de verkoop. Slechts eieren van z.g. "doomed nests" (nesten, die vanwege strandafslag toch verloren zullen gaan) worden geoogst. STINASU contracteert eierenrapers uit de lokale indiaanse bevolking en koopt de eieren ter plaatse van hen. De eieren worden dan door STINASU op de markt gebracht. Een deel van de inkomsten, die STINASU met deze verkoop verdient, wordt in het Indiaanse dorpsfonds gestort terwijl STINASU haar aandeel gebruikt voor het aannemen van seizoenarbeiders voor de bewaking van alle legstranden in Suriname. Vanwege de goede natuurbeheerswetgeving, die reeds geruime tijd bestaat, is er maar één bedreigde soort in Suriname en dat is de warana.

De oorzaken van de teruggang van de waranapopulatie kunnen meerdere zijn maar de belangrijkste daarvan zijn: a) een te grote oogst van warana eieren door lokale indianen (dit kon pas in 1969 gestopt worden); b) het niet gebruiken van de z.g. turtle excluder devices (TED's) op de garnalenboten die langs de kusten van de Guiana's opereren; c) het toenemende gebruik van drijfnetten in de kustvisserij. Het verdrinken van zeeschildpadden, als gevolg van incidentele

vangst in netten van garnalenboten en drijfnetten, is het grootste probleem voor de instandhouding van zeeschildpadden in Suriname.

Suriname heeft een uitstekende natuurbeschermingswetgeving, die reeds zo'n halve eeuw geleden van kracht werd. Desondanks is er verbetering mogelijk. Met name de wetgeving om zeeschildpadden ook op zee volledig te beschermen (tot de grens van Suriname's 200 mijl Economische Zone) is vaag in de huidige artikelen en straffen (inclusief boetes) zijn onvoldoende om als redelijke afschrikking te dienen tegen onwettige handelingen. Bovendien is de uitvoering van de wetgeving niet optimaal door gebrek aan personeel. Het is noodzakelijk om de infrastructuur van de verschillende organisaties belast met het uitvoeren van zeeschildpaddenbescherming en -beheer op te bouwen. Er is een schrijnend tekort aan zowel personeel als uitrusting; de weinige bewakers of veldassistenten die er nu zijn kunnen hun taken niet optimaal uitvoeren. De spanningen in het binnenland en de illegale bezetting van het Galibi Natuurreservaat door indianen (beiden vreedzaam beëindigd in 1993) hebben zeer schadelijke gevolgen gehad voor het monitoren and beschermen van de zeeschildpadden in het reservaat. Recente rapporten, inclusief dit recovery action plan, bevelen een grotere samenwerking aan met de indiaanse bevolking die rond het Galibi Natuurreservaat woont. Er wordt ook aanbevolen, dat er een infusie van beschermingfondsen komt om het personeelskader uit te breiden en te trainen, educatie materiaal te ontwikkelen en een tweetalige (Nederlands/Engels) handleiding getiteld: "Technieken en Procedures voor het beheer van zeeschildpadden in Suriname" samen te stellen.

Het is overduidelijk, dat de zeeschildpaddenpopulaties van de Guiana's beschermd moeten worden door middel van een raamwerk van regionale verordeningen. Dit zal een volledige samenwerking tussen Suriname, Guiana, Frans Guiana, Brazilië en Venezuela vereisen. Het is moeilijk deze samenwerking tot stand te brengen door middel van individuele onderhandelingen, maar WIDECAST zou een belangrijke rol kunnen spelen in het bewerkstelligen hiervan. Elk van betrokken landen moet natuurlijk zijn eigen nationale wetgeving hebben, maar voor de optimale bescherming van zeeschildpadden moeten deze landen ook een toepasselijk raamwerk van regionale regels hebben. Wat dit betreft bevelen wij aan dat de Cartagena Convention, met zijn Protocol betreffende Speciaal Beschermde Gebieden en Flora en Fauna (SPAW Protocol), zo spoedig mogelijk geratificeerd wordt.

RESUMEN

Surinam es el país más central entre las tres Guayanas, las cuales se encuentran localizadas en la costa Atlántica del norte de América del Sur. Las cuatro especies de tortugas marinas que anidan en Surinam son la Laúd o la Tora (Dermochelys coricea), la Tortuga Verde del Atlántico (Chelonia mydas), la Golfina (Lepidochelys olivacea), y la Carey (Eretmochelys imbricata). Solamente una vez se ha visto una Caguama (o una Cabezona Caretta caretta) en las playas de Surinam y para todo efecto práctico se puede decir que las Caguamas no son una especie que anida en Surinam. Las especies que más comúnmente anidan en Surinam son la Laúd y la Tortuga Verde del Atlántico. La anidación de la Golfina fue relativamente abundante en los años sesentas y setentas, pero la población anidante en Surinam (la más importante en el Atlántico Occidental) ahora parece estar en peligro de extinción. Las Careys solo anidan ocasionalmente, y raramente más de treinta nidos por año. La época de anidación es generalmente de febrero a agosto, con el período de mayor intensidad que varía ligeramente dependiendo de la especie. Las poblaciones de la Laúd y la Tortuga Verde del Atlántico parecen estables y saludables. Estas inclusive podrían estar aumentando, aunque puede ser también un movimiento de las poblaciones de la Guayana Francesa, donde se están erosionando las playas de anidación. El forraje local más que todo lo realiza la Golfina. Estudios donde los animales son etiquetados demuestran que las Tortugas Verdes del Atlántico migran hacia pastizales de forraje muy alejados, principalmente en Brasil, y las Laúds regresan a latitudes templadas después de anidar.

La única explotación de las tortugas marinas en Surinam actualmente es por sus huevos. Excepto algunos incidentes ocasionales, no son capturadas por su carne. El Gobierno ha establecido límites estrictos para la recolección de huevos, la cual debe hacerse por los Amerindios locales en la Reserva Natural Galibi bajo la supervisión de la fundación semi-gubernamental STINASU (Fundación para la Preservación de la Naturaleza en Surinam). Cada año se le otorga a STINASU un permiso para recolectar de 200.000 a 250.000 huevos para la venta en los mercados locales. Unicamente se recogen para la venta los huevos de "nidos perdidos" (aquellos nidos que se anticipa se perderán por la erosión). STINASU contrata a los recolectores de huevos de las comunidades locales de Amerindios. Una porción de los ingresos que STINASU deriva de la venta de los huevos es depositada en la tesorería de la aldea Amerindia, y STINASU utiliza su porción para contratar guardas adicionales para proteger las otras playas de anidación. Debido a que se han implementado medidas de conservación por varias décadas, solamente una especie local, la Golfina se encuentra seriamente amenazada. Las razones de su disminución pueden ser muchas, dentro de las más importantes se encuentran: (a) la sobre-recolección por los Amerindios locales hasta 1969 y (b) el no poner en vigor la utilización de aparatos que excluyen tortugas (TEDs) en los barcos camaroneros que operan en las costas de las Guayanas. La captura y ahogamiento accidental en las redes camaroneras y de arrastre es el problema más importante y aún por resolver para la conservación de las tortugas marinas en Surinam.

Surinam tiene una excelente legislación sobre protección de la naturaleza que data desde hace casi medio siglo. Sin embargo, existe campo para mejorar el marco regulador, específicamente, son vagos los dispositivos para la protección total de las tortugas marinas en el mar (hasta la franja de las 200 millas de la zona económica del país) en la legislación actual y las penalidades (incluídas multas) son inadecuadas para servir como freno a cualquier actividad ileg-

al. Adicionalmente, el cumplimiento de la ley es marginal debido a la falta de personal. Existe la necesidad crítica de mejorar la infraestructura de varias agencias involucradas con el manejo y protección de las tortugas marinas. Hace falta equipo para que los pocos guardas y empleados de campo realicen sus tareas satisfactoriamente. Una reciente rebelión armada en el interior y la ocupación ilegal por los Amerindios de la Reserva Natural Galibi (ambas resueltas pacíficamente en 1993) han ocasionado serios atrasos a los esfuerzos de vigilancia y conservación de la población que anteriormente se dirigían hacia las tortugas marinas. Varios informes recientes, incluído este, recomiendan una mayor participación y beneficio económico para los Amerindios que habitan en las cercanías de la Reserva Natural Galibi. Adicionalmente, se ha recomendado que se asegure la entrada de fondos para la conservación y que estos se utilicen para contratar y capacitar personal, desarrollar material educativo y preparar un manual bilingüe (holandés/ inglés) titulado: "Técnicas y Procedimientos para la Conservación de la Tortuga Marina en Surinam".

Es perfectamente claro que las poblaciones de tortugas marinas que anidan a lo largo de las Guayanas deben ser protegidas a través de un marco de regulaciones regionales. Esto requerirá la cooperación inequívoca entre Surinam, Guayana, Guayana Francesa, Brasil y Venezuela. Lograr esta cooperación a través de negociaciones de país a país será muy difícil, pero es allí donde WIDECAST puede jugar un papel esencial en acelerar este proceso. Cada país, por supuesto, debe tener su propia política nacional, pero para la conservación de las tortugas marinas también se debe trabajar en un marco de regulaciones regionales. En este sentido tambien recomendamos, que el Convenio de Cartagena con su Protocolo Relativo a las Areas y Flora y Fauna Silvestres Especialmente Protegidas (Protocolo de SPAW) sea ratificado lo antes posible.

RESUME

Le Suriname est situé au centre des trois guyanes du long de la côte Atlantique au nord de l'Amérique du Sud. Les quatre espèces de tortues de mer qui pondent au Suriname sont la tortue luth (Dermochelys coriacea), la tortue verte (Chelonia mydas), la tortue olivâtre (Lepidochelys olivacea) et la tortue imbriquée (Eretmochelys imbricata). Du fait de n'avoir vu qu'une fois la tortue caouanne (Caretta caretta) sur une plage du Suriname, on ne peut donc en tenir compte dans la détermination des espèces pondant au Suriname. Les espèces les plus communes qui pondent sont la tortue luth et la tortue verte. Alors que la ponte de la tortue olivâtre était relativement abondante dans les années 60-70, la population pondante de Suriname (la plus importante dans l'Atlantique occidentale) s'avère actuellement être en voie de disparition. La fréquence de ponte de la tortue imbriquée est très peu élevée (jamais plus de 30 pontes par an). La saison de ponte dure généralement du mois de février au mois d'août avec bien sûr quelques variantes en fonction de l'espèce. Les populations de tortues luths et de tortues vertes restent stables et en bonne santé. Leur nombre peut même augmenter, bien que cela pourrait provenir du déplacement de leurs populations de la Guyane française, où quelques plages de ponte s'érodent. Les fourrages locaux sont vraisemblablement limités à la tortue olivâtre. Des études de contrôle montrent que les tortues vertes émigrent vers des pâturages fourragers lointains, principalement au Brésil; et les tortues luths retournent aux latitudes tempérées après la ponte.

Aujourd'hui, l'exploitation des tortues de mer se fait seulement au niveau du ramassage des oeufs. Exceptionnellement, sont-elles capturées pour leur chair. Le Gouvernement a établi des règles strictes quant à la récolte des oeufs. En effet, ceux-ci ne peuvent être collectés que dans le Galibi Natural Reserve par les Amérindiens locaux sous la supervision de la fondation semi-gouvernementale STINASU (Fondation pour la conservation de la nature au Suriname). Chaque année on accorde à STINASU un permis pour collecter 200.000 à 250.000 oeufs pour vente sur les marchés locaux. Seulement seront recueillis pour la vente les oeufs de "doomed-nests" (les nids qui apparemment seront perdus à cause de l'érosion). STINASU emploie des gens pour recueillir les oeufs des communautés amérindiennes locales. Une portion des revenus de STINASU provenant de la vente des oeufs est déposée dans la caisse du village Amérindien, et STINASU utilise sa part pour employer des gardiens additionnels pour protéger les autres plages de ponte. A cause des mesures de conservation en place depuis plusieurs années, seulement une espèce locale est sérieusement menacée et c'est la tortue olivâtre. La réduction de cette espèce peut avoir plusieurs causes. Parmi les plus vraisemblables on peut citer: (a) la trop grande récolte faite par les Amérindiens jusqu'en 1969 approximativement; (b) le manque de renforcement de la défense d'utiliser des instruments d'élimination des tortues (TEDs) sur les bateaux de crevettes opérant près de la côte des guyanes. Des prises et noyades accidentelles et le noyage de trainées et de bandes de crevettes sont le problème le plus sévère et non résolu en ce qui concerne la conservation de tortues de mer au Suriname.

Suriname a une excellente gamme de réglements sur la protection de la nature datant de près d'un demi-siècle. Cependant des améliorations demeurent nécessaires dans le cadre régulateur. Notamment, les provisions pour la protection totale des tortues marines de mer (jusqu'au bord des 200 miles de la zone économique du pays) sont vagues dans les réglements actuels et les pénalités (y compris les amendes) sont inadéquates et ne peuvent donc constituer

une action préventive contre les activités illégales. De plus, leur application est marginale à cause du manque de personnel. Un besoin critique existe pour créer l'infrastructure de plusieurs agences s'intéressant à la protection et à la gestion des tortues marines. Le besoin de personnel et de matériel se fait sentir même au niveau des quelques gardes et de travailleurs des champs dans l'exécution de leurs tâches avec satisfaction. Une récente rébellion armée intérne et l'occupation illégale par les amérindiens du Galibi Nature Reserve (les deux ont paisiblement cessé en 1993) ont retardé sérieusement les efforts de surveillance et de conservation de la population qui auparavant se concentraient sur les tortues de mer. Plusieurs rapports récents, y compris celui-ci, recommandent une plus grande participation et le bénéfice économique pour les amérindiens vivant près du Galibi Nature Reserve. De plus, nous avons recommandé qu'une infusion de fonds pour la conservation soit assurée et utilisée pour le recrutement et la formation de personnel supplémentaire, le développement de matériel éducatif, et la préparation d'un ouvrage bilingue (anglais/dutch) titré: "Techniques et procédures pour la conservation des tortues de mers au Suriname".

Il est très clair que les populations de tortues marines pondant à travers les guyanes doivent être protégées dans le cadre des règlements régionaux. Ceci demandera coopération non équivoque entre le Suriname, le Guyana, la Guyane française, le Brésil et le Venezuela. Il serait difficile d'atteindre cette coopération par des négociations de pays en pays, mais c'est ici que WIDECAST pourrait jouer un rôle essentiel. Chaque pays doit avoir sa police nationale, bien sûr, mais pour la conservation des tortues marines ils doivent aussi travailler avec une vaste gamme de règlements régionaux. Aussi à cette fin, nous recommandons que la Convention de Carthagène avec son Protocole relatif aux zones et à la vie sauvage spécialement protégées (Protocole SPAW) soit ratifiée au plus vite possible.

I. INTRODUCTION

The Republic of Suriname is situated on the northeast coast of South America, between 2^{o} and 6^{o} North latitude at about 54^{o} West longitude (Figure 1). The country borders the Atlantic Ocean to the north, Guyana to the west, French Guiana to the east, and Brazil to the south. Suriname, with its size of about 164,000 km^{2} and total population of about 380,000, is one of the more thinly populated countries in South America. The warmest month is October, averaging 28.3°C; the coolest month is January, averaging 26.1°C (Reichart, 1992). The annual rainfall varies from 1,500 mm in the coastal region to about 3,000 mm in the more mountainous interior. Heavy rains usually fall from May to mid-August. A relatively dry season characterizes the periods February through April and mid-August through November, especially the latter. The average daily wind velocity along the coast is 5 km per hour. In general, winds are strongest during the short dry season (February-April), and weakest during the long rainy season (May to mid-August). The roughest seas occur in February and March; this is also the time when the most dramatic changes in the coastline occur. The difference in air temperature above land and sea creates an air circulation where during the day there is a wind from the sea to land, and at night a wind from land to sea. This wind circulation determines to a great extent the weather in the coastal region (Reichart, 1992). About 80% of the country is virtually uninhabited and covered with undisturbed Neotropical rain forest. In the north and the extreme south there are a variety of savanna types. Suriname has set a number of these ecosystems aside as protected areas (Figure 2). Along almost the entire coast mangrove forests occur, but these are punctuated with sandy beaches where four species of sea turtle lay their eggs.

Nesting by sea turtles in Suriname has been documented for more than three centuries (Anonymous, 1686; Stedman, 1796; Kappler, 1881), but Diemont (1941) and Geijskes (1945) were the first to record precise observations on this topic. Prior to 1940, green (Chelonia mydas) and olive ridley (Lepidochelys olivacea) sea turtles were caught for export (Geijskes, 1945). Geijskes estimated that for the period from 1933-1940, an average of 1,000 green turtles and 1,500 ridleys were killed per year by local Amerindians. These were sold in the Surinam border town of Albina (Figure 3) to a Mr. Berkeley who controlled the export business. From 1938-1939, approximately 3,000 green turtles were killed (Geijskes, 1945). Thirty years later, in 1968, a year in which more green turtles nested in Suriname than in previous years, only about 1,000 green turtles came ashore (Schulz, 1975). Schulz (1975) explains that after 1940 the slaughter of turtles for export almost came to an end, but that many turtles were still being killed on the beach by, among others, fishermen (from Geijskes' remarks). The "Jachtverordening 1954" (Game Law of 1954) and the subsequent "Jachtbesluit 1970" (Game Resolution of 1970) provided all sea turtle species (but not their eggs) with complete protection (section 4.21).

Historically, egg collection was excessive, and this has taken its toll on the sea turtles of Suriname. The harvesting of turtle eggs has long been a tradition of coastal Amerindians, especially the Caribs inhabiting the Marowijne estuary. [N.B. Throughout this Action Plan, the terms "Amerindians", "Caribs" and "Galibi Indians" will be used interchangeably. They will all refer to the Carib Indians living near the Galibi Nature Reserve.] According to Geijskes (1945), the taking of eggs in the 1940's was more intensive than in the previous century due to the increased demand by Chinese and other people of Asiatic origin (especially Javanese). The egg-takers kept the eggs in their camps until enough were collected (which could be anywhere

from 17,000 to 100,000) to load a boat. These were taken to Paramaribo, in the Commewijne District of Suriname, and also to St. Laurent, French Guiana. Yearly harvest levels were not given.

In 1963, a research and protection program for marine turtles was initiated by personnel of the Surinam Forest Service (LBB) under the direction of J. P. Schulz. The results from this remarkable program were published in "Sea Turtles Nesting in Surinam" (Schulz, 1975). In 1969, the responsibility for the sea turtle conservation program was assigned to the Foundation for Nature Preservation in Suriname (STINASU), a semi-governmental agency entrusted with promoting and facilitating conservation research, nature education, and tourism in Suriname's nature reserves. After Schulz retired, H. A. Reichart became Director of STINASU and continued the program. On Reichart's departure, K. Mohadin became Director. Today STINASU is directed by M. M. Held with L. Autar serving as field project coordinator of the marine turtle conservation program. Reichart, funded by World Wildlife Fund-Netherlands, currently serves as Senior Technical Advisor to the LBB and STINASU, which includes providing technical support for the marine turtle conservation program in Suriname. Although currently faced with an acute shortage of funds, materials, and personnel, STINASU continues to protect the turtles and nesting beaches to the best of its ability. Assistance is sometimes given by artisanal fishermen, a few of whom are allowed to operate in the nature reserves with a special permit from the Forest Service. Their permits can be revoked if they are involved in poaching or harassing sea turtles, or any other protected wildlife species.

As part of Suriname's conservation strategy, which includes the harvest for human consumption of otherwise doomed eggs from the nation's spatially dynamic beaches, 200,000-250,000 eggs were legally harvested per year during the 1970's. This egg harvest was agreed upon to ensure public acceptance of Suriname's marine turtle conservation program. In the mid-1980's, the harvest was temporarily increased to about 400,000 eggs. It is currently at the original level, and the open season is limited to March-May. Only the eggs of leatherbacks (Dermochelys coriacea) and green turtles are allowed to be collected. The exact number to be harvested is based on the number of eggs laid the previous year (Mohadin, 1987) and, as a rule, only nests obviously doomed by natural forces (such as tidal inundation or erosion) are harvested. If manpower is available, other doomed nests are relocated to safer places for hatching. An illegal harvest also occurs, but has not yet been fully quantified (section 3.3). The major Surinam nesting beaches are located in the Galibi Nature Reserve and are fully protected. The legal quota of turtle eggs on these beaches is collected by Amerindians under the supervision of STINASU. Some other nesting beaches which, because of continual erosion and accretion cannot be fixed in a nature reserve, are protected by annual decrees. Only a few, marginal nesting sites are open for egg collecting by the public.

The objectives of this Sea Turtle Recovery Action Plan are to (a) provide the most current and comprehensive information on the distribution and status of sea turtles in Suriname, (b) review the national and international legal responsibilities of the Government toward sea turtles, (c) discuss contemporary threats to the continued survival of sea turtles in Suriname, and (d) make recommendations for their conservation and management. Our recommendations include designation of protected areas, enhancement of law enforcement capabilities, and upgrading of personnel capabilities. It is anticipated that the document will provide information

and impetus to all those interested in improving the plight of sea turtles in this country. The Plan has also been designed to support fund-raising initiatives and includes a draft budget for rehabilitating the Surinam marine turtle conservation program.

II. STATUS AND DISTRIBUTION OF SEA TURTLES IN SURINAME

Five species of sea turtle are recognized as *Endangered* in the Western Atlantic region and a sixth, the loggerhead turtle, is classified as *Vulnerable* by the World Conservation Union (IUCN) (Groombridge, 1982). Sea turtles are still harvested in many areas for meat, shell, oil, and eggs. They are also accidentally captured in active or abandoned fishing gear, resulting in the deaths of tens of thousands of turtles each year. Oil spills, chemical waste and persistent plastic debris, as well as the ongoing degradation of important nesting beaches and feeding grounds, also threaten the continued existence of Western Atlantic populations. Five species of sea turtle are recorded from Suriname. As summarized below (and see Table 1), nesting by Chelonia mydas and Dermochelys coriacea is quite heavy (and the latter is increasing dramatically), Lepidochelys olivacea shows wide fluctuations but is declining, Eretmochelys imbricata reaches perhaps 30 nests per year, and Caretta caretta occurs in Surinam waters but has been observed nesting only once. The distribution and abundance of feeding sea turtles has not been quantified, but may be largely restricted to L. olivacea preying on invertebrates in river delta areas. Incidental catch, particularly of L. olivacea, occurs at a high but uncertain level in offshore waters (section 4.27).

2.1 Caretta caretta, Loggerhead Sea Turtle

Loggerheads are rare in Suriname. The local name is *Onechte Karèt*. Although their presence in coastal waters has long been known from specimens in the collection of The Netherlands' Leiden Museum (Brongersma, 1968), only one nesting has been reported and that in 1969 (Schulz, 1975). Important foraging areas, if present, have not been determined. There are no data available as to which age/size classes are present in Surinam waters, or whether these individuals are migratory or resident. Adult loggerheads are recognized by a large head, thick and somewhat tapered carapace, and five pairs of lateral scutes. The large head and strong jaws, for which the species was named, are necessary adaptations to a diet of mollusks and hard-shelled crabs; tunicates, fishes, and plants are also eaten (Dodd, 1988). Nesting females in Florida, USA, average 92 cm in shell length (straight line, nuchal notch to posterior tip) (range 81-110 cm; n=194) and 116 kg (255 lb) (range 71.7-180.7 kg; n=261) (Ehrhart and Yoder, 1978). Pritchard et al. (1983) suggest that adults can weigh as much as 200 kg (440 lb). Color is red-brown to brown; hatchlings are sometimes gray.

In general, this species has a wide oceanic distribution. Individuals have been sighted as far north as Newfoundland (Squires, 1954) and northern Europe (Brongersma, 1972) and as far south as Argentina (Frazier, 1984). Nesting grounds are often located in temperate latitudes, with the greatest numbers of nesting females recorded along the Atlantic coast of Florida and at Masirah Island (Oman). In the Wider Caribbean, nesting is reported on the Caribbean coasts of Mexico and Central America, the Atlantic coast from Venezuela to Brazil, and occasionally in the eastern Caribbean (summarized by Dodd, 1988). According to the existing paradigm, hatch-

lings leave their natal beaches and are carried passively on the North Atlantic subtropical gyre in Sargassum seaweed rafts to areas of the eastern North Atlantic, including the Azores. After several years, juveniles (typically 50-65 cm shell length) return or are returned by currents to the western North Atlantic to become resident benthic (=bottom) feeders on the continental shelf. Studies of Florida loggerheads suggest that individuals reach sexual maturity at 12-30 years old, more likely at ages closer to 30 years (Frazer and Ehrhart, 1985).

2.2 Chelonia mydas, Green Sea Turtle

The local name for this species is *Krapé*. The green turtle is recognized by a round, blunt beak with serrated cutting edges, one pair of enlarged scales between the eyes, and four pairs of lateral carapace scutes that do not overlap as they do on the hawksbill (cf. section 2.4) (Figure 4). The shell color is light to dark brown, sometimes shaded with olive, with radiating wavy or mottled markings of darker color or with large blotches of dark brown. The plastron (=belly plate) is whitish or light yellow (Carr, 1952). Green turtles nesting in Suriname are among the largest in the world. Fifty individuals, measured in the Galibi Nature Reserve and on the no longer existing nesting beach of Bigisanti in the Wia-Wia Nature Reserve, ranged from 130-235 kg (average 182 kg). In 1970, 291 females nesting at Baboensanti beach (in the Galibi Nature Reserve) measured some 97-125 cm straight line carapace length (average: 109 cm) and had a straight line carapace width of 70-96 cm (average: 84 cm) (Schulz, 1975). Green turtles in the Caribbean feed primarily on the sea grass Thalassia testudinum (Bjorndal, 1982). At least some green turtles nesting in Suriname forage on the algal fields off the Brazilian coast (Schulz, 1975) (see section 4.111).

The nesting population of this species is relatively stable and is estimated to be between 3,700 and 7,200 females (Schulz, 1975; Mohadin and Reichart, 1984). The peak of the nesting period for green turtles extends from March through May, though nesting is recorded from January through August (Table 2). Green turtles nest mainly on the beaches of Baboensanti and Galibi in the Galibi Nature Reserve (Figure 5); they nest to a lesser extent at Matapica, Katkreek and Diana (Figure 6). During January-March copulating pairs can be seen floating "for days" at the ocean surface near the mouth of the Marowijne River (Kappler, 1881). From his tagging studies, Schulz (1975) has found that a female nests about 2-3 times per season, and that she returns every two to three years, with the biennial cycle predominating. Nesting is nocturnal, and clutches are laid 12-14 days apart (perhaps with some correlation between moon and/or tidal phases). An average of 138 eggs are laid per nest (Schulz, 1975). In 1987, of the 6,324 green turtle nests laid, 1,381 (21.8%) were harvested and 111 (1.7%) were poached (Mohadin, 1987). Of 6,776 nests laid in 1988, 642 (9.5%) were harvested and 456 (6.7%) were poached (H. Reichart, unpubl. data). In 1989, green turtles made 7,046 nests (Reichart, 1992). After the 1989 nesting season, armed Galibi Amerindians forced STINASU and LBB personnel out of the Galibi Nature Reserve, and for all practical purposes sea turtle conservation activities in this reserve have come to a standstill since that time. The nesting data for 1990 through 1992 (see Table 1) therefore pertain only to the beaches west of the Wia-Wia Nature Reserve.

Hatchlings emerge from their nests, scurry to the sea, orient offshore in a swimming frenzy that persists over a period of days, and ultimately enter an offshore convergence or weed line. It is well known, for example, that Sargassum seaweed rafts shelter hatchling green turtles

and also harbor a diverse, specialized fauna, including many kinds of little fishes, crustaceans, worms, mollusks, tunicates, and coelenterates; these may provide food for the young turtles (Carr, 1987a). The turtles remain epipelagic (surface dwelling in the open sea) for an unknown period of time (perhaps 1-3 years) before taking up residence in continental shelf habitats. Upon leaving the open sea existence that characterizes their earliest years, green turtles become herbivores and remain so for the rest of their lives (Bjorndal, 1985). Juveniles travel extensively and, in the years preceding reproductive maturity, take up temporary residence in many locations (Carr et al., 1978). They may travel thousands of kilometers throughout the Western Atlantic before the urge to reproduce impels them to migrate to mating and nesting grounds, the latter presumed to be their natal (=birth) beach. Sexual maturity is reached at an estimated 18-36 years of age (reviewed by Frazer and Ladner, 1986).

2.3 **Dermochelys coriacea**, Leatherback Sea Turtle

The leatherback turtle is the largest (adults often weighing 300-500 kg, or 660-1100 lb) of the sea turtles. The Galibi Indians sometimes refer to this species as *Kawana*, but the more common name is *Aitkanti*. In addition, some fishermen recognize a smaller leatherback that they call *Siksikanti*. They claim that *Siksikanti* nests at a different time, exhibits different nesting behavior, and is a distinct species (Schulz, 1975; Reichart, 1992). Their contention has yet to be examined scientifically and at the present time the leatherback is believed to be monotypic. Leatherbacks lack a bony shell and the smooth black skin is spotted with grey-white blotches. The carapace is strongly tapered, measuring 130-165 cm in length (straight line, nuchal notch to posterior tip), and is raised into seven prominent ridges (Figure 4). Powerful front flippers extend nearly the length of the body. The upper mandible is deeply notched. The species is a seasonal visitor to Suriname, migrating from temperate foraging areas to nesting beaches in the Guianas. Nesting is from April through June, at times as early as January (Table 2). Eggs average 5.3 cm in diameter and each clutch contains an average of 85 yolked eggs, with a variable number of markedly undersized "yolkless" eggs also present (Schulz, 1975).

Studies elsewhere in the Wider Caribbean region have shown that leatherbacks typically nest six or seven times per season and return to the nesting beach on multiple year intervals, with the biennial cycle predominating. In 1991, 11 nests were laid by one tagged individual at Sandy Point National Wildlife Refuge (St. Croix, USVI) (Dutton et al., 1992). Since leatherbacks prefer high energy beaches with unobstructed and often deep offshore access, rookery sites are often spatially unpredictable (Mrosovsky, 1983a; Eckert, 1987). This is the situation in the Guianas where, due to natural erosion, the reduction in beaches suitable for nesting by leatherbacks in French Guiana has caused the females to come in greater numbers to the coast of Suriname. Consequently, over the last 16 years leatherback nesting frequency has more than doubled. Although nesting takes place between January and August, the nesting peak for this species occurs from March to July in Suriname. Of the 9,816 nests laid in 1987 (nationwide, see Table 1), some 838 (8.5%) were harvested and 214 (2.2%) were poached (Mohadin, 1987). In 1988, 11,436 leatherback nests were laid, of which 454 (4.0%) were harvested and only 60 (0.05%) were poached (H. Reichart, unpubl. data). A secondary peak in leatherback nesting has recently been noted in December. That could possibly be a different nesting population, but supporting data have not yet been collected (L. Autar, pers. comm.).

Leatherbacks are rarely seen offshore during the nesting season, but recent studies deploying time-depth recorders on gravid females nesting in the West Indies have shown that individuals spend the inter-nesting interval diving continuously and can attain depths greater than 1,000 m (Eckert et al., 1986, 1989). Leatherbacks feed predominantly on jellyfish and other soft-bodied prey (Den Hartog and Van Nierop, 1984; Davenport and Balazs, 1991). The impetus behind the diving behavior may be to feed on deep water siphonophores in the "deep scattering layer" (DSL); that is, to feed within the strata of plankton that migrate to the surface of the ocean at night and descend to just below the depth of light penetration during the day. The diving may also represent thermoregulation behavior or predator escape. Preferred offshore habitats for this species have not been defined in Suriname, but tagging studies have shown that after nesting the animals disperse widely across the Atlantic Ocean (Schulz, 1975). Tag returns from females marked on Surinam nesting beaches have come from as far north as Nova Scotia, as far south as Argentina, and as far east as Ghana in West Africa (e.g., Pritchard, 1976). Age at ma-turity is not known.

2.4 Eretmochelys imbricata, Hawksbill Sea Turtle

The local name is *Karèt*. The species is distinguished by a narrow, pointed beak with which it pries sponges and other soft-bodied organisms from coral reefs and other hard bottom habitats. The carapace is often posteriorly serrated and, particularly as the animal matures, the carapace scutes overlap one another (Figure 4). Adults rarely exceed 80 kg (175 lb) in weight and seldom have a carapace length of more than 90 cm (straight line, nuchal notch to posterior tip). Amber coloration with red-brown (to black-brown) and yellow markings is common (Schulz, 1975). Hatchlings are uniformly brown or grey. Hawksbills are "spongivores" and feed mainly on reef-associated sponges in the Caribbean region. Sponges contributed 95.3% of the total dry mass of all food items in digestive tract samples from 61 animals from seven Caribbean countries (Meylan, 1988). Surinam waters are turbid and coral reefs are not known to occur. Thus, it is not likely that Suriname provides important foraging grounds for this species.

Hawksbills are difficult to study and little is known about Caribbean/Atlantic populations. Individuals are migratory, high-density nesting is rare, and the relatively few tagging programs have not been in place long enough to generate a useful number of tag returns (that is, a sufficiently large number of recaptures to illustrate post-nesting movement). Nesting often takes place on isolated beaches which are difficult to monitor on a consistent basis. Gravid females generally retreat into supralittoral vegetation before nesting, leaving little evidence of the nest site aside from a faint asymmetrical crawl (about 0.7 m wide) to and from the ocean. Data collected in Antigua, West Indies, indicate that the average female deposits five clutches of eggs per year, each separated by intervals of 13-18 days (cf. Corliss et al., 1989). Neither intra- nor inter-seasonal nesting frequency is known for Suriname, but Schulz (1975) reports that an average of 146 eggs are laid per nest. A low level of nesting (perhaps 30 nests per year) takes place in Suriname approximately between April and August.

2.5 Lepidochelys kempi, Kemp's Ridley Sea Turtles

There are no records of Kemp's ridleys in Suriname, nor would the species be expected to occur. The diminutive Kemp's ridley is gray in color as an immature and primarily olive green

as an adult (Pritchard et al., 1983). The carapace is round, often as wide as it is long, and carapace scutes do not overlap one another. According to Ross et al. (1989), adults weigh 60-90 lb (27-41 kg) and have a shell length of 23-30 inches (58-76 cm). The species is carnivorous and eats mostly crabs, but also preys upon other crustaceans, shellfish, jellyfish, sea urchins, starfish, and fish. With the exception of a single recapture from Caribbean Nicaragua (Manzella et al., 1991), Kemp's ridleys are confined to the Gulf of Mexico and temperate northern Atlantic. The total adult population is thought to number no more than 900 females and an unknown number of males (Ross et al., 1989), making it the world's most endangered sea turtle. The species nests almost exclusively in the state of Tamaulipas, Mexico.

2.6 Lepidochelys olivacea, Olive Ridley Sea Turtle

Olive ridleys, referred to as *Warana*, are similar in appearance to Kemp's ridleys (section 2.5), having a nearly round carapace (width about 90% of the length) and an adult color of olive green or brown dorsally and yellow-white ventrally. Pores are visible in the inframarginal scales. Each front flipper bears a single claw, the horny beak may be finely serrated, and carapace scutes do not overlap one another. The lateral scutes (those to either side of the median on the shell) are divided into 5-9 pairs (Figure 4), considerably more than other sea turtles which typically have 4-5 pairs. Adults average about 35 kg (77 lb) and rarely exceed 50 kg (Reichart, 1993). At Eilanti, the average straightline carapace length is 68.5 cm (range 63-75 cm, n=500) (Schulz, 1975). The species is carnivorous, preferring crabs, shrimps, clams, snails and fish; plant material is occasionally taken. Specific foraging areas have not yet been identified in Suriname. Tag returns indicate that, after nesting, most of the olive ridleys remain in the offshore waters of the Guianas. A smaller group forages in the Orinoco estuary in Venezuela, and a few have been recorded off the Brazilian coast (P. C. H. Pritchard *in* Schulz, 1975).

Most nesting takes place from mid-May through July with some nests being laid before and after this period (Table 2). In Suriname, olive ridleys nest 1-2 times per season and most, but not all, return the next year; some return to nest every other year. Clutch size over a five-year period averaged 116 eggs (Schulz, 1975). It is generally accepted that Suriname has the most important nesting beaches in the Atlantic for this species, but the number of females arriving each year is declining (Table 1 and Reichart, 1989). The number of olive ridley nests counted on all Surinam beaches in 1968 was 3,290 (Schulz, 1975). By 1989, the number of nests had fallen by more than 80% to only 585 (Table 1). The concomitant disappearance of this species in French Guiana during the same period reinforces the hypothesis that nesting populations may be declining in the entire region. Olive ridleys are captured and often drown in shrimp trawls (P. Pritchard, pers. comm.; C. Tambiah, unpubl. data; H. Reichart, unpubl data) (see also sections 3.3 and 4.27), and this is undoubtedly a significant source of mortality.

III. STRESSES ON SEA TURTLES IN SURINAME

3.1 Destruction or Modification of Habitat

The slow, westward-directed North Equatorial Current (or Guiana Current) carries a large volume of mud (presumably of Andean origin and transported to the Atlantic by the Amazon

River) to the Guianas. A good portion of this settles on and near the coast of Suriname. Because of a combination of strong environmental forces, including the Guiana Current and the northeast trade winds, the entire Surinam coast is characterized by sequential phases of erosion and accretion. The combined effects of sea current and wave action result in erosion on the east side of mud banks and beaches, and siltation on their west side. This causes an apparent movement of the beaches in a westerly direction at a rate of 1-2 km per year, with the result that the location of the nesting beaches continually changes. This erosion/accretion cycle is estimated to take about 35 years (Augustinus, 1978). In spite of the transient nature of suitable beaches in Suriname, important marine turtle nesting sites are always found in two general areas: (a) the beaches in the estuary of the Marowijne River in and near the Galibi Nature Reserve (Figure 5) and (b) the ocean-facing beaches between the Marowijne River and the Suriname River (Figure 6). Only rarely is a turtle nest found anywhere west of the Suriname River. Hence, that part of the coast is monitored only occasionally.

The destruction or modification of important sea turtle nesting beaches by man (e.g., coastal construction and development) is not a serious problem in Suriname. With the exception of fishermen's camps and some minor tourist impact, the beaches are virtually untouched by human development (Mohadin, 1987). Nonetheless, some other human activities on the nesting beaches may present an indirect disturbance for some sea turtle species, and this should be evaluated. For instance, people hunting in the coastal swamps often build overnight shelters on the beaches to avoid mosquitoes. These camp sites are sometimes (unintentionally) located on top of nests and, after the hunters leave, camp remnants (construction materials and garbage) have been known to block hatchling emergence.

At this time, only the nesting beaches in the estuary of the Marowijne River have nature reserve status. The nesting beaches in the Wia-Wia Nature Reserve disappeared from the area in the early 1970's (Figure 7), and this reserve no longer has any nesting beaches within its confines. Because of their impermanent characteristic, some nesting beaches cannot be incorporated in fixed-boundary nature reserves. The turtles and nests on those beaches, however, are protected by annual decrees during the nesting season. A proposed multiple-use management plan for the entire Surinam coast will include provision for the permanent protection of all sea turtle nesting beaches. Such protection is strongly supported by this Recovery Action Plan.

Oil exploitation takes place near the coast in the Saramacca District, but it is far removed and "downstream" with the prevalent ocean current from the nesting beaches. There has been offshore exploration in the past and there will undoubtedly be some in the near future, but there are no known offshore drilling sites at this time. It would be useful to have environmental guide-lines already in place when that time comes. There is some sand mining along the coast, but it is minor and does not take place on the nesting beaches. The Government is keeping close watch on the mining activity, but primarily from the point of view of how it affects protection of the fragile coastline and the shipping channels.

Pollution from agricultural activities, particularly in northwestern Suriname where there are extensive rice fields, is a potentially serious problem. Fertilizer and pesticide run-offs enter the estuary with the effluent eventually discharging into the ocean. Although this type of pollution does not affect the nesting turtles directly (because the area is also "downstream" from

The nesting beaches), it could affect turtles at sea. Coastal water samples should be collected periodically to test for a pollution gradient and the effects of pollution on turtles frequenting the area should be monitored.

Physical damage from fisheries activities that affect the sea bed is unknown. Artisanal fishermen use mostly gill nets and lines; shrimp are caught by trawling. Most of the sea bed is muddy and anchorage appears to do no damage to habitat important to marine turtles.

3.2 Disease or Predation

It is known that marine turtles harbor a variety of parasites and commensals, both external and internal, but there are no data available regarding sea turtle diseases in Suriname. Turtles of all species nesting in Suriname appear healthy and fit, but admittedly, there has never been a study on the subject. Fibropapilloma has not yet been seen on any of the sea turtle species nesting in Suriname (H. Reichart, pers. obs.; L. Autar, pers. comm.). Fibropapilloma disease is a herpesvirus-like infection which has been documented extensively in Florida (Ehrhart, 1991) and has more recently been found in Curaçao (Jacobson, 1990) and Venezuela (Guada et al., 1991). Visible symptoms include external tumors of varying sizes. The tumors can result in blindness and debilitation; in several cases, internal tumors have been seen in the lungs, intestinal surface, and kidneys (Jacobson, 1990). The cause of this potentially fatal disease is not known. If turtles with visible tumors are captured they should be released. Under no circumstances should diseased turtles be eaten.

Predators on nesting turtles include jaguars (Panthera onca), and sharks which patrol close to the coasts in May and June at the height of the nesting season (Schulz, 1975). The jaguar is the most important predator of adult females on the beach. In 1980, a single jaguar killed 13 nesting green turtles on the Baboensanti Beach in the Galibi Nature Reserve within a period of two weeks (H. Reichart, pers. obs.). On 4 July 1987, a jaguar killed a tagged olive ridley nesting on Eilanti beach (Mohadin, 1987). Another important predator, and one that can be controlled, is the dog. Dogs harass nesting females to the point that these turtles sometimes abandon their nesting efforts. Just prior to the nesting season in Suriname, game wardens alert villagers and fishermen to tie up their dogs when they are on the nesting beaches. There are also a number of feral dogs along the coast. These are usually lost hunting dogs or animals that have been purposely abandoned by their owners. Dogs seen harassing turtles are shot. This drastic measure has to be taken, because dogs have a considerable negative impact on the nesting success of endangered marine turtles.

Eggs and emerging hatchlings are threatened by a large number of enemies, including dogs, raccoons (Procyon cancrivorous), birds (especially the black vulture, Coragyps atratus), and crabs. The ghost crab (Ocypode quadrata) probably presents the greatest danger to the eggs as well as to the newly emerged hatchlings on the beach (Hill and Green, 1971; Schulz, 1975). Mole crickets (Gryllotalpa sp., Scapteriscus sp.) also attack eggs (J. Fretey, unpubl. data). Finally, illegal egg predation by humans can be a serious problem (see section 3.3).

At sea, birds, sharks, catfish, and a number of other species of fish are a threat to the small hatchlings.

3.3 Over-utilization

According to Schulz (1975), the earliest account of sea turtle nesting in Suriname is found in the narrative of a Labbadist expedition (Anonymous, 1686; Knappert, 1926). In Stedman's narrative (1796), comments about the consumption of turtle meat in the colony are found; he also reported having observed off the Cayenne coast on 30 January 1773 one or two large turtles floating past the ship's side. Stedman stated further that in Suriname "the turtles are generally distinguished by the names of calipee or green turtle, and carett." Nevertheless, it seemed that, except for a short period before the Second World War, sea turtles on the Surinam coast were never killed for food on a large scale. At the time of Schulz's writing, sea turtle meat was not used by the Caribs living near the principal nesting places. Capture of hawksbill turtles for tortoiseshell was probably never important, presumably because this species is not numerous here and, according to Kappler, because American tortoiseshell was worth less than that from Asia.

Geijskes (1945) records the following about the use of green turtle meat. Before 1940, green turtles were caught for export. This business was in the hands of a Mr. Berkeley at Albina. How long this trade had already been going on, and to what scale, was not mentioned and no information was given about method of capture. Information obtained from the Caribs indicates that the turtles were caught as they came ashore to nest. The late Mr. Lijkwan, who for many years worked for 'the Honourable Mr. Berkeley', mentions an average of approximately 600 female turtles killed by the Indians for Berkeley for export during the period 1933 to 1940. According to Geijskes, this is an underestimate. He mentions a figure of 1,000 green turtles and 1,500 ridleys each year. In 1938 and 1939, for example, he had caught at least 3,000 green turtles. In 1968, a year in which more green turtles nested than in previous years, only about 1,000 came ashore in this region. This means that 30 years ago, many green turtles and ridleys nested on the beaches near the mouth of the Marowijne River.

After 1940 the slaughter of turtles for export almost came to an end. Yet many turtles were still being killed on the beach by, among others, the fishermen, as appears from Geijskes' remarks. About the hawksbill, Geijskes (1945) reported that people in Suriname mostly did not recognize this species and killed the turtle only for the meat which, however, cannot be particularly tasty as the Caribs considered it to be poisonous. Collecting of eggs, mostly from the green turtle and olive ridley, seems to have been quite important. This was a tradition of the coastal Caribs at least during the last century -- chiefly in and near the Marowijne estuary. According to Geijskes' (1945) report, egg taking in the 1940's was more intensive than in the previous century, due to the increased demand by Chinese and other people of Asiatic origin, especially Javanese. The egg takers kept the daily proceeds of eggs in their camps until enough were collected to load a boat (17,000 to 100,000 eggs). In those days, the eggs were taken to Paramaribo, the Commewijne district, and also to St. Laurent (French Guiana). No data are available detailed the total number of eggs collected each year. [N.B. The three paragraphs above were derived from Mohadin, 1987.]

In 1967, egg collection for local market sale by the Carib Indians living in the Galibi area reached 90% of the total eggs laid. It was this excessive harvest that prompted the Surinam Forest Service to take protective measures by banning the taking of sea turtle eggs. Eventually a

legal annual harvest was allowed under close supervision of STINASU. Eggs are collected from those nests laid below the high tide waterline, or from doomed nests on eroding beach sections. The legal harvest, confined to leatherback and green turtle eggs, is more or less controlled and represents an effort to (a) rationally exploit eggs on a sustainable-yield basis, (b) promote a cheap source of protein for coastal people, (c) foster goodwill toward local villagers, and (d) generate revenue for STINASU for conservation. The annual quota is currently about 20% of the Chelonia eggs laid per season and about 10% of Dermochelys eggs. The quota is designed to be roughly proportional to the number of nests that would otherwise be lost to beach erosion had STINASU not intervened. Based on data provided by Schulz (1975), Mrosovsky (1983a) estimated that 37-46% of leatherback nests are laid below the high tide line in Suriname. Dutton and Whitmore (1983) placed the figure at 31.6% for leatherbacks and 21% for green turtles. The eggs of other sea turtle species are fully protected (section 4.21).

In addition to a legal harvest by Amerindians who apply for a permit to collect eggs in the Galibi reserve, egg poaching occurs on both shores of the Marowijne River. Eggs from the Galibi (Marowijne) beaches are often taken directly to Paramaribo by boat, or via the overland route from Albina. STINASU estimates that poaching accounts for less than 5% of the annual legal take. In view of the currently poor economic situation in Suriname and the potential access to a "free" source of protein this may be an optimistic estimate. See section 4.231 for further discussion on egg poaching. Poaching of turtles is also a problem in some areas, although it is not viewed as a major threat. It has been illegal to hunt sea turtles (all species) in Suriname since 1954 (section 4.21), but a low level of poaching still occurs. Recently an increase in poaching has been noticed on the Atlantic coast beaches (Matapica, Katkreek, Diana). This is attributable to the currently bad economic situation in Suriname. Although still minor, it must nevertheless not be ignored. According to Kappler (1881), oil was historically extracted from slaughtered leatherback sea turtles. This no longer takes place, because they are neither used for oil extraction nor for food. Only leatherback eggs are taken by poachers -- and then only if there are no olive ridley or green turtle eggs to be found. Although leatherback carcasses are seen on the beaches, these are almost all stranded individuals; none shows signs of having been slaughtered for oil or meat.

The species most affected by over-utilization in Suriname is the olive ridley. Schulz (1975) states that up to 1967 more than 90% of the olive ridley eggs laid on the Galibi beaches were harvested by the local Indians. Even though olive ridleys and their eggs are now fully protected by law, the effects of this early over-utilization, combined with some current poaching and the lack of TEDs on shrimp vessels operating in Surinam waters, may now be felt. Because of these factors, the Surinam olive ridley population may not be able to recover. On the other hand, in spite of the heavy harvesting of eggs as well as adults for food prior to 1964 (Schulz, 1975), the green turtle population has increased (Table 1), primarily as the result of protection measures in the conservation program started in 1967.

At the present time, mortality due to the incidental catch from various fishing activities (such as shrimp trawling and the use of long set nets) may be an example of indirect over-exploitation. This is a problem throughout the Guianas and may be the largest unaddressed problem in turtle conservation in the region. It is highly recommended that a comprehensive survey of the incidental catch problem be undertaken as soon as possible (see also section 4.27).

3.4 Inadequate Regulatory Mechanisms

Legislation for the protection and management of nesting sea turtles is quite good (section 4.21), but protection at sea is vague and should be clarified (section 4.23) and fines are considered inadequate to act as reasonable deterrents to illegal activity (section 4.25). It is notable that the Forest Service and STINASU maintain field stations at Galibi, Eilanti, Matapica and Braamspunt (Figures 5 and 6). During the entire nesting season, personnel on daily patrols count newly laid nests and transfer nests considered "doomed" to safer locations. STINASU controls the egg harvest (section 3.3), but it is difficult to be 100% effective in controlling illegal activities. The Galibi area is a special problem, because local Amerindians claim traditional rights to exploit the resources there as they see fit, including the unregulated harvest of sea turtles. Although the Surinam Government has made some concessions to accommodate the indigenous people's tenet of "Traditional Rights", the management and utilization of the marine turtle resource cannot be left at the discretion of the local population alone. National laws must be obeyed and international commitments complied with. Reichart (1991) makes recommendations for new negotiations between the local villagers and the Government in order to establish and define their rights, but also to point out international obligations for the conservation of marine turtles.

Galibi lies directly across the Marowijne River from French Guiana (Figures 3 and 4). Coordination of management procedures between Suriname and French Guiana is highly advisable. Some informal agreements regarding cooperation on sea turtle management procedures have been reached, but rebel activities in that part of Suriname have caused temporary disruption in the implementation. The hostilities have ceased, and the various ethnic groups inhabiting the remote regions of Suriname have expressed the desire for stability in their areas. The Galibi Amerindians, likewise, have made overtures to cooperate with STINASU and LBB regarding the management of the Galibi Nature Reserve. Three guards from the local population have been hired to assist two Government workers in protecting the Galibi beaches. However, funds to repair the destroyed facilities and to replace stolen equipment are lacking in order to run what may be the most important marine turtle sanctuary in the western Atlantic region. Galibi has only a portion of the marine turtle nesting beaches in the area (see Figure 3).

Coordination of conservation activities between Suriname and French Guiana is essential to the protection of the nesting beaches on both sides of the mouth of the Marowijne River. Mechanisms designed to make bilateral enforcement of existing regulations in both countries more effective are needed (see sections 4.22 and 4.33).

3.5 Other Natural or Man-made Factors

Many nests are destroyed either by beach erosion, or by the sea because they are laid below the high tide level. STINASU estimates that approximately 25-30% of the total number of eggs laid is lost in this manner. Dutton and Whitmore (1983) report that some 21% of green turtle eggs and 31.6% of leatherback eggs are laid below the high tide line. If not moved and reburied by conservation personnel, these are subsequently lost through repeated inundation. In addition, driftwood carried by currents and tides is regularly stranded on the beach. In general, driftwood is a natural part of the habitat and should not be removed. It can be a hazard to nesting

sea turtles, though. Each year, a few turtles are trapped in snags and die from exposure. Large driftwood snags should therefore be cut up, removed or destroyed.

Fishermen's nets pose a real danger to sea turtles along the Surinam coast. Because of the deteriorating economic situation in the country, Suriname is intensifying its fisheries activities, both nearshore and offshore. The incidental catch of sea turtles, although based on circumstantial evidence, appears to be on the increase, because more strandings of drowned turtles are seen on the beaches today than ten years ago. This is especially true for leatherbacks in the Marowijne estuary. Whereas along the Atlantic Ocean beaches turtle carcasses may float west-ward with the Guiana Current or seem to disappear into the extensive and inaccessible mud flats, they are easily stranded, and quite visible, on the beaches of the Marowijne River. This could make the observed strandings in the Galibi area seem higher than mortality observed on ocean-front nesting beaches in Suriname. Relatively few olive ridley strandings are seen. There could be several reasons for this: (a) most olive ridleys nest on Eilanti Beach, and dead individuals could easily disappear into the nearby mudflats along the Atlantic coast; (b) incidentally caught specimens are usually kept aboard the trawlers and consumed on board, or surreptitiously taken to port for domestic consumption. There are no reliable records on observed strandings.

On the Surinam side of the Marowijne River, motorized boat traffic is minimal because the river is shallow here and not navigable for even medium-sized crafts. At low tides, extensive sand banks impede any kind of boat travel. Propeller strikes on turtles are rare. Some larger ships, traveling to St. Laurent in French Guiana, use the ship's channel, located very close to the shoreline of French Guiana; however, there are no reports from French Guiana of turtles having being struck by propellers. Finally, the Guianas are blessed with a lack of natural disasters. There are no hurricanes, thunderstorms are rare, and earth tremors are even more so. Suriname has not known a natural disaster, which could affect turtles or for that matter the country, in recorded history.

IV. SOLUTIONS TO STRESSES ON MARINE TURTLES IN SURINAME

4.1 Manage and Protect Habitat

4.11 Identify essential habitat

It is obvious that protecting and managing sea turtles and their eggs is only the first step in assuring the long term survival of Surinam populations. Habitats essential for breeding and foraging must be identified and given some measure of protection. Foraging areas are poorly known for all species (section 4.111) and a survey of foraging (or at least inter-nesting) habitats must receive a high priority in view of potentially hazardous levels of incidental catch by various forms of fishing gear (section 4.27). Much more is known about the distribution of nesting beaches (section 4.112). As a result, most nesting beaches have been consolidated in nature reserves. Because of dramatic changes of some beaches, it is necessary to monitor beach conditions continually, and to ensure that action is undertaken to rescue doomed eggs.

4.111 Survey foraging areas

The Guiana Current carries a large volume of mud, part of which is deposited in Suriname, creating, among other things, extensive mud flats in front of the nesting beaches. But 20-30 km off the coast, the brown hue of the muddy water suddenly changes into a clear, blue-green color. At 50-70 km offshore, the water is blue. Because Surinam nearshore waters are very muddy and photosynthesis is virtually nil, marine vegetation appropriate as sea turtle food does not occur. According to Schulz (1975), the population of green turtles nesting in Suriname migrates to algal pastures situated off the coast of Brazil. Several females tagged while nesting in Suriname have subsequently been recovered offshore near the Brazilian states of Alagoas and Rio Grande do Norte. Some others were captured near the villages of Itapipoca, Acaraú, Timbauba in the state of Ceará (Pritchard, 1973, 1976; Schulz, 1975). [N.B. Tagging stopped in 1973 and recent recaptures of tagged turtles have not been reported.] Some individuals may also feed in sea grass meadows around Iles du Salut (Devil's Island) in French Guiana. If so, it reinforces the need for coordination of protection efforts throughout the western Atlantic Region (in particular between French Guiana, Suriname, and Brazil) for these migratory species (section 4.33). There are currently no ongoing tagging studies in Suriname.

Very little is known about the feeding habits of olive ridleys in the Guianas. Schulz (1975) reports that recoveries of olive ridleys tagged while nesting in Suriname span roughly 4,500 km of coastline, extending from Natal (Brazil) to the Gulf of Venezuela. Most remain offshore in the vicinity of the Guianas, but there is a secondary concentration in the area around the Island of Margarita and in the Gulf of París (Schulz, 1975). It could be that females feed along the mouths of the larger rivers in the region and which are rich in crustaceans and invertebrates (Pritchard and Trebbau, 1984). Even less is understood about the feeding habits (if any) of leatherbacks during the nesting season off the South American coast. Recent studies deploying time-depth recorders on leatherbacks nesting in the northeastern Caribbean have shown that they routinely spend the inter-nesting interval diving to an average depth of about 60 m, and have attained maximum depths >1000 m (Eckert et al., 1986, 1989). Eckert et al. (1989) pro-pose that the impetus behind the diving may be to feed on deep water prey. Gravid leatherbacks may spend the inter-nesting period in blue water offshore. Nothing is known about foraging areas important to the rarer species, hawksbills and loggerheads, in the Guianas.

It is a recommendation of this Recovery Action Plan that, in the absence of the financial and human resources necessary to conduct a systematic survey of potential or actual foraging areas for marine turtles in Surinam waters, STINASU interview fishermen and other informed observers to gain insight into the distribution of sea turtles in offshore waters. Coupling distribution information with a knowledge of habitat types, a general picture of the habitats most frequently visited by turtles will emerge. More detailed follow-up studies may result in recommendations to establish protected zones encompassing important feeding areas. Data gained from remote sensing techniques can alert managers to areas most frequented by turtles, and suggest delineation of restricted fishing zones in order to curb entanglement and death in fishing gear. Finally, cooperative turtle tagging programs between the Guianas, Brazil, and Venezuela, including studies in the islands and coastal lagoons of these countries, may help identify presently unknown feeding and/or juvenile developmental habitats.

4.112 Survey nesting habitat

An inventory of nesting sites was completed by Schulz (1975), who also noted and mapped physical changes from erosion and accretion of the beaches in various years. The beaches east of the Suriname River, including Diana, Katkreek, Walapakreek, Matapica, Baboensanti, Eilanti, and Galibi (Figure 5 and 6) are important for green turtles and leatherbacks Although some olive ridley nesting also takes place in this area, most nesting by this species occurs on Eilanti. The few hawksbills that nest in Suriname are dispersed over all beaches. With the exception of Matapica, which has some tourism and several fishermen's camps, these beaches are virtually untouched by human development (Mohadin, 1987). The extensive Bigisanti Beach of the 1960's, which was situated inside the Wia-Wia Nature Reserve, has moved west-ward and out of the reserve's boundaries (Figure 7). This beach first became Motkreek Beach, then Krofajapasi Beach, and after moving farther west, became the current Matapica area beaches (Figure 6). Several important nesting beaches are located inside the Galibi Nature Reserve: Galibi, Baboensanti, Eilanti (Figure 5); these are relatively stable (Reichart, 1992) and surveillance is done from fixed camps established by STINASU (although depending on sea state it can be difficult to reach the camps). Surveillance on the nesting beaches is done from rather primitive beach huts. Beaches where the temporary camps are located pose significant logistical challenges.

There is a very marked tidal difference along the coast which clearly has an influence on the nesting periodicity of sea turtles, and in contrast with conditions in French Guiana, some of the beaches in the Galibi Nature Reserve are narrow with various combinations of herbaceous vegetation, low shrubs and a thin line of trees. This type of beach appears to favor female green turtles, which are also able to negotiate the shallow ocean approaches better than leatherbacks, particularly at low tide. Some of the beaches in the Galibi Nature Reserve are separated from each other by swampy areas, often densely covered by mangroves; for instance, between Baboensanti and Eilanti. Green turtles often make their nests on small sandy patches under the stiltroots of mangrove trees or under the branches. They frequently get entrapped there and die. At Eilanti, the main olive ridley nesting site, a broad mud bank lies right in front of the beach, and the tide generally determines accessibility. Leatherbacks and green turtles avoid such beaches, but for the relatively small olive ridley, this mud bank is not a great problem (Reichart, 1992). The beaches at Matapica, and farther west, are wider and mostly devoid of trees; they usually have only some sparse herbaceous ground cover. In some sections, the approach to the beach platform is quite steep, often culminating in an almost vertical wall, some 1-1.5 m high, caused by tidal erosion. Olive ridleys are unable to negotiate this obstacle, and are rarely seen here. These beaches are frequented primarily by leatherbacks and some green turtles.

It is a recommendation of this Recovery Action Plan that the Forest Service and STINASU establish as a priority the monitoring of long-term changes in the beaches, either by regular aerial surveys (as conducted for WATS I and II) or by ground surveys from the camps mentioned above. Better facilities should be established for personnel on the more remote beaches. For patrolling the longer beach sections, suitable vehicles should be provided in order to ease the workload. Both aspects will go a long way to increase morale, and thus the worker's efficiency. Acquisition of an "ultra-light" aircraft would provide for better surveys. A two-seat "ultra-light" aircraft would be a versatile and effective management tool for marine turtle conser-

vation work in Suriname. Many of the nesting beaches are accessible only over sea, and then only at high tides. These beaches are often also separated by mud flats or swamps. Ground patrols are arduous and time-consuming in just getting there. Because an "ultra-light" can land in these areas, more intense patrolling of the isolated nesting beaches is possible. An "ultra-light" is also eminently suited to conduct a wide variety of habitat surveys. These vehicles are relatively cheap to acquire, operate and maintain when compared to the standard, fixed wing aircraft usually used.

4.12 Develop area-specific management plans

On all marine turtle nesting beaches, whether in nature reserves or in annually protected areas, the management program includes at least four activities: (a) protection of adult females, (b) beach surveys to prevent egg poaching, (c) relocation of nests doomed by environmental factors, and (d) conducting nest counts per species per beach per season. In spite of the (now ended) armed conflict of the past few years, and the serious lack of personnel and financial resources, this program has regularly been implemented. It is a recommendation of this Recovery Action Plan that greater emphasis be placed on management and conservation efforts at Eilanti. Eilanti is currently the main nesting site for olive ridleys in the Atlantic Ocean, but it is subject to strong, natural erosive forces. Here, tagging of nesting females should have priority and should be coordinated with the countries where this population forages (i.e., Brazil, French Gui-ana, Guyana, Venezuela, Trinidad). A management plan for the Galibi Nature Reserve, emphasizing sea turtle protection and management on Eilanti, has already been made (Reichart, 1992), but its implementation is slow in getting started because of lack of funds, and residual resistance of the local population.

4.121 Involve local coastal zone authorities

At the present time there is no commercial development of the beaches. The entire coast of Suriname consists of shoreline mangrove forests and tidal mud flats fringed in places with sandy beaches. As long as the beaches are unstable (see section 3.1) the prospects for development will remain low. Suriname understood, before its neighboring countries, the importance of protecting the nesting beaches and preventing marine turtle exploitation in the coastal areas. The basic structure of the research and protection put in place by the Surinam Government is exemplary and it has served as a model to initiate similar action in French Guiana. On the other hand, the resentment some local people have shown towards the presence of the Galibi Nature Reserve in their traditionally held area has been the result of misunderstandings between Government and village negotiators. Several Amerindians from the villages near the Galibi Nature Reserve are employed at the field stations in the reserve, but there is disagreement concerning the Government's authority in the area. The local population considers the area theirs, because of the concept of "Traditional Rights" (see section 3.4 and Reichart, 1991). The Government should renew efforts to come to an equitable arrangement regarding the management of the area's natural resources, especially marine turtles. Reichart (1991, 1992) discusses these problems and gives recommendations on possible ways to resolve them.

It is a recommendation of this Recovery Action Plan that local Amerindians become more involved in the process of managing the Galibi Nature Reserve's natural resources, includ-

ing marine turtles. It is desirable to appoint a community-nominated person to work closely with Government marine turtle specialists, and be in charge of a local team that will deal with marine turtle related conservation issues, and disseminate such information to the local population. Another task of this team will be to involve fishermen in trying to find solutions to the problems of entanglement in nets, incidental catch mortality, and resuscitation techniques. Finally, we recommend that the practice of relocating doomed nests and, where needed, the establishment of central egg hatcheries be maintained and improved on all Surinam nesting beaches.

4.122 Develop regulatory guidelines

When areas are defined as especially critical for remaining sea turtle stocks, it is a recommendation of this Recovery Action Plan that regulatory guidelines be established to provide a framework within which appropriate land use can occur. Coastal development on or near important nesting beaches should include the requirement that beachfront lighting be designed to prevent the disorientation of nesting adults and hatchlings. Activities such as sand mining, dredging, construction of jetties and sea walls, and the siting of fishing camps should be regulated so that they do not degrade nesting sites or foraging areas. Although neither mining nor commercial construction is currently taking place on Surinam nesting beaches, it is prudent to have such guidelines prepared in order to stave off potential future problems. A more detailed discussion, with solutions proposed, is presented in sections 4.13 and 4.14.

Some important and pertinent regulatory guidelines regarding habitat conservation already exist in Suriname. For example, the "Natuurbeschermingsverordening 1954" (Nature Protection Law of 1954) gives the legal basis for the establishment of nature reserves, assigning their management to the Surinam Forest Service. The Galibi Nature Reserve, incorporating 4,000 hectares of coastal terrain within the estuary of the Marowijne River, was established in 1969 with the "Natuurbeschermingsbesluit Galibi" (Nature Protection Ordinance Galibi). It includes some major marine turtle nesting beaches, such as Galibi, Baboensanti, and Eilanti (Figure 5).

The Wia-Wia Nature Reserve, established in 1961, begins 25 km west of the Galibi Nature Reserve and covers an area of approximately 36,000 hectares (Figure 2). Its main purpose was to protect the Bigisanti nesting beach but, because of erosion and accretion seemingly moving this beach westward, there no longer are any nesting beaches within the reserve. The Wia-Wia Nature Reserve now serves as an important sanctuary for nesting and foraging shorebirds -- resident as well as migratory birds from North America. An approximately 6 km long sand beach has appeared along the Atlantic coast, just west of the Galibi Nature Reserve. In addition, at the west end of Eilanti Beach, some large offshore sand plates have appeared that are exposed at low tides. With the dynamic characteristics of the Surinam coast, as described by Augustinus (1978), these could well be the precursors of a new Bigisanti Beach. This would make the Wia-Wia Nature Reserve once again an important turtle sanctuary.

4.123 Provide for enforcement of guidelines

It is essential that management guidelines for protected areas include favorable provisions for the needs and aspirations of the indigenous populations. The Galibi Amerindians

consider the region theirs and consider the presence of the Galibi Nature Reserve an infringement of their rights. It is a recommendation of this Recovery Action Plan that a reserve management team be installed, with equitable participation from representatives of the local population. This could serve as a model for other protected areas. When the Galibi Nature Reserve was gazetted in 1969, the Surinam Government, with great foresight for those days, allowed continuation of subsistence use of the reserve by the local people (food gardens, hunting, fishing, and gathering of plant material). The reserve's main goal was to give full protection to all sea turtles species nesting on the Galibi beaches; the local Amerindians had been over-harvesting the eggs of green turtles and olive ridleys for many years, and continuation of this practice would have been disastrous. The problem is a rather complex social issue, because the Caribs resent any government interference in their activities. Reichart (1991) gives a historical overview of the problems at Galibi and makes suggestions for improving compliance with resource management laws, keeping the needs and aspirations of the local people in perspective.

4.124 Develop educational materials

Public cooperation and acceptance of conservation measures are crucial to the survival of endangered species. Education plays an especially important role in this. STINASU has a department which conducted an education program in the schools and which occasionally took schoolchildren on field trips to nature reserves. During the armed conflict of 1986-1992, funding and access became problems, and the program had to be interrupted. It is a recommendation of this Recovery Action Plan that this program be revitalized. There are various education materials, such as brochures, posters and stickers both in Dutch (the country's official language) and Sranan Tongo (Surinam's *lingua franca*). These are available from STINASU and should be more widely distributed, but the supplies are dwindling, and funds for reprinting are lacking. With specific reference to critical habitat, we recommend that information panels be installed at beach access points to alert visitors about marine turtle conservation activities taking place and on protective regulations for visitors to comply with while on the nesting beaches.

4.13 Prevent or mitigate degradation of nesting beaches

4.131 Sand mining

It is a recommendation of this Recovery Action Plan that commercial beach sand mining be prohibited in Suriname. The persistent removal of sand from nesting beaches accelerates erosion and can degrade and sometimes destroy stabilizing beach vegetation. In severe cases the beach is lost entirely and saline ponds are formed in unsightly pits left by mining operations. Indirect consequences also accrue, as in situations where the mining activity has a detrimental effect on ocean approaches to the nesting beaches. Finally, offshore sand mining and extraction of sediments at river mouths can have disastrous effects on "downstream" beaches which are deprived of renourishing sediments to replace natural processes of erosion. At the mouth of the Suriname River, some commercial sand mining takes place. It is a recommendation of this Recovery Action Plan that this activity be closely monitored because it is not known whether nearby nesting beaches, or access to them, are being adversely affected.

4.132 Lights

After emergence, sea turtle hatchlings scramble towards the sea, presumably using the relative brightness at the open ocean horizon as their primary cue. When light sources are present landward of the beach, hatchlings often orient toward those instead of the ocean horizon. Under these circumstances, they have been known to crawl towards campfires, residential lights, recreational lights, etc. As such, hatchlings have been known to wander into fishing camps, often to be crushed, eaten by dogs, or die from exposure in the morning sun. Nesting females are also known to be easily disoriented by artificial lights. Examples are found throughout the Caribbean of adult females that were confused by beach-front lighting and then wandered inland. When daylight comes, they usually die from exposure to the sun.

An absence of lighting is the best guarantee that hatchlings will safely find the sea. Where this is not an option, Witherington (1990) proposes several "next-best" solutions, including (a) time restrictions (lights extinguished during evening hours when hatching is most likely to occur; e.g., 1900-2300 hrs), (b) area restrictions (restrict beach lighting to areas of the beach where little or no nesting occurs; the effectiveness of this is diminished, however, since sources of light several km away can disrupt hatchling orientation), (c) motion sensitive lighting (sensor-activated lighting comes on only when a moving object, such as a person, approaches the light; this might be effective in low traffic areas), (d) shielding and lowering light sources (low intensity lighting at low elevations can be both attractive and adequate for most purposes; the glow can be shielded from the beach by ornamental flowering hedges or other barriers), (e) alternative light sources (low pressure sodium vapor lighting is known to be less attractive to hatchlings than full-spectrum white light).

It is fortunate for sea turtles that the cyclic movements of the Surinam shoreline are the reason for the low human population density in the coastal zone. Permanent human-made structures would not last long. The largest concentration of people living near marine turtle nesting beaches is found along the mouth of the Marowijne River, and this amounts to fewer than 1,000 Amerindians living in two villages (Figure 4). The beaches at these two villages are stable and suitable for permanent dwellings. The few artificial night lights in these villages should not be a great disturbance for the turtles nesting at Galibi, located only a few kilometers north along the river, but no specific study has been done on this subject. Lights from camps of artisanal fishermen living on the sand spit near the mouth of the Matapica Canal are potentially detrimental to the turtles nesting there. Because of the prevalent winds, however, the entrances of these camps are always facing away from the sea. The ocean-facing sides of the camps are usually fully enclosed, which implies few lights beaming towards the ocean. In addition, fishermen have generally complied with STINASU's request to keep light sources directed towards the ocean to a minimum.

While disorientation by ill-directed artificial lights seems to be a minor problem in Suriname at this time, it is a recommendation of this Recovery Action Plan that a study assessing the negative influence of lighting associated with the villages of Christiaankondre and Langaman-kondre in the Galibi area be undertaken. If lighting there is found to be a problem, the solution may lie in switching to low pressure sodium vapor light bulbs. Mercury vapor lights should be avoided in all cases. Light fixtures can also be lowered and/or shielded to block the

light rays from shining towards the beach. A line of vegetation planted as a buffer may work well in some countries, but is not practical in Suriname. We also recommend that the program to educate fishermen regarding the problems of marine turtle disorientation as a result of incidental lights be continued and intensified. Problems associated with artificial lighting, and some potential solutions, are summarized by Raymond (1984) and an updated book is being prepared by Blair Witherington, Florida Department of Environmental Protection (K. Eckert, pers. comm.).

4.133 Beach stabilization structures

Most beaches are naturally dynamic. In order to protect commercial investments such as beach-front hotels, beach stabilization typically involves the use of breakwaters, jetties, impermeable groynes and/or seawalls. These structures are expensive and rarely effective in the long-term. Furthermore, because they interfere with the natural longshore transport of sediment, the armoring of one beach segment can result in the "starvation" and eventual loss of other beach segments "downcurrent". Finally, the armoring of beaches can sometimes limit access to nesting turtles or prevent hatchlings from reaching the sea. This is a serious concern in some countries, but we are fortunate in that this activity does not occur in Suriname. Most beaches in Suriname are highly dynamic, so much so that no attempt can reasonably be made to stabilize them.

The alternating of beaches and mud flats between the Marowijne River and the Suriname River is cyclical, and of long standing. This natural phenomenon plays a large role in the nesting process of marine turtles in this region. In contrast, beaches in the estuary of the Marowijne River are relatively stable; in spite of some minor erosion and accretion, they may have been in existence since the Holocene period (Schulz, 1975). When an important nesting beach disappears in Suriname or in French Guiana, the turtles move to other nearby beaches which correspond to their criteria for nesting. In fact, there is little true nest site fidelity in the Guianas. Tagging studies of nesting females have shown that individuals (at least of leatherbacks) may nest several times per season on various beaches in the region, both in Suriname and in French Guiana (Pritchard, 1973, 1976). With this in mind, it is a recommendation of this Recovery Action Plan that no action be (or for that matter can be) taken to stabilize nesting beaches in Suriname. Efforts should instead be concentrated on identifying and saving nests threatened by erosion. These efforts must be closely supervised and be based on the latest management techniques, which Suriname is already using.

4.134 Beach cleaning equipment and vehicular use of beaches

Driftwood, discarded fish line, pieces of fish nets, and plastic sheets accumulate on the beaches and are a hazard to sea turtles. Other dangers, such as plastic bottles or boat wrecks are negligible. In general, the Surinam beaches are relatively clean and have no visible pollution from oil or chemicals. Commercial beach cleaning equipment is a luxury that Suriname cannot afford, and at any rate can easily do without at this time. On nesting beaches where there sometimes is heavy accumulation of driftwood, field workers manually eliminate the most obstructive pieces to prevent turtle entrapment and subsequent death in snags, keeping in mind that drift-wood is a normal feature of marine turtle nesting beach habitat in Suriname and should only be eliminated when it presents a lethal obstacle for nesting turtles or their offspring. There are no motorized vehicles used on any of the Surinam beaches; all work (by turtle workers and fishermen alike) is done on foot. There are also no recreational vehicles or beasts of burden used

on beaches. In some nations, vehicles and/or horses compact nests and crush developing embryos.

It is a recommendation of this Recovery Action Plan that an assessment of the debris situation during the nesting season be routinely undertaken using ground or aerial surveillance. In cases of hazardous accumulations, clean-up should be initiated only after careful assessment and consideration of the situation [N.B. selective clean-up may be particularly useful for leatherbacks, which are extremely large and lack the ability to take even a single step to reverse out of entrapment]. It must be reiterated that driftwood on the beaches is part of the natural habitat and its removal is only justified if it is a lethal barrier for sea turtles. Reichart (1992) recommends several clean-up tasks to be done on the Galibi beaches to mitigate driftwood and general debris problems for nesting sea turtles. Mechanized beach cleaning equipment can crush or puncture incubating sea turtle eggs and its use should be avoided.

4.135 Beach rebuilding projects

In general, beach rebuilding has been a source of controversy in the USA for many years, mainly because the replacement sand rarely has the same characteristics (e.g., organic content, grain size) as the original sand. As a consequence, the "new" beach can become hardened and unusable to nesting sea turtles. Furthermore, dredging and replenishment done during nesting or hatching seasons can discourage nesting, crush existing nests, and/or bury incubating eggs under an extra layer of new sand, possibly preventing hatchlings from emerging. Fortunately there are no plans for beach rebuilding projects in Suriname. It would be unwise to even contemplate it, because the natural forces at work along the coast are insurmountable.

4.14 Prevent or mitigate degradation of marine habitat

4.141 Dynamiting reefs

There are no coral reefs along the Surinam coast. The physical destruction of reef eco-systems, which are potentially important as feeding areas for marine turtles and nursery grounds for local fisheries resources, is not a problem applicable to Suriname.

4.142 Chemical fishing

There are no coral reefs along the Surinam coast. Consequently, the degradation of coral reefs by the use of chlorine or other noxious chemicals to obtain reef fish is not a relevant problem for a Surinam marine turtle management plan.

4.143 Industrial discharges

There are no industrial discharges into the ocean between the Marowijne River and the Suriname River that originate in Suriname. Spent chemical and other industrial waste products are known to be indiscriminately dumped into the Suriname River, however, and the same is true for domestic waste, including septic tank effluents. There is virtually no government control over this activity. While industrial waste coming from the Suriname River flows westward, away

from the nesting beaches (Figure 3), it could affect foraging and migrating turtles traveling in that direction. On the other hand, it is not known if any industrial waste originating in French Guiana flows down the Marowijne River or the Mana River. If this is the case, it could affect the beaches at Galibi. It is a recommendation of this Recovery Action Plan that in cooperation with personnel from the turtle project in Les Hattes, French Guiana, a comprehensive survey be made regarding industrial discharges along both these rivers. A monitoring station should be established at a suitable place to assess water quality in the region.

4.144 At-sea dumping of garbage

The dumping of waste at sea is recognized as a growing problem throughout the world. Death to marine organisms as a result of ingestion or entanglement is widespread (e.g., O'Hara et al., 1986; Laist, 1987; CEE, 1987). Several years ago, Mrosovsky (1981) summarized data showing that 44% of adult non-breeding leatherbacks had plastic in their stomachs. In Suriname, there are 100 to 200 Surinam-based trawlers operating offshore and an unknown number of foreign-based fishing vessels (some quite large), large cargo ships, small Brazilian cargo schooners (which travel regularly between Belèm in Brazil, and Paramaribo), and artisanal fishing boats. All these vessels are known to dump their garbage overboard. Plastic, netting, and other debris washes ashore. In November 1993, the Galibi beach was heavily littered with plastic, mostly bottles with French writing. The problem is less severe elsewhere in the country and does not appear to pose a priority threat to sea turtles in Suriname at this time. There is no known regulatory mechanism to counteract ocean dumping in Surinam waters.

4.145 Oil exploration, production, refining, transport

An oil-contaminated environment can be lethal to sea turtles and incubating eggs. Behavioral experiments indicate that green and loggerhead turtles possess limited ability to avoid oil slicks, and physiological experiments show that the respiration, skin, some aspects of blood chemistry and composition, and salt gland function of 15-18 month old loggerheads are significantly affected by exposure to crude oil preweathered for 48 hours (Vargo et al., 1986). There is some evidence to suggest that hawksbills are also vulnerable to oil pollution. Hawksbills (predominantly juveniles), were only 2.2% (34/1551) of the total sea turtle strandings in Florida between 1980-1984, yet comprised 28.0% of petroleum-related strandings. Oil and tar fouling was both external and internal. Chemical analysis of internal organs provided clear evidence that crude oil from tanker discharge had been ingested (Vargo et al., 1986). Carr (1987b) re-ported juvenile hawksbills (to 20 cm) "stranded [in Florida] with tar smeared sargassum"; some individuals had ingested tar.

In 1980, the Government-owned "Staatsolie Maatschappij Suriname" (Staatsolie) was established to explore and exploit the country's oil resources. So far, there is only a relatively small oil field, the Tambaredjo Field (about 50 km west of Paramaribo, in the Saramacca District), which produces a heavy type oil with low sulfur and metal content. In 1984, the oil re-serves in this field were estimated at 200 million barrels (Anonymous, 1988). The various wells are only a few kilometers inland from the coast but they are west, and "downstream" from the nesting beaches. The crude oil is transported to Paramaribo through inland waterways and is shipped overseas for refining. A refinery is being planned for Suriname, to be completed in the

mid-1990's. The inland waterways show general pollution from industrial waste and oil transport, but pollution from domestic oil production is not evident at sea or on the beaches. Despite ongoing exploration activities, there are currently no producing offshore wells. Ocean pollution from oil exploration activities is not quantified, but at the present time there is no oil pollution noticeable on the nesting beaches.

Since oil spills know no national boundaries, it is important that Suriname be prepared to respond to any oil-related disaster that threatens national territory regardless of its geographic origin. It is a recommendation of this Recovery Action Plan that an Oil Spill Contingency Plan be developed and implemented, and that Government proceed with the acquisition of emergency equipment and personnel training. We further recommend that Suriname ratify the UNEP Cartagena Convention with its Protocol concerning Cooperation in Combating Oil Spills in the Wider Caribbean Region. Article 3 of the Protocol states:

a. The contracting Parties shall, within their capabilities, cooperate in taking all necessary measures, both preventive and remedial, for the protection of the marine and coastal environment of the Wider Caribbean, particularly the coastal areas of the islands of the region, from oil spill incidents.

b. The contracting Parties shall, within their capabilities, establish and maintain, or ensure the establishment and maintenance of, the means of responding to oil spill incidents and shall endeavor to reduce the risk thereof. Such means shall include the enactment, as necessary, of relevant legislation, the preparation of contingency plans, the identification and development of the capability to respond to an oil spill incident and the designation of an authority responsible for the implementation of this protocol.

4.146 Agricultural runoff and sewage

Insecticides and herbicides are applied in large quantities on rice fields in Suriname. This most certainly include harmful substances, but it is almost impossible to get specific information on this from pertinent agencies. Vermeer et al. (1974) have documented the harmful effects of these products, and in particular of pentachlorophenol, on the birds and fishes in the estuarine zone. These chemical discharges, although assumed to be quite heavy, occur in the western part of the country, far removed from important nesting areas in Suriname. Nonetheless, the potential contamination of the marine habitats for sea turtles and commercial fishes is a serious issue and should not be overlooked. The Guiana Current will no doubt transport any harmful substance westward, possibly to the nesting beaches in Guyana. The Surinam rice fields and the Guyanese cultivated areas form a large, nearly continuous agricultural region. The combined discharge of harmful waste products may be substantial. Suriname has no sewage disposal or sewage treatment facilities. When septic tanks are cleaned, the discharges are dumped in the river. Some buildings near canals or rivers route their sewer discharge pipes directly into these waters.

In Suriname it is the responsibility of the Ministry of Public Health to monitor pollution, but more attention needs to be given to pollution control. Almost all industrial activities take place in the coastal region. Because of its small population size, meager industrial base, and minor oil exploitation activities, the estuarine system has been able to absorb and mitigate most of any resultant pollution -- so far. But as industrial and agricultural activities in the coastal zone increase, this type of pollution, if uncontrolled, may become an environmental problem in the near future. It is a recommendation of this Recovery Action Plan that stricter control of (toxic) products used in industry as well as in agriculture be initiated. The existing Surinam Pesticide Commission should have a greater voice in regulating the import and the use of toxic products. The Commission should also have a greater mandate to ban certain products whose use is already forbidden in other countries. Suriname must not become a dumping ground for the international chemical industry. It will require considerable lobbying to overcome commercial interests.

As an immediate step, monitoring stations should be installed throughout the coastal region to measure degrees and trends in environmental pollution. The results could then be used to support the need for greater control and spur government decision-makers to quicker action. It is also a recommendation of this Recovery Action Plan that ocean water quality in the western part of Suriname, as well as in Guyana, be monitored for pollution emanating from these two agricultural regions.

4.147 Others (anchoring, land reclamation, dredging)

Only small artisanal boats anchor offshore from the nesting beaches, and then only sporadically. Any damage caused by this type of anchoring is negligible. The coast of Suriname is unsuitable for land reclamation, and none is taking place. The coast near the village of Totness in the Coronie District is sometimes worked on, but this is a matter of protection and not of reclamation. Virtually no dredging occurs in Suriname. The Suriname River is only occasionally dredged to keep the shipping channel to the harbor in Paramaribo open. It is minor, and not a factor for marine turtle management in Suriname.

4.2 Manage and Protect all Life Stages

4.21 Review existing local laws and regulations

De Jachtwet 1954, Gouvernementsblad van Suriname No. 25 (the Game Law of 1954, Government Publication of Suriname No. 25) gives full protection to all mammals, birds and sea turtles, except those designated by Resolution as game species, "cage" animals (birds) or predominantly harmful species. The law also authorizes protection of other species specifically designated by Resolution. The status of any species may be changed by Resolution upon recommendation of a scientific advisory committee, De Natuurbeschermingscommissie (Nature Protection Commission). As part of Resolution No. 104 of October 1970, the five species of sea turtle occurring in Suriname were classified as game species in order to provide a legal basis for a limited, seasonal egg harvest. In principle, the harvest season is open from 1 March - 31 May, but it can be shortened by annual decrees for greater conservation of eggs if needed. A total of about 200,000-250,000 eggs (exclusively those of green turtles and leatherbacks) are legally col-

lected annually under the control of STINASU. Other life stages remain fully protected; that is, it is illegal to collect, possess, kill, sell or offer for sale all or any portion of any sea turtle species. Implementation of the Law since 1 February 1985 has been the responsibility of the Forest Service (Ministry of Natural Resources and Energy).

De Landsverordening van 3 April 1954, Gouvernementsblad No. 26 van Suriname (the Nature Protection Law, Government Publication No. 26, extends protection to Suriname's wild lands. It is the fundamental nature protection law in Suriname and is the basis for, among other things, gazetting nature reserves. An area can be designated a reserve on the basis of "diversity of natural communities and/or because of the presence of scientifically or culturally important objects of flora, fauna, and geology." The Galibi Nature Reserve was gazetted on 23 May 1969 and includes almost all nesting beaches in the Marowijne estuary, meaning that the public cannot collect eggs there at any time. Galibi Amerindians, supervised by STINASU, harvest about 25% of the nests laid in the reserve, which are then sold under the supervision of STINASU (see section 3.3). The official egg harvest by STINASU takes place only in the Galibi Nature Reserve; doomed eggs in the Matapica area and west are always translocated. Only during the temporary occupation of the Galibi Nature Reserve by the local Amerindians (fall of 1989 to spring of 1992) were eggs for market sale collected at Matapica. In addition to the STINASU-supervised harvest from the reserve, Galibi Indians are allowed to collect eggs during the brief open season on the few nesting beaches outside the reserve. Egg poaching during the entire nesting season between the Marowijne River and the Suriname River is estimated to be less than 5% but there admittedly is no accurate, quantitative information.

In 1961, the Wia-Wia Nature Reserve was set aside, primarily for the protection of some marine turtle nesting beaches there (e.g., Bigisanti). In 1969, the reserve was enlarged in an unsuccessful attempt to keep the westward shifting Bigisanti Beach within its boundaries. Now all nesting beaches in the reserve have eroded and, since 1974, there are no nesting beaches inside the Wia-Wia reserve. The reserve nevertheless serves an extremely useful function by being a major staging and over-wintering site for millions of migratory shore birds from North America. Because most of the coast between the Wia-Wia Nature Reserve and the Suriname River is subject to erosion and accretion, nesting beaches in that area cannot be protected by consolidating them in a nature reserve. Therefore, the beaches between the west border of the Wia-Wia Nature Reserve and the mouth of the Suriname River are protected by annual decree, almost like a "floating" nature reserve. To accommodate the general public, a few minor nesting beaches near the mouth of the Suriname River are left for harvesting of eggs during the open season.

In an attempt to reduce incidental capture and drowning of sea turtles in shrimp trawls plying Surinam waters, the Government recently published a new law, "Beschikking van 6 juli 1992" (Decree of 6 July 1992) making the use of turtle excluder devices (TEDs) on fishing vessels mandatory. Enforcement of this law, however, is non-existent (for further discussion, see section 4.28).

4.22 Evaluate the effectiveness of law enforcement

Illegal trade is mostly related to egg poaching. The sale of legally collected sea turtle eggs is supervised by STINASU. This organization tries to sell no more than 100 eggs to one

family in order to avoid illegal resale. Nonetheless, improvements in law enforcement and procedures are necessary. Up to the mid-1980's, it was extremely rare to find evidence of a turtle having been slaughtered on the beach. Turtle meat was not seen in public, although there were occasional rumors of turtle meat being available in some restaurants [N.B. subsequent investigations were unable to confirm the rumors]. Due to the worsening economic situation in Suriname and the resulting financial difficulties at STINASU (which are limiting effective patrols), an increase in egg poaching has been observed. There is also evidence of a few nesting green turtles being killed for meat. Although a matter of concern, this amount of poaching is negligible when compared to that which takes place in other countries of the region.

The effectiveness of law enforcement is hindered by limited facilities and personnel. Fortunately, the exploitation which does occur is on a small, generally non-commercial, scale. In order to make protection efforts more effective, it is a recommendation of this Recovery Action Plan that additional personnel be hired to patrol the beaches. This will require an infusion of financial support to STINASU and the Nature Conservation Department of the Forest Service so that additional field stations can be established, in particular on Eilanti Beach, Walapa Beach, and Diana Beach (all rather remote places). Shallow draft, ocean-going boats should be acquired and kept in good repair in order to patrol the beaches by sea and to inspect fishing boats for illegally caught turtles and eggs. Each field station should have at least one resident game warden empowered to arrest poachers.

4.23 Propose new legislation where needed

Suriname has a comprehensive set of conservation laws. The conservation of marine turtles while on the nesting beaches is well covered in this legislation, and no new laws are necessary in this regard. In contrast, legislation pertaining to turtles at sea (i.e., when they are within the territorial waters of Suriname) is somewhat vague. The Game Law does not apply at sea; it goes only as far as the low tide line. The sea near the Surinam coast is very rich in fisheries resources, and ships of several nations fish in Surinam waters both legally and illegally. There is considerable, circumstantial evidence that marine turtles (especially olive ridleys, see section 4.27) are caught incidentally in trawl and drift nets but, except for shrimp trawlers having to use TEDs (see section 4.21), there is no legislation compelling fishermen to take any conservation action. It is a recommendation of this Recovery Action Plan that the Game Law of 1954 be modified to clearly include the oceanic ecosystems of the country's 200 mile economical zone. And the law must apply to *all* vessels operating in Surinam waters.

4.231 Eggs

In order to allow for a legal egg harvest using existing laws, sea turtles have been designated as "game animals". The egg harvest appears sustainable and we do not recommend terminating it. Admittedly the system is somewhat haphazard in that it relies on nesting information from the previous year; nevertheless, there are no clear alternatives and no evidence that the present system is failing in its conservation goals. The harvest has been ongoing for nearly a quarter century, and declines in recruitment to green turtle and leatherback populations are not evident (Table 1). The proportion of eggs doomed by environmental factors (predominantly erosion) is relatively constant, but the absolute numbers vary as nesting frequencies

vary per season. Doomed nests amount to roughly 25% of the nests laid, and this percentage is used as a basis to establish the harvest quota -- which is well below this figure. Public acceptance of the sea turtle conservation program is in large measure based on the Government's concession for the egg harvest. It is clear, however, that our unique circumstances (large, relatively unstressed populations with predictable natural egg wastage) invite a sustainable egg harvest and we would not recommend the program to other countries.

4.232 Immature turtles

As part of the Game Law of 1954, immature turtles are fully protected (section 4.21). There is no need to propose new legislation prohibiting the harvest of juvenile age classes, but the pertinent laws should be clarified so that the area of protection includes the 200 mile, oceanic economic zone of Suriname (section 4.23). Incidental catch of immature turtles, especially of olive ridleys, in fishing operations appears to be a very serious problem. The problem should be mitigated by the widespread and mandatory use of trawl-inserted "turtle excluder devices" (TEDs), but this does not mean that other efforts to protect immature turtles should be ignored. Information should be made available to fishermen on the subjects of resuscitating comatose sea turtles and on alternative, more turtle-friendly, fishing technologies.

4.233 Nesting females

Nesting females of all five marine turtle species known to occur in Suriname are fully protected (section 4.21). New legislation on this subject is not necessary, but the existing legislation should be clarified so that the area of protection includes the 200 mile oceanic, economic zone of Suriname (section 4.23).

4.234 Unprotected species

None of the marine turtle species known to occur in Surinam waters is unprotected.

4.24 Augment existing law enforcement efforts

Law enforcement is severely hindered by a shortage of trained personnel, facilities, and a lack of appropriate transportation. Enforcement would be more effective with the addition of qualified personnel, more comfortable facilities, and suitable means of transportation. Fishing vessels operating along the nesting beaches on the Marowijne estuary and along the entire coast between the Marowijne and Suriname rivers must be checked by means of regular patrols. Many of these vessels operate illegally in Surinam waters and probably take more turtles and/or eggs than is assumed.

Game wardens, empowered to make arrests, should be on board patrol vessels. Between the Marowijne River and the Suriname River, the only other access to the ocean-facing beaches is via the Matapica Canal (Figure 3). It is a recommendation of this Recovery Action Plan that checkpoints be established at some point along the canal and along the major rivers to inspect boats returning from the beach for turtle products. Occasional spot-checks could act as a deterrent. Again, certified game wardens, empowered to make arrests must be part of the team.

An ultra-light aircraft would be invaluable in patrolling remote, hard to get to, nesting beaches (section 4.112).

4.25 Makes fines commensurate with product value

At this time, enforcement of the Game Law is rather ineffective. This can in part be attributed to a lack of enforcement personnel (section 4.22), but another reason is that fines and other penalties are inadequate. Fines should be a strong deterrent against poaching and this is currently not the case. The fines levied against egg poachers amount to roughly Sf. 1.25 (Sf. = Surinam Guilders) per egg, or about one cent US$. That is about the market price of an egg in Suriname. All the poacher has to do is go out again, not get caught, and his fine will be more than covered by his next sale. The Game Law sets a maximum penalty of a Sf. 1,000.- fine *or* three months in jail. Confiscation of equipment used in the illegal act can also be included in the penalty. The maximum fine is never invoked, however, and confiscation of equipment (means of transport are specifically excluded from confiscation in the law) is rare.

It is a recommendation of this Recovery Action Plan that penalties for violations of the Game Law significantly transcend product value, and that violators be prosecuted to the fullest extent of the law. Most commercially oriented violators are well-to-do, and a fine is of minor concern. Penalties should consist of stiff jail sentences, the confiscation of vehicles used in the transgression, and long-term community work.

4.26 Investigate alternative livelihoods for turtle fishermen

There are no sea turtle fishery activities in Suriname, but seasonal income derived from the sale of eggs can be considerable. This has been the primary reason that the Galibi Amerindians resent the presence of the Galibi Nature Reserve. The Indians claim the sole rights over this food resource, but the Government contends that it is responsible for the management of the turtles. As a concession to their "Traditional Rights", the Galibi Amerindians are allowed to collect the eggs in the reserve, but only under the following conditions: (a) STINASU determines which nests can be harvested (ensuring that only doomed eggs are collected), (b) STINASU, in agreement with the village council, establishes the price paid per egg to the Amerindian egg collectors, (c) STINASU arranges for transport of the eggs to population centers and for their sale there, and (d) STINASU deposits a mutually agreed-upon amount of money derived from the sale of the eggs in the village treasury. If the turtle egg harvest were eliminated it would be necessary to provide some other source of income to the egg collectors, as well as to the village itself. The management plan for the Galibi Nature Reserve (Reichart, 1992) proposes greater participation (and therefore economic benefit) of local people in the management of the reserve. The plan also proposes that indigenous people participate in tourism to the reserve, agroforestry activities in its buffer zones, and a fishing cooperative.

4.27 Determine incidental catch and promote the use of TEDs

Sea turtles must surface to breathe and can drown during forced submergence, as when trapped in active or abandoned fishing gear. Mortality which results from capture in shrimp trawls continues at a high but unquantified level in Suriname. There are some 150 Surinam-

based Korean and Japanese trawlers operating in Surinam waters (Surinam Fisheries Department (Visserijdienst) data). The Surinam American Industries, Ltd. (SAIL) controls most of the shrimp trawling fleet in Suriname. All vessels report that the incidental catch of marine turtles -- mostly olive ridleys -- occurs, but numerical estimates vary considerably. The incidental catch is mostly reported during the turtle nesting season which, although it varies somewhat per species, starts in February, peaks in March-May for green turtles and leatherbacks, and ends around July or August. Some fishermen report that each trawler catches about one turtle per week (since there is no closed season and trawlers operate year-around, this suggests some 52 turtles/boat/yr) (H. Reichart, pers. data). Others report an incidental catch of 16-25 turtles per boat per year (C. Tambiah, pers. comm.). In contrast, deep water fishing boats report only about one turtle per boat per year. In general, no attempts are made to resuscitate comatose turtles; they are either tossed overboard or eaten by the crew. There are also some 30 Venezuelan trawlers operating legally in Suriname waters at any given time (Y. Bap, pers. comm.). These vessels are not providing data. Furthermore, illegal fishing is done by an undetermined number of mostly Guyanese and Venezuelan vessels; this number may equal the number of legally operating vessels (Surinam Fisheries Dept., pers. comm.).

It is a recommendation of this Recovery Action Plan that highest priority be given to (a) mandating and enforcing the use of "turtle excluder devices" (TEDs) in all trawlers plying Surinam waters and (b) *reliably* determining the extent to which sea turtles are included in trawl by-catch. Shrimp fishermen should also be educated and encouraged to attempt resuscitation of turtles caught incidentally, before returning them to the ocean. STINASU is preparing brochures and a demonstration for the proper techniques to be used. Incidental catch by shrimp vessels is a serious issue because it has the potential to undermine all other conservation efforts on behalf of endangered turtles in Suriname. The U. S. National Academy of Sciences has concluded that shrimp trawling results in more sea turtle deaths in U. S. waters than all other human activities combined and is an important factor in the continuing decline of nesting populations of loggerhead turtles (National Research Council, 1990). Shrimp vessels operating in U. S. waters are required to install TEDs in their trawls during all times of the year (Crouse, 1993). Olive ridleys are the only sea turtles nesting in Suriname to remain in the waters off the Guianas, and the dramatic decline in olive ridley turtles (while all other species are stable or increasing) has been partly attributed to offshore trawling.

A 1989 law passed by the U. S. Congress bans the importation of shrimp or shrimp products into the U. S. unless (a) the government of the harvesting nation provides documentary evidence of the adoption of a regulatory program governing the incidental taking of sea turtles in the course of such harvesting that is comparable to that of the United States, (b) the average rate of that incidental taking by the vessels of the harvesting nation is comparable to the average rate of incidental taking of sea turtles by United States vessels in the course of such harvesting, or (c) the particular fishing environment of the harvesting nation does not pose a threat of the incidental taking of sea turtles in the course of such harvesting (Appendix A). Because Suriname failed to provide by 1 May 1991 the necessary commitment that it would develop and implement a program consistent with U. S. guidelines, shrimp imports from Suriname were prohibited. The ban was lifted in October 1991 once the necessary commitment was received (U. S. Department of State, 1991).

In March 1992, the Ministry of Foreign Affairs submitted a preliminary progress report to the U. S. Embassy on the subject of implementing its sea turtle conservation program. The report noted that jointly with STINASU, the Fisheries Department had provided forms to the shrimp trawlers regarding the incidental catch of sea turtles; these forms were to be completed, signed, and returned to the Head of the Fisheries Department within three days of the discharge of the catch (and this condition was mentioned in the finfish and shrimp license of 1992). The Government of Suriname also organized and sponsored (with technical support from the U. S. National Marine Fisheries Service) a training session and TED demonstration in Paramaribo in May 1992 for captains, fleet managers, and government officials. The Ministry noted that regulations requiring licensed shrimp trawlers to carry out fishing operations with nets fitted with TEDs would be drafted, and provisions for monitoring compliance would be adopted. Finally, the Ministry assured the Embassy that regulations would also be considered to prohibit retention of turtles on board commercial shrimp vessels and require that turtles brought on board in a comatose state be resuscitated and returned to the sea. Unfortunately, this program has not been fully implemented. No evidence of TED use was provided to the U. S. Government in 1993, and Surinam-caught shrimp has been embargoed again by the U. S. since 1 May 1993.

In addition to the incidental catch by shrimpers, coastal net fisheries also ensnare sea turtles. Coastal Indians and Fisheries personnel are unanimous in claiming that the use of driftnets is increasing in Surinam waters, and that more turtles die in these nets than in trawls. With regard to the use of driftnets and setnets in coastal fisheries, it is a recommendation of this Recovery Action Plan that better regulations and a better information campaign toward the fishermen are needed to reduce the numbers of turtles caught during their approach to the nesting beaches. Since the nesting seasons are well-established, Government might consider regulating the use of setnets and driftnets in coastal waters offshore the nesting beaches during the nesting season. A radio-tracking study may be useful to delineate the area(s) most frequented by the turtles. Many leatherback turtles are accidentally captured in fishermen's nets, especially near Galibi (Fretey, 1984; H. Reichart, pers. obs.). Fishermen do not like to catch turtles in their nets because they cause considerable damage. In past years, STINASU was able to compensate Galibi fishermen for such damage, but financial problems caused this practice to be discontinued. Solutions which could save the life of turtles, while avoiding damage to the fishermen's nets, demand high priority. A partial solution may be for fishermen to raise their nets above the water surface at night when they are not fishing. It is a recommendation of this Recovery Action Plan that all incidents of sea turtle capture be reported to STINASU and/or the Fisheries Department, allowing the extent of incidental catch to be determined and mitigating measures taken.

4.28 Supplement reduced populations using management techniques

Between 1978 and 1985, attempts at supplementing green turtle populations included periodic releases of several thousand juveniles (yearlings) from a sea turtle ranching facility at Matapica. According to information derived from tag returns of these immature animals, it appears that they rejoin the natural population and that they follow the migration routes to the feeding areas (Schulz and Reichart, 1980). The initial results must not be misconstrued as proof of the hypothesis that with the release of captive-reared green turtles natural populations can be enhanced, but they are promising enough to consider continuation of experimental "head-starting" procedures in places where the natural populations are severely depleted. Unfortunately,

problems in obtaining verifiable results are many. For instance, cohorts of several generations must be followed for many years and a marking system for hatchlings (that can still be identified at adulthood), are only some of them. For these and other reasons, including doubts that the yearlings were imprinting properly (a necessary prerequisite to hypothesized natal homing), the 15-year old Kemp's ridley sea turtle head-starting project in the USA was recently terminated (Byles, 1993; Williams, 1993). At the present time, neither the green turtle nor the leatherback nesting population is considered "endangered" in Suriname, and there is no need to attempt to enhance them through head-starting.

The number of olive ridleys nesting in Suriname has decreased considerably over the past twenty years (Table 1). This nesting population (the most important one known in the Atlantic) has declined from a few thousand in 1968 to only a few hundred in 1989. Regretfully, the lack of access to the Galibi beaches during the 1990-1993 seasons have caused a serious hiatus for an accurate analysis of the decline in the olive ridley nesting population in Suriname. Incidental reports from this area, though, indicate a continuing decline in olive ridleys. Drastic measures are necessary in an attempt to save this species population in the western Atlantic. The first step must be to equip Surinam-based shrimp trawlers with TEDs (section 4.27). This would significantly reduce the incidental mortality of olive ridleys. Concomitant with this must be an enhanced ability to provide surveillance of our territorial sea to ensure that all shrimp vessels plying Surinam waters are equipped with TEDs. "Beschikking van 6 juli 1992" (Decree of 6 July 1992) makes the use of TEDs mandatory. Enforcement of this new law, however, is lacking. It is a recommendation of this Recovery Action Plan that TED use be a requirement for trawling in Surinam's EEZ, and that a team of inspectors be designated to ensure compliance. French Guiana is presently not mandating the use of TEDs, a decision which is under-mining efforts of adjoining nations to control the incidental catch and drowning of endangered sea turtles. International pressure from the IUCN/SSC Marine Turtle Specialist Group and WIDECAST should be directed at countries fishing in the region that do not yet require TEDs.

In view of the dramatic decline of Surinam's olive ridley nesting population, head-starting a percentage of hatchlings of this species each year may be a viable means to enhance the natural population. It is well known that the captive rearing of Kemp's ridleys is fraught with problems because of intraspecific aggression; but a captive rearing test of olive ridley hatchlings in Suriname in 1990 showed that there is no such aggression between individuals of this species (H. Reichart, unpubl. data). Monitoring the released yearlings (or older age classes) may be somewhat easier than for green turtles, because from tag return data collected by Schulz (1975) the vast majority of them do not migrate far; most olive ridleys remain in the waters off the coast of the three Guianas (Figure 8). Certain questions could perhaps then also be answered, such as: is there a problem of adaptation for these turtles when fed from birth by high protein foods? do the young females, once mature, find nesting beaches? do captive-reared, and subsequently released, animals integrate well with the natural population? Head-starting, however, is a controversial issue and fraught with potential problems; it should only be used as a last-ditch effort and should occur in concert with proven conservation measures, such as beach protection and enforced TED regulations.

It is a recommendation of this Recovery Action Plan that the best way to protect and enhance olive ridley populations in the Guianas is to ensure (a) use of TEDs on all shrimp trawl-

ers belonging to, or fishing in, the seas off coasts of Venezuela, Guyana, Suriname, French Guiana, and Brazil; (b) strict enforcement of TED regulations by all the pertinent nations in the region; (c) education programs aimed especially at the local people, regarding the plight of the olive ridley populations in the region, emphasizing the need to eliminate all exploitation of the species; (d) elimination of the use of any kind of fishing net in front of olive ridley nesting beaches; and (e) greater cooperative conservation and coordination efforts between the countries in the region, specifically directed at enhancing the shared olive ridley populations.

With regard to supplementing populations by enhancing hatch success, STINASU initially adopted styrofoam boxes as standard incubators for the hatcheries in the Galibi Nature Reserve (after a few experiments in 1971 and 1972, and following the example of the turtle farm on Grand Cayman Island). The primary species involved were the green turtle and the olive ridley, although some leatherback eggs were also incubated. Due to concerns over possible sex ratio biasing in the styrofoam boxes, STINASU initiated research to evaluate this hatchery practice in the early 1980's and, when there were indications that incubation in styrofoam cool-boxes produced a significant male bias among the resulting hatchlings (Dutton et al., 1985; Mrosovsky et al., 1984; Whitmore and Dutton, 1985), abandoned styrofoam boxes in favor of re-burying clutches in beach hatcheries or at "safe" locations higher up on the beach. The Matapica beaches, and those farther west, are well suited for *in situ* relocation or beach hatcheries. On the Galibi Beach and Eilanti Beach, however, there is a shortage of suitable, natural sites for reburial of the eggs, and an above-ground hatchery must sometimes be used as a last resort there.

Even for natural nests, the problem of temperature-triggered sex bias is far from resolved. For example, the majority of nests laid at Galibi are under dense vegetation (P. Dutton, pers. obs.) and the resulting natural sex ratio may be less female-biased than that reported for Krofajapasi by Mrosovsky et al. (1984) where shading effect is almost non-existent (Whitmore and Dutton, 1985). This hypothesis remains to be tested, and it is a recommendation of this Recovery Action Plan that further study is needed. STINASU employees stationed at Galibi, Baboensanti, Eilanti, and Matapica patrol the beaches, not only to guard against egg poaching, but also to relocate nests that are obviously endangered by the next high tide, coastal erosion, or other environmental dangers.

4.29 Monitor stocks

Since 1967, and on all the nesting beaches (such as Galibi, Baboensanti, Eilanti, Krofajapasi, Matapica, Diana), nests have been counted regularly throughout the nesting season by field workers from STINASU and the Conservation Department of the Surinam Forest Service as well as by occasional volunteers and seasonal workers. Nest data from the Galibi Nature Reserve are summarized in Table 3. It is a recommendation of this Recovery Action Plan that sea turtle populations, at least breeding populations, continue to be closely monitored for long-term fluctuations in numbers that will reveal the success or failure of historic and ongoing conservation efforts. If monitoring all the nation's nesting beaches becomes impractical or impossible, Index Beaches (or zones on beaches) should be selected for long-term intensive monitoring. Index Beaches should encompass areas of primary importance to sea turtles; sites where long-term databases have already been established are preferred. Ongoing research to provide statistical estimates of stocks is important and is encouraged by this Recovery Action Plan.

4.291 Nests

Historically, erosion and nests laid below the high tide line have been the most important problems of marine turtle conservation in Suriname. If unattended, they can lead to the destruction of many nests, affecting hundreds of thousand of eggs. Over the years, the major sea turtle management effort in Suriname has therefore been aimed at saving as many of these nests as possible by translocating them to safer nearby areas. Many such "doomed" nests are moved to a higher level on the same beach or, if predation could become a factor, they are carried back to the field station for reburial in a protected hatchery. No matter what precautions are taken, transplanting doomed nests is likely to lower the hatch success rate. Whereas the average hatch success rate of natural green turtle nests is 83-85%, it is 53-63% for replanted nests; for olive ridleys the average hatch success of natural nests is 59%, for replanted nests 17-36% (Schulz, 1875). For leatherbacks it is worse: 20-50% for natural nests vs. 6-39% for replanted nests. When eggs have to be carried some distance to a central hatchery, the hatching success rate for all these species is even lower (Schulz, 1975). Central hatcheries should, therefore, be constructed only if absolutely necessary. The artificial incubation of eggs in styrofoam boxes or other containers, and the improper handling of eggs and hatchlings can be disastrous. Incubation temperature is largely responsible for determining hatchling sex, so any attempt to artificially incubate eggs may skew the normal sex ratio of the nest.

Because of its policy to facilitate research whenever it can contribute to marine turtle conservation, Suriname has attracted a number of foreign researchers to do field projects on the country's beaches. Much of what is known now about marine turtles has come from pioneering studies done in Suriname from the mid-1960's up until the early 1980's. Starting around 1983, however, an armed, internal conflict in the country limited access to certain areas, causing a lapse in field research opportunities. As of August 1992, all such hostilities have ended, and for the 1993 nesting season, all beaches should be available again for field studies. Because of the currently poor economic situation, Suriname lacks funds and personnel to conduct its own research. Foreign researchers with projects that have bearing on the conservation of sea turtles, especially olive ridleys, should consider the excellent opportunities the Surinam nesting beaches offer for fieldwork. A number of issues raised by our national monitoring effort warrant further study. For instance, malformed embryos are very common in the hatcheries and an examination should be undertaken of possible cause(s). Further information about the seasonal pattern in natural sex ratios (Mrosovsky et al., 1984) would also be very useful.

4.292 Hatchlings

Any successful management program must be based upon credible estimates of reproductive success. Thus, data regarding nest loss to erosion, predators, and poachers should be obtained. Other threats should also be evaluated, such as entrapment in beach debris. Much of this information is already known in Suriname. Our priority need is funding to protect olive ridley hatchlings from terrestrial predators by installing chicken wire cages just prior to emergence. Avian predators are generally minor problems for screened nests, but black vultures are a menace in some areas. Thus, project personnel should be equipped to provide the circular cages with tops. The caged nests will be regularly checked for hatchling emergence. The hatchlings will be released as soon as they emerge by placing them on the beach and watching them

until they safely reach the sea. Central hatcheries should be constructed only if absolutely necessary (see section 4.291).

4.293 Immature and adult turtles

By daily beach patrols during the nesting season, the numbers of adult females nesting on Surinam beaches have been monitored since 1967, but there are no programs designed to assess populations of immature sea turtles. Tagging started in 1966 with students from the University of Florida, led by Peter C. H. Pritchard. Some of the turtles were weighed and measured. Pritchard continued to tag green turtles, ridleys and leatherbacks until 1969. From 1969 through 1973, J. P. Schulz and his field assistants tagged some 4,500 turtles, giving a total of 5,676 turtles of various species having been tagged on Surinam beaches since 1966 (Schulz, 1975). The data derived from tagged turtles captured at sea, and from tagged turtles returning to the Suriname nesting beaches, allowed him to establish the migratory patterns of olive ridley turtles and green turtles nesting in Suriname (Figures 8 and 9) (see also Pritchard, 1973, 1976).

Long-term tagging 100% of the nesting turtles is very labor-intensive, and may even be counter-productive. Most of the data that could be obtained from a tagging program in Suriname was obtained over a period of eight years (1966-1973). There is no need to continue a tagging program for olive ridley, leatherback, and green turtles to determine, among other things: nesting periodicity, nesting intervals, and where they go after leaving the nesting beaches in Suriname. Suriname does not plan to partake in the "Tagging Reflex" so aptly named by Mrosovsky (1983b). We believe that in our situation, continuing the tagging program would constitute undo harassment. Comprehensive, well-designed tagging programs to address long-term demographic questions are ongoing at other sites and are not deemed necessary in Suriname at this time. A certain amount of tagging equipment should be kept on hand, though, in order to replace corroded tags, engage in short-term tagging studies to answer specific questions, etc.

4.3 Encourage and Support International Legislation

4.31 CITES

The 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was established to protect certain endangered species from over-exploitation by means of a system of import/export permits. The Convention regulates international commerce in animals and plants whether dead or alive, and any recognizable parts or derivatives thereof. Appendix I lists endangered species (including all species of sea turtle), trade in which is tightly controlled; Appendix II lists species that may become endangered unless trade is regulated; Appendix III lists species that any Party wishes to regulate and requires international cooperation to control trade; Appendix IV contains model permits. Permits are required for species listed in appendices I and II stating that export/import will not be detrimental to the survival of the species. CITES is one of the most widely supported wildlife treaties of all time. With the recent accession of Korea, the Convention has 120 Parties (S. Lieberman, U.S. FWS, pers. comm., 1993).

Although most nations in the region have taken CITES very seriously, some have been unable to make much progress in maintaining the level of Customs surveillance required to enforce the treaty. Even though CITES has ameliorated the traffic in threatened species products, it has by no means ended it. The Wider Caribbean region continues to export large quantities of threatened species products, including those of sea turtles (e.g., Milliken and Tokunaga, 1987; Canin, 1991). In an effort to enhance both membership and treaty implementation in the region, the CITES Secretariat hosted the "Caribbean CITES Implementation Training Seminar" in September 1992 in Trinidad and Tobago. The Seminar was attended by Radjinder Kumar Hiralall (Wildlife Officer, Surinam Forest Service) and Rudi V. Mangal (Chief of Customs at International Airport Zanderij). Surinam officials take CITES seriously. Rules and regulations set by CITES are scrupulously adhered to and there is no evidence of corruption or illicit practices with regard to use of CITES permits.

In November 1980, the Republic of Suriname ratified CITES, but took exemptions for C. mydas and D. coriacea, both Appendix I species. With regard to the exemption of D. coriacea, Suriname does not consider its leatherback nesting population as being endangered, but the exemption is mostly a matter of principle. Suriname's position is that CITES is an international trade treaty, not an endangered species act. There is hardly, if any, international trade in leatherbacks nor in their products. Prior to Suriname ratifying CITES, a proposal to down-list the Surinam C. mydas nesting population to CITES Appendix II was submitted. Because the proposal was not accepted by the Parties, Suriname acceded to the treaty with an exemption on C. mydas in order to provide eggs or hatchlings for a planned green turtle ranching pilot project at Matapica. The pilot project (which was never undertaken) would not have required CITES approval but, if successful and approved by CITES, a commercial "turtle ranch" would have followed, enabling Suriname to sell ranched turtle products on international markets. The rationale for this commercialization and suggested conservation benefits are discussed by Reichart (1982).

4.32 Regional treaties

In 1940, the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere was negotiated under the auspices of the Pan American Union. Twelve of the parties to the Western Hemisphere Convention are in the wider Caribbean region, including Suriname (date of entry into force: 30 July 1985). A shortfall of this Convention is that it contains no mechanism for reaching decisions binding upon the parties, but leaves each party to implement the treaty's provisions as it find "appropriate". The Bonn Convention for the Conservation of Migratory Wild Animals, if ratified by enough nations in the Wider Caribbean region, could be an effective tool in the conservation of migratory species, such as sea turtles. It was developed to deal with all threats to migratory species, including habitat destruction and taking for domestic consumption. Suriname has been a party to the Bonn Convention since 1985, but few other Western Atlantic nations have joined (UNEP, 1989).

A relatively recent regional environmental Convention that shows great promise is the United Nations Environment Programme's (UNEP) Regional Seas Convention in the Caribbean, known as the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (or, the "Cartagena Convention"). The Convention is coupled with an Action Plan, known as the Action Plan for the Caribbean Environment Programme (APCEP).

The First Intergovernmental Meeting on APCEP was convened by UNEP in cooperation with the Economic Commission for Latin America (ECLA) in Montego Bay, Jamaica, 6-8 April 1981. The representatives of Governments from 22 States in the region, including Suriname, adopted APCEP at this meeting and established the Caribbean Trust Fund to support common costs and activities associated with the implementation of the Action Plan.

In March, 1983, a Conference of Plenipotentiaries met in Cartagena, Colombia to negotiate the "Cartagena Convention". Representatives from 16 States participated (Suriname was not represented). The Conference adopted both the Convention and a Protocol concerning cooperation in combating oil spills in the region. The Convention describes the responsibilities of Contracting Parties to "prevent, reduce and control" pollution from a variety of sources (i.e., pollution from ships, from at-sea dumping of waste, from land-based sources, from sea bed activities, and from airborne sources). Article 10 is of special interest in that it addresses the responsibilities of Contracting Parties to "individually or jointly, take all appropriate measures to protect and preserve rare or fragile ecosystems, as well as the habitat of depleted, threatened or endangered species, in the Convention area." The Cartagena Convention entered into force on 11 October 1986.

In January 1990, a Protocol Concerning Specially Protected Areas and Wildlife (SPAW) to the Cartagena Convention was adopted by a Conference of Plenipotentiaries, providing a mechanism whereby species of wild fauna and flora could be protected on a regional scale. The landmark Protocol grants explicit protection to species listed in three categories, or annexes. Annex I includes species of flora exempt from all forms of destruction or disturbance. Annex II ensures total protection and recovery to listed species of fauna, with minor exceptions. Specifically, Annex II listing prohibits (a) the taking, possession or killing (including, to the extent possible, the incidental taking, possession or killing) or commercial trade in such species, their eggs, parts or products, and (b) to the extent possible, the disturbance of such species, particularly during periods of breeding, incubation, estivation or migration, as well as other periods of biological stress. Annex III denotes species in need of "protection and recovery", but subject to a regulated harvest.

On 11 June 1991, Plenipotentiaries again met in Kingston, Jamaica, to formally adopt the Annexes. The Conference voted unanimously to include all six species of sea turtle inhabiting the Wider Caribbean (i.e., Caretta caretta, Chelonia mydas, Eretmochelys imbricata, Dermochelys coriacea, Lepidochelys kempi, L. olivacea) in Annex II (UNEP, 1991; Eckert, 1991). The unanimous vote on this issue is a clear statement on the part of Caribbean governments that the protection of regionally depleted species, including sea turtles, is a priority. Having already established itself as a leader in sea turtle conservation in the Western Atlantic region, it is a recommendation of this Recovery Action Plan that Suriname ratify the Cartagena Convention and its Protocols as soon as possible.

4.33 Subregional sea turtle management

For many years now, marine turtle conservationists in Suriname have proposed the establishment of a multilateral agreement between Suriname, French Guiana and Brazil for the protection and joint management of the green turtle populations they share. Up until now such

attempts have been futile. Especially with regard to protecting depleted populations of olive ridleys, it is an urgent recommendation of this Recovery Action Plan that a regional agreement be made between Venezuela, Brazil, and the three Guianas (see also section 4.28). WIDECAST could play an important role in this by lobbying at high Government levels.

4.4 Develop Public Education

4.41 Residents

Since the late 1960's, STINASU has been involved in providing the general public as well as local villagers with information regarding the need to manage and protect marine turtles. It is a recommendation of this Recovery Action Plan that greater emphasis be placed on developing up-to-date educational materials for dissemination to schools and the public media.

Amerindians from the two villages of Christiaankondre and Langamankondre on the Sur-inam side of the Marowijne River (Figure 4) have always resented the presence of the Galibi Nature Reserve in what they consider their area. The education and information activities of the Surinam Government and STINASU have not been very successful in explaining the rationale of the reserve. The villagers claim their "Traditional Rights" to the region, including unrestricted use of the marine turtle resources; they have even undertaken armed hostilities to force the issue. Admittedly, the Surinam Government has made mistakes in the gazetting of the reserve, mostly by not including more Amerindian representation in the management of the reserve. Reichart (1991) provides a review of the conflict, and suggests solutions for its remedy. It is a recommendation of this Recovery Action Plan that a new start be made in arriving at a just settlement of these issues. The Amerindians are an integral part of the area, and they should derive economic benefit from the reserve. Marine turtle management is an international responsibility and, as such, must remain under control of the Government, although more local people should be included in the management team. In the Management Plan for the Galibi Nature Reserve (Reichart, 1992) several recommendations are made which may be acceptable to the villagers.

4.42 Fishermen

It is important that shrimp fishermen be adequately informed about the need and merit of turtle excluder devices (TEDs). SAIL is the agency having the responsibility to implement the use of TEDs on Surinam-based foreign fishing vessels (see section 4.27). As far as the artisanal fishermen are concerned, many, but not all, are already aware of the need to protect marine turtles. It is a recommendation of this Recovery Action Plan that education and information activities should continue in the villages with the support and help of the village chiefs (*kapiteins*) in the form of public meetings, slide shows, and a continuing dialogue between villagers, nature reserve management personnel, and the Government.

4.43 Tourists

It is a recommendation of this Recovery Action Plan that notices be placed in the arrival and departure halls of Suriname's international airport at Zanderij to alert travelers about national

as well as international regulations concerning possession and transport of protected wildlife species, including all species of sea turtles. Efforts are already made to provide tourists with educational materials. For example, STINASU provides stenciled brochures for tourists visiting the nesting beaches on its guided tours. Visitors can also purchase various informative booklets on marine turtle conservation published by STINASU or the Surinam Forest Service.

Visiting the nesting beaches at Galibi Nature Reserve is also an educational option for tourists, although access is not easy. There is no direct road connection, nor is there an airstrip present in or near the reserve. From Paramaribo, the reserve can be reached in several ways (see Figure 3): (a) by car and boat (take the Paramaribo-Meerzorg ferry across the Suriname River, drive east to Albina at the Marowijne River, obtain boat transport down the Marowijne River to the reserve headquarters at Baboensanti), (b) by boat down the Suriname River, up the Commewijne River, through the Matapica Canal to the ocean, then eastward over sea to the Marowijne River, up the Marowijne River to Baboensanti, or (c) by boat down the Suriname River to the ocean, then eastward over sea to the Marowijne River, up the Marowijne River to Baboensanti. The first option is the easiest and quickest way to reach the reserve.

The Galibi nesting beaches can also be reached from French Guiana in about 40 minutes by driving to the Amerindian village of Ya:lima:po, near the town of Les Hattes in the northwest corner of the country, and crossing the Marowijne River by boat. All boat travel should be done in a seaworthy vessel equipped with survival gear. For reserve access, travel arrangements and accommodations, including those at other nesting beaches, contact the Foundation for Nature Preservation in Suriname (STINASU). The address is:

Cornelis Jongbawstraat 14
P. O. Box 436
Paramaribo, Suriname
Telephone: 471856 (country code 597)

It is a recommendation of this Recovery Action Plan that on the nesting beaches visited by tourists, information boards should be placed to inform visitors about the rules and regulations pertaining to observing marine turtles. Brochures, describing the attractions of the reserve and an overview of the marine turtle species nesting in Suriname, should be readily available at all field stations. Nature tourism in Suriname, which declined considerably during the civil strife of the late 1980's, is now being revitalized. The infrastructure of the Galibi Nature Reserve will have to be rebuilt, and indigenous people from the area must be included in this development process. STINASU as well as local people can derive economic benefit from nature tourism to the reserve. STINASU has brochures available in Dutch and English to inform tourists on aspects of marine turtle biology. In order to attract more tourism from French Guiana, documentation in French and Portuguese would be helpful.

4.44 Non-consumptive activities that generate revenue

The challenge is to convince local people to use sea turtles, and other wildlife resources, in a non-consumptive way to generate revenue, and that, by maintaining viable populations, there is great potential for a well managed tourism industry. STINASU currently organizes trips for

tourists to the Brownsberg Nature Park in the interior and to the nesting beaches at Matapica. Because of recent civil strife in the area, the Galibi Nature Reserve is still closed for the public, but the reserve is expected to be open for tourism again in 1994. On the beaches, tourists can stay in simple housing or in primitive camps. Prior to walking the nesting beaches at night, tourists are instructed by field personnel on the proper way to behave when observing a nesting turtle. During the turtle nesting season, the use of flashlights on Surinam beaches is strongly discouraged. There is no specific law to that effect, but information brochures and familiarization talks by field personnel inform the public about the dangers of disorientation from artificial lights. It is a recommendation of this Recovery Action Plan that comprehensive guidelines be developed for nature tourism on nesting beaches, including beach etiquette, tour guide training, impact monitoring (e.g., harassment, erosion, litter), etc.

4.5 Increase Information Exchange

4.51 Marine Turtle Newsletter

STINASU currently receives the Marine Turtle Newsletter (MTN), which is available at no charge from the Editors: Scott and Karen Eckert, c/o Hubbs Sea World Research Institute, 1700 South Shores Road, San Diego, California 92109 USA. Other interested parties are encouraged to contact the Editors and request to be placed on the mailing list. When pertinent and of local value, certain articles from the MTN should be translated into Dutch and distributed to tourists, local newspapers, radio, TV (giving proper credit to the source) or posted in the field stations and/or the facilities at Paramaribo.

4.52 Western Atlantic Turtle Symposium (WATS)

Suriname participated in both WATS I (in San José, Costa Rica, in 1983) and WATS II (in Mayagüez, Puerto Rico, in 1987). As a country with major nesting sites for several species of sea turtle and long-term conservation work, including some 25 years of record-keeping, Suriname provided important data to these symposia (Mohadin and Reichart, 1984; Mohadin, 1987). Suriname is encouraged to continue to participate fully in this important regional data base for sea turtles. The WATS manual (Pritchard et al., 1983) is available in English and Spanish and can be used as a reference and guide for implementing various sea turtle conservation and management programs, such as aerial surveys, turtle tagging, and hatchery techniques.

4.53 WIDECAST

The Wider Caribbean Sea Turtle Conservation Network (WIDECAST) consists of a regional Recovery Team of sea turtle experts which works closely with local Country Coordinators, who in turn enlist the support and participation of citizens in and out of government who have an interest in sea turtle conservation. The primary project outputs are Sea Turtle Recovery Action Plans (STRAPs) for each of 39 government regions, including Suriname, in the Wider Caribbean. Each STRAP is tailored specifically to local circumstances and provides the following information:

1. The local status and distribution of nesting and feeding sea turtles.

2. The major causes of mortality to sea turtles.
3. The effectiveness of existing national and international laws protecting sea turtles.
4. The present and historical role of sea turtles in local culture and economy.
5. Local, national, and multi-lateral implementing measures for scientifically sound sea turtle conservation.

The short-term objectives of WIDECAST are to provide Wider Caribbean governments with updated information on the status of sea turtles in the region, to provide specific recommendations for the management and recovery of endangered, threatened, and vulnerable sea turtle stocks, and to assist Wider Caribbean governments in the discharge of their obligations under the Protocol Concerning Specially Protected Areas and Wildlife (SPAW) in the Wider Caribbean Region (see section 4.32). The longer-term objectives are to promote a regional capability to implement scientifically sound sea turtle conservation programmes by developing and supporting a technical understanding of sea turtle biology and management among local individuals and organizations. These objectives are accomplished by:

1. Implementing WIDECAST through resident Country Coordinators.
2. Utilising local network participants to collect information and draft, with the assistance of regional sea turtle experts, locally appropriate sea turtle management recommendations.
3. Providing or assisting in the development of educational materials (slides, brochures, posters, pamphlets).
4. Sponsoring or supporting local or subregional workshops on sea turtle biology and management.
5. Assisting governments and non-government groups with the implementation of effective management and conservation programmes for turtles.

Beyond supporting the local and national efforts of governments and non-governmental organizations, WIDECAST works to integrate these efforts into a collective regional response to a common problem, the disappearance of sea turtles. WIDECAST is supported by the Caribbean Trust Fund of the UNEP Caribbean Environment Programme, as well as by a wide variety of government and non-government agencies and groups. Government and non-government personnel, biologists, fishermen, educators, developers, and other interested persons are encouraged to join WIDECAST's efforts. Locally, WIDECAST is implemented through the Director of STINASU (Cornelis Jongbawstraat 14, P. O. Box 436, Paramaribo; Tel (597) 471856). WIDECAST is seen as an innovative and effective regional conservation program, and we hope to continue our involvement and participation.

4.54 IUCN/SSC Marine Turtle Specialist Group

The Marine Turtle Specialist Group is responsible for tracking the status of sea turtle populations for the Species Survival Commission (SSC) of the World Conservation Union (IUCN). The group is a valuable source of information and technical advice on local projects. It is highly desirable that, as in the past, STINASU maintains close contact with the IUCN in order to remain up-to-date on developments around the world in matters of sea turtle conservation.

4.55 Workshops on research and management

STINASU and other relevant agencies are encouraged to provide training sessions for employees and volunteers who will assist in the collection of sea turtle life history data, and be involved in conservation projects. It is a recommendation of this Recovery Action Plan that such workshops extend to local fishermen and include sea turtle resuscitation and/or (where appropriate) other techniques such as tagging.

4.56 Exchange of information among local groups

Sea turtles are listed in the Game Law of 1954 as "game animals", but only to provide a legal basis for a limited egg harvest; all other life stages are protected. Enforcement is administered by Game Wardens of the Nature Conservation Division of the Surinam Forest Service. Other sea turtle conservation activities, such as nest counts, transfer of doomed nests, basic research, study of population dynamics, and public education have been delegated to STINASU. Although an independent conservation agency, STINASU is closely associated with the Surinam Forest Service. It participates in international meetings concerning marine turtle conservation, such as the Western Atlantic Turtle Symposium (WATS), and it receives various publications that are pertinent to this subject.

STINASU publishes information and education materials for handouts at schools and in the reserves and regularly visits schools in the accessible northern part of the country to show nature films and/or give nature-oriented talks. There are no specific, local groups concerned with sea turtle conservation in Suriname, but STINASU regularly announces news items of interest regarding sea turtles in the public media. Several booklets, in Dutch (Schulz, 1980) as well as stencils in Dutch and English, have also been published. Because of these activities, there is a considerable awareness regarding the need for sea turtle conservation in the country, and the mention of the word STINASU is synonymous with sea turtle conservation in Suriname.

4.6 Implement a National Sea Turtle Conservation Project

4.61 Rationale

Suriname has an excellent and longstanding marine turtle conservation program and, with publication of this document, has laid the foundation for a national conservation action plan. Techniques for marine turtle conservation activities, which started in the mid 1960's, have evolved over many years. From visiting scientists, from published research findings in other countries, and from fieldwork in Suriname, new ideas and procedures became known. If these were deemed applicable for Suriname, they were integrated in the program. Consequently, the Surinam marine turtle conservation program has been a dynamic one, using the latest information and techniques available.

The military coup of 1980, and the subsequent political turmoil of the 1980's, caused a considerable setback in the program. Key staff members and fieldworkers left and could not be replaced; equipment and materials deteriorated to the point where the project began to suffer, causing, among other things, a loss of morale among the remaining workers. Furthermore, when

Amerindians occupied the Galibi Nature Reserve in 1989, the few basic management tasks that were still being carried out there had to be abandoned.

Since 1990, Suriname once again has a democratically elected government, and the various rebellious ethnic groups in the interior of the country have signed a peace treaty, which includes their pledge to cooperate in healing the wounds of the past conflict. The repercussions of events over the past decade will not magically disappear, however. Among other things, the infrastructure of the Galibi Nature Reserve has, by and large, been destroyed, and facilities on the other nesting beaches are extremely precarious. Only the dedication of the few remaining workers makes it possible that any nesting data at all are being recorded.

The legacy of the problems of the 1980s is that Suriname now has serious economic problems, and marine turtle management does not rank very high on the country's list of priori-ties at this time. Funding for much-needed personnel, equipment and materials will therefore have to come from private sources. To restore the Surinam marine turtle conservation program to its former level of excellence will require action on the following items.

Personnel

An academically-trained manager to coordinate the program (and to train local counterparts) is a prime prerequisite. At this time there is no one available, nor qualified, to do so in Suriname.

Because of the geographic separation of the beaches, two mid-level field co-ordinators are necessary: one for the Galibi area and one for the Matapica Canal-Suriname River beaches.

Several additional fieldworkers are needed to patrol the beaches, record data, and perform the necessary conservation tasks (e.g., transplant doomed nests).

Housing

Housing for personnel is a perennial problem on Surinam beaches. Beach personnel have always had to work under deplorable living conditions. Because of continually shifting beaches, permanent structures are not practical. Prefabri-cated, modular units would be quite suitable, however. When the beach erodes after a few years, these buildings would not have to be abandoned and left to the elements, but could be disassembled for erection farther west.

Equipment

There are no more boats, outboard motors, and communication equipment to adequately perform the field tasks. The standard, sea-worthy boat generally used in Suriname (called a *piaka*) has been a very effective tool over the years. These can be constructed and purchased locally.

Beach personnel have to walk many kilometers every day to patrol the beaches. This is tiring and monotonous -- possibly causing inaccurate data collection. Mechanized beach transport, such as a suitable dune buggy, would be a valuable tool.

Communications between the beach stations is non-existent; the distance between them is too far for the use of "walkie-talkies". A VHF system would be useful for coordination between the various nesting areas. An 18 VDC solar panel, in conjunction with a battery, at each station can be used to run the radio and provide enough additional power for some lights at night.

Data processing still occurs by hand. A Paramaribo-based data bank on a personal computer would be appropriate. A laptop computer, although not essential, would certainly be a convenience for the program manager when in the field.

Materials

An assortment of materials is needed to facilitate the beach work, including measuring equipment, tagging tools and supplies, screening for nest or hatchery enclosures, and flagging material.

Miscellaneous

A new approach will have to be made in bringing the marine turtle conservation issues to the public. To accomplish this, a brand new set of education and information material will have to be developed. Neither the know-how nor the personnel for this is available in Suriname at this time.

What is most needed for the field is a standardized manual on techniques and procedures. Current procedures have been developed over the years by scientific staff and fieldworkers together, but they have not been written down in a comprehensive document. If key persons leave, a precarious hiatus will be created in information transfer. It is essential that a project be implemented to develop a national marine turtle conservation manual to ensure that no expertise is lost with the departure of key personnel.

4.62 Activities

The following activities should be undertaken in listed order:

1. obtain the necessary funding (see section 4.63),

2. compile all relevant national data regarding sea turtle legislation and conservation,

3. compile all pertinent international data as they may pertain to sea turtle legislation and conservation in Suriname,

4. produce a comprehensive, loose-leaf (for easy future updating) manual in Dutch and English on sea turtle conservation techniques and procedures in Suriname,

5. produce a comprehensive document (in Dutch and English) on the goals and objectives of marine turtle conservation in Suriname, based on information provided in this and other (e.g., Reichart, 1992) management plans,

6. rebuild the marine turtle conservation program's infrastructure, including personnel, facilities, and equipment, and

7. conduct periodic workshops on marine turtle conservation in nearby Amerindian communities and establish roundtable discussions on the sustainable benefits to be derived through joint programs with STINASU.

4.63 Budget

The following is a draft budget intended to show the expected cost for rehabilitating the Surinam marine turtle conservation program to an optimum level and for maintaining it there. This is a one-time budget and, except for personnel costs, not an annual budget.

ITEM	TOTAL COST (US$)
Personnel	
Program manager (per year)	20,000
Field coordinators (2) (per year)	15,000
Field workers (6) (per year)	7,500
Housing (modules)	
Eilanti beach (2)	14,000
Matapica beach (2)	14,000
Walapa beach (1)	7,000
Katkreek beach (1)	7,000
Diana beach (1)	7,000
Braamspunt (1)	7,000
Storage sheds (3)	21,000

Budget, *continued*.

ITEM	**TOTAL COST (US$)**
Equipment	
Piaka (boat) (4)	6,000
40 HP outboard motor (4)	16,000
25 HP outboard motor (4)	10,000
Dune buggy (3)	24,000
VHF communication system (4)	3,200
Solar panels (6)	1,500
12 VDC batteries (6)	500
Personal computer and software (1)	3,500
Laptop computer (1)	3,500
Research materials	
Measuring equipment	1,000
Tagging tools and tags	500
Enclosure materials	4,500
Miscellaneous	
Training materials	3,500
Education/Information brochures	4,500
Aerial survey time (3 yrs, "ultra-light")	7,500
TOTAL	US$ 209,200

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Table 1. Annual number of sea turtle nests laid in Suriname, 1967-1989 (source: Reichart, 1992). Green turtle (*krapé*), Chelonia mydas = C.m.; leatherback turtle (*aitkanti*), Dermochelys coriacea = D.c.; olive ridley turtle (*warana*), Lepidochelys olivacea = L.o.; hawksbill turtle (*karèt*), Eretmochelys imbricata = E.i.

Year	C.m.	D.c.	L.o.	E.i.
1967	---	90	2875	10
1968	± 5000	200	3290	4
1969	2495	305	1665	10
1970	3115	255	1750	4
1971	5755	285	1595	15
1972	6885	380	1270	13
1973	6600	900	890	8
1974	7465	785	1080	30
1975	3610	1625	1070	12
1976	8080	670	1160	45
1977	4955	5565	1030	7
1978	8465	2160	870	10
1979	4330	3900	795	?
1980	4510	1300	1020	26
1981	7410	1990	1220	25
1982	4180	3680	1045	15
1983	5547	5912	1212	17
1984	7546	7291	944	19
1985	5125	12401	670	31
1986	5879	3599	537	21
1987	6324	9816	659	11
1988	6776	11436	563	24
1989	7046	2732	585	20
1990 *	1524	1182	175	10
1991 *	1529	1482	225	23
1992 *	1613	2732	158	31

* Note: Nest counts through 1989 are the yearly totals for all sea turtle nesting beaches in Suriname combined. For the period 1990-1993, access to the Galibi Nature Reserve was blocked by rebellious Carib villagers, and the data presented for these years refer to beaches west of the Wia-Wia Nature Reserve only. Nest counts for 1993 have not yet been completed.

Table 2. Seasonality of sea turtle nesting in Suriname (sources: Schulz, 1975 and Reichart, unpubl. data). Green turtle (*krapê*), Chelonia mydas = C.m.; leatherback turtle (*aitkanti*), Dermochelys coriacea = D.c.; olive ridley turtle (*warana*), Lepidochelys olivacea = L.o.; hawksbill turtle (*karèt*), Eretmochelys imbricata = E.i.

Beach	Species	Nesting season (peak)
Galibi	C.m.	Feb-Jul (Mar-May)
	D.c.	Jan-Aug (Apr-Jun)
	L.o.	Apr-Jul (May-Jun)
Baboensanti	C.m.	Feb-Aug (Mar-May)
	D.c.	Jan-Aug (Apr-Jun)
	L.o.	Apr-Aug (May-Jun)
Eilanti	C.m.	Feb-Jul (Mar-May)
	D.c.	Jan-Aug (Apr-Jun)
	L.o.	Apr-Aug (May-Jun)
Krofajapasi	C.m.	Feb-Aug (Mar-May)
	D.c.	Jan-Aug (Mar-May)
	L.o.	Mar-Aug (Apr-May)
	E.i.	Apr-Jul (?)
Matapica	C.m.	Feb-Jul (Mar-May)
	D.c.	Jan-Aug (Apr-Jun)
	L.o.	Apr-Aug (May-Jun)
	E.i.	Apr-Jul (?)
Walapakreek	C.m.	Feb-Jul (Mar-May)
	D.c.	Jan-Aug (Apr-Jun)
	L.o.	Apr-Aug (May-Jun)
	E.i.	Apr-Jul (?)
Katkreek and Diana Beach	C.m.	Feb-Jul (Mar-May)
	D.c.	Jan-Aug (Apr-Jun)
	L.o.	Apr-Aug (Apr-May)
	E.i.	Apr-Jul (?)

Table 3. Annual numbers of sea turtle nests in the Galibi Nature Reserve, 1984-1989 (source: Reichart, 1992). Green turtle (*krapé*), Chelonia mydas = C.m.; leatherback turtle (*aitkanti*), Dermochelys coriacea = D.c.; olive ridley turtle (*warana*), Lepidochelys olivacea = L.o.

Year	Beach	Numbers of nests laid per species		
		C.m.	**D.c.**	**L.o.**
1984	Baboensanti	2730	3306	88
	Eilanti	1031	1219	617
	Galibi	2074	514	27
	Yearly total	**5835**	**5039**	**732**
1985	Baboensanti	1892	4846	94
	Eilanti	468	1245	310
	Galibi	1395	644	11
	Yearly total	**3755**	**6735**	**415**
1986	Baboensanti	2225	1482	72
	Eilanti	728	526	326
	Galibi	1334	122	23
	Yearly total	**4287**	**2130**	**421**
1987	Baboensanti	2478	3224	112
	Eilanti	1206	2005	401
	Galibi	1267	439	34
	Yearly total	**4951**	**5668**	**547**
1988	Baboensanti	2878	6289	113
	Eilanti	835	2023	273
	Galibi	1449	618	26
	Yearly total	**5162**	**8930**	**412**
1989	Baboensanti	3108	1348	136
	Eilanti	713	58	271
	Galibi	1601	134	17
	Yearly total	**5422**	**1540**	**424**

Note: Because of the illegal occupation of the reserve by armed Carib villagers, nest counts could not be conducted during the period 1990-1993 in the Galibi Nature Reserve. With the recently concluded peace agreement, it is expected that nest counts will start again on Galibi beaches in 1994.

Table 4. The nature reserves of Suriname. FR = Forest Reserve, MA = Multiple-Use Management Area; NP = Nature Park; NR = Nature Reserve. Hectares (ha) listed are estimates of land surface only (source: Reichart, 1993). For map, see Figure 2.

Protected Area	Hectares	
Existing Protected Areas		
1. Hertenrits NR	100	
2. Coppename Monding NR	12,000	
3. Wia-Wia NR	36,000	
4. Galibi NR	4,000	
5. Brinck-heuvel NR	6,000	
6. Brownsberg NP	8,400	
7. Raleighvallen-Voltzberg NR	78,170	
8. Tafelberg NR	140,000	
9. Eilerts de Haan NR	220,000	
10. Sipaliwini NR	100,000	
13. Peruvia NR	31,000	
14. Boven-Coesewijne NR	27,000	
15. Copi NR	28,000	
16. Wanekreek NR	45,000	
19a.Bigi Pan MA	68,000	1/
Proposed Protected Areas		
11. Kaboeri kreek NR	68,000	
12. Nani NR	54,000	
17. Mac Clemen FR	6,000	
18. Snake Creek FR	4,000	
19. Estuarine Zone MA	310,000	

1/ excludes adjacent sea area

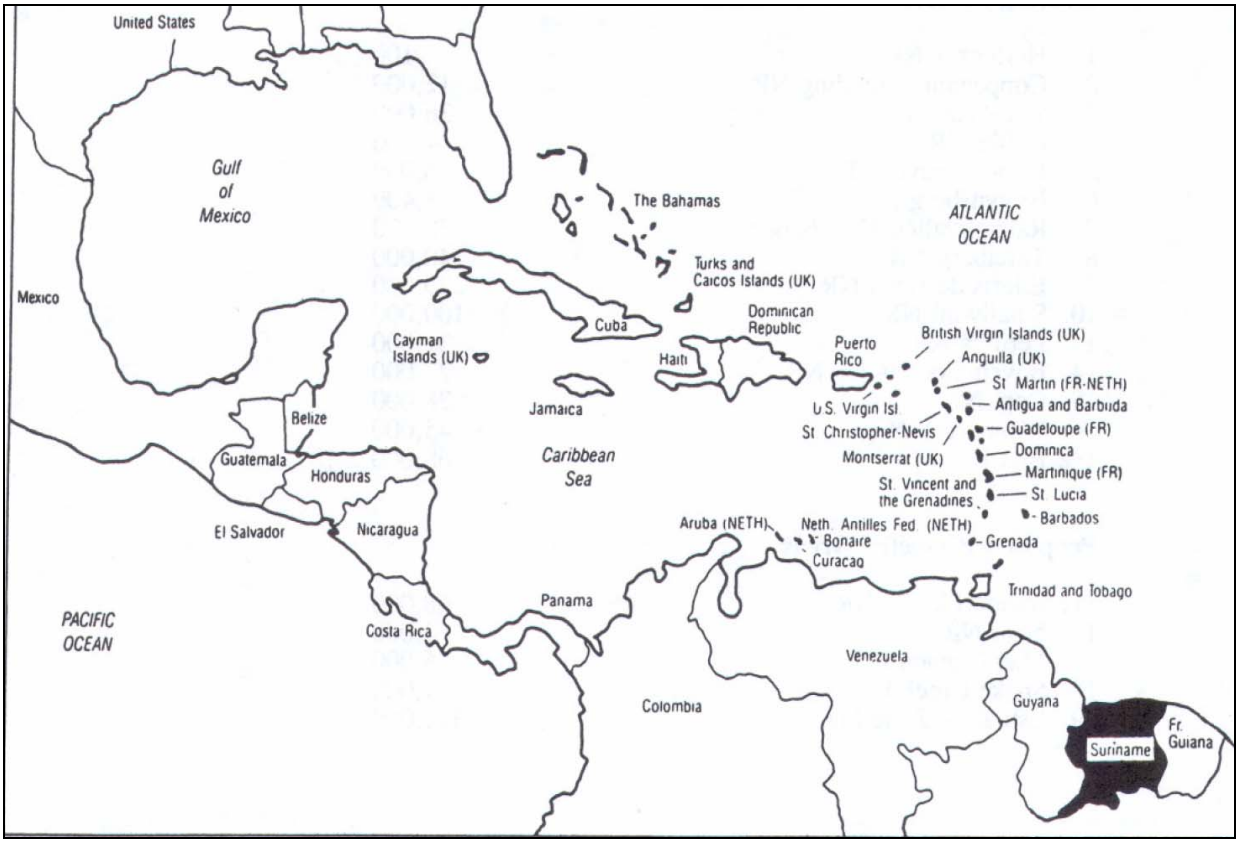

Figure 1. Location of the Republic of Suriname in South America (source: adapted from UNEP, 1989b).

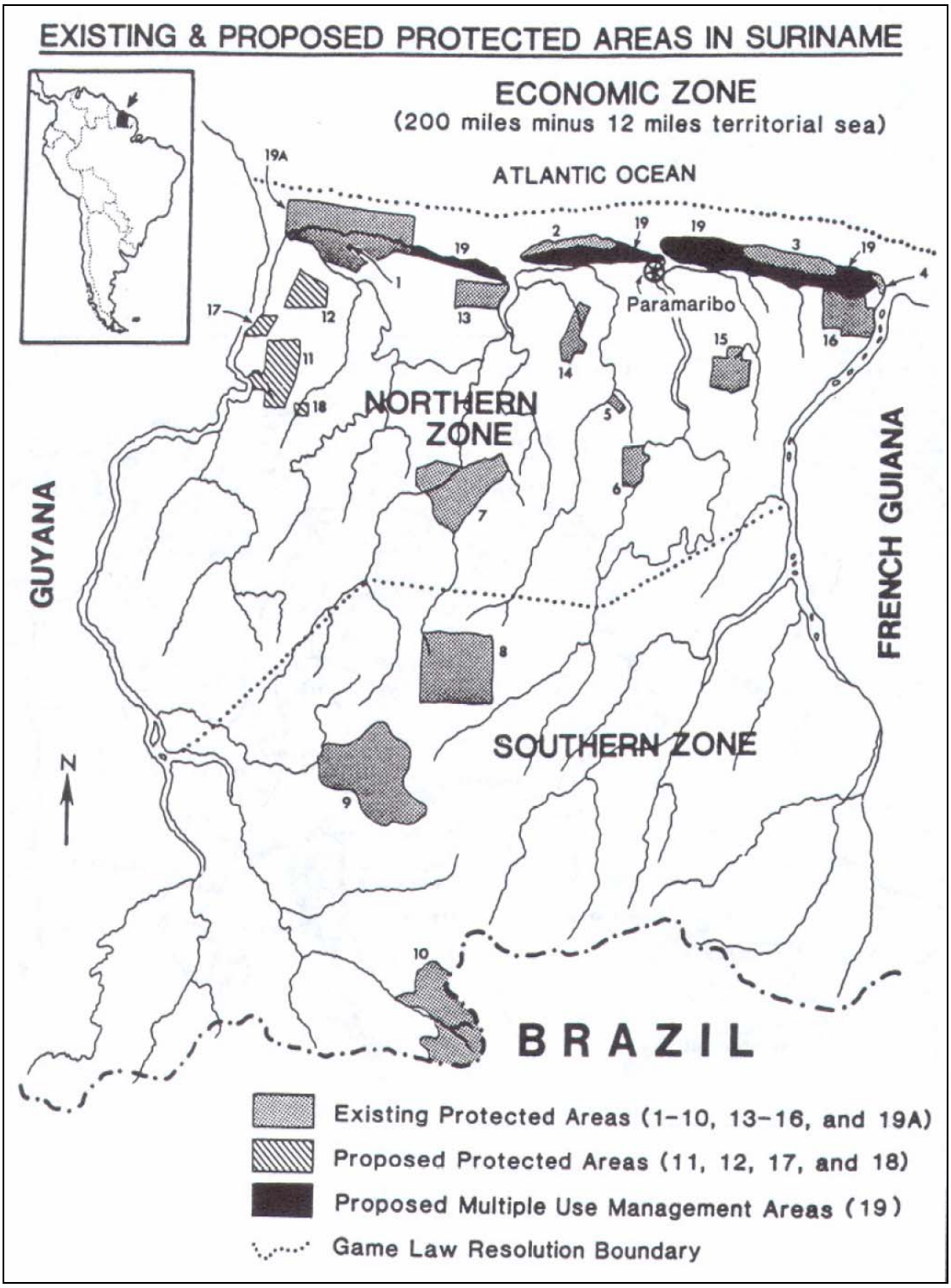

Figure 2. Existing and proposed protected areas in Suriname (source: Mittermeier et al., 1990). Numbers correspond to reserves listed in Table 4.

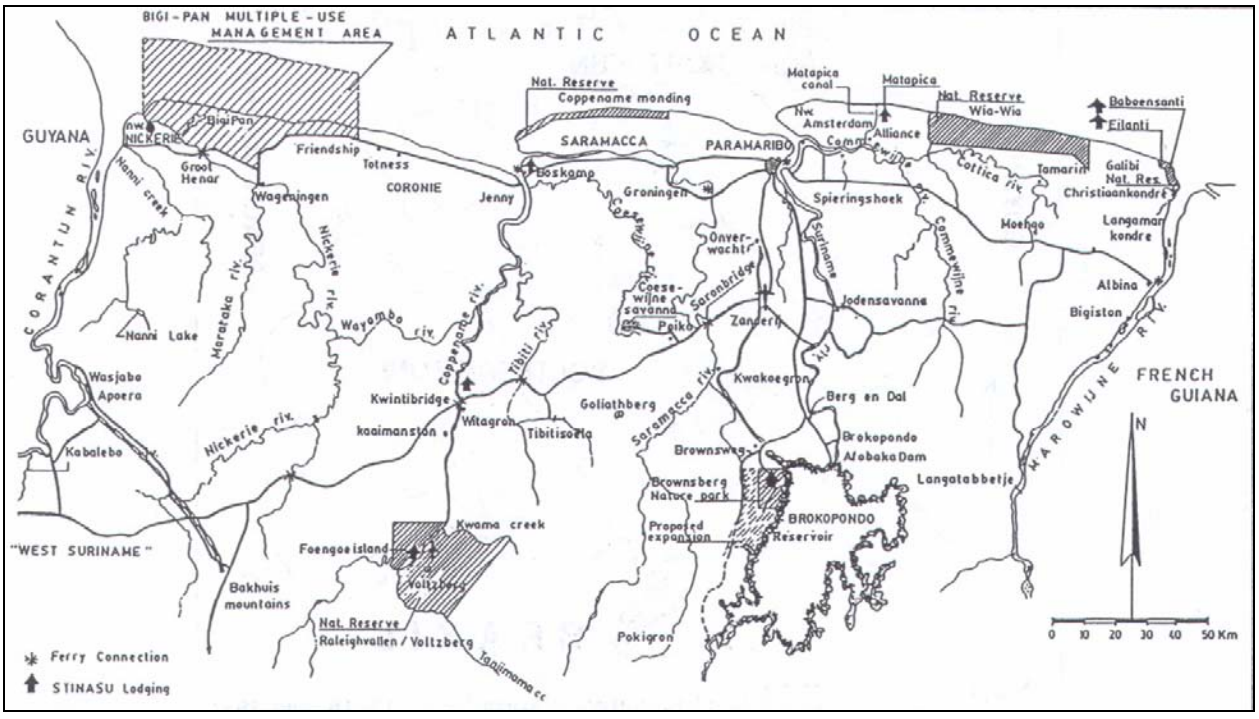

Figure 3. Map of Northern Suriname (source: Reichart, 1992).

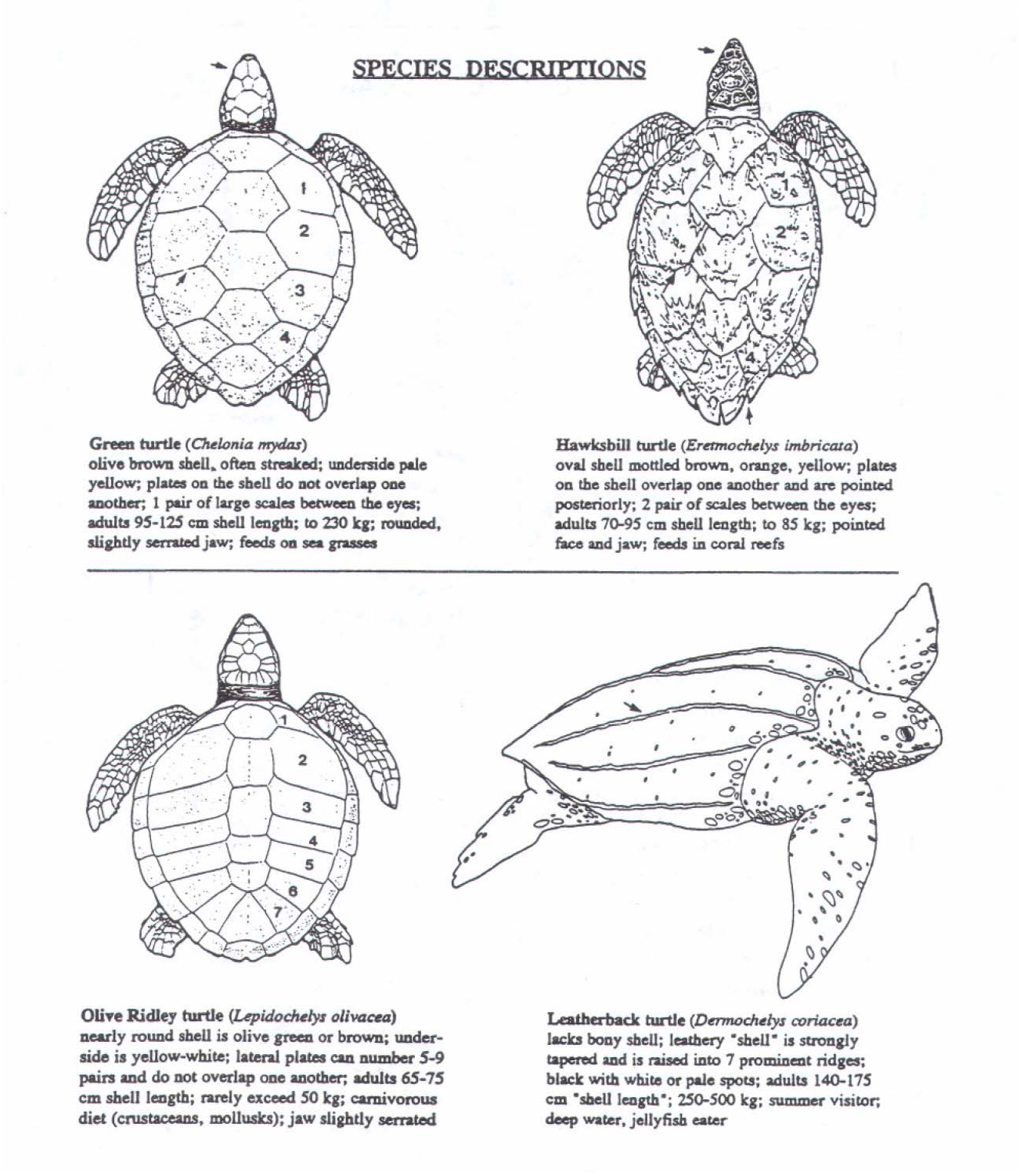

Figure 4. An identification guide to sea turtles in Suriname.

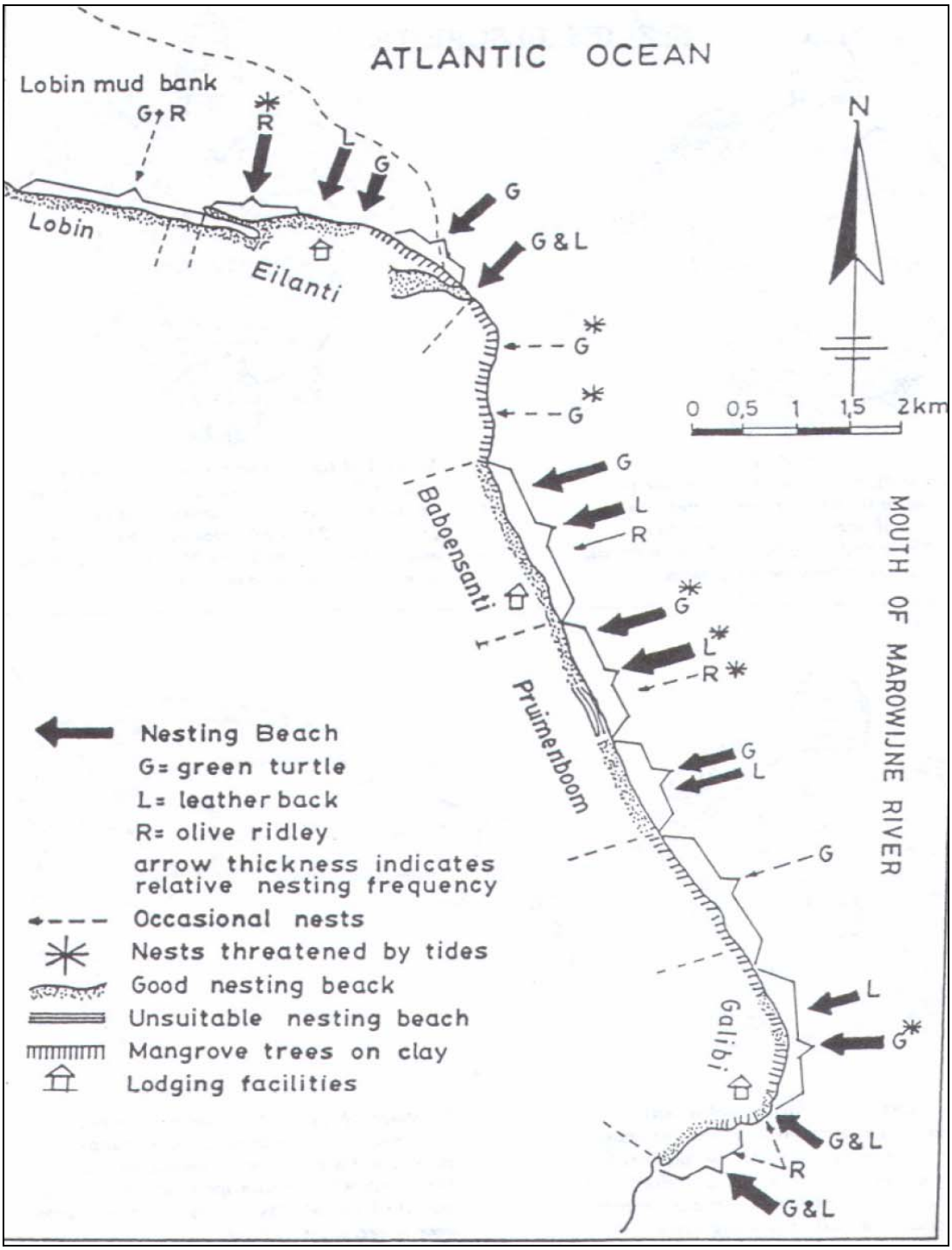

Figure 5. Sea turtle nesting beaches in the Galibi Nature Reserve (no. 4 in Figure 2) (source: Reichart, 1992).

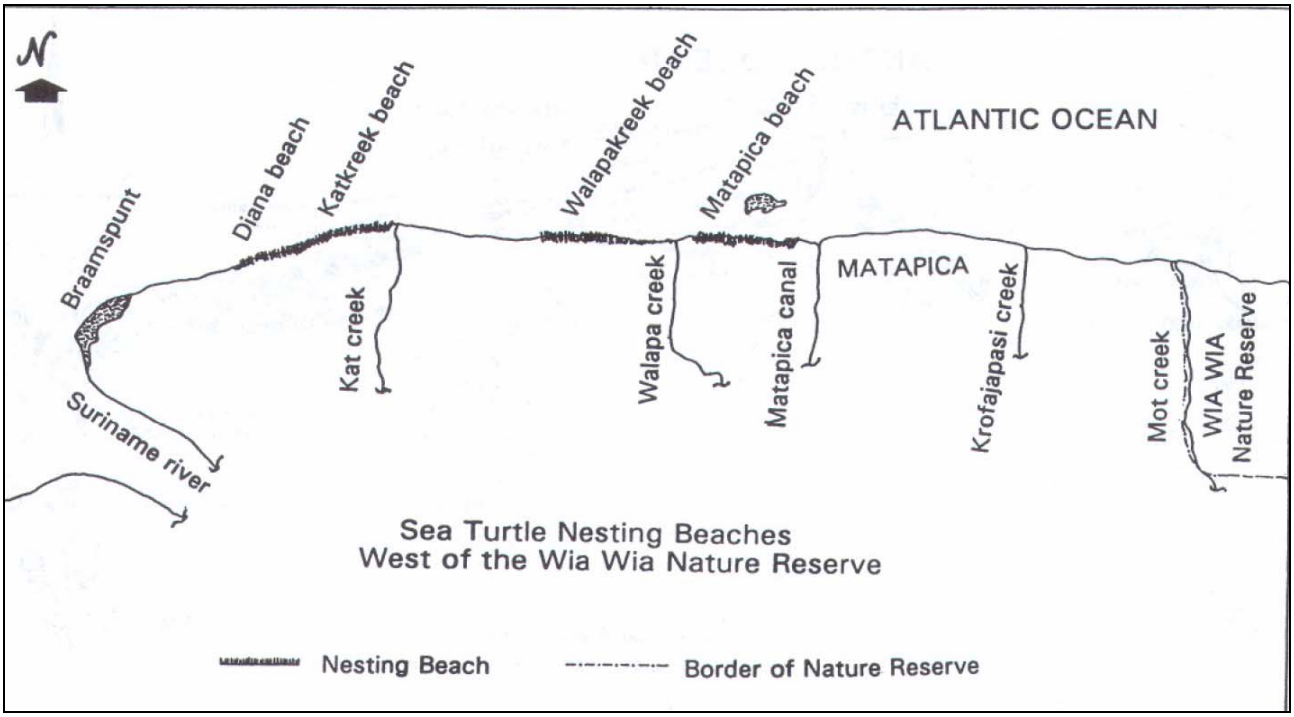

Figure 6. Sea turtle nesting beaches between the Wia-Wia Nature Reserve and the Suriname River.

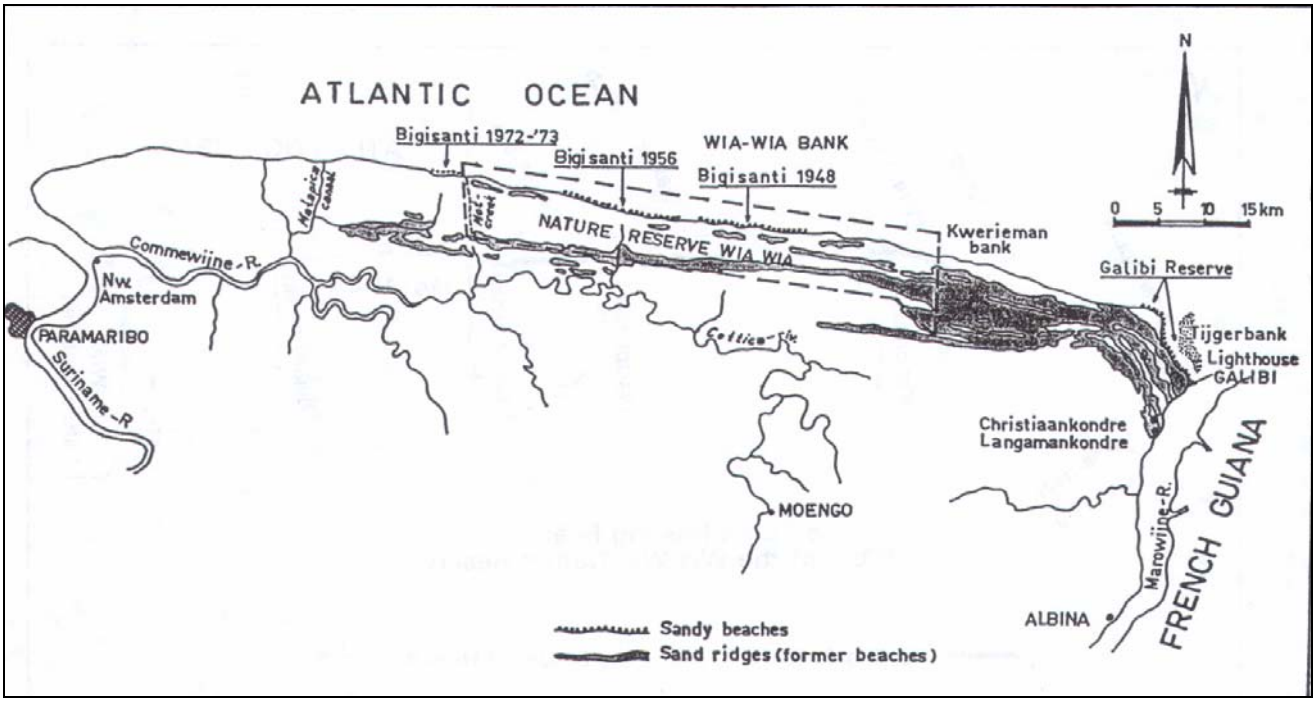

Figure 7. The shifting of the Bigi Santi nesting beach out of the Wia-Wia Nature Reserve (source: Schulz, 1975).

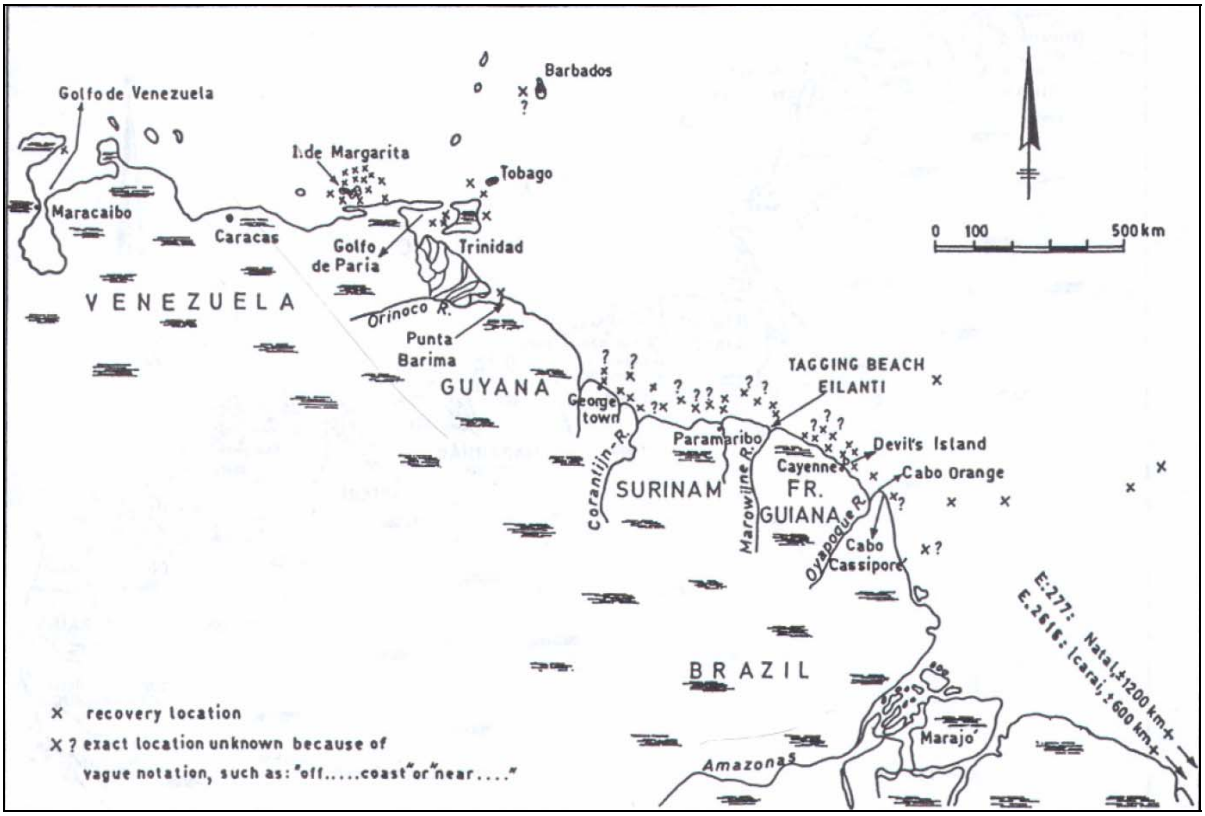

Figure 8. Recovery locations of olive ridley sea turtles (Lepidochelys olivacea) tagged at Eilanti Beach in Suriname (source: Schulz, 1975).

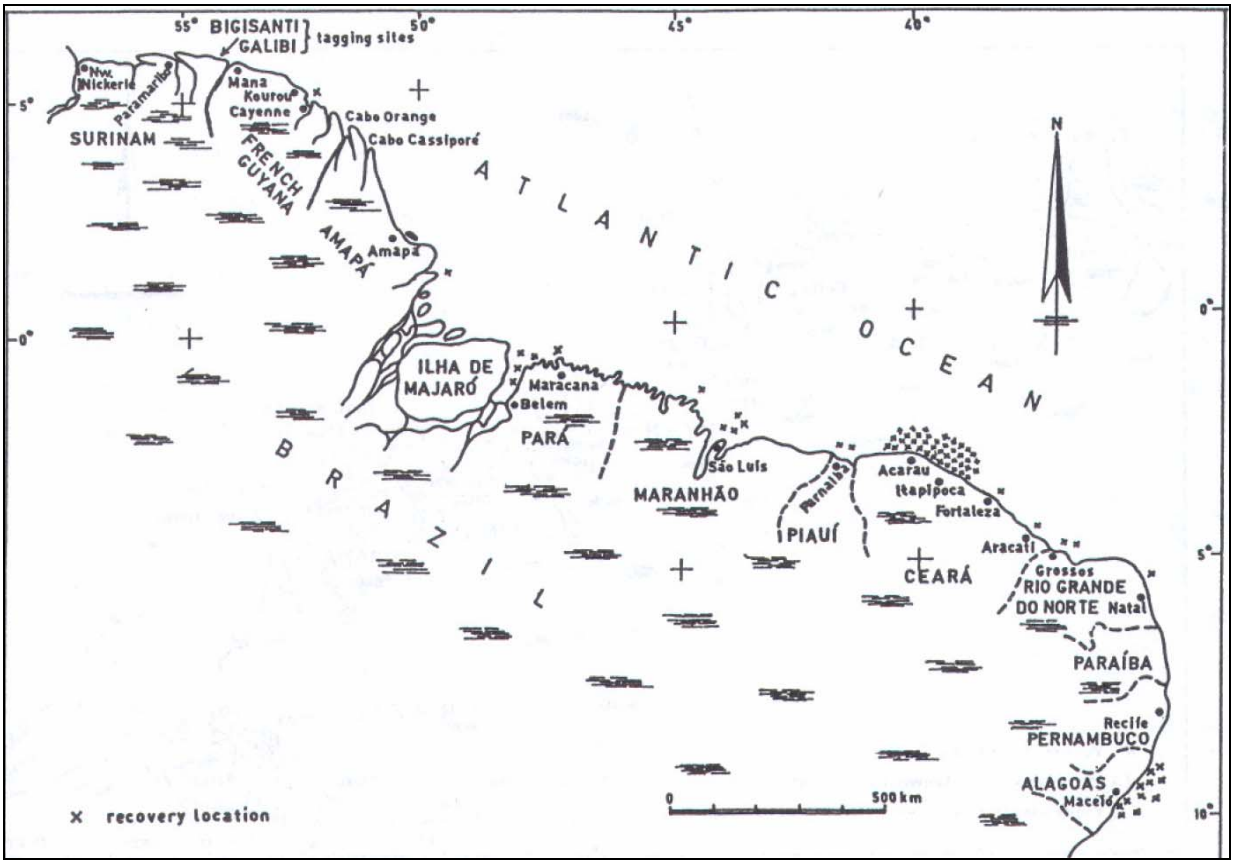

Figure 9. Recovery locations of green sea turtles (Chelonia mydas) tagged at Bigi Santi and Galibi beaches in Suriname (source: Schulz, 1975).

APPENDIX A

U.S. Public Law 101-162 was passed by Congress in November 1989 and reads, in part:

Sec. 609. (a) The Secretary of State, in consultation with the Secretary of Commerce, shall, with respect to those species of sea turtles the conservation of which is the subject of regulations promulgated by the Secretary of Commerce on June 29, 1987 --

(1) initiate negotiations as soon as possible for the development of bilateral or multilateral agreements with other nations for the protection and conservation of such species of sea turtles;

(2) initiate negotiations as soon as possible with all foreign governments which are engaged in, or which have persons or companies engaged in, commercial fishing operations which, as determined by the Secretary of Commerce, may affect adversely such species of sea turtles, for the purpose of entering into bilateral and multilateral treaties with such countries to protect such species of sea turtles;

(3) encourage such other agreements to promote the purposes of this section with other nations for the protection of specific ocean and land regions which are of special significance to the health and stability of such species of sea turtles;

(4) initiate the amendment of any existing international treaty for the protection and conservation of such species of sea turtles to which the United States is a party in order to make such treaty consistent with the purposes and policies of this section; and

(5) provide to the Congress by not later than one year after the date of enactment of this section—

> (A) a list of each nation which conducts commercial shrimp fishing operations within the geographic range of distribution of such sea turtles;
> (B) a list of each nation which conducts commercial shrimp fishing operations which may affect adversely such species of sea turtles; and
> (C) a full report on--
>
> (i) the results of his efforts under this section; and
>
> (ii) the status of measures taken by each nation listed pursuant to paragraph (A) or (B) to protect and conserve such sea turtles.

(b)(1) IN GENERAL.-- The importation of shrimp or products from shrimp which have been harvested with commercial fishing technology which may affect adversely such species of sea turtles shall be prohibited not later than May 1, 1991, except as provided in paragraph (2).

(2) CERTIFICATION PROCEDURE.-- The ban on importation of shrimp or products from shrimp pursuant to paragraph (1) shall not apply if the President shall determine and certify to the Congress not later than May 1, 1991, and annually thereafter that—

> (A) the government of the harvesting nation has provided documentary evidence of the adoption of a regulatory program governing the incidental taking of such sea turtles in the course of such harvesting that is comparable to that of the United States; and
> (B) the average rate of that incidental taking by the vessels of the harvesting nation is comparable to the average rate of incidental taking of sea turtles by United States vessels in the course of such harvesting; or
> (C) the particular fishing environment of the harvesting nation does not pose a threat of the incidental taking of such sea turtles in the course of such harvesting.

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The series of CEP Technical Reports contains selected information resulting from the various activities performed within the framework of the UNEP Caribbean Environment Programme (CEP). CEP was initiated in 1976 by UNEP with the assistance of ECLAC, at the request of the Governments of the region. A framework for regional projects and activities was first formulated in Montego Bay in 1981, when the Action Plan for the Caribbean Environment Programme was adopted by the First Intergovernmental Meeting.

The major legal instrument of CEP was adopted at the Second Intergovernmental Meeting, convened at Cartagena de Indias, in 1983: the Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region. The Cartagena Convention provides a framework for the development of specific protocols.

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Currently, the Action Plan of CEP concentrates in six major areas for the management of marine and coastal resources: Overall Co-ordination, Specially Protected Areas and Wildlife (SPAW), Assessment and Control of Marine Pollution (CEPPOL), Integrated Planning and Institutional Development (IPID), Information Systems (CEPNET), and Education, Training and Awareness (ETA).

*

The Protocol Concerning Specially Protected Areas and Wildlife (SPAW) to the Cartagena Convention was adopted in two stages: the text of the Protocol was adopted on 18 January 1990 and the initial Annexes listing relevant marine and coastal species, were adopted on 11 June 1991. The Protocol will enter into force following ratification by nine Contracting Parties.

The Regional Programme for Specially Protected Areas and Wildlife in the Wider Caribbean Region (SPAW) was designed to implement the provisions and requirements of the SPAW Protocol. Its objectives are: (a) to develop specific management plans for economically and ecologically important species; (b) to significantly increase the number of adequately managed protected areas and species in the region; and © to develop a strong regional capability for the co-ordination of information exchange, training and technical assistance in support of national, subregional and regional efforts on management of protected areas and wildlife.