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Sea Turtle Recovery Action Plan for St. Lucia

Prepared by:

WIDECAST

Wider Caribbean Sea Turtle Recovery Team and Conservation Network

CEP Technical Report No. 26

1993

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UNEP United Nations Environment Programme

Sea Turtle Recovery Action Plan for St. Lucia

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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 sea grass 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 ninth 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 Coordinators, 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 known 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 Re-sources 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.

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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 Marine Turtle Specialist Group (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). Chelonia Institute provided travel assistance to Dr. K. L. Eckert and to Dr. J. I. Richardson for technical visits during 1993. Special appreciation is due Col. Milton Kaufmann (President of Monitor International and Founder of WIDECAST) for his unwavering personal commitment to WIDECAST since its inception more than a decade ago.

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Management Plan for St. Lucia's Sea Turtles: An Overview

LIST OF ACRONYMS

BVI	British Virgin Islands
CARIPOL	Caribbean Pollution Prevention Programme
CCA	Caribbean Conservation Association
CEHI	Caribbean Environmental Health Institute
CEP	UNEP Caribbean Environment Programme
CFRAMP	Caricom Fisheries Resource Assessment and Management Programme
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
ECNAMP	Eastern Caribbean Natural Areas Management Programme
EIA	Environmental Impact Assessment
ENCORE	Environmental and Coastal Resources Project
GDP	Gross Domestic Product
IRF	Island Resources Foundation
IUCN	World Conservation Union
MARPOL	International Convention for the Prevention of Pollution from Ships
OECS	Organisation of Eastern Caribbean States
SLNS	St. Lucia Naturalists' Society
SPAW Protocol	Protocol concerning Specially Protected Areas and Wildlife
STRAP	Sea Turtle Recovery Action Plan
TED	Turtle Excluder Device
UNEP	United Nations Environment Programme
UNESCO	United Nations Education, Science, and Cultural Organization
USVI	United States Virgin Islands
WATS	Western Atlantic Turtle Symposium
WIDECAST	Wider Caribbean Sea Turtle Conservation Network
WWF	World Wildlife Fund

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ABSTRACT

St. Lucia (61^{o}W, 14^{o}N) is one of the Windward Islands of the Lesser Antilles, lying to the south of Martinique and to the north of St. Vincent in the eastern Caribbean Sea. Four species of sea turtle occur in the waters of St. Lucia; namely, the green turtle (Chelonia mydas), leatherback (Dermochelys coriacea), hawksbill (Eretmochelys imbricata) and, on rare occasions, the loggerhead (Caretta caretta). Hawksbill and green turtles are commonly observed in nearshore waters. The former are generally associated with coral reef systems, while the latter are usually seen foraging in sea grass beds.

Records suggest that the major nesting species are the leatherback and the hawksbill. Leatherbacks nest mainly between April and July, although nesting activity has been recorded in March. Nesting is more frequent on the high energy windward beaches of the east coast. Hawksbills are believed to nest primarily between June and December or January on beaches all around the island; precise data are lacking. Little information has been obtained on green turtle nesting. Literature references notwithstanding, there is no conclusive evidence that loggerheads nest in St. Lucia.

Over the last ten years, leatherback nesting on Grande Anse Beach has been monitored by the Department of Fisheries and the St. Lucia Naturalists' Society (SLNS). While this programme has been hampered by a number of problems, a great deal has been learned about the nesting patterns of the turtles. In the mid-1980's, the data suggested that 12-28 leatherbacks nested on Grande Anse annually. Record numbers of nests were recorded in 1991 and 1992, but many and perhaps all of the nesting females were killed on the beach during these years. Leatherbacks are not usually killed for their meat, but rather for unlaid eggs and body organs. Carcasses are often left to rot.

Green and hawksbill turtles are caught at sea or during nesting. The eggs and meat of both species are consumed. Hawksbill shell was once used in the making of souvenirs and jewelry, but this activity appears virtually non-existent today. A closed season (1 March-30 September) is in effect for all species, as are minimum weight limits. Eggs and nesting females are fully protected, but enforcement is lacking. A year-around ban on the harvest of sea turtles of all sizes is a priority recommendation of this Recovery Action Plan.

St. Lucia exported nearly 3,000 kg of hawksbill shell to Japan from 1973-1983, but this trade has now ended due in large measure to the fact that St. Lucia ratified the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1982. Until recently, hawksbill shell jewelry and trinkets were sold within St. Lucia, primarily to tourists, but an educational campaign appears to have virtually eliminated this activity. Public awareness of the plight of the sea turtles is particularly important since law enforcement of national conservation legislation is inadequate.

Sea turtle populations in St. Lucia have been subjected to a variety of pressures, both historically and at the present time. Today very few persons depend on the capture of turtles for a significant portion of their livelihood, but the fishery has persisted and opportunistic capture is also reported. An estimated 10-15 persons fish seasonally for turtle at the present time; only one

individual relies substantively on income derived. Fisheries landing data indicate that 3055 and 1468 lb (whole weight) of turtle were landed in 1991 and 1992, respectively, during the annual five-month open season. The catch consists of green turtles and hawksbills, mostly juveniles. In all, 200 or more turtles are legally landed each year and in addition there is a unquantified clandestine catch. The wholly illegal slaughter of leatherbacks on east coast nesting beaches is pursued by two dozen or more persons from several surrounding villages. Many fishermen and informed observers agree that populations of all species are declining.

In addition to direct harvest (netting at sea, as well as the killing of egg-laying females), nesting beaches are degraded by human activity. The two major threats are beach sand mining for construction material and beach-front development for the tourist industry. The mining problem has been aggravated by conflicting legislation concerning the management of beaches. Turtle foraging areas have also been affected by rising human populations and an increase in ocean-based commercial and recreational activities. This is especially true of the coral reefs which have been affected by dynamiting, anchoring, siltation, and over-fishing.

If sea turtle populations in St. Lucia are to be meaningfully protected and restored, a comprehensive approach must be adopted. First, monitoring and data collection capabilities must be developed in order to obtain more accurate information on the status of various species. The regulatory framework must be consolidated and strengthened, not only in terms of sea turtle legislation, but with regard to national coastal zone management. Very importantly, the enforcement capability of the relevant institutions must also be strengthened.

Enhancing public awareness is crucial. The population at large, and especially resource user groups, must be sensitised to the need to protect the turtles. Where possible, the public should become involved in monitoring and data collection efforts. There must be a clear idea in the minds of citizens of what actions are needed to conserve our remaining sea turtles. Public support and understanding of conservation measures (e.g., gear restrictions, closed seasons, licensing arrangements) are central to programme success.

Finally, it must be borne in mind that it will be necessary to collaborate with other countries in the Wider Caribbean region, as well as to support relevant international initiatives (e.g., CITES, SPAW Protocol to the Cartagena Convention, WIDECAST). This is necessary because all species of endangered sea turtle are highly migratory and move freely between territories. Also, the sharing of ideas and experience within the international conservation and fisheries communities is useful and is strongly encouraged.

The WIDECAST Sea Turtle Recovery Action Plan for St. Lucia is fully supportive of all efforts aimed at improving the national capability to conserve sea turtle populations. This Action Plan represents a significant advance for conservation in St. Lucia in that it provides for the first time a comprehensive assessment of the status of sea turtles in our waters, of the threats facing sea turtles, and of the solutions that are relevant to our situation. We envisage that as a result of the community-based effort to draft and implement this Action Plan, legislation, public awareness, population monitoring, community-based conservation initiatives, and regional cooperation will be expanded and improved.

RESUMEN

A los 61^{o} Oeste, 14^{o} Norte, Santa Lucia es una de las Islas a Sotavento de las Antillas Menores localizada al sur de Martinica y al norte de San Vicente. Es sabido que en las aguas de Santa Lucia se hallan cuatro especies de tortugas marinas a saber: la Tortuga Verde del Atlantico (Chelonia mydas), la Tortuga Laúd (Dermochelys coriacea), la Tortuga Carey (Eretmochelys imbricata), y en raras ocasiones, la Tortuga Caguama (Caretta caretta). La tortuga Carey y las tortugas Verdes del Atlántico se observan comúnmente en las aguas cercanas a las costas. Las primeras se hallan generalmente asociadas a los sistemas de arrecifes coralinos, mientras que las últimas se ven alimentándose en las praderas marinas.

Los registros sugieren que las especies principales de anidación son las tortugas Laúd y la Carey. Las tortugas Laúd anidan principalmente entre abril y julio, aunque se ha registrado actividad de anidación en el mes de marzo. La anidación es más frecuente sobre las playas de alta energía a sotavento de la costa oriental. Se cree que las tortugas Carey anidan especialmente entre junio y diciembre o enero sobre las playas que rodean la isla; se carece de datos precisos. Se ha obtenido poca información sobre la anidación de la tortuga Verde del Atlántico. A pesar de las referencias en la literatura, no existe evidencia concluyente de que la Tortuga Caguama anida en Santa Lucía.

Durante la década pasada, la anidación de tortugas Laúd en la Playa de Grande Anse ha sido vigilada por el Departamento de Pesquerías y la Sociedad de Naturalistas de Santa Lucía (SLNS). Mientras este programa ha sido obstaculizado por una serie de problemas, mucho se ha aprendido acerca de los patrones de anidación de las tortugas. A mediados de los años ochenta, los datos sugieren que anualmente, unas 12 a 28 tortugas Laúd anidaron en Grande Anse. Se tiene constancia de una cantidad récord de nidos en 1991 y 1992, pero en esos años muchas y tal vez todas las hembras que anidaron fueron muertas en la playa. Por lo general no se mata a las tortugas Laúd por su carne sino por los huevos y por sus órganos. A menudo se dejan podrir los cuerpos.

Las tortugas Carey y las Verdes del Atlántico se capturan en el mar o durante la anidación. Tanto los huevos como la carne de ambas especies se consumen. La caparazón de la tortuga Carey se utilizaba antes en la fabricación de recuerdos y joyas, pero esta actividad parece que no existe hoy en día. Existe una temporada de veda (1 de marzo al 30 de septiembre) en efecto para todas las especies, así como límites mínimos de peso. Los huevos y las hembras que anidan están plenamente protegidos, pero se carece de fuerza coercitiva. Una de las recomendaciones principales de este Plan de Acción para la Recuperación es la prohibición durante todo el año del aprovechamiento de las tortugas marinas de todos los tamaños.

De 1973 a 1983, Santa Lucía exportó a Japón cerca de 3.000 kg de caparazón de tortuga Carey, pero el comercio de la tortuga marina ha cesado. Esto se debe en gran medida a que en 1982, Santa Lucía ratificó el Convenio sobre el Comercio Internacional de Especies de Flora y Fauna Silvestres en Peligro (CITES). Hasta hace poco, las joyas y pequeños objetos de carey se vendían en Santa Lucía a los turistas, principalmente; por medio de una campaña educativa se ha eliminado grandemente esta actividad. La toma de conciencia pública sobre la difícil situación

de tortuga marina es de particular importancia ya que la capacidad cohercitiva de la legislación nacional de la conservación resulta inadecuada.

Las poblaciones de tortugas en Santa Lucía han estado sujetas a una variedad de presiones, tanto históricamente como en la actualidad. Hoy en día muy pocas personas dependen de la captura de tortugas para una parte significativa de cómo se ganan la vida, pero la pesca ha persistido y también se ha informado sobre la captura oportunista. Se estima que en la actualidad, de 10 a 15 personas se dedican a la pesca de la tortuga por temporadas; solamente un pescador tiene en la tortuga marina su única fuente de ingresos. Datos de pesca sobre las tortugas indican que de 3055 a 1468 lb (peso total) fueron recogidas durante 1991 y 1992, respectivamente, durante la temporada anual abierta de cinco meses. La captura consiste en tortugas Verdes del Atlántico y tortugas Carey, en su mayoría juveniles. En total, 200 o más tortugas aparecen en las costas cada año, además de las capturas clandestinas. La matanza ilegal de tortugas Toras en las playas de anidación de la costa oriental es llevada a cabo por dos docenas o más personas de varias poblaciones cercanas. Muchos de los pescadores y los observadores informados conciden en que las poblaciones de todas las especies están en descenso.

Además de la explotación directa (redes en el mar, así como la muerte de hembras ponedoras), las playas de anidación se degradan por la actividad humana. Las dos amenazas mayores son el minado de arena para obtener material de construcción y el desarrollo de las playas para la industria turística. El problema del minado ha sido agravado por la existente legislación conflictiva relativa al manejo de playas. Las areas de forraje para las tortugas también han sido afectadas por el aumento de la población humana y por un aumento de las actividades comerciales y recreativas que se originan en el océano. Esto es verdad en especial cuando se trata de los arrecifes coralinos que han sido afectados por las explosiones de dinamita, los buques que anclan, la erosión, y la sobrepesca.

Si las poblaciones de tortugas marinas en Santa Lucía se protegen y restauran significativamente, debe adoptarse un enfoque integral. Primero, deben desarrollarse las capacidades de vigilancia y recolección de datos con el objeto de obtener información más exacta sobre el estado de varias especies. El marco regulador debe consolidarse y fortalecerse, no solo en términos de legislación sobre la tortuga marina, sino con respecto al manejo nacional de las zonas costeras. Lo que es más importante, también debe fortalecerse la capacidad de cumplimiento de las leyes por parte de las instituciones pertinentes.

La intensificación de la conciencia pública es crítica. La población en general, y en especial los grupos de usuarios de los recursos, deben sensibilizarse a la necesidad de proteger las tortugas. En lo posible, el público debe involucrarse en los esfuerzos de vigilancia y recolección de datos. Debe existir una idea clara en las mentes de los ciudadanos de cu les acciones son necesarias para conservar las restantes tortugas marinas. El apoyo del público y la comprensión de las medidas de conservación (p.ej., restricciones en los equipos, temporadas de veda, obtención de licencias) son esenciales para el éxito del programa.

Finalmente, debe tenerse en cuenta que será necesario colaborar con otros países en las comunidades regionales e internacionales, así como apoyar las iniciativas internacionales pertinentes (p.ej., CITES, Protocolo de SPAW del Convenio de Cartagena, WIDECAST). Lo anterior

se hace necesario porque todas las especies de tortugas marinas en peligro son altamente migratorias y se mueven libremente entre los territorios. También, es útil y se recomienda el compartir ideas y experiencia dentro de la comunidad dedicada a la pesquería y a la conservación internacional.

El Plan de Acción para la Recuperación de la Tortuga Marina de WIDECAST para Santa Lucía apoya plenamente los esfuerzos dirigidos al mejoramiento de la capacidad nacional para conservar las poblaciones de tortugas marinas. Este Plan de Acción representa un avance significativo para la conservación en Santa Lucía en cuanto por primera vez provee una evaluación integral del estado de las tortugas marinas en nuestras aguas, de las amenazas que enfrentan las tortugas, y de las soluciones que son pertinentes a nuestra situación. Preveemos que como resultado de los esfuerzos comunitarios para redactar e implementar este Plan de Acción, se ampliar y mejorar la legislación, la concientización pública, la vigilancia de las poblaciones, las iniciativas de conservación originadas en la comunidad, así como la cooperación regional.

RESUME

Sainte-Lucie (61^{o} O, 14^{o} N) fait partie des îles du vent des Petites Antilles, se trouvant au sud de la Martinique et au nord de Saint-Vincent. Quatre espèces de tortue de mer vivent dans les eaux de Sainte-Lucie, à savoir, la tortue verte (Chelonia mydas), la tortue luth (Dermochelys coriacea), la tortue à écaille (Eretmochelys imbricata), et, rarement, la tortue caouanne, (Caretta caretta). La tortue à écaille et la tortue verte se rencontrent très souvent dans les eaux près des côtes. La première se trouve souvent dans les r,cifs coralliens, tandis que la dernière s'alimente dans les bancs d'algues.

Selon les informations disponibles, la tortue luth et la tortue à écaille sont les deux espèces qui ont plus tendance à établir un nid. La tortue luth fait son nid en général entre avril et juillet, bien que cette activité ait été observée au mois de mars. La nidation est plus fréquente sur les plages exposées au vents forts de la côte est. Bien que des données précises ne soient pas disponibles, on estime que la tortue à écaille fait son nid entre juin et décembre ou janvier sur les plages entourant l'île. Des informations relatives à cette activité chez la tortue verte ne sont pas très abondantes. Malgré les références bibliographiques, il n'y a pas de preuve concluante que la tortue caouanne fasse son nid sur l'île de Sainte-Lucie.

Au cours des dix dernières années, la nidation de la tortue luth sur la plage Grande Anse a été, surveillée par le Département de la Pêche et par la Société, des Naturalistes de Sainte-Lucie (SLNS). Beaucoup d'informations ont été obtenues sur la nidation des tortues, malgré les problèmes rencontrés par ce programme. Selon les données disponibles, entre 12 et 28 tortues luth faisaient leur nid chaque année sur la plage de Grande Anse. Un nombre record de nids a été observe en 1991 et 1992 mais beaucoup et peut-être toutes les femelles ont été tuées sur les plages pendant cette même période. En général, la tortue luth n'est pas tuée pour sa chair, mais plutôt pour ses oeufs non pondus et ses organes. La carcasse est souvent abandonnée.

La tortue verte et la tortue à écaille sont capturées en mer pendant la nidation. Les oeufs et la chair des deux espèces sont consommées. La carapace de la tortue à écaille était utilisée autrefois pour la confection des souvenirs et des bijoux, mais cette activité semble ne plus exister aujourd'hui. Une saison de fermeture (du 1er mars au 30 septembre), ainsi qu'un poids minimal, sont de rigueur pour la protection de toutes les espèces. Les oeufs et les femelles sont complètement protégés, mais cette protection n'est pas bien appliquée. Le Plan d'action pour la protection des tortues de mer a fixé comme priorité l'interdiction totale de capturer des tortues de toutes tailles.

Entre 1973 et 1983, Sainte-Lucie a exporté près de 3 000 kilogrammes d'écailles de tortue. Néanmoins, la commercialisation des produits de tortues de mer a cessé. Ceci est dûe en grande partie au fait que Sainte-Lucie a ratifi, en 1982 la Convention sur le commerce international des espèces de faune et de flore sauvages menacées d'extinction (CITES). Jusqu'à très récemment, des bijoux en écaille de tortue étaient vendus à Sainte-Lucie, surtout aux touristes. Cette pratique a quasimment disparu grâce à une campagne d'éducation. La sensibilisation du public au sort de la tortue de mer est très importante étant donné l'inadéquation de la législation nationale relative à la conservation.

Depuis toujours, les populations de tortue de mer à Sainte- Lucie ont été victimes de tous types de pressions. Aujourd'hui, très peu de gens vivent de la capture des tortues de mer mais cette pratique a continué et la capture accidentelle a également été signalée. Bien qu'il soit estimé qu'entre 10 et 15 personnes capturent actuellement les tortues de mer pendant la saison ouverte, une seule d'entre elles vit exclusivement de cette activité. Selon les données disponibles, 1.389,65 kg et 667,30 kg de tortue ont été prises en 1991 et 1992 respectivement pendant la saison ouverte annuelle qui dure cinq mois. La capture consiste en tortues vertes et tortues à écaille dont la plupart des jeunes. En tout, plus de 200 tortues ou plus sont capturées chaque année, sans compter les prises clandestines. La mise à mort illicite de tortues cuir sur les plages de nidation de la côte est pratiquée par au moins vingt-quatre personnes venant des villages avoisinants. Selon beaucoup de pêcheurs et d'observateurs, les populations de toutes les espèces sont en baisse.

En plus de la récolte directe (la prise en mer et la mort des femelles en ponte), les plages de nidation ont été détruites par les activités de l'homme. L'exploitation des plages pour l'extraction du sable de construction et pour l'industrie du tourisme constituent les deux principales menaces. Le premier problème a été aggravé par une législation contradictoire concernant la gestion des plages. Les zones d'alimentation des tortues ont également été touchées par la croissance démographique et l'augmentation des activités commerciales et de loisirs maritimes. Ceci est vrai des récifs coralliens en particulier qui ont été détruits par les travaux à la dynamite, l'ancrage, la siltation et la sur-exploitation de la pêche.

Afin de protéger et de restaurer les populations de tortue de mer de facon efficace, une approche d'ensemble doit être adoptée. Tout d'abord, la capacité de surveillance et de collecte de données doit être développée afin d'obtenir des informations plus précises sur la situation des différentes espèces. Le cadre de regulation doit être consolidé et renforcé, non seulement en ce qui concerne la législation relative à la tortue de mer, mais également pour ce qui touche à la gestion nationale de la zone côtière. Il devient donc absolument primordial de renforcer la capacité des institutions concernées à appliquer les mesures.

La sensibilisation du public est très importante. La population en général, et surtout les groupes utilisateurs des différentes ressources doivent être convaincus de la nécessité de protéger les tortues. Le public doit participer, si possible, aux efforts de de surveillance et de collecte des données. Les citoyens doivent avoir une idée claire des mesures à prendre pour protéger les tortues de mer restantes. L'appui et la compréhension du public des mesures de protection (par exemple, des restrictions concernant l'équipement, les saisons de fermeture, l'octroi des permis) sont indispensables au succès du programme.

Finalement, il faut tenir compte de la nécessité de collaborer avec d'autres pays de la communauté régionale et internationale et d'appuyer les initiatives internationales importantes telles que la CITES, le Protocole SPAW à la Convention de Carthagène et le WIDECAST. Cette collaboration est nécessaire car toutes les espèces de tortures menacées sont migratrices et circulent librement entre les differents territoires. De plus, le partage des idées et des expériences au sein des communautés internationales de protection et de pêche est très utile et hautement recommandé.

Le Plan d'action de WIDECAST pour la récupération des tortues marines à Sainte-Lucie appuie tous les efforts visant à améliorer la capacité nationale de protection des populations de tortue. Ce Plan d'action représente un succès majeur pour la protection des tortues à Sainte-Lucie car, pour la première fois, il evalue de manière complète la situation des tortues de mer dans les eaux du pays, les menaces contre la tortue marine et les solutions qui s'appliquent à la situation. Nous envisageons qu'en raison de l'effort accompli au niveau de la communauté pour élaborer et mettre en oeuvre ce Plan d'action, la législation, la sensibilisation du public, la surveillance des activités de la population, des initiatives de protection entreprises au niveau de la communauté ainsi que la coopération régionale seront élargies et améliorées.

I. INTRODUCTION

Sea turtles were caught in St. Lucia (61^{o}W, 14^{o}N; see Figure 1) by the Caribs and Arawaks, and possibly by those who settled the island before them. Based on archaeological evidence (e.g., from Grande Anse, Marie Galante, and Folle Anse), sea turtles were important to the pre-historic fishing economy of St. Lucia (Wing and Reitz, 1982). There are few literature references to the industry prior to World War II, but it is likely that turtles were an important component of local culture and economy through most of the twentieth century. The fishery has declined considerably in the last two decades or so, but persists to the present day. An estimated 10-15 persons target sea turtles at the present time and the legal catch is obtained entirely by netting (see section 3.3). In addition, an unquantified number of turtles are caught in nets (usually trammel nets) set for other species and some are taken while nesting on local beaches. The general opinion of fishermen is that the populations of sea turtles have declined. Green turtles, hawksbills and leatherbacks are all taken, sometimes in contravention of existing laws. The illegal collection of eggs is widespread. The uncontrolled slaughter of nesting leatherbacks on east coast beaches is perhaps the most serious, unresolved sea turtle conservation issue.

Two species of sea turtle are most frequently seen in St. Lucia's waters: the green turtle (Chelonia mydas) and the hawksbill (Eretmochelys imbricata). The leatherback (Dermochelys coriacea) is less common and is observed only during the reproductive season (April-July; section 2.3). There have been infrequent reports of turtles which by their description may be loggerheads (Caretta caretta), but these have yet to be substantiated (in any event, we are quite certain that loggerheads do not nest on the island). Hawksbills are observed most frequently near coral reefs, while green turtles are associated with sea grass communities along the coast. The leatherbacks present are almost invariably breeding adults which probably remain in deep water between nestings. A notable exception was an injured neonate (11.5 cm straight carapace length) recovered alive on the east coast in September 1991 and later released (Sparks, 1993).

Existing legislation offers some protection, but enforcement has never been rigorous. The Fisheries Act (No. 10 of 1984) protects nesting turtles and their eggs, authorizes a closed season (1 March-30 September), and establishes minimum weight limits. While potentially useful in controlling the depletion of turtle stocks, the Act is inadequate to promote recovery because large juveniles and breeding-age adults (theoretically the most important size classes to conserve relative to population recovery) can legally be taken at sea at all times of the year. Furthermore, the closed season does not encompass the entire breeding season. Unfortunately, the new Fisheries Regulations (1994) (see section 4.21) do not correct these deficiencies. St. Lucia has signed several important international conservation treaties in recent years, including CITES (ratified in 1982, prohibits international trade in sea turtles and their parts or products), the UNEP Cartagena Convention (ratified in 1984, calls for management and recovery planning on behalf of endangered species), and the SPAW Protocol to the Cartagena Convention (signed in 1991, calls for full protection of sea turtles).

The objectives of this Recovery Action Plan are to compile existing data on the status and distribution of sea turtles in St. Lucia, assess the role played by sea turtles in the culture and economy, discuss factors threatening turtles and their habitats, and provide specific management recommendations, including revised legislation, designed to enhance the survival prospects of

these ancient reptiles. The process of developing the Action Plan enhanced public awareness of the sea turtles' plight and encouraged public participation in sea turtle conservation measures. Maintaining momentum in the sea turtle conservation programme, including full implementation of this Action Plan, is crucial to the survival of sea turtles in St. Lucia. The Action Plan includes recommendations for implementing a comprehensive National Sea Turtle Conservation Programme (section 4.6), as well as a brief summary of specific Government actions deemed necessary in the immediate term (Appendix I, Management Plan for St. Lucia's Sea Turtles: An Overview).

II. STATUS AND DISTRIBUTION OF SEA TURTLES IN ST. LUCIA

In the Caribbean Sea and Gulf of Mexico, five species of sea turtle are recognised as *Endangered* and a sixth, the loggerhead turtle, as *Vulnerable* by the World Conservation Union (IUCN) (Groombridge, 1982). Sea turtles are harvested throughout the region for meat, shell, oil, and eggs. They are 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 continuing degradation of important nesting beaches and feeding areas, also threaten the continued existence of Caribbean populations. A recent report concluded that about half the world's nesting populations of hawksbills are known or suspected to be in decline; in particular, the study found "the entire Western Atlantic-Caribbean region is greatly depleted" (Groombridge and Luxmoore, 1989).

Three species of endangered sea turtle are known to nest in St. Lucia: the hawksbill, the green turtle, and the leatherback. In addition, foraging hawksbills and green turtles of varying sizes are present year-around. Loggerhead nesting has not been verified, but unconfirmed reports of sightings by fishermen indicate that the species may pass through our waters. Neither of the ridley turtles have been documented. While our information is far from complete, it provides general guidelines for management purposes and indicates where further study is most needed. In general, the status of sea turtle stocks in St. Lucia can be described as declining. Seasonal nesting occurs on beaches throughout the country and foraging areas tend to correspond with healthy sea grass and coral reef ecosystems. Table 1 and Figure 2 summarize the distribution of known nesting beaches.

2.1 Caretta caretta, Loggerhead Sea Turtle

There are no indigenous common names applied to this species; the preferred name is "loggerhead". Adults are recognised by a large head, thick, somewhat tapered carapace, and characteristically heavy encrustation of invertebrate epifauna (especially barnacles) (Figure 3). 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 (summarised by Dodd, 1988). Nesting females in Florida USA average 92 cm in straight shell length (range 81-110 cm; n=194) and 116 kg (71.7-180.7 kg; n=261) (Ehrhart and Yoder, 1978). Adults can weigh up to 200 kg (440 lb) (Pritchard et al., 1983). The colour is red-brown to brown; hatchlings are sometimes gray.

Loggerheads have a wide oceanic distribution. In the Atlantic Ocean, they are seen 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 in Florida (USA) and Masirah Island (Oman). An estimated 14,150 females nest annually on the Atlantic coast of Florida (Murphy and Hopkins, 1984; Ehrhart, 1989), where the peak nesting season extends from mid-May to mid-July. Moderate nesting populations are also found in Mexico, where Gulf and Caribbean coasts support some 380-400 females per annum (Ehrhart, 1989). Loggerheads nest occasionally during the summer months on islands in the eastern Caribbean (Rebel, 1974; Dodd, 1988; Ehrhart, 1989).

The species' juvenile years are characterised by trans-Atlantic movement. According to the existing paradigm for populations nesting in the USA, hatchlings 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 of pelagic existence, 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 closer to 30 years than to 12 (Frazer and Ehrhart, 1985).

Although Carr et al. (1982) (later quoted by Dodd, 1988) reported that the loggerhead nested infrequently on beaches such as Pigeon Island, Cas-en-Bas, and Pitton Sivons (=Anse L'Ivrogne), the St. Lucia Department of Fisheries has no evidence to substantiate nesting in St. Lucia. There are some unconfirmed reports of sightings at sea by fishermen. The seasonality of such sightings has not been determined and there are presently no data available to specify what age/size classes are observed. Preferred foraging areas have not been delimited. The species is considerably rarer than either the green turtle or the hawksbill. Cato et al. (1978) reported one loggerhead shell on the premises of a "souvenir dealer and turtleshell merchant in Castries".

2.2 Chelonia mydas, Green Sea Turtle

Local common names for the species include "tortie", "green turtle" and "green back". The green turtle is recognised by its round, blunt beak with serrated cutting edges and smooth carapace plates (=scutes) that do not overlap one another (cf. hawksbill turtle, section 2.4). The single pair of large scales situated between the eyes is also a diagnostic feature (Figure 3). The carapace is generally devoid of barnacles. Adults usually measure 95-120 cm in straightline carapace length (nuchal notch to posterior tip). The maximum reported weight of an adult female nesting in Suriname was 182 kg (400 lb) (Schulz, 1975). Individuals of varying sizes are present throughout the year and are frequently sighted in coastal waters, mainly off the eastern shoreline.

It is likely that individual green turtles do not remain in local waters throughout their lives. 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 harbour 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 yrs) before taking up residence in continental shelf habitats.

Upon leaving the open sea existence that characterises their earliest years, green turtles become herbivores and remain so for the rest of their lives (Bjorndal, 1985). In the Caribbean Sea, green turtles feed primarily on the sea grass Thalassia testudinum (Bjorndal, 1982), commonly referred to as "turtle grass". Field studies indicate that individual turtles maintain feeding "scars" by returning to the same area of sea grass meadow to forage each day (Ogden et al., 1980, 1983). These scars, or grazing plots, are maintained by regular cropping for several months and the more digestible newer growth (higher in protein, lower in lignin) is preferred (Bjorndal, 1980). When the cropped grasses show signs of stress (blade thinning, increased inter-nodal distance), the turtle apparently abandons the scar and moves on to form another.

Juvenile green turtles 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 in the Caribbean Sea before the urge to reproduce impels them to migrate to mating and nesting grounds, the latter presumed to be their natal (=birth) beach. Caribbean green turtles reach sexual maturity at an estimated 18-36 years of age (reviewed by Frazer and Ladner, 1986). After reproducing, there is some evidence that turtles return to resident foraging grounds. Therefore, the movements of adults are likely to be less extensive than those of juveniles, since adults move seasonally between relatively fixed feeding and breeding areas.

There is ample evidence that green turtles feed on sea grass in St. Lucia's waters, but specific foraging grounds have yet to be delineated. Bacon (1981) reported frequent foraging by juveniles and adults and named foraging sites at SoufriŠre, Choiseul, Anse Sable, Micoud, and from Gros Islet to Anse Lavoutte. Carr et al. (1982) made similar observations and added that, during the time of their survey, two "washtub-sized" green turtles had been caught at Gros Islet, killed, and sold in the public market at Castries. A green turtle originally tagged while nesting at Aves Island (Venezuela) was captured near Vieux-Fort (Carr et al., 1982). Foraging habitat also occurs in the areas of Choc Bay, north of SoufriŠre to Jambette Point, and south of Micoud to Vieux-Fort.

It is believed that some beaches on both coasts may be used for nesting by this species, but reports are very rare and population estimates cannot be derived from existing data. Nesting frequency is not known but on the basis of information available from other areas, 2-6 nests are probably laid per female every 2-3 years. Nesting is nocturnal and clutches are laid 12-14 days apart. The nesting season in St. Lucia is not clearly defined, but nesting at Grande Anse has not been observed before July. Field studies elsewhere in the Eastern Caribbean suggest that the number of eggs deposited per nest generally ranges from 125 to 150.

Reports from fishermen and Fisheries extension staff indicate that green turtles are caught more often than any other species by the few remaining fishermen who specialise in sea turtle fishing. These persons use turtle nets known as "folle" for this purpose. Murray (1984) reported that the Fisheries Management Unit purchased five green turtles from a local fisherman ranging in weight from 7.3-15.2 kg (35.6-55.9 cm carapace length). These turtles, which had been

caught on the east side of the island, were tagged and released. In addition to direct harvest (which occurs both legally and illegally), incidental capture in beach seine nets and opportunistic catches are frequent on the northwest and southeast coasts. Meat is consumed locally, usually by the family and friends of the fishermen (see section 3.3.)

2.3 **Dermochelys coriacea**, Leatherback Sea Turtle

The leatherback (sometimes referred to locally as "tortie aclen") is the largest of all sea turtles. Females nesting in the Caribbean typically weigh 300-500 kg (650-1100 lb). The largest leatherback on record is a 916 kg (2015 lb) male that washed ashore dead on the coast of Wales, U.K. (Morgan, 1989). The species is easily distinguished because it lacks a bony shell, having instead a slightly flexible skin-covered carapace (Figure 3). The smooth, black skin is spotted with pale yellow or white. The tapered carapace is raised into seven prominent ridges and powerful front flippers extend nearly the length of the body. Leatherbacks are found in the tropics, as well as in cold Canadian and European waters; they have the most extensive range of any reptile. Leatherbacks are seasonal visitors to St. Lucia. It is likely that they leave northern foraging and residence areas to migrate to nesting beaches in St. Lucia and then return to these latitudes after egg-laying is complete (cf. Eckert and Eckert, 1988).

The species is not often observed or caught in St. Lucia's waters, but it nests on the island. Nesting is concentrated on a number of large, high energy windward beaches along the east coast, the major one being Grande Anse (Table 1, Figure 2). d'Auvergne et al. (1989) estimate that 12-28 females nest on Grande Anse beach annually. Nesting is also reported from the southernmost tip of the island to Burgot Point, on the Maria Islands, at the mouth of the Troumassee River, at Fond Bay and Cas-en-Bas (Carr et al., 1982). While virtually all nesting occurs at night, one female was seen nesting at Anse Sable in April 1991 during the day, the first diurnal nesting documented by the Department of Fisheries. Females nesting at Grande Anse beach measure 129.5-186.7 cm curved carapace length (n=19) (Charles, 1987) (Table 2).

Data collected at the well-studied beach at Sandy Point National Wildlife Refuge (St. Croix, U. S. Virgin Islands) indicate that each female deposits an average of 6-7 clutches of eggs at 10-day intervals (range 7-13 days) during the nesting season. Females generally return to nest every 2-3 years, but individuals occasionally nest in consecutive years and sometimes return after intervals longer than three years. Clutch size is typically 60-100 yolked eggs, averaging 85; a variable number of small, yolkless eggs is also deposited. The eggs incubate in the sand at a depth of 60-70 cm. Hatchlings emerge from their nest, generally at dusk, 60-65 days after egg-laying (e.g., McDonald et al., 1991). The reason leatherbacks are so rarely seen offshore during the nesting season may be that they spend little time at the surface. Recent studies deploying time-depth recorders on gravid (egg-bearing) females nesting on St. Croix have shown that individuals routinely spend the inter-nesting interval diving to an average depth of about 60 m, and have attained maximum depths exceeding 1000 m (Eckert et al., 1986, 1989).

Neither feeding nor mating has ever been documented in the waters of St. Lucia. Males are not seen, only adult females come to the nesting beaches. Nothing is known about distribution or behaviour of the juveniles. On 14 September 1991, a very young turtle (11.5 cm straight

carapace length, 8.0 cm carapace width, weight about 6 oz) was found on an east coast beach. The front right flipper had been badly damaged and it could not be made to return to the sea. It was cared for aboard the yacht *Quandry* for about a week. When it could not be made to eat crushed egg yolk or live jellyfish, it was released (Sparks, 1993).

The harvest of leatherbacks has traditionally been low in St. Lucia, but has sometimes reached critical levels, especially in recent years (section 3.3). Egg poaching is a significant threat. Not only are eggs collected from the beach, but nesting females are often slaughtered primarily for the eggs within; most and often all of the meat is left behind. The eggs are consumed mainly for reputed aphrodisiac qualities, despite the fact that this is against the law (c.f. section 4.21). In contrast to some other Eastern Caribbean islands (e.g., Tortola, St. Kitts, Grenada) where leatherbacks are (or were until recently) killed for oil, there is no evidence of a market for this product in St. Lucia.

2.4 Eretmochelys imbricata, Hawksbill Sea Turtle

The hawksbill (sometimes referred to as "kawet" or "carey") is distinguished by a narrow, pointed beak which may be useful in removing sponges and other prey items from the reef. The carapace is often posteriorly serrated and the carapace scutes overlap, like shingles on a roof (Figure 3). Two pair of scales are located directly between the eyes. Adults rarely exceed 80 kg (175 lb) and a straightline carapace length of about 90 cm. Bright mottled colouration (brown, gold, orange) is common. This rare turtle is challenging to study. Hawksbills are migratory, high-density nesting is rare, and the relatively few tagging programmes 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). Gravid (=egg-bearing) females often nest on isolated beaches (including those flanked by exposed coral and rock) that are difficult to monitor on a consistent basis.

Principal nesting beaches in the West Indies are not easily identified, but one of the best known is Pasture Bay Beach (Jumby Bay Resort) on Long Island, Antigua. Data collected at this site indicate that over the course of the main nesting season (mid-June to mid-November) turtles make an average of five nests separated by intervals of 13-18 days (Corliss et al., 1989; Hoyle and Richardson, 1993). Average clutch size ranges from 120-160 eggs in the Western Atlantic (summarised by Witzell, 1983). The female often lays her eggs in the shelter of beach vegetation, such as the sea grape (Coccoloba uvifera). In many cases, the only evidence of the visit is a faint asymmetrical crawl (flippers alternating) about 0.7 m wide leading to and from the ocean. Incubation periods average 60 to 75 days in the Western Atlantic (Witzell, 1983). Females predictably return to the same beach or area to renest on intervals of 2-3 years, again based on data collected in Antigua. As is the case with all other species of sea turtle, sand temperature plays a large role in determining hatchling sex. Warmer incubation temperatures favour females, whereas cooler temperatures favour males.

In St. Lucia, hawksbills appear most frequently along the sheltered west coast, although some sightings have occurred on the east and primarily the southeast coast. Some nesting also takes place on the northeast (Grande Anse) and west (Anse Chastanet) coasts. Bacon (1981) reported nesting at Anse Becune, Point Saline, Pigeon Island, Anse Cochon, Anse Jambon, Anse

Mamin, Anse Ger, Praslin, Grande Anse, Cas-en-Bas, the mouth of the Troumassee River, and from the southern tip of the island to Burgot Point. Additional nesting sites, including Cariblue, Anse Chastanet, Dennery, Honeymoon Beach and possibly Trou L'Oranger, Anse Micoud, Anse de Sables, Anse Commerette, Fond d'Or, and Anse Lapins, were reported by Murray (1984). Carr et al. (1982) concluded that hawksbills nest to some extent on nearly all of St. Lucia's beaches. Murray (1984) roughly estimated the annual number of nesting females at 11 (the equivalent of about 55 nests island-wide), but supporting data are not available. Nesting is believed to occur in very low densities. Peak nesting appears to occur between June and August, but some activity may occur year around.

Hawksbills of various size classes are present in the waters of St. Lucia year around. Systematic studies have not been undertaken, but the species is generally observed in association with coral reefs. 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). Hawksbills are still caught, usually at sea and often illegally, for consumption. Reports indicate that eggs are also collected. There is a limited local market for hawksbill shell, but no known export at the present time (sections 3.3, 4.31).

2.5 Lepidochelys kempii, Kemp's Ridley Sea Turtle

There are no records of Kemp's ridleys in St. Lucia, nor would the species be expected to occur. The diminutive Kemp's ridley is gray in colour 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 of a "head-started" individual (Manzella et al., 1991), which may have displayed altered behaviour due to being held captive during its first year (Woody, 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 in Tamaulipas, Mexico.

2.6 Lepidochelys olivacea, Olive Ridley Sea Turtle

There are no records of this species from the waters of St. Lucia, nor would it be expected to occur. Olive ridleys 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 colour of olive green or brown dorsally and yellow-white ventrally. The turtle rarely exceeds 100 lb (45 kg) (Pritchard et al., 1983). 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, considerably more than other sea turtles which typically have 4-5 pairs. The only significant nesting colony in the Western Atlantic is in Suriname, primarily at Eilanti Beach (Schulz, 1975). Olive ridleys nesting in Suriname have declined considerably in recent years, from about 3,000 nests per year in the late 1960's to fewer than 500

nests per year today (Reichart and Fretey, 1993). Diffuse nesting occurs in northwestern Guyana and in French Guiana (Reichart, 1989).

III. STRESSES ON SEA TURTLES IN ST. LUCIA

3.1 Destruction or Modification of Habitat

St. Lucia's population has soared from 42,220 in 1891 (CCA/IRF, 1991) to 135,975 in 1991 (Government of St. Lucia, 1991). Today St. Lucia has a balanced economy with a sophisticated manufacturing structure and a well-developed tourism sector. In hand with economic development and an increasing human population, commercial and recreational activity along the coastline has noticeably affected the habitat of sea turtles. One of the major factors has been and continues to be sand mining (section 4.131). The construction industry relies on beach sand as a source of fine building aggregate. In recent years, some sandy beaches (e.g., Soufrière) have been reduced to cobble by the mining. At the present time at least six turtle nesting beaches are heavily exploited, legally or otherwise. Of these, at least two have become unsuitable for nesting. Grand Anse beach, the largest in St. Lucia and a regionally important nesting site for endangered leatherback sea turtles, is experiencing severe structural instability. Grand Anse is now characterised by an unnaturally shallow profile, which means that in many cases leatherbacks are forced to abandon the nesting sequence after digging into the water table.

In addition to sand mining, sea turtles face additional threats to their survival as a direct result of coastal development and industry (see section 4.13 for details). For example, the emphasis on tourism (an industry which contributed 22% of the total GDP in 1986: CCA/IRF, 1991) has seen the establishment of hotels on some nesting beaches. As a consequence, vegetation has been removed and beach footage above high water has been lost. Beach-front lighting is also a problem in that it disorients emerging hatchlings and may dissuade gravid females from coming ashore. Not all coastal development has been associated with tourism, however. Dennery and other long-established communities are clustered along once prominent turtle nesting beaches. These shorelines are densely populated and characterised by modest homes, fishing and market facilities, roads, and subsistence fishing vessels. Some beaches are affected by tar globules from ocean-going vessels and by debris such as plastic bags and bottles. This problem is greater on the windward east coast. In addition, domestic garbage is carried to the sea by rivers and storms and ultimately washes ashore on sandy beaches.

Some of the reefs around the island have been damaged or destroyed by the use of dynamite, in contravention of the Fisheries Act of 1984 (see section 4.141). Other reefs have been completely obliterated by dredging during coastal projects, such as land reclamation. There is also the serious problem of reef destruction which results when yachts, dive boats, and fishing vessels anchor on living coral and when fish pots are dropped on coral reefs. This is especially serious along the west coast (in general, the east coast is too rough to provide good anchorage). Finally, it is believed that marine habitats are being affected by siltation due to the erosion of upland regions, agricultural run-off, and indiscriminate waste disposal. These problems are discussed in greater detail, and some solutions proposed, in later sections (especially section 4.14).

3.2 Disease or Predation

No studies have been carried out on local sea turtle populations to determine the incidence of disease or predation. To date, no cases of green turtle fibropapilloma, a debilitating and sometimes fatal tumor disease reported elsewhere in the Caribbean (Jacobson, 1990), have been reported in St. Lucia. Ghost crabs (Ocypode quadratus) and night herons (Nyctanassa violacea) prey on emerging hatchlings. Pigs sometimes dig up nests, such as at Anse Sable. Consumption of eggs and hatchlings by domestic dogs is reported from Vigie Beach, Castries (P. James, pers. comm., 1993). The extent of nest loss to these predators is unquantified. Predation by mongooses (Herpestes auropunctatus) has not been documented. On a few occasions nesting female leatherbacks have been observed with bitten-off flippers, suggesting attacks by sharks at sea. Some years ago, leatherback remains were found in the stomachs of three killer whales captured off St. Vincent (Caldwell and Caldwell, 1969). In the absence of evidence to the contrary, the level of predation is assumed to be within normal and natural limits.

3.3 Over-utilisation

The commercial sea turtle industry in St. Lucia appears to have begun in about 1937 when live green turtles were shipped to England and the USA; after 1941, the shipments consisted primarily of dried green turtle meat (Murray, 1984). Most of the trade after 1949 depended on turtles imported from Aves Island (Venezuela) and landed at Castries. Each year about 300 turtles weighing approximately 45,000 lb were imported under special licence during the local closed season, which was 1 May-31 August at that time (Rebel, 1974; Murray, 1984). [N.B. This number and weight are not entirely consistent; only large adult turtles, typically weighing 250-400 lb, are found on Aves Island, which would suggest an aggregated weight of about 75,000 to 120,000 lb for 300 turtles (Cato et al., 1978).] A portion of the meat was sold locally and about 30% was exported to the U. S. Virgin Islands and to England. In addition, about 600 lb of dried turtle meat and calipee and calipash were exported annually to England, and the same to Germany (Rebel, 1974). Even though collection of turtles from Aves Island was illegal, a favourable price ($75/turtle) made the effort worthwhile (Cato et al., 1978). Eggs were also brought from Aves Island, as reported by Oliver Calderon (Ranger, Pigeon Island National Landmark) who remembers them (from his youth) displayed in the local market in small piles; they were inexpensive and frequently purchased (pers. comm. to K. Eckert, October 1993). It is not clear when imports from Aves Island came to an end, but perhaps by the mid-1970's. Local landing estimates for the 1969 open season (1 September-30 April) were 37,500 lb of green turtle and 24,000 lb of hawksbill (Rebel, 1974).

A decade later, Cato et al. (1978) described the fishery as follows: "St. Lucia is both an importer and exporter of tortoiseshell, and has a fishery based upon both the hawksbill and the green turtle. The hawksbill is known to nest periodically on St. Lucia, and the green turtle probably does also. One loggerhead shell was seen on the premises of a souvenir dealer and turtleshell merchant in Castries. The chief informant on St. Lucia was Mr. Leonard Stephen, a fisherman resident at Choiseul, at the southern end of the island. Stephen reported that he caught green turtles and hawksbills in comparable numbers, using 18 inch (45 cm) stretch nets fabricated from green nylon twine. The upper border of the net is provided with floats, and the ends have both larger floats and heavy rocks attached to keep the net upright in the water. The

net is set overnight in areas known to be frequented by turtles. Fish usually pass straight through; adult turtles and some juveniles are caught.

"Stephen estimated that he caught approximately 100 turtles in 1975, and approximately 60 in 1977, but the capture success was so variable that accurate estimates were hard to make. Stephen's estimate for the total annual catch from St. Lucia was 500 turtles per year, but emphasized that this was an order-of-magnitude estimate only. Stephen felt that dynamite fishing was responsible for the destruction of significant numbers of turtles in St. Lucia waters. Turtle meat sold in St. Lucia fetches about US$ 1.25 per pound, though meat exported to the neighboring French Island of Martinique fetched as much as US$ 4.00 per pound. Hawksbill shell was purchased by an exporter in Castries by the name of Fritsch for EC$ 25.00 per pound. While fishermen did not consider this to be a particularly competitive price, the market was always available for whatever quantity they had to sell. Fritsch exported the product to Liverpool, England, where it was manufactured into artifacts. The writer also visited a local manufacturer in a village on the west coast of St. Lucia; but while this individual produced large numbers of artifacts, they were small items such as earrings, and the total number of entire hawksbill shells consumed by such an operator would be very low. [N.B. Today US$ 1.00 = EC$ 2.72.]

"A difference in the yield of shell for male and female hawksbills was reported. Males yield only about three pounds, but the females often produce six pounds, and in one exceptional case the five largest scutes alone from a single turtle weighed a total of $7^{1}/_{2}$ pounds. The writer can testify to the occasional capture of hawksbills with unusually thick, heavy shells; a bisected raw costal [=lateral] scute in a workshop in Castries had a thickness of over one centimeter. Islanders from St. Lucia participate occasionally in the illicit capture of nesting green turtles on Aves Island, over a hundred miles to the west. Eddie King, a boat navigator from Micoud, used to travel to Aves Island to catch turtles and sell them in Puerto Rico, but he had stopped two-three years ago (i.e., around 1974-1975)." (Cato et al., 1978).

Today, as in years' past, the number of turtles landed annually can only be estimated. These estimates are comparatively low when compared to historical values; nevertheless, it is clear from interviews and Fisheries data that 200 or more turtles have been legally landed per year since 1990, in addition to an unquantified number caught during the closed season and a most likely large number of females removed illegally from nesting beaches. The latter practice is particularly prevalent on the east coast north of Dennery where fishermen travel to the beaches at night and, while ostensibly hand-lining from shore, take the opportunity to kill any nesting turtle that is encountered (P. James, pers. comm., 1993). With regard to legal landings, Department of Fisheries statistics indicate that approximately 90 turtles were slaughtered in the Vieux-Fort area during the open season, October 1990-February 1991. Most were caught in the Micoud area. Because Vieux-Fort is the major slaughter centre, perhaps another 80 turtles were killed legally at other centres such as Castries. Murray (1984) estimated that five green turtles were landed at Castries and four green turtles and one hawksbill at Canaries in September, and four green turtles at Vieux-Fort between September and November of 1992.

Department of Fisheries data indicate that during the annual five-month open season in 1991 and 1992, 3055 and 1468 lb (whole weight), respectively, of sea turtle (hawksbill and green turtle combined, mostly juveniles) were landed at 11 landing sites (Gros Islet, Castries, Bannas,

Dennery, Micoud, Vieux-Fort, Laborie, Choiseul, SoufriŠre, Praslin Bay, Savanne). The majority of turtles were landed at Dennery and Gros Islet (see Figure 2). As noted above, the data surely underestimate the total catch on an annual basis because unquantified numbers of turtles are landed in isolated areas, landed illegally during the closed season, or killed clandestinely whilst nesting. An estimated 10-15 fishermen still target turtles using large mesh, homemade turtle nets ("folle"); an estimated 15-20 nets are in operation during the open season. Only one individual reportedly relies heavily on the income derived; in most cases full-time fishermen simply augment their annual income by targetting turtles when it is legal to do so. In contrast, dozens of rural, part-time fishermen visit nesting beaches during the breeding season to fish in the evening and kill nesting females on an opportunistic basis. Effective law enforcement is nearly impossible.

In addition to the direct harvest, green and hawksbill turtles are sometimes caught incidental to other fishing activities. The continuing harvest (legal and illegal, direct and accidental) is cause for serious concern. Murray (1984) indicated that the numbers of sea turtles seen in 1982 showed a significant decrease relative to 1980 and a major decrease relative to 1972. Fishermen have been among the first to concede that stocks are decreasing, but the adage that "my grandfather caught turtles, my father caught turtles, and I will catch turtles" is powerful here. There is a genuine belief that the resource is inexhaustible, that "there are plenty more turtles in the sea". It is noteworthy that the take of eggs is also a continuing threat to remaining populations. The proportion of eggs removed from nesting beaches is impossible to quantify, but informed observers unanimously agree that virtually any nest discovered by rural fishermen will be raided. As an example, of 33 green and hawksbill nests recorded by SLNS volunteers on Grande Anse in 1993, 30 had been dug (the other three "escaped" only because they had been camouflaged by the SLNS; P. James, pers. comm., 1993).

With regard to the seasonally present leatherbacks, the available evidence (i.e., informal reports) suggests that nesting females are killed by a relatively small number of individuals resident in the communities of Garrand and Boguis. In the past, evidence suggested that many turtles were killed by persons who came to the beach to collect sand illegally at night. However, this activity seems to have declined and now most of the poaching is done by persons who come to Grande Anse specifically for that purpose. There is no indication that the persons involved rely on turtle meat for their subsistence. Rather, it appears that the turtles are killed more for sport; the meat (which is not very popular) and eggs are taken only incidentally. When taken, the meat is distributed clandestinely among friends and families since it is unavailable in public markets. It is not uncommon that only the eggs are removed and the entire carcass is left to rot. The number of leatherbacks killed each year has varied over the last decade. In the early- to mid-1980's, an average of 5-6 turtles was killed annually. In 1989 this activity was significantly reduced due to the presence of two Wardens employed by the Department of Fisheries to patrol Grande Anse Beach and Mangroves Marine Reserve. The Wardens were employed only part-time, however, and despite their best efforts the number of leatherback carcasses rose again in 1991. Funding to support the Wardens expired in 1992. Some estimates place the number of leatherbacks killed in 1993 as high as 25, although this figure may be inflated due to inadvertent double-reporting. It is almost certain that at least 10 turtles were killed in 1993, not only at Grande Anse but also on the neighbouring beach at Petit Anse, and that this number represents a majority of the nesting population that year (based on an informal nest count).

Finally, trade has played a role in the depletion of St. Lucia's turtles. According to Japanese Customs statistics, 2,997 kg of hawksbill shell was received from St. Lucia between 1973-1983; import volumes ranged from 143 kg in 1980 to a high of 489 kg in 1977. Based on an estimated 1.34 kg of shell scutes [the average yield from Caribbean hawksbills; Milliken and Tokunaga, 1987] per animal, we conclude that about 2,240 hawksbills have been killed for export to Japan since 1970. In addition, a total of 434 kg of green turtle shell was received from St. Lucia in 1979 and 1980, according to Japanese Customs data (Milliken and Tokunaga, 1987). St. Lucia ratified CITES in 1982 and the absence of trade in recent years is likely attributable to the strict local implementation of CITES controls. Hawksbill shell jewelry and other items were once commonly sold to tourists visiting St. Lucia, but an educational campaign appears to have been successful in removing these items from local boutiques. An informal survey of shops in Castries (including Pointe Seraphine) and Rodney Bay in June 1993 failed to find any such items. In October 1993, two hawksbill shells (about 20 and 25 cm) and one green turtle shell (about 35 cm) were found for sale at the Central Craft Center in Victoria (north of Choiseul) for EC$ 60, 100 and 300, respectively. The owner indicated that the turtles had been local-caught and had been in the store for several years. They were not prominently displayed and he was not interested in selling them unless someone was "really interested"; he was aware of the endangered status of turtles and said that he had long ago stopped buying turtle products from local fishermen (pers. comm. to K. Eckert, 1993).

3.4 Inadequate Regulatory Mechanisms

The Fisheries Regulations (No. 9 of 1994) declare it illegal to catch, sell, purchase or hold turtles eggs at any time, or to interfere with turtle nests or nesting turtles. The same applies for undersized turtles. The minimum allowable sizes are 27.22 kg for hawksbills, 34.02 kg for green and loggerhead turtles, and 294.84 kg for leatherbacks. It is also illegal to set nets within 100 m of the shore for the purpose of catching turtles or to catch any species of turtle during the closed season (1 March-30 September). A person who contravenes any of these regulations is liable upon summary conviction to a fine not exceeding EC$ 5000.

The regulations as proposed (which are expected to come into force in early 1994) are sorely inadequate to promote the recovery of depleted sea turtle stocks in St. Lucia. A moratorium on sea turtle harvest is necessary, as repeatedly acknowledged by member OECS states (including St. Lucia) and mandated by the SPAW Protocol to the UNEP Cartagena Convention (see section 4.32). If an interim harvest period pending full protection is unavoidable, then the harvest should be limited to green and loggerhead turtles *smaller* than 60 cm shell length during the five-month open season (see section 4.23 for details). The Fisheries Act of 1984 empowers the Minister to make or change regulations as required, including declaring an indefinite closed season.

Additional resources are needed to support law enforcement activities. Poaching typically occurs in isolated areas, often at night, and is difficult to control. Turtle meat and eggs are easily sold without being displayed in the open market; hence it is impossible to quantify closed-season violations. While there is a Marine Unit in the Police Force, the Unit lacks the manpower and resources (especially boats) to fully patrol the coastline. In addition, Fisheries personnel have no powers of arrest. Enforcement might be enhanced if Fisheries personnel were

deputised and empowered with greater enforcement capabilities (see section 4.123). The public should be encouraged to become more active in reporting violations.

With regard to protected areas, there is at present no single conservation authority in the country, or something akin to a national parks framework to administer all protected areas under one management agency. CCA/IRF (1991) emphasizes the importance of cooperation among the various institutions (government and non-government) responsible for "conservation of the nation's heritage". Financial resources are needed to administer and protect designated protected areas, and a coordinated and multi-disciplinary approach to the establishment of protected areas, including a national land use policy which identifies areas of particular concern and defines management criteria for each, is needed (CCA/IRF, 1991).

3.5 Other Natural or Man-made Factors

On at least one beach (Grande Anse), erosion is documented and nests are sometimes lost to wave action. It is also reasonable to assume that heavy swells accompanying cyclones may destroy nests from time to time. During the summer of 1992, a gravid leatherback was struck by a boat, as evidenced by deep abrasions along the length of her carapace which were recorded by observers at Grande Anse when she came ashore to nest. An informal investigation of the incident revealed that she had been struck by a local sailboat. Mortality resulting from entanglement in abandoned netting has not been recorded, but in May 1993 a green turtle died after becoming entangled in the buoy line of fish pot in the area of Labrelotte Bay (V. Charles, ENCORE, pers. comm.). Horse and vehicle traffic is degrading some beaches, but has not been reported from important nesting beaches. Public awareness is low on the issue of horses and vehicles as potential threats to incubating sea turtle eggs; for example, the October 1993 issue of St. Lucia's *Tropical Traveler* boasts "there's no better place for an invigorating canter than along our beaches"! To avoid crushing eggs and embryos, horse riding should be restricted to zones below the high tide line.

IV. SOLUTIONS TO STRESSES ON SEA TURTLES IN ST. LUCIA

4.1 Manage and Protect Habitat

It is intuitive that in order to conserve depleted species such as sea turtles, the habitats upon which they depend must be protected. This can be accomplished in a variety of ways, including setting aside areas as Nature or Marine Reserves (under the Wildlife Protection Act or the Fisheries Act, respectively) or as National Parks (National Parks legislation has not yet been enacted). Where protected area status is not feasible, regulatory guidelines must be enforced to restrict potentially harmful activities. In the marine environment, harmful activities include indiscriminate anchoring, chemical pollution, and other damage to coral reefs and sea grass. On land, the protection of nesting beaches requires strict controls on sand mining, coastal lighting, beach armouring, etc. The first step in the effective management of habitat is to identify critical areas (section 4.11); then, specific management plans can be designed and zoning or other regulations implemented (section 4.12). The protection of habitat important to the survival of sea turtles should occur within a larger coastal zone management framework.

It is noteworthy that a healthy coastal environment is essential to the economy, and not just to endangered turtles. According to Mitchell and Gold (1982 *in* CCA/IRF, 1991), an estimated 33% of St. Lucia's GDP in 1978 was derived from coastal and marine-related industries. The proportion is surely greater today. The nearshore habitats upon which turtles depend also have enormous recreational potential, as clearly shown by the concentration of tourist facilities along the coast and emphasis on water-related activities (e.g., diving, nature excursions, sport fishing, boating, sun bathing) in promotional advertising. Many of these activities are not inherently extractive of natural resources and can actually complement resource management objectives if, for example, the added value (business income and tax revenues) associated with recreational tourism is viewed as an incentive for sound resource management (CCA/IRF, 1991). Care must be taken not to over-use sensitive areas, however. Popular dive sites (e.g., Anse Chastanet) frequently suffer damage from careless divers and indiscriminate anchoring.

4.11 Identify essential habitat

Sea turtles forage predominantly on sea grass and in coral reef communities. In addition, adult females depend on St. Lucia's sandy beaches for egg-laying. Some nesting beaches are known (Table 1, Figure 2); others remain unidentified and undocumented. Preliminary resource data maps were published by ECNAMP (1980), but further research is needed to compile a comprehensive inventory. Surveys to identify essential habitat are a recognised priority and a goal of the proposed national Sea Turtle Conservation Programme (section 4.6).

4.111 Survey foraging areas

Sea grasses in St. Lucia include Thalassia testudinum ("turtle grass"), Syringodium filiforme ("manatee grass"), and Halodule wrightii ("shoal grass"). Major sea grass beds occur in close proximity to coral reefs along the north, south, and southeast coasts at Laborie, Anse Epouge, and from Burgot Point to Saltibus Point. Sea grasses are characterised by an extensive root and rhizome system, dense leaf cover, high growth rates, and high organic productivity that rivals some of the most intensive agricultural crops. Sea grasses exert considerable influence over their environment. Their exceptionally high productivity is supplemented by that of associated epiphytic algae and benthic and planktonic micro-algae, which together provide food for a wide variety of marine animals; they are also vital nursery areas for commercially important fishes and invertebrates (queen conch, spiny lobster). Extensive root systems prevent the suspension of sediments (thus stabilising sand and other sediments) and the leafy canopy slows water movement and filters the water column.

As summarised by CCA/IRF (1991), coral reefs and coral veneers are found on all of St. Lucia's coasts (Roberts, 1972), but there is considerable variation among these areas in terms of species diversity and overall structure. Available information on the status of St. Lucian coral reefs is summarised by Wells (1987). Many areas identified as "reefs" are actually veneers of coral and associated organisms on volcanic rock substrates. Reefs that have been largely produced by corals are found primarily on the south and east coasts. These are patch reefs or small fringing reefs; large barrier reefs are not present. Coral reefs provide shelter to all sea turtles, except the giant leatherback. The reef is also a source of food for hawksbill turtles, which consume mainly reef-associated sponges (see section 2.4). Healthy reef systems reduce incoming

wave energy, provide a source of beach sand, and are critical habitat for many invertebrates and the majority of bottom-dwelling or demersal fish living in nearshore areas of the Caribbean.

At the present time, the reefs and most of the sea grass beds which have been identified (see Figure 2) have not been accurately mapped. Most of these habitats are not regularly monitored although some are known to have been affected by siltation and other factors. The Choc Bay and Anse des Pitons (Jalousie) reefs, for example, have been degraded by siltation due to dredging and excavation, respectively. The Department of Fisheries has an ongoing Coral Reef Programme, involving *inter-alia* the execution of quantitative surveys and regular monitoring of a number of reef systems. It is therefore possible that this programme could be expanded to allow for the occasional monitoring of some additional reefs, as well as selected sea grass systems. It is a recommendation of this Recovery Action Plan that turtle sightings also be documented as part of this programme. Standard sea turtle sightings forms are needed. Aerial photographs could play a useful role in mapping and monitoring. Fishermen and dive tour operators should be encouraged to provide the Department with information about the extent and distribution of foraging activity.

4.112 Survey nesting habitats

A large number of actual and potential nesting beaches have been identified by the Department of Fisheries (Table 1, Figure 2), but there are many obstacles to obtaining a systematic determination of nesting activity. It is not feasible to survey all of those beaches on a regular basis because many of them are isolated and/or not readily accessible. In addition, the frequency of nesting on some beaches is so low that little may be learnt from occasional spot-checks. Finally, on beaches frequently used by man, tracks and other signs are easily obliterated. The Department of Fisheries plans to solicit assistance from residents proximal to potential nesting habitat and ask them to watch for evidence of sea turtle nesting. School groups could also become involved in survey initiatives. With technical support from WIDECAST, informal workshops will be convened to show residents what to look for and what to report.

Since 1982, the Department of Fisheries and the SLNS have carried out night watches and beach treks at Grande Anse Beach, although occasional treks are also carried out in other areas. Data have been collected on leatherback turtle nesting (d'Auvergne et al., 1989) and on occasional green and hawksbill nestings. These surveys should be extended to other beaches such as Fond d'Or where nesting is sufficiently frequent and where access is easy enough to allow regular surveys. Less accessible sites, such as Louvet and Marquis, should also be considered. In many cases, useful information can be collected from the public. For example, beach-bathers sometimes report turtles in nearshore waters and hoteliers have called in to report nestings. This sort of communication should be encouraged (see also section 4.41).

At the present time, the SLNS continues to carry out weekly night-patrol watches at Grande Anse Beach during the leatherback nesting season (March-July). In addition, the volunteer efforts of Presley James in surveying nesting beaches on the east coast have been invaluable. Twice weekly from mid-June to the first week of October 1993, James day-patrolled the east coast from Donkey Beach (Cap Estate) on the north tip of the island (see Figure 2) south to Dennery, and then examined Anse Sable, Point Sable, and Maria Island on the southeast coast.

Vigie Beach (Castries) was patrolled irregularly during this time. Notes were made regarding sea turtle nesting, hatching, and/or harvest (see Table 1). The Society hopes to secure funding to continue these efforts in 1994 and beyond. It is a recommendation of this Recovery Action Plan that the SLNS continue and, to the extent possible, extend these monitoring activities, ideally with institutional and manpower support from the Department of Fisheries and other relevant agencies.

At some cost, aerial photography could also be employed to survey nesting beaches. The cost of aerial surveying for three years is included in the proposed Sea Turtle Conservation Programme (section 4.65). Whether by land and/or air, a three-year island-wide beach survey is sorely needed in order to identify which habitats still support significant numbers of nesting turtles. Only in this way can management plans be developed for long-term protection and monitoring of critically important areas.

It is noteworthy that in 1990 the Department of Fisheries began beach profile surveys of a number of beaches islandwide under the aegis of a UNESCO beach monitoring programme. Monitored beaches included Fond d'Or, Grande Anse, Anse Ger, Anse Sable, Anse Cochon, Vigie (Choc Bay), R,duit (Rodney Bay) and Pigeon Point. These activities were discontinued in 1991. The Department of Fisheries hopes to resume this programme in the near future. Profile data are important to the long-term monitoring of sea turtle nesting beaches.

4.12 Develop area-specific management plans

The Department of Fisheries has long recognised the need for a complete and comprehensive plan for the management of sea turtles and their habitats in St. Lucia. Thus, the opportunity presented by WIDECAST for assistance in developing a plan to focus and prioritise conservation activities was both timely and greatly appreciated. An important thrust of this Action Plan is an emphasis on area-specific management (zoning and protective measures) within important foraging and nesting areas. Some meaningful initiatives are already in place in protected areas, including irregular nocturnal monitoring of Grande Anse beach during the nesting season and the patrol of other beaches where possible. Flipper tags were sometimes applied during the years 1982-1990, both on night watches and occasionally when turtles were caught at sea. However, record-keeping has not been rigorous and details could not be compiled for this Action Plan. It is a recommendation of this Recovery Action Plan that in-house data (e.g., tag records, catch statistics) be assembled and computerized by the Department of Fisheries and that the results of more than a decade of informal field work at Grande Anse be formalised by the SLNS and submitted with management recommendations to the Department of Fisheries.

In addition to the serious and immediate need to draft and enact a management plan to protect leatherbacks nesting at Grande Anse beach, it is a recommendation of this Recovery Action Plan that management plans be developed for other specific areas critical to the survival of sea turtles in St. Lucia. A System of Protected Areas (Hudson et al., 1992), when implemented, will greatly assist the planning effort. Many National Park and Protected Landscape sites proposed by Hudson et al. (1992) encompass sea turtle nesting beaches. Grande Anse would be the most suitable location for the establishment of a pilot project since conservation work is ongoing at this important nesting site and experience gained there could be applied to other areas.

In any case, sand mining (section 4.131), artificial lighting (section 4.132), the construction of seawalls and jetties (section 4.133), vehicle use on the beach (section 4.134), and sewage and other waste disposal (sections 4.143, 4.144) should be closely evaluated in zones proximal to nesting beaches. Zoning of specific areas by the Development Control Authority can help in the protection of habitat. An annotated summary of recommended guidelines can be found in section 4.122.

In addition to safeguarding nesting beaches, management plans should be constructed for important foraging grounds. A number of Marine Reserves have already been created under the provision of the Fisheries Act to protect coral reefs, beaches, and mangroves (Figure 4). Some of these reserves encompass important sea turtle foraging areas and nesting beaches; at least two (Grande Anse and Fond d'Or) were instituted specifically with reference to sea turtles. Hudson et al. (1992) envisage Nature Reserves encompassing "land or sea or both designated for the protection of habitat for plants and animals, especially those which are endangered or threatened." Unfortunately, sea turtles do not confine themselves to a limited area and as such they are vulnerable to pressures outside reserve boundaries. Therefore, general guidelines for protection of our entire marine zone need to be adopted. These should include prohibiting indiscriminate anchoring in sea grass or coral areas and banning the nearshore disposal of chemical or solid waste. A national system of mooring buoys would be very useful (see section 4.147). Enforcement of regulations will be needed (see section 4.123).

4.121 Involve local coastal zone authorities

Consultation should be initiated to include all bodies involved in development of the coastal zone. These include the Development Control Authority, the Ministry of the Environment, the Parks and Beaches Commission, the Air and Sea Ports Authority, and the Department of Fisheries. The police should also be involved, as they are responsible for law enforcement. Cooperation is absolutely essential if area-specific management plans are to achieve their objective. At present there is no legal mandate for concerned agencies to work together. However, a number of crucial matters have been discussed recently. It is hoped that consultation will continue, and that the harmonisation of legislation can be achieved to provide a framework for efficient management.

4.122 Develop regulatory guidelines

When areas are defined as especially critical to remaining sea turtle stocks, such as Grande Anse beach, regulatory guidelines should be drafted and implemented to establish a framework within which appropriate land use and development (commercial, recreational, residential) can occur. The Fisheries Act of 1984 allows for the creation of such regulations. In terms of coastal development the relevant authorities will have to design a system of zoning to protect sensitive areas. The lead organization would almost certainly be the Ministry of Planning, with input and participation from the Department of Fisheries, St. Lucia Tourist Board, St. Lucia National Trust, St. Lucia Air and Sea Ports Authority, and others. Any regulations, in order to be effective, must be enforceable. Standard guidelines for the conservation of sea turtle habitat are summarised below and are discussed in further detail in sections 4.13 and 4.14.

1) *Sand mining*: Commercial mining of beach sand should not be permitted under any circumstances (section 4.131). The persistent removal of beach sand disrupts stabilising vegetation, exacerbates erosion, and can eliminate nesting habitat. Mining pits invite injury to humans and livestock, and accumulate water to serve as breeding areas for mosquitoes and other unwanted insects. Mining sediments offshore should be carefully evaluated for potential effects on coastal beaches, since offshore material is essential for beach maintenance. Preferred extraction sites should be confined to ghauts (ravines) and interior sites.

2) *Artificial lighting*: Sea turtles, especially hatchlings, are profoundly influenced by light. Baby sea turtles, freshly emerged from the nest, depend largely on a visual response to natural seaward light to guide them to the ocean. In zones of coastal development, sources of artificial light distract hatchlings so that they turn away from the sea and crawl landward. It is essential that artificial light sources be positioned so that the source of light is not directly visible from the beach and does not directly illuminate areas of the beach; if lighting must be seen from the beach, it should emit wavelengths (560-620 nm) which are least attractive to sea turtles (Witherington, 1990). Low pressure sodium lights should be used to the maximum extent possible. Low intensity, ground-level lighting is encouraged. Nighttime and security lighting should be mounted not more than 5 m above the ground and should not directly illuminate areas seaward of the primary dune or line of permanent vegetation. No lighting, regardless of wavelength, should be placed between turtle nests and the sea.

Natural or artificial structures rising above the ground should be used to the maximum extent possible to prevent lighting from directly illuminating the beach/dune system and to buffer noise and conceal human activity from the beach. Improving dune height in areas of low dune profile, planting native or ornamental vegetation, or using hedges and/or privacy fences is encouraged. Barriers between 76-85 cm high are generally sufficient to block visual cues from artificial lights (Ehrenfeld, 1968; Mrosovsky, 1970). Ferris (1986) showed that a simple "fence" of black polyester material stretched between three posts and positioned between the nest and a lighthouse resulted in the hatchlings orienting correctly to the sea. Balcony lights should be shielded from the beach, decorative lighting (especially spotlights or floodlights) within line-of-sight of the beach should be prohibited, and safety/security lights should be limited to the minimum number required to achieve their functional roles (section 4.132).

3) *Beach stabilisation structures*: Hard engineering options to beach protection, including impermeable breakwaters, jetties, groynes and seawalls positioned on the beach or in the nearshore zone, should be considered only as a last resort. Throughout the Caribbean region there are numerous examples of beaches lost, rather than secured, as a result of armouring; St. Lucia is no exception (section 4.133). Sandy beaches are naturally dynamic. The physical characteristics of the coastline should be taken into account prior to coastal construction so that adequate setbacks, rather than expensive and often counter-productive armouring, can be used to provide for the long-term conservation of the beach resource.

4) *Design setbacks*: If development of land adjoining a sandy beach is planned, setback limits should be defined that reflect the damage likely to be caused to the beach and backshore environment during a major storm, and that take into consideration beach and backshore characteristics. Setbacks should provide for vegetated areas including lawns and dunes between hotels,

homes and similar structures, and the beach proper. Setbacks of 30-40 m and 80-120 m from the line of permanent vegetation are reasonable guidelines for upland coast development and lowland beach coast development, respectively (section 4.133). Setbacks not only help to protect coastal properties from storm damage, but also reduce over-crowding of the shorezone, lessen the likelihood that local residents will be excluded from the beach, and enhance the probability that artificial lighting will not shine directly on the beach.

5) *Access*: The use of motorised vehicles should be prohibited on beaches at all times and parking lots and roadways (including any paved or unpaved areas where vehicles will operate) should be positioned so that headlights do not cast light onto the beach at night. Driving on the beach creates unsightly ruts, exacerbates erosion, and lowers sea turtle hatch success by compacting nests (section 4.134). Tyre ruts also present a significant hazard to hatchlings crossing the beach. Where vehicles are needed to transport heavy fishing or recreational equipment, multiple access points should be provided and vehicles parked landward of the line of permanent vegetation. Pedestrian access to beaches should be confined to specific locations and strictly regulated so as to minimise destruction of the beach, including vegetation, by trampling.

6) *Waste disposal*: No dumping should be permitted within the nearshore, beach, dune, or wetland environment of the shorezone. Such dumping as has already occurred should be subject to immediate cleanup. The fouling of beaches runs counter to the economic interests of both residents and commercial landowners. Litter can obstruct hatchlings on their journey to the sea, discarded glass and metal can injure turtles, and larger objects on the beach can prevent females from finding a nest site. Visitors should be required to take with them any garbage or other waste brought to or generated at the beach. Trash cans and regular pickup should be provided at all beaches. To the extent that beach cleanup is necessary, it should be done using hand tools (section 4.134).

7) *Vegetation cover and fires*: All attempts should be made to preserve vegetation above the mean high tide mark. Creeping and standing vegetation stabilises the beach and offers protection against destructive erosion by wind and waves. The beach forest provides important nesting habitat for the hawksbill turtle and offers natural shielding for the beach from the artificial lighting of shoreline development (section 4.132). Fires, either for recreation or charcoal production, should be prohibited on beaches. Fires are a hazard to the surrounding dry forest, create unsightly scars, may scorch sea turtle eggs and hatchlings beneath the surface of the sand, and can disorient hatchlings. Cooking fires should be restricted to designated grill facilities.

8) *Marine pollution*: The dumping of solid or chemical wastes into the sea should be prohibited under all circumstances. In addition to degrading the environment for residents and visitors alike, sea turtles often ingest tar, plastic, rope, and other substances (e.g., Mrosovsky, 1981; Balazs, 1985; Lutz and Alfaro-Schulman, 1991), presumably mistaking these for food, and become weakened or die. It is commonplace for sea turtles to confuse plastic bags with jellyfish and eat them. Polluted effluent, including sewage, from land-based sources should be centrally treated before its discharge into the sea. See sections 4.143 to 4.146.

9) *Anchoring and dredging*: Anchor damage is a leading cause of destruction to sea grass meadows and coral reefs throughout the Wider Caribbean. It is essential that yachts and other boats be required to either anchor in designated sand bottom areas, or tie in at approved moorings in coral reef areas. Alternatively, vessels should be required to remain offshore, beyond the zone of living coral and sea grass. Dredging activities should be planned to minimize damage (i.e., sedimentation) to down current coral and sea grass. Severe disruption of the sea bed, especially in living sea grass and coral communities, can ruin actual or potential foraging areas for sea turtles, negatively affect the natural dynamics of the marine environment, and result in the loss of beach sand. See also section 4.147.

10) *Physical destruction of coral and sea grass*: In the absence of the sheltering influence of offshore reefs, shorelines are often severely altered, resulting in great economic and environmental losses. Neither coral reefs nor algal ridges should be dynamited or dragged with chains in order to provide boat access. Anchoring should not occur in reef or sea grass areas (see above, and section 4.147). Divers should be thoroughly coached on diving etiquette so as to preclude trampling, collecting, and touching living coral. The practices of using chemicals or dynamite (sections 4.141, 4.142) for the purpose of stunning fish for harvest are prohibited under all circumstances. The destruction of coral reefs resulting from these practices can be irreversible in our lifetime.

4.123 Provide for enforcement of guidelines

In order to effect compliance with rules and regulations concerning the protection of habitat, institutional and governmental support for law enforcement cannot be over-emphasised. Most Reserves are inadequately policed. Grande Anse Beach is one of the few Reserves where part-time (seasonal) Wardens have been employed. As a direct result, 1989 was the first year turtles were not reported killed on this beach (budgetary shortfalls have since terminated the Warden programme). It is a recommendation of this Recovery Action Plan that a team of Conservation Officers, Wardens, or other enforcement personnel be responsible for monitoring compliance in protected areas. In Marine Reserves, Wardens are authorised under section 22(c) of the Fisheries Act. With regard to conditions imposed on beach-front construction projects, such as setbacks and lighting restrictions, a registered architect, professional engineer, or other authority designated by the Government should conduct a site inspection, including a night survey with all beach-front lights turned on.

4.124 Develop educational materials

It is a recommendation of this Recovery Action Plan that educational material on the importance of protected areas and special management zones be developed for distribution to schools, fishermen, hoteliers, dive operators, and the general public. Where possible, interested and sensitised school teachers should be used as a medium for passing on information. Educational materials should be supplemented by talks and audio-visual presentations. The Department of Fisheries has over the years carried out some of these activities, but they should be stepped up and regularised. Assistance could be sought from organisations such as the St. Lucia National Trust, SLNS, and the Forestry Department. In addition, sign boards or other outdoor public displays would be useful to educate persons visiting protected areas. Visible

displays of information that include rules and restrictions on behaviour while in protected areas are crucial to compliance.

4.13 Prevent or mitigate degradation of nesting beaches

4.131 Sand mining

As is clearly seen in St. Lucia, the chronic removal of sand from beaches accelerates erosion and can destroy stabilising beach vegetation. In severe cases saline ponds are formed in unsightly pits left by mining operations, shoreline trees are lost to the sea, and entire beach habitats are eliminated. With their loss is lost the coast's potential for supporting recreation, wildlife, tourism and commercial development. The Beach Protection (Amendment) Act 1984 reads, "4.(1) No person shall, *(a)* dig, stockpile, take or carry away or aid or assist in digging, stockpiling, taking, or carrying away any sand, stone, shingle or gravel from any beach, seashore or floor of the sea of St. Lucia . . . except under and in accordance with a written permit from the Director of Public Works or an authorised officer and subject to such terms and conditions as are specified in the permit." Permits are granted for a maximum period of three months, and only if the Director of Public Works is "satisfied that the removal or such sand, stone, shingle or gravel is not likely to adversely affect the beach, the seashore or the floor of the sea."

Several sea turtle nesting beaches were being seriously affected by sand mining until the 1984 declaration. These include Grande Anse and Comerette (Anse Lavoutte area), both of which have been seriously compromised as nesting habitat; indeed, Comerette has all but been destroyed. Both beaches are now closed to mining, although extraction still takes place behind Grande Anse beach. The Ministry has promised to seek alternative sources of aggregate, such as local pumice, in order to safeguard the nation's beaches. Greater surveillance is needed to curb the illegal removal of sand from beaches island-wide. The Department of Fisheries has been working with the police and the Ministry of Works to this end. It is a recommendation of this Recovery Action Plan that every effort be made to wholly and effectively prohibit the practice of beach sand mining throughout St. Lucia. The loss of sandy beaches not only reduces the reproductive success of sea turtles, but endangers beach-front investment (e.g., piers, hotels, houses) and has serious economic implications for the future of vital industries (e.g., tourism).

Historically, it was not until World War II, with construction of the Vigie Airport runway and of U. S. military bases, that demand for sand increased significantly. Vigie and Choc beaches were once sea turtle nesting beaches but were mined extensively from 1942 until 1969 when both beaches collapsed under the impact of normal winter swells. By 1969-1970, mining activities had shifted to Reduit, Anse La Raye, Dennery, and Black Bay, which together contributed 96% of the total. Attention subsequently shifted away from weakened beaches at Vigie, Choc and Reduit, but sand mining persisted (despite implementation of the Beach Protection Act) in response to the demands of an expanding construction industry, notably at Dennery (both Fond d'Or and the Dennery Village), Anse La Raye, and Vieux-Fort (Black Bay/Pointe Sable). Major new sources were also developed in the north, including Anse Lavoutte, Esperance, and Grand Anse.

According to data summarised by CCA/IRF (1991), 17,810 tons of cement were imported and used in concrete that consumed an average of 110,000 cubic yards of sand extracted from

local sources for the period 1969-1970. In 1984, cement imports had increased to 21,713 tons, requiring 134,000 cubic yards of sand. Largely as a consequence of decades of commercial mining, several beaches are eroding and showing signs of increasing instability. Grand Anse beach, the largest in St. Lucia and an important nesting site for endangered leatherback sea turtles, has an unnaturally low profile as a result of heavy mining activity. The beach is described as having "severe structural instability" (Devaux, 1987 *in* CCA/IRF, 1991) and turtles are often forced to abandon their nesting attempts after digging into the water table. It is crucial that alternative sources of aggregate be found to sustain the construction industry. These should be inland deposits. The mining of river mouths should be considered only as a last resort. Sand from rivers also contributes to maintenance of beaches, and its removal means that less is available to replenish losses to erosion.

4.132 Lights

On the beaches where lighting is a problem, lights should be shielded or extinguished to prevent the disorientation of hatchlings and to preclude the possibility that nesting turtles will be dissuaded from coming ashore. Sea turtles, particularly hatchlings but also gravid females, are profoundly influenced by light. Hatchlings, freshly emerged from the nest, depend largely on a visual response to natural seaward light to guide them to the ocean. Consequently, in zones of coastal development, sources of artificial light distract the little turtles so that they turn away from the sea and crawl landward. Having done so, they are eaten by crabs, birds and dogs, or die in the morning sun. They never reach the sea. This problem and some potential solutions are discussed by Raymond (1984). Recent research has shown that low-pressure sodium vapor (LPS) luminaires, which emit light in the 590 nm range (yellow), do not attract hatchlings to the extent that full-spectrum white light does and thus should be considered by coastal developers (Witherington, 1990).

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 (1) time restrictions (lights extinguished during evening hours when hatching is most likely to occur; e.g., 1900-2300 hrs), (2) 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), (3) 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), (4) 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), (5) alternative light sources (e.g., LPS lighting is known to be less attractive to hatchlings than full-spectrum white light).

In St. Lucia, hotel beach-front lighting has been known to disorientate emerging hatchlings. It is also likely that female turtles may be deterred from nesting. Some years ago hatchlings were found in the kitchen of a major hotel on the west coast (Yellow Sands Beach, La Toc). In 1992 and 1993, hatchlings were found on the brightly lit highway along Choc Bay (Vigie beach). In neighbouring Barbados, 83% of hatchlings from monitored nests in 1990 were disoriented by artificial lighting (Horrocks, 1992). The problem of lighting may become much more significant with the expansion of the tourist industry and the concurrent increase in the

number of beach hotels. It is a recommendation of this Recovery Action Plan that owners of existing hotels as well as developers of new resorts on nesting beaches be targeted for education with regard to this potential problem. Letters should be mailed from the Department of Fisheries to all beach-front restaurants and hotels asking that lights be appropriately modified to take sea turtles into account, nesting and hatching be reported, and the grounds be checked each morning to "rescue" hatchlings misoriented landward.

4.133 Beach stabilisation structures

At present, very few beaches have installed stabilisation structures (e.g., Vigie, Pigeon Point). Groynes and gabion baskets have been used mostly to protect beaches which have been created or altered by dredging and similar activities. Such structures have been largely unsuccessful and at times have even been washed away. This is because stabilisation structures such as breakwaters, groynes, and solid jetties constructed perpendicular to the shoreline can actually exacerbate beach erosion, especially downcurrent. Beach stabilisation structures constructed parallel to the shore can also provoke erosion, especially if they armour the zone of fore dunes, and can hinder natural beach regeneration. Furthermore, seawalls and rip-rap (unconsolidated rock and boulders) can prevent access by female sea turtles to the nesting beach. It is a recommendation of this Recovery Action Plan that holistic coastal zone regulations be developed that mandate responsible coastal zone development, including setback limits, so the loss of sandy beach (and the need for stabilising structures) is minimised. Prior to any construction, an environmental impact assessment (EIA) should be required by a competent independent consultant approved by the Government and construction permits granted based on the results of the EIA.

Setback limits are especially important to the conservation of nesting beaches. If development of land adjoining a sandy beach is planned, it is a recommendation of this Recovery Action Plan that setback limits be defined that reflect the damage likely to be caused to the beach and backshore environment during a major storm, and that take into consideration beach and backshore characteristics. Setbacks should provide for vegetated areas, including lawns and dunes between hotels, homes and similar structures, and the beach proper. Setbacks of 30-40 m and 80-100 m from the line of permanent vegetation are reasonable guidelines for upland coast development and lowland beach coast development, respectively. Setbacks not only help to protect coastal properties from storm damage, but also reduce overcrowding of the shorezone, lessen the likelihood that local residents will be excluded from the beach, and enhance the probability that artificial lighting will not shine directly on the beach.

4.134 Beach cleaning equipment and vehicular use of beaches

Mechanised beach cleaning equipment can crush or puncture incubating sea turtle eggs. Fortunately, this equipment is not currently in use in St. Lucia. Every effort should be made to provide alternatives to the disposal of garbage on sandy beaches and to educate St. Lucians about the environmental hazards posed by indiscriminate waste disposal (section 4.144). Periodic beach cleanup campaigns might be sponsored by local youth (or other civic) groups; this has been successful elsewhere in the Caribbean [N.B. for details on participating in international beach clean-up campaigns, contact the Center for Marine Conservation, 1725 DeSales Street NW Washington D. C. 20036]. When removal of debris, litter, or accumulated seaweed is necessary, it is a recommendation of this Recovery Action Plan that hand rakes be used. Beach clean-up

should not include the removal of vegetative cover. The beach forest, including shrubbery, provides hawksbills with important nesting habitat (e.g., Ryder et al., 1989). Even the raking and removal of leaves and grasses above the high tide line can increase the probability of wind erosion and degrade nesting habitat.

Driving cars and trucks on the beach compacts the sand, damages beach vegetation, and can cause or exacerbate erosion. Erosion exposes eggs to wave action and reduces the amount of beach available for sea turtles to nest on. Compaction adversely affects sea turtles by crushing eggs and killing hatchlings. After breaking free from their eggs, hatchlings work together with their siblings to reach the surface of the beach and then remain just below the sand until nightfall. When the sun sets and the beach cools, they are cued by the change in temperature to emerge fully and crawl to the sea. If vehicles run over the unseen hatchlings waiting below the surface, they can be fatally crushed. In addition, tyre ruts left in the sand can trap hatchlings and prevent them from reaching the sea (Hosier et al., 1981). Vehicles can also strike and kill hatchlings crawling to the sea, or frighten females away from nesting. It is a recommendation of this Recovery Action Plan that vehicles not be allowed to drive on sandy beaches. Unfortunately, regulations recently promulgated under the authority of the Parks and Beaches Commission Act (No. 4 of 1983) do not include such a prohibition.

4.135 Beach rebuilding projects

Artificial beach rebuilding is not considered a priority. When it has been attempted (e.g., dredge spoils were deposited at Vigie, sand was removed from Grande Anse to renourish Labrellotte), the investment has been all but lost when the new sand eroded away. The biggest need is to allow beaches to recover naturally (wherever possible) from the effects of sand mining. In some cases this could be assisted by the re-establishment of beach vegetation. When unavoidable, rebuilding should proceed carefully. Sand brought to a beach from inland or offshore deposits is often of a different constitution (e.g., grain size, organic content). Experience in Florida USA and elsewhere suggests that this sediment is easily compacted and can become useless for sea turtle nesting. It is a recommendation of this Recovery Action Plan that replacement sand be similar to that which was eroded, thereby maintaining the suitability of the beach for the incubation of sea turtle eggs. Rebuilding should not be undertaken during nesting and hatching seasons (primarily April-December) when heavy equipment and activity can deter nesting and crush eggs, and the new overburden can prevent hatchlings from successfully emerging.

It is worth noting that there is an imbalance in the system somewhere when sand is lost from an otherwise predictable beach habitat and is not replaced by natural accretion processes. The underlying cause can be as direct as an upcurrent solid jetty or pier that is literally "starving" the downcurrent beaches by interrupting the constant longshore transport of sand and sediments. Or the impetus may be more subtle, as occurs with the removal of beach vegetation [N.B. the Parks and Beaches Commission Act, 1983, prohibits "willful damage" to any tree, shrub or grass on a beach] or when nearshore pollution retards the productivity of calcareous (coralline) algae and other sand sources. The linkages between development and the persistence of sandy beaches are complex and should be considered with great care before construction proximal to sandy beaches is permitted. If dunes are leveled, vegetation removed and/or jetties constructed, the likelihood of committing the owners to repetitive and increasingly expensive rebuilding is heightened. Useful information regarding beach rebuilding in sea turtle nesting

habitat can be obtained from the Florida Department of Environmental Protection, 19100 SE Federal Hwy, Tequesta, Florida 33469-1712 USA.

4.14 Prevent or mitigate degradation of marine habitat

4.141 Dynamiting reefs

Dynamiting is an extremely short-sighted and destructive form of fishing. Many fish killed by dynamiting are non-target species, others do not float to the surface and therefore are not collected. Moreover, the habitat destruction accompanying dynamiting reduces the fish carrying capacity of the system. Dynamite fishing has also been implicated in "the destruction of significant numbers of turtles in St. Lucia waters" (L. Stephen *in* Cato et al., 1978). In St. Lucia the use of dynamite for fishing is prohibited.

The Fisheries Act of 1984 states: 24.(1) Any person who *(a)* permits to be used, uses, or attempts to use any explosive, poison or other noxious substance for the purpose of killing, stunning, disabling or catching fish, or in any way rendering fish more easily caught; or *(b)* carries or has in his possession or control any explosive, poison or other noxious substance in circumstances indicating an intention of using such explo-sive, poison or other noxious substance for any of the purposes referred to in the preceding para-graph, is guilty of an offence and shall be liable on summary conviction to a fine not exceeding five thousand dollars.

The Fisheries Act notwithstanding, the use of dynamite for the purpose of catching fish (mainly reef fish) until recently occurred frequently in some places, especially along the north-eastern and western coasts. Today this clandestine activity has lessened, but informed observers report that Dennery fishermen regularly blast in the Louvette area. Increased surveillance would reduce this problem, as would successful prosecution of offenders. Other uses of dynamite in reef areas (e.g., localised blasting to improve fishing boat navigation channels) also pose dangers. The long term effects of these actions are not clearly known. In Barbados it appears that the exposed coral and coral rubble created by such blasts are very susceptible to erosion; beaches parallel to reef cut channels may also be more prone to erosion (Horrocks, 1992).

It is a recommendation of this Recovery Action Plan that enforcement of the relevant Fisheries Act provisions be strict and consistent.

4.142 Chemical fishing

The application of chlorine bleach for the purpose of catching fish results in the death of coral reef organisms and can poison important nursery areas for commercial fishes. As is the case with fishing using explosives, the destruction of coral reefs seriously compromises hawks-bill turtle foraging habitat. In St. Lucia, the use of bleach and other noxious substances for fishing is illegal under section 24 of the Fisheries Act of 1984 (see section 4.141 of this Recovery Action Plan). The practice is not common, and is typically carried out in rivers (rather than at sea) by persons fishing for crayfish (=prawns). It is a recommendation of this Recovery Action Plan that enforcement of the relevant Fisheries Act provisions be strict and consistent.

4.143 Industrial discharges

Archer (1984) estimated that 534,500 cubic metres of waste and waste water are discharged annually from distillery, brewery, soft drink, dairy products, edible oil and margarine, soap, coconut meal, and meat products operations. The primary effects of these water-borne wastes is to increase biochemical oxygen demand and suspended and dissolved solids, rendering the receiving water murky and prone to excessive algal growth (CCA/IRF, 1991). There is some discharge of detergent from hotels on the northwest coast. Perhaps the greatest risk is that of an oil spill in the Castries or Cul-de-Sac harbours (section 4.145). Stiffer legislation concerning the discharge of effluent is needed, as it is well known from the experience of other countries that marine pollution can seriously disturb the integrity of the marine environment. All that is necessary should be done to determine to what extent pollution is affecting St. Lucia's marine ecosystems and the stocks and fishermen they support. The Caribbean Environmental Health Institute (CEHI) has carried out water quality surveys in St. Lucia for several years and could play a major role in this regard.

It is a recommendation of this Recovery Action Plan that (1) existing pollution laws be reviewed for completeness and enforceability, providing Government with recommendations for changes where needed, (2) industries be monitored to confirm that discharges are duly registered with Government and properly identified as to content, and (3) fish and other marine life in suspected polluted areas be tested for the presence of toxins.

4.144 At sea dumping of garbage

The dumping of sewage, plastics and other waste from the yachting/cruise industry, from military vessels, and from fishing boats is a problem throughout the region. Worldwide, the death or debilitation of tens of thousands of marine animals, including sea turtles, occurs each year as a result of entanglement in or ingestion of marine debris. In St. Lucia, beaches on the windward coast are "chronically strewn with a variety of plastic debris and heavy fishing nets washed ashore" (CCA/IRF, 1991). Dumping violations are difficult to monitor. A solution to this growing problem will demand a concentrated effort at public education, a requirement that vessels retain their waste pending safe disposal, convenient places to safely dispose of refuse on shore, and stiff penalties for offenders. Most of the relevant legislation is in place. The Air and Sea Ports Authority (Seaport) Regulations of 1985 state: "rubbish of any sort whatsoever shall not be thrown or allowed to fall or drift into the water at a port". Nevertheless, enforcement is problematic.

A related problem is the dumping of garbage in ravines or on the coast. This is significant in some coastal communities and is aggravated by the washing into the sea of domestic garbage from inland areas by rivers. Some beaches and bays such as Tapion and Grande Anse are badly affected, and this in turn discourages sea turtle nesting and foraging activity. Plastic bags used in the banana industry are frequently found close to and on shore. Balazs (1985) summarized worldwide records of ingestion of oceanic debris by sea turtles and listed a wide variety of items consumed, including banana bags ingested by green turtles in Costa Rica. Leatherbacks frequently ingest plastic bags, mistaking them for jellyfish (Mrosovsky, 1981). According to CCA/IRF (1991), solid waste management is for St. Lucia "a serious, unresolved, and growing

environmental problem in nearly all coastal areas where tourism, residential housing, industry, commerce, and recreation are all concentrated." It is noteworthy that the Parks and Beaches Commission Act (No. 4 of 1983) states that "any person who, without authority or excuse, . . . deposits any waste paper, waste matter, rubbish or litter in any public park or garden or on a beach is guilty of an offence." Penalties include a fine of EC$ 500 or six months in prison, or both.

It is a recommendation of this Recovery Action Plan that all advantage should be taken of relevant national and international legislation to curb both at-sea and land-based sources of litter on nesting beaches and that a campaign of public awareness be undertaken.

4.145 Oil exploitation, production, refining, transport

An oil-contaminated environment can be lethal to sea turtles and incubating eggs. Behavioural experiments indicate that green and loggerhead sea 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) reported juvenile hawksbills (to 20 cm) "stranded [in Florida] with tar smeared sargassum"; some individuals had ingested tar. Fortunately, there are as yet no records to date of the oil-fouling of turtles or their eggs in St. Lucia.

There are no known problems at the present time concerning oil exploitation, production or refining in St. Lucia. However, tanker traffic and the Hess Oil Storage Terminal at Grande Cul-de-Sac Bay "offer the potential for catastrophic pollution through a major spill or accident" (CCA/IRF, 1991). Other suppliers of petroleum products operate smaller terminals in the Castries harbour where spills have been known to occur in the recent past (one of these suppliers has since moved to Cul-de-Sac). Tar is a problem on some beaches, particularly east coast beaches including Grande Anse, Cas-en-Bas, and Anse Sable. This problem is being monitored by the Caribbean Environmental Health Institute as part of CARIPOL. The Air and Sea Ports Authority (Seaport) Regulations of 1985 prohibit the discharge of "oil or any similar substances" into a port and the pumping/cleaning of tanks or bilges within 200 nautical miles of St. Lucia. At present an Oil Spill Contingency Plan is being prepared for St. Lucia. It is a recommendation of this Recovery Action Plan that the relevant authorities place the onus on operators to minimise spillage and to be responsible for cleanup, and that the Oil Spill Contingency Plan be completed and implemented as soon as possible.

St. Lucia is a signatory to the Cartagena Convention (section 4.32) and 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 run-off and sewage discharges

St. Lucia's economy is based largely on agriculture. The backbone of this industry is the cultivation of bananas in which many chemical inputs (including fertilisers, pesticides and herbicides) are used. In addition, much of the island's agricultural activity is carried out on steep slopes. Consequently, with abundant rainfall (2000 mm p.a.) there is a heavy runoff of silt and agrochemicals into the sea. Some reefs, such as those in Choc Bay, appear to have suffered considerably from sedimentation but virtually no baseline research has been done on the effects of agrochemicals on marine systems. The problems outlined above have far-reaching implications, and not only for the marine environment. Soil conservation, reforestation, and more prudent use of economical agrochemicals would also have long-term benefits for terrestrial systems.

At present, sewage is disposed mainly into septic tanks and pits. In some rural areas, night soil (raw sewage) enters the ocean. Most large hotels operate their own sewage plants, although these do not always function effectively. A treatment plant located at the St. Lucian Hotel services both the hotel and the developed housing areas of Rodney Bay. The treated effluent is discharged through on outfall pipe into Rodney Bay. CEHI monitors selected sewage treatment facilities and especially their discharge areas. The impact of sewage from yachts in marinas is unstudied. While fecal coliform counts are "relatively high" at Rodney Bay lagoon, the primary source is from housing developments upstream (CCA/IRF, 1991). A sewage treatment plant to serve the Rodney Bay/Gros Islet residential-tourism-industrial zone is presently under construction.

It is a recommendation of this Recovery Action Plan that strong environmental protection laws be developed to address the threat of coastal and ground water contamination resulting from run-off and indiscriminate disposal of agro-chemicals and untreated or incompletely treated sewage. Further, it is recommended that investment in infrastructure to treat and properly dispose of raw sewage be a priority for both Government and industry and that the Pesticide Control Act (1985) be rigorously enforced. Routine monitoring for compliance with environmental standards is essential.

4.147 Others (anchoring, dredging, sedimentation)

Extensive damage has been caused to reefs by yachts anchoring on them. The systematic demolition of coral by heavy anchors severely degrades potentially important sea turtle foraging and resting habitats. Under the Fisheries Regulations of 1987 the practice of dropping anchor on living coral is illegal. Anchor damage is most noticeable at Anse Cochon which is frequently used by dive boats and day charter vessels. Yacht anchor damage is noticeable at Malgretoute (SoufriŠre area) and Turtle Reef, Anse Chastanet. In the latter case the problem has been reduced due to increased awareness and monitoring on the part of hotel staff.

It is a recommendation of this Recovery Action Plan that relevant legislation be fully enforced, a public awareness campaign be undertaken, and a national system of moorings be developed. In some areas (e.g., SoufriŠre), permanent moorings are already under consideration. Inexpensive and effective mooring systems are currently available (see Halas, 1985). In the British Virgin Islands, Eckert et al. (1992) describe how local dive operators raised the money necessary to install more than 200 Halas-type moorings, donated time and labour toward the installation, and took the lead in drafting supporting legislation. User fees are paid directly to the BVI National Parks Trust and are earmarked for mooring maintenance, as well as conservation and law enforcement in sensitive marine areas. Moorings are not only vital to the protection of coral reef habitat, but can also provide much-needed revenue in support of protected areas.

According to CCA/IRF (1991), sedimentation due to coastal erosion caused by sand mining and to a lesser extent dredging is "one of the most pervasive threats" to St. Lucia's nearshore marine environments [N.B. sand mining is discussed in section 4.131]. In the past, major dredging projects such as the Pigeon Island Causeway caused significant damage to coral reefs and sea grass. There have been no such projects in the last few years. It is a recommendation of this Recovery Action Plan that careful consideration be given in the future *before* such activities are carried out. EIA recommendations should be followed to minimise adverse affects to the dredge site and to downstream communities (coral, sea grass) potentially important to turtles.

Heavy sediment loading has been reported at a number of reefs along the west coast. Reefs in the vicinity of river mouths are particularly vulnerable to increased sediment loads due to upland construction as well as run-off containing agricultural chemicals (see section 4.146). At Rodney Bay, siltation has reduced the average lagoon depth by about 1 m in 12 years (Archer, 1985). Nearshore sedimentation indirectly affects endangered sea turtles by reducing the productivity of foraging grounds. When suspended particles settle, they can stress reef corals, slow feeding and photosynthesis, and may ultimately kill both coral species and sea grass. It is a recommendation of this Recovery Action Plan that all possible measures be taken to minimise watershed erosion and the run-off of sediments to the sea.

4.2 Manage and Protect all Life Stages

4.21 Review existing local laws and regulations

The Turtle, Lobster and Fish Protection Act (No. 13 of 1971) was repealed by the Fisheries Act (No. 10 of 1984). According to the Fisheries Regulations of 1994, which are promul-

gated under the authority of the Fisheries Act (39.(2)(q) prescribing measures for the protection of turtles, lobsters and conchs):

33. (1) No person shall –

(a) disturb, remove from the fishery waters, expose for sale, sell, purchase, or at any time have in his possession any turtle eggs;
(b) interfere with any turtle nest, or turtle that is nesting;
(c) remove from the fishery waters, expose for sale, sell, purchase, or at any time have in his possession any undersized turtle;
(d) set within 100 metres of the shores of Saint Lucia any net or seine or any other artifice for the purpose of or with the intention of fishing for, catching or taking any turtle; or
(e) fish for, remove from the fishery waters, or at any time have in his possession, expose for sale, sell, or purchase any turtle between the 28th day of February to the 1st day of October in every year or as otherwise stated by the Minister by notice published in the Gazette and in a newspaper which is printed or circulated in the State.

(2) In this Regulation –

(a) "Turtle" includes the whole or any part of any turtle;
(b) "undersized" means a weight less than --
  (i) 27.22 kg for Hawksbill (Eretmochelys imbricata);
  (ii) 34.02 kg for Green (Chelonia mydas) and Loggerhead (Caretta caretta); or
  (iii) 294.84 kg for Leatherback (Dermochelys coriacea).

4.22 Evaluate the effectiveness of law enforcement

The nation as a whole has yet to come to terms with the idea that it can be a criminal offence of a serious nature to violate sea turtle or other conservation laws. Consequently, throughout the law enforcement system, there is a reluctance to take the law seriously. Entrenched cultural traditions further complicate the situation. It is well known that green and hawksbill turtles are harvested during the closed season and that eggs and gravid females of all species are removed illegally from nesting beaches. Yet few persons have been prosecuted (and all unsuccessfully) for violating sea turtle protection laws. Other significant hindrances include the fact that (1) the Marine Police Unit is not sufficiently staffed or equipped to effectively patrol St. Lucia's territorial waters, (2) many east coast nesting beaches are almost inaccessible by land or sea, and (3) Police are too often unfamiliar and/or unsympathetic to the provisions of conservation law. Recommendations to improve the current situation are found in section 4.24.

4.23 Propose new regulations where needed

Wildlife management laws and regulations pertaining to sea turtles must reflect biological realities. The Fisheries Regulations of 1994 do not reflect the current understanding of sea turtle ecology, nor do they respond to the critical situation of diminishing sea turtle numbers in

St. Lucia. It is an urgent recommendation of this Recovery Action Plan that a moratorium be implemented on the capture and sale of all sea turtles, their eggs and products until such time as there is sufficient information to show that a regulated harvest will not compromise the sustainable recovery of depleted stocks. Specifically, we recommend that a closed season be declared for an indefinite period of time commencing 1 March 1995. In the interim, Fisheries personnel should be preparing the fishing community for a ban. Technically, the Minister can enable a moratorium by declaring a non-existent open season for a number of consecutive years (1984 Fisheries Act 43.(2)).

4.231 Eggs

The removal, sale and/or purchase of turtle eggs is prohibited at all times. No new regulations are necessary. However, given that the illegal collection of eggs continues, it is a recommendation of this Recovery Action Plan that a concentrated effort be made to inform the public that the harvest of sea turtle eggs is prohibited. Reports to the Fisheries Department or Police of violations should be encouraged. Penalties upon conviction should be strict in order to set an example for others who may consider contravening the regulations. It is unambiguous that the unchecked harvest of eggs will ultimately guarantee the extinction of local nesting populations, regardless of any other conservation measures.

4.232 Immature turtles

Any continued harvest of the already depleted sea turtle resource is viewed as counterproductive to the objective of sustained recovery of local sea turtle populations. It is a recommendation of this Recovery Action Plan that a moratorium on the harvest of sea turtles of all sizes be enacted, as has been urged by the OECS for several years. In the event *and only in the event* that a complete ban is politically impossible in the immediate term, the Department of Fisheries should, at a minimum, consider imposing maximum rather than minimum size limits and extending the closed season to encompass the peak breeding season (1 April-30 November).

To this end, Section 33 of the Fisheries Regulations would need to be revised to extend the closed season and to confine the legal harvest to green and loggerhead turtles with a curved carapace length *less than* 24 inches (60 cm). Small juveniles are completing a period of rapid growth. If turtles must be harvested, this size class is theoretically more capable of being replaced than the adult class (Crouse et al., 1987; Frazer, 1989). The harvest of olive ridleys, hawksbills, and leatherbacks *of any size* should be forbidden. Olive ridleys and hawksbills are seriously depleted in the Western Atlantic and no amount of harvest can be justified, even on an interim basis. Since only adult leatherbacks are encountered, there is no opportunity to harvest immatures of this species. Revised text (Section 33, Fisheries Regulations) is herein proposed:

33. (1) No person shall -
- (a) disturb, remove from the fishery waters, expose for sale, sell, purchase, or at any time have in his possession any turtle eggs;
- (b) interfere with any turtle nest, or turtle that is nesting;
- (c) remove from the fishery waters, expose for sale, sell, purchase, or at any time have in his possession any oversized turtle;

(d) set within 100 metres of the shores of Saint Lucia any net or seine or any other artifice for the purpose of or with the intention of fishing for, catching or taking any turtle; or

(e) fish for, remove from the fishery waters, or at any time have in his possession, expose for sale, sell, or purchase any turtle between the 1st day of April to the 30th day of November in every year or as otherwise stated by the Minister by notice published in the Gazette and in a newspaper which is printed or circulated in the State.

(2) In this Regulation --

(a) "Turtle" includes the whole or any part of any Loggerhead (Caretta caretta) or Green (Chelonia mydas) Turtle;

(b) "oversized" means a curved shell length greater than 24 inches (60 cm).

(3) By this Regulation --

(a) Leatherback (Dermochelys coriacea), Hawksbill (Eretmochelys imbricata) and Olive Ridley (Lepidochelys olivacea) Turtles of all sizes are protected at all times of the year in Saint Lucia.

Turtles must be landed alive in order that oversized turtles and protected species can be released unharmed. Consequently, the provision that turtles not be speared is an important one. Nets should be checked regularly to ensure that ensnared turtles do not drown or become vulnerable to predators. Turtles legally landed should be killed humanely prior to butchering.

4.233 Nesting females

The taking of nesting females of all species is prohibited at all times; thus no new regulations are necessary, only the diligent enforcement of existing law.

4.234 Unprotected Species

All species of sea turtles known or believed to occur in St. Lucia's waters are covered under the Fisheries Regulations (1994) and will be included in any revised legislation.

4.24 Augment existing law enforcement efforts

Additional personnel and supporting resources are greatly needed in the area of law enforcement. As has been suggested elsewhere in this document, the deputising of Fisheries Officers would ease the strain on Police who must also see to general law and order (at the present time, Fisheries Officers have only the powers of search and seizure). Deputising Fisheries personnel may result in strained relations between the Fisheries Department and the fishing community, however, and thus it is highly desirable that Government secure personnel specifically as game and fisheries Wardens through the Fisheries and Forestry Departments or the St. Lucia National Trust.

Recognising that environmental law is becoming increasingly important and increasingly technical in St. Lucia, as is the case throughout the Eastern Caribbean, it is a recommendation of this Recovery Action Plan that a Division of Environmental Enforcement be created within an appropriate Ministry. Such consolidation of resources and expertise has proven effective elsewhere in the region. Division officers should be specifically trained in environmental law and enforcement procedures and be responsible for regulations concerning mining and minerals, pollution, protected species, fisheries and marine resources, boater safety, game and hunting, coastal zone permits and compliance, etc. Officers would logically coordinate closely with wardens having enforcement responsibility for conservation zones and other protected areas.

As an alternative to creating a new Division, four officers could be selected from within the Royal St. Lucia Police Force. These officers would remain part of the general police force, but would be trained as focal points for the investigation of crimes against environmental statutes. Another alternative might be for Government to hire older, respected fishermen to serve as conservation wardens in their communities [N.B. similar recommendations have been put forward to strengthen community enforcement in St. Vincent and the Grenadines (Scott and Horrocks, 1993)]. In order to facilitate enforcement of environmental legislation by Police, Customs, Immigation, and other relevant agencies, it is a recommendation of this Recovery Action Plan that a concise yet comprehensive manual of existing environmental legislation should be developed for public distribution. Finally, divers, fishermen, and other residents should be encouraged to participate in law enforcement.

In rare cases it has been possible to provide adequate resources to protect nesting populations. For example, the number of gravid leatherbacks killed on Grande Anse beach declined in 1989-1992 when two Wardens were paid by the Fisheries Department to patrol the area. Unfortunately, funding expired and the Wardens are no longer on site. It is a recommendation of this Recovery Action Plan that a mechanism for deputising Voluntary Wardens be implemented in St. Lucia. This has been very successful in Trinidad where the most recent training session graduated more than 200 Voluntary Wardens for the Fisheries Act (K. Fournillier, Wildlife Section-Forestry Division, Trinidad, pers. comm.). Further, it is hoped that an educational effort in schools and communities will serve both to reduce the need for surveillance (because of greater understanding and awareness on the part of the public) and to enhance the prospects for successful prosecution in court.

An inter-agency workshop to explain and discuss the provisions of the Fisheries Act of 1984 was convened in 1991 under the aegis of the Department of Fisheries. Enforcement officials from Forestry, Customs, the Police, and other relevant authorities attended. Many participants, even those in senior positions, were unfamiliar with the details of the Act and the session was very well received. It is a recommendation of this Recovery Action Plan that a follow-up workshop be convened as soon as practicable with the twin objectives of (1) explaining and discussing environmental and conservation law in general (including rules of search, seizure, and the handling of evidence since cases are often dismissed on technicalities) and (2) making it clear to the enforcement community that these laws must be enforced fully and consistently throughout the nation.

4.25 Make fines commensurate with product value

The maximum fine of EC$ 5000 allowed under the Fisheries Act of 1984 is deemed adequate for the present time. Also, vessels and gear can be impounded.

4.26 Investigate alternative livelihoods for turtle fishermen

We estimate that 10-15 men rely on turtles as a means of seasonal subsistence. It is a recommendation of this Recovery Action Plan that fair compensation be offered to fishermen who turn over their turtle nets to the Department of Fisheries and that without further delay a moratorium be declared on the capture of sea turtles (see section 4.23). It is not considered necessary to provide alternative livelihoods; however, funds are needed to purchase turtle nets. The Department of Fisheries has requested money for the purchase of gear expected to become obsolete under the new Fisheries Regulations, but the amount allotted (EC$ 25,000) by the FY 1993 budget is wholly insufficient for the task. Trammel nets, for example, will be banned, as will selected mesh sizes in seines. A single seine can cost EC$ 35,000 or more. Turtle nets are handmade and vary in value from EC$ 500 for very simple styles (e.g., Vieux-Fort area) to EC$ 1000 for more elaborate styles (e.g., Choiseul area) (source: Fisheries Department data). An estimated 10-15 men operate 15-20 turtle nets.

To discourage poachers who kill nesting turtles, incentives might be considered such as hiring these individuals as Wardens or paying them to participate in turtle watches and related activities on a part-time basis. It is conceivable that if some of these men are given the opportunity to sensitise their friends about the need to protect sea turtles, positive changes in attitude may be achieved. To discourage poachers from taking eggs, the Department of Fisheries has suggested that people who report and protect nests be paid EC$ 1 for every hatchling successfully making it to the sea. It is a recommendation of this Recovery Action Plan that a series of Town Meetings be convened to discuss the issue of protecting endangered sea turtles. During these gatherings, the complex life history of sea turtles should be explained, as well as their precarious status region-wide (see section 4.42 for discussion points). As part of the CFRAMP initiative, a number of Fisheries Management Workshops will be convened in St. Lucia in 1994, including one focused on sea turtles. This would be an excellent opportunity to solicit feedback from the fishing community on how best to phase-in and enforce full protection for sea turtles.

4.27 Determine incidental catch and promote the use of TEDs

Migratory pelagic fishes harvested by hand trolling from outboard powered canoes account for about 70% of annual landings. Other technologies used in St. Lucia, especially during the "low season" for the pelagic stocks (i.e., July-December), include fish traps, bottom gill nets, and bottom longlines (CCA/IRF, 1991). Some anecdotal data regarding incidental capture are available. For instance, turtles are occasionally caught in beach seines or gill nets set for fish, and in May 1993 a green turtle drowned after becoming entangled in the buoy line of a fish pot. The full extent of incidental capture is not known. It is a recommendation of this Recovery Action Plan that all cases of sea turtle capture, as well as the fate of the animal, be reported to the Fisheries Officer (Tel: 26172). Mitigating measures should be imposed where necessary (e.g. closed seasons and areas, gear modification, requirements that nets not be left unattended).

In some parts of the Wider Caribbean, the incidental catch and subsequent drowning of sea turtles in longlines is a growing concern. There is no longline industry in St. Lucia. So-called "bottom longlines" (branched lines from a single vertical line anchored at the bottom, floated at the top, and hauled by hand) are common, but do not appear to catch sea turtles. The Department of Fisheries operates the only vessel equipped to engage in mechanised longlining for tuna and billfish. There is no commercial use of this technology at the present time, but the Department is developing the technology for local industry. Fisheries personnel should be aware that the longlining industry has the potential to accidentally catch and kill sea turtles during normal operations. The capture of leatherbacks by longlines is documented in the northeastern Caribbean Sea (Cambers and Lima, 1990; Tobias, 1991), Gulf of Mexico (Hildebrand, 1987), and southeast U. S. (Witzell, 1984). Leatherbacks and loggerheads are captured on longlines in Antigua (Fuller et al., 1992).

Trawls are not used in St. Lucia and thus trawl-inserted "turtle excluder devices" (TEDs) are not relevant to local fishing operations. TED technology is crucial to sea turtle survival in the region, however, because shrimping fleets operating off continental coastlines (South and Central America, Gulf of Mexico, eastern seaboard of the USA) drown tens of thousands of sea turtles every year (National Research Council, 1990) and are partly or largely responsible for dramatic declines in olive ridleys in Suriname (Reichart and Fretey, 1992), Kemp's ridleys in Mexico (Ross et al., 1989), and loggerheads in the USA (e.g., Hopkins-Murphy and Murphy, 1988). It is a recommendation of this Recovery Action Plan that the Government of St. Lucia support the use of TEDs throughout the Western Atlantic.

4.28 Supplement reduced populations using management techniques

Methods described in the Manual of Sea Turtle Research and Conservation Techniques (Pritchard et al., 1983), the scientific support of WIDECAST personnel, and the knowledge and contacts obtained by St. Lucia being represented at the Annual Symposium on Sea Turtle Biology and Conservation (convened each year in the USA) have to date been very useful in formulating management strategies. Our present management priorities are to (1) revise legislation, (2) improve enforcement, (3) designate protected areas, and (4) undertake nightly beach watches. To this end, we have also found very useful the knowledge gained from the Western Atlantic Turtle Symposia (WATS) and from our own field experience. In order to enhance hatch success on east coast beaches where leatherback nests are regularly lost to erosion, we have proposed a programme of nest relocation and protection. SLNS has requested the necessary permits from the Department of Fisheries and has asked WIDECAST to sponsor a local workshop specifically focused on tagging, nest relocation, and data analysis. Tagging as a management technique is viewed as useful since virtually nothing is known about intra- and inter-seasonal nesting frequency.

Fenced egg hatcheries should be used only if absolutely necessary. The artificial incubation of eggs and the improper handling of eggs and hatchlings can be disastrous. The decision to move eggs should be made at the time of laying. If eggs are moved after the first 24 hours, the risk is high of dislodging the tiny embryo from the inner lining of the eggshell and killing it. Sometimes a compromise has to be made. If for example eggs are being washed away, such as by a storm surge, an attempt to salvage the clutch is prudent. There may be a steep decline in the

hatch success of the rescued nest, but this would be preferable to a total loss. Eggs should always be handled with great care and reburied on a natural beach, preferably the one where the female made the original nest. The new nest should be dug to the same depth as the original nest and in the same type of habitat (open beach vs. beach forest) so that the temperature of incubation (which determines the sex of the hatchlings) is not altered. Hatchlings should always be allowed to emerge from the nest naturally and traverse the beach unaided as soon as they emerge.

4.29 Monitor stocks

Sea turtle populations, at least local breeding stocks, should be closely monitored for long-term fluctuations in numbers that will reveal the success or failure of conservation efforts. Since it is neither practical nor necessary (at least from a data collection perspective) to monitor all breeding areas, it is a recommendation of this Recovery Action Plan that Index Beaches be selected for long-term study. Volunteers will likely be needed to participate in the monitoring effort and training workshops should be convened as needed (see section 4.55). Research to provide statistical estimates of stocks will be encouraged and a long-term stock assessment programme to identify trends over a period of decades will be developed [N.B. population monitoring should continue for at least one sea turtle generation; that is, about 25 years]. A Lead Organisation, logically the Department of Fisheries, should be designated to function as a repository for statistical data. Since it is likely that both the Department and the SLNS will continue to participate substantively in the monitoring effort, we recommend that the SLNS provide yearly reports to the Department of Fisheries summarising their turtle conservation activities, data collected, and recommendations.

The following subsections articulate standard guidelines for monitoring nests, hatchlings, and the larger size classes of turtles. A preliminary time-table and budget for the monitoring effort are presented in section 4.6.

4.291 Nests

Monitoring the deposition of eggs provides a wealth of useful information, including the distribution and timing of the breeding effort, the species involved, the location of the most important breeding habitats, and nest fate. Any successful management programme must be based on accurate estimates of productivity (the number of nests laid) and mortality (losses due to erosion, feral animals, crabs, birds, mongooses, poachers, etc.). Monitoring nests will also provide baseline data with which to evaluate the success of nest and habitat protection efforts. Positive results may not be seen right away, however, since eggs protected today are not likely to mature into breeding adults for two decades or more.

The Department of Fisheries and the SLNS (with students of various Secondary Schools and other volunteers) have been monitoring nesting at Grande Anse since 1983. In addition, a number of beaches on the east coast (Donkey Beach to Point Sable; Figure 2) were monitored irregularly in 1992 and twice-weekly in 1993 (June-October) by Presley James of the SLNS. We hope that resources will become available for the aerial survey of some of the more isolated beaches. The assistance of hotel staff, dive clubs, and pleasure-boat operators will also be sought to complete the monitoring effort.

An island-wide survey, as recommended in section 4.112, is needed to determine with confidence which areas are most used by green and hawksbill turtles. At least two beaches with the most nesting activity should be carefully protected from activities that will compromise the suitability of the habitat to support sea turtle nesting. Since these beaches represent the most important nesting areas for endangered sea turtles in St. Lucia, it is vital to preserve them as focal points for conservation, management, and monitoring. These beaches will be referred to as "Index Beaches" and it is a recommendation of this Recovery Action Plan that they be targeted for comprehensive study. Grande Anse is the logical choice for leatherback turtles. Data collected from these will enable the Fisheries Department to evaluate the success of conservation and recovery measures implemented on behalf of sea turtles. These beaches should be monitored for nest and hatch success, by species, during the full breeding season (at least 1 April-30 November). The data should be centrally compiled. Field workers should receive preparatory instruction prior to their survey efforts (see section 4.55).

Nest monitoring efforts to date have relied on reports from residents and crawl counts obtained by Fisheries personnel, local volunteers, or visiting biologists. The number of crawls counted has formed the basis for comparison among beaches and among years. With the possible exception of Grand Anse, it cannot be said that there has been reliable differentiation between successful egg-laying (a nesting crawl) and unsuccessful egg-laying (a "false crawl"). Such a determination is problematic after the fact. Whether or not eggs are deposited depends on obstacles (erosion bluffs, fallen trees, beach lagoons) encountered by the female during the course of her time on the beach, disturbance (human activity, dogs, lighting), the physical condition of the site chosen (she may encounter impenetrable roots or water or the sand may be too dry to hold a nest cavity), and injuries such as a missing flipper. A nest:false crawl ratio is best determined from all-night patrols and will permit an estimate of nest density from crawl tallies obtained during day census efforts. Pending financial support for comprehensive surveying, full advantage should be taken of the willingness of volunteers to walk beaches and collect data on nest distribution and abundance.

While it is usually difficult to confirm eggs during day surveys, in some cases the outcome is obvious. For example, sometimes it is clear that a turtle returned to the sea without attempting to dig. This is a "false crawl" and should be reported as such. Alternatively, when a poacher or predator has exposed eggs, or hatchlings are observed, nesting can be confirmed. When the activity site includes both a crawl and an associated disturbance which may or may not contain eggs, distinguishing a true nest from an unsuccessful attempt is challenging even for an experienced worker. Probing for the eggs with a sharp stick will sometimes confirm the presence of a nest, but this is strongly discouraged because subsequent bacterial invasion of the broken eggs may destroy the entire nest. In the case of hawksbill nests in dense vegetation, even finding a site suitable for probing can be difficult. Hence the logic that crawls, rather than nests, be the basis of reporting. When a crawl has been counted, it should be disguised with a palm frond or a gentle sweeping motion of hands or feet in order to dissuade possible poachers from finding the site and also to prevent the crawl from being counted twice.

Identifying a fresh crawl to species is easy in many cases, since sea turtles leave either a symmetrical or an asymmetrical track in the sand. In the first case, the pattern is made by the simultaneous movement of the fore-flippers. In the second case, the pattern alternates like a zip-

per, a result of the turtle moving her front flippers in an alternating rhythm. Leatherbacks leave a deep, symmetrical crawl about 2 m in width. Green turtles also leave a symmetrical crawl, but it is only about 1-1.2 m in width and the nest site is often characterised by a deep, solitary pit sometimes measuring 1 m or more more in depth and breadth. Hawksbills and loggerheads leave an asymmetrical crawl, the hawksbill about 0.7 m in width and the loggerhead about 1-1.2 m in width. The hawksbill crawl is often faint since the animal averages a mere 54 kg (Caribbean Nicaragua: Nietschmann, 1972 *in* Witzell, 1983). Loggerheads are typically twice as massive, averaging about 116 kg in Florida (Ehrhart and Yoder, 1978 *in* Dodd, 1988). Hawksbills prefer to nest in the shelter of Coccoloba or other beach vegetation. [N.B. Loggerhead nesting has never been verified in St. Lucia.]

Once the nest:false crawl ratio has been determined for a beach and the number of nests laid (per species) is known, a knowledge of the average number of clutches laid per female (which varies slightly amongst species and can be gleaned from well-studied populations elsewhere in the region) can be used to estimate the number of breeding females at that site. As a general rule, leatherbacks average 6-7 nests per summer, hawksbills 5 nests, and green turtles 4-5 nests. Sixty leatherback tracks on a beach may represent only 48 actual nests, which in turn represent only *six* adult females. To obtain a more accurate assessment of the number of females nesting per year on a particular beach, as well as the return intervals both within and between seasons by individuals, all-night patrols must be undertaken by trained personnel and the tagging of nesting females initiated.

Turtle tagging is not something to be undertaken lightly. It is time-consuming and can be expensive. Most importantly, not much is learned about nesting dynamics from tagging for a year or two. A long term research commitment is requisite to gain knowledge beyond that obtained from daily nest counts. It is imperative, too, that accurate records be kept. Despite the fact that tags were sometimes applied to turtles in St. Lucia during the years 1982-1990, these records appear to have been lost. It seems that turtles were tagged both on night watches (17 leatherbacks and 1 green turtle were tagged at Grande Anse) and occasionally when juvenile green (n = 8) or hawksbill (n = 1) turtles were caught at sea, primarily in the Micoud area, but details are sparse. In the absence of a registry of applied tag numbers, recapture information lacks meaning.

4.292 Hatchlings

Any successful management programme must be based upon credible estimates of reproductive success. Thus, while nest counts are vital (see above), follow-up at the hatchling stage is also important. Estimates of mortality, including losses due to erosion or high seas, domestic or feral animals (dogs, pigs), natural predators (crabs, mongooses, birds) and poachers should be obtained. Dogs appear to be a particular threat to eggs and hatchlings at Vigie Beach in Castries (P. James, pers. comm., 1993). Other threats should also be watched for and reported. These might include entrapment in debris or tyre ruts, entanglement in beach vines, disorientation by artificial lighting, and/or harassment by onlookers. Some information can be collected on an opportunistic basis, such as disorientation, depredation, or the spilling of eggs from a bluff created during a storm. In addition, it is useful if some nests are marked for study. It is not recommended that the nest site *per se* be marked, but rather the distance from the nest site to two

proximal objects, such as trees or other landmarks, should be recorded so that the site can be precisely located by triangulation prior to hatching two months later. Photographs taken in three directions while standing over the nest are a useful reference.

Hatchlings can be expected after about 55-72 days of incubation. Hatchling emergence at the beach surface usually occurs at dusk. Predators, disorientation, and/or entanglement at the time of emergence should be noted. If the emergence is missed, the hatch can be confirmed by the presence of dozens of little tracks leading from the nest site to the sea. After a day or two has passed, the nest can be excavated and the number of hatchlings roughly estimated from the remains of broken egg shells. In addition, unhatched (whole) eggs can be counted to determine the proportion of eggs which did not produce hatchlings. These eggs can be opened for an analysis of embryo stage death. If a particular problem recurs, such as nest flooding, then a conservation programme to move eggs either at the time of laying or early the next morning to higher ground should be considered. In this case, it is crucial that nest dimensions (depth and width) reflect the original so that incubation temperature and hence hatchling sex is not distorted. An in-depth evaluation of hatch success should be undertaken by trained personnel at selected important nesting beaches as soon as resources permit. Hatchlings should not be retained in captivity.

4.293 Immature and adult turtles

The monitoring of juvenile and adult turtles at sea requires special preparation and can be considerably more difficult than counting nests or evaluating hatchling mortality. In order to monitor foraging juveniles, systematic surveys of specific foraging grounds must be undertaken. If such survey work is undertaken in conjunction with a tagging programme, it is possible to evaluate both the foraging periodicities of individuals and their movements (should a tagged turtle turn up at some point distant from where it was tagged, for instance). It is not necessary, however, to tag individual turtles. Valuable information can be gained by repeated observation of foraging areas and reporting the number of turtles seen. Resources are not available at the present time to initiate population surveys at sea, nor is this seen as a top priority in St. Lucia. It is sufficient at this time to work toward full (and enforced) protection of sea turtles and a long-term commitment to the preservation of nesting beaches, coral reefs, and sea grass.

4.3 Encourage and Support International Cooperation

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 recognisable parts of 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.

St. Lucia ratified the Convention in December 1982 (Br„utigam, 1987) and no imports of hawksbill shell to Japan were recorded after 1983 (Milliken and Tokunaga, 1987) (see also section 3.3). Some nations in the region have taken CITES very seriously, others have been largely unable to maintain the level of Customs surveillance necessary to enforce the treaty, still others do not yet belong. Thus the Caribbean continues to export large quantities of threatened and depleted species products, including sea turtles (Milliken and Tokunaga, 1987). In 1988, Japan imported from the Wider Caribbean the tortoiseshell from nearly 12,000 adult hawksbill turtles (Canin, 1989). Many thousands of sea turtles would be saved each year if all Caribbean nations would ratify CITES and enforce its trade restrictions. CITES has no effect on habitat restriction or the harvest of sea turtles for subsistence or internal markets; these activities must be regulated at the national level.

St. Lucia (represented by Martha Biscette of the Customs and Excise Department and Brian James of the Department of Forestry) attended the Caribbean CITES Implementation Training Seminar held in Trinidad, 14-18 September 1992. This comprehensive seminar, hosted by the Government of Trinidad and Tobago and the CITES Secretariat, was convened to familiarise Eastern Caribbean governments, especially non-CITES parties, with the Convention. It is a recommendation of this Recovery Action Plan that Customs officials and other relevant parties be fully supported at all levels of Government in their important and difficult task of implementing the provisions of the CITES treaty.

4.32 Regional treaties

In March, 1983, a Conference of Plenipotentiaries met in Cartagena, Colombia, to negotiate a UNEP Regional Seas Convention in the Caribbean -- the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention). Representatives from 16 States participated, including St. Lucia. 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., ships, at-sea dumping, land-based sources, sea-bed activities, and 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." St. Lucia ratified the Convention on 30 September 1984.

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 pos-

sible, 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 to include all six species of sea turtle inhabiting the Wider Caribbean (i.e., Caretta caretta, Chelonia mydas, Eretmochelys imbricata, Dermochelys coriacea, Lepidochelys kempii, and 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. It is a recommendation of this Recovery Action Plan that St. Lucia ratify the SPAW Protocol with its Annexes at the earliest possible opportunity. Finally, St. Lucia should attempt whenever possible to ratify other regional conventions in order to strengthen the drive to protect sea turtles, as well as other living resources.

The 1973 MARPOL treaty (with 1978 Protocol) is important to the survival of sea turtles. This Convention has five Annexes that give detailed technical specifications regarding the way in which a ship must be built and equipped to prevent major pollution of the marine environment in case of accidents, and also norms and technical requirements to minimize operational discharges. The five Annexes are for oil, chemicals in bulk, packaged chemicals, liquid sewage, and garbage. Regarding Annex 5 (garbage), it has been proposed to the International Maritime Organization (IMO) by the nations of the Caribbean that the Caribbean Region be declared a "Special Area". This proposal has been accepted, but will only come into force when the nations have put in place the facilities to receive garbage on shore. It is a recommendation of this Recovery Action Plan that St. Lucia ratify MARPOL as soon as practicable.

4.33 Subregional sea turtle management

It is well known that sea turtles are highly migratory. Information on the movement of tagged turtles includes a report in Carr et al. (1982) that a green turtle originally tagged while nesting on Aves Island (Venezuela) was subsequently captured near Vieux-Fort, St. Lucia. Leatherbacks migrate over especially long distances; there are many accounts of females tagged during nesting in the Caribbean and subsequently found in the Gulf of Mexico, New England, and even west Africa. Studies of barnacle colonization on leatherbacks nesting on St. Croix (USVI) indicate that gravid females depart from and later return to north temperate latitudes (Eckert and Eckert, 1988). It is therefore quite obvious that "our" leatherbacks, and other species as well, swim through the waters of many nations on their way to nest on the beaches of St. Lucia.

Tagging turtles, as well as watching for tagged turtles on our beaches and in our waters, is a necessary prerequisite to more fully documenting the extent of shared sea turtle stocks. A cooperative tagging and monitoring programme that includes at least St. Lucia, St. Vincent and the Grenadines, Barbados, and Grenada would be most useful. This is proposed in the WIDECAST Sea Turtle Recovery Plan for Barbados (Horrocks, 1992) and is supported in St. Lucia.

When it is established that nations share sea turtle stocks in common, it will be necessary to discuss ways and means of jointly managing and conserving the shared resource. The fact that all nations of the Wider Caribbean are participating in the sea turtle conservation planning activities of WIDECAST speaks well of the region's willingness to work co-operatively to recover depleted populations. It is a recommendation of this Recovery Action Plan that St. Lucia fully support region-wide sea turtle conservation initiatives by ratifying the SPAW Protocol to the Cartagena Convention (section 4.32) and urging neighbouring countries to enact moratoria on the capture and sale of sea turtles year-around.

4.4 Develop public education

In order to create among people an awareness of the biology and endangered status of sea turtles, it is a recommendation of this Recovery Action Plan that a national education programme be implemented. Various media should be used to achieve maximum results. Ongoing and anticipated initiatives are discussed below.

4.41 Residents

Laws designed to protect sea turtles in St. Lucia are widely ignored, fueling an entirely unacceptable level of exploitation of all species and their eggs. It is an urgent recommendation of this Recovery Action Plan that efforts to educate the national citizenry be a top priority. Since 1983, the Department of Fisheries has implemented an outreach programme consisting primarily of slide presentations, lectures, and the distribution of printed matter. The Department is hoping to step up its activities to include public schools and some of the more isolated fishing communities.

The SLNS has also been very involved in public education efforts, providing slide shows, media articles, and highlighting sea turtle conservation activities in their newsletter, *News and Views*. Time and resources permitting, the SLNS should become even more involved in making presentations to schools, since the children are the future resource users and managers. Civic and youth groups will be encouraged to join the SLNS in incorporating conservation messages, and especially information about endangered species such as sea turtles, in their community outreach activities.

We hope that video documentaries will become available in the near future and we fully support the efforts of WIDECAST to produce a video for use throughout the region. Ideally, coastal residents should be encouraged to become involved in monitoring nesting habitat and protecting sea turtles, eggs, and hatchlings. The assistance of WIDECAST has been solicited in the design, printing, and distribution of a brochure and posters on the subject of sea turtle conservation.

4.42 Fishermen

There is a need for specific extension work on the subject of sea turtle conservation. We recommend that informal Town Meetings be planned in key communities to focus on the subject of sea turtle biology and the need for an indefinite moratorium on the harvest of turtles and their

eggs. In this way, fishermen would learn why late-maturing, long-lived species such as turtles must be managed very differently from the way most fishes are managed, they would have an opportunity to see that the Government is serious about the protection of sea turtles, and they would have a chance to discuss ways in which the transition to a zero quota could be eased. It is a recommendation of this Recovery Action Plan that all efforts be made using Extension personnel of the Department of Fisheries to inform fishermen about the plight of sea turtles, to discourage fishermen from breaching regulations, and to encourage reporting of violations. Fishermen should be invited to participate in surveys and to provide relevant information (i.e., turtle sightings) to the Department.

The following points should be emphasised to turtle fishermen and their colleagues:

1. Sea turtles are long-lived, reaching sexual maturity in 20-35 years.
2. Mortality is high in young juveniles, but very low for fully armoured large juveniles and adults.
3. Adult females average five clutches of eggs per year and nest every 2-5 years; under natural conditions females live for many years and lay thousands of eggs to ensure population stability.
4. Unfortunately, large turtles have historically been targeted because they provide the most meat; Fisheries laws usually protect only small turtles.
5. Egg-bearing adult females are taken in disproportionate numbers because they are easily obtained from the nesting beach.
6. Over-harvesting large turtles, especially gravid females, is a sure way to invite population collapse (this has been observed at rookeries throughout the world and is easily shown mathematically).
7. Sea turtle populations *cannot sustain* the persistent harvest of large juvenile and adult animals.
8. Nesting populations have been greatly reduced or exterminated all over the Caribbean, including St. Lucia, because adults are not surviving long enough to produce the next generation (the widespread harvest of eggs only exacerbates this problem).
9. The fact that nesting populations are crashing but juvenile turtles are still seen in local waters is not surprising -- the two stocks are unrelated.
10. Juveniles travel widely during the many years prior to maturity – local juveniles are not residents, they are a shared regional resource.
11. Nesting females, which return to St. Lucia at regular intervals to lay their eggs on beaches where they were born many years ago, leave St. Lucia at the end of the nesting season and return to resident feeding areas which are most likely located in distant countries.
12. All nations must work together if this shared and endangered natural resource is to survive.

4.43 Tourists

It is a recommendation of this Recovery Action Plan that the Department of Fisheries, as part of its ongoing education programme, make brochures concerning the marine environment in

general and the endangered status of sea turtles in particular available at hotels and ports of entry. Colourful posters should be placed in strategic locations. Hotels have already been provided with notices to solicit information from visitors and hotel staff regarding any turtle sightings. In the past, tourists have accompanied members of the Department of Fisheries and the SLNS on "turtle watches" after paying a fee. This has proven to be a useful and educational exercise and we recommend that it be resumed in the future if beaches can be located where sufficient turtles are still nesting to warrant the excercise.

4.44 Non-consumptive use of sea turtles to generate revenue

At one time it would have been possible to design a programme where tourists paid local guides to lead them to the Grande Anse nesting beach to witness the leatherback turtles. This has been a significant source of community income in other areas (e.g., Trinidad) and has proven an excellent lure for guests at selected hotels that sponsor sea turtle conservation programmes on their beaches (e.g., Long Island, Antigua). However, field surveys conducted by the SLNS since 1991 indicate that virtually every female coming ashore to nest on Grande Anse has been killed. This lawless behaviour on the part of a small band of poachers has effectively eliminated the opportunity for local villages to capitalize on sea turtle eco-tourism. It is unlikely that there are other beaches in St. Lucia where eco-tourism is possible, but in the event that such initiatives are undertaken, it is vital that a trained Guide or Warden supervise the beach walks and that appropriate beach etiquette be maintained (e.g., no flash pictures of nesting females). WIDECAST is currently designing a techniques manual for use in designing sea turtle eco-tour-ism ventures.

4.5 Increase Information Exchange

4.51 Marine Turtle Newsletter

This Newsletter is regularly received by the Fisheries Department, Forest and Lands Department, Castries Central Library, Ministry of Planning's Documentation Centre, St. Lucia National Trust, and members of the SLNS. It is viewed as an invaluable source of information. The Newsletter is distributed free of charge to interested readers in more than 100 countries and focuses on sea turtle research and conservation issues around the world. It is available from the Editors upon request: Marine Turtle Newsletter (Attn: Karen and Scott Eckert, Editors), Hubbs-Sea World Research Institute, 2595 Ingraham Street, San Diego, California 92109 USA.

4.52 Western Atlantic Turtle Symposium (WATS)

St. Lucia participated in both the first (Murray, 1984) and second (Charles, 1987) Western Atlantic Turtle Symposia (WATS). The Government intends to continue to participate in this valuable regional database. The WATS Manual of Sea Turtle Research and Conservation Techniques (Pritchard et al., 1983) has been distributed to all concerned organisations.

4.53 WIDECAST

The Wider Caribbean Sea Turtle Recovery Team and Conservation Network (WIDECAST) consists of a regional team of sea turtle experts who work closely with in-country Coor-

dinators. National Coordinators 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 St. Lucia, 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. Specifically, to develop and support a technical understanding of sea turtle biology and management among local individuals and organizations 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 organizations with the implementation of effective management and conservation programmes for sea 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 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. The WIDECAST Coordinator in St. Lucia is Mr. Crispin d'Auvergne, former Conservation Fisheries Officer and now National Coordinator for the ENCORE project (Ministry of Planning). The Lead Organizations for implementation are the Fisheries Department (tel:

452-6172, 452-3987) and the SLNS (Crispin d'Auvergne, Chairman; tel: 451-6957). WIDECAST is viewed as an important mechanism for cooperation and the exchange of information, as well as for support in conservation planning and programme implementation on behalf of endangered sea turtles.

4.54 IUCN/SSC Marine Turtle Specialist Group

The Marine Turtle Specialist Group (Dr. Karen Bjornal, Chair) is responsible for tracking the status of sea turtle populations around the world for the World Resources Union (IUCN) Species Survival Commission (SSC). The Group is presently drafting an outline for a global Marine Turtle Action Plan. The Group is a valuable source of information about sea turtles and technical advise on conservation projects. Contact Dr. Karen Bjorndal, Archie Carr Center for Sea Turtle Research, c/o Department of Zoology, University of Florida, Gainesville, Florida 32611 USA.

4.55 Workshops on research and management

Prior to the implementation of field surveys or other sea turtle conservation projects, participants should be educated concerning basic sea turtle ecology. This training would logically include the identification of sea turtle species, whether the evidence available was a live turtle, a hatchling, an egg, or a crawl on the beach. Additional detail, provided as needed, should include the proper way to conduct beach patrols, tag turtles, move eggs, survey by air, etc. The Department of Fisheries presently trains persons involved with sea turtle field work in St. Lucia. Support and expertise will be sought from WIDECAST. Also useful would be formal field instruction at the annual sea turtle training course in Tortuguero, Costa Rica (Caribbean Conservation Corporation, P. O. Box 2866, Gainesville, Florida 32602 USA). Finally, WIDECAST has offered to provide members of the sea turtle conservation community in St. Lucia with opportunities to work for short periods on specific field projects elsewhere in the Wider Caribbean.

4.56 Exchange of information among local groups

The Department of Fisheries, the SLNS, the St. Lucia National Trust, and the Forestry Division work co-operatively on sea turtle conservation issues. This is encouraged as a way to maximise the expertise and resources that can be brought to bear on a particular conservation problem or activity. We recommend that the national media become more involved in stressing the importance and immediacy of sea turtle conservation.

4.6 Implement a National Sea Turtle Conservation Programme

4.61 Rational

It is clear from the information provided in this Recovery Action Plan that three species of sea turtle nest on beaches in St. Lucia. A fourth, the loggerhead, is believed to occur in coastal waters from time to time. At least two species (green and hawksbill turtles) feed and take refuge in coastal coral reefs and sea grass meadows. Turtles have been hunted on a subsistence basis for centuries and harvested commercially for many years. Today there are two main fac-

tions within the hunting community, (1) fishermen who catch turtles at sea, generally green turtles and hawksbills, on a part-time or opportunistic basis (this occurs both legally and illegally) and (2) poachers who remove turtles wholly illegally from the nesting beach in contravention both of the closed season and regulations prohibiting the disturbance of nesting turtles and their eggs. In the latter case, leatherback carcasses are often left to spoil after the eggs and sometimes the heart and liver have been removed. Sustained exploitation and the destruction of critical habitat has led to serious population declines. St. Lucia is not alone in this regard, for sea turtles are endangered worldwide and significant resources are being expended by many nations to promote their conservation.

Co-ordinated efforts at sea turtle conservation in St. Lucia began in 1983 when the Department of Fisheries (hereafter the Department) began night patrols on the east coast beach of Grande Anse in order to quantify the extent of nesting there. Since then, weekend patrols have continued at Grande Anse during the leatherback nesting season (March-July). Much assistance has been received from the St. Lucia Naturalists' Society (hereafter the SLNS) and the general public in this regard. In addition, the Department has made every effort to determine the extent of nesting island wide. Several reports, both published and unpublished, on the subject of sea turtles have been prepared (e.g., d'Auvergne, 1984; d'Auvergne et al., 1989; numerous in-house Department of Fisheries reports). At this time the survival of sea turtles in St. Lucia is jeopardised by two main factors, (1) the legal and illegal harvesting of animals and eggs and (2) the destruction of habitats, especially sandy beaches. Turtle conservation efforts in turn have been hampered by a number of problems. These include:

1. Turtle watches, even at Grande Anse (the major nesting beach), have been sporadic because volunteers are available only on weekends and reliable transport is a chronic problem. At present, it is not possible to employ persons to carry out watches throughout a season.

2. Most of the major turtle beaches are on the northeast coast and are very remote. The Department owns four-wheel drive vehicles, but they are often needed for other purposes and it is not always possible to obtain transportation to carry out patrols or surveys, especially at night.

3. The lack of vehicles and manpower restricts the Department and the SLNS to carrying out patrols mainly at Grande Anse. It would be highly desirable to work in other areas without neglecting Grande Anse.

4. Due to the infrequency and irregularity of watches, poachers and sand miners are often able to kill turtles or dig nests without being caught. Two dozen or more leatherbacks have been killed in one season at Grande Anse, with an unknown level of mortality at other beaches.

5. Because of the informal disposal of turtle meat and eggs it is usually difficult to determine levels of exploitation. This situation is made worse by the fact that most poaching occurs in isolated areas and law enforcement is difficult.

6. The coastline of St. Lucia is possessed of many beaches (about 70). It is difficult to carry out regular and comprehensive field surveys of all these often isolated beaches throughout the year.

7. A lack of funding prevents the Department from carrying out a number of important activities, such as: (a) buying turtle fishing nets from the fishermen, (b) purchasing turtles for tagging and release, (c) purchasing tags and tagging equipment, (d) offering a reward for information about tagged turtles, (e) conducting aerial surveys of remote areas, and (f) offering effecttive education programmes to fishermen and other resource users.

The inconsistent execution of conservation activities, for the many reasons outlined above, has made it virtually impossible to arrive at accurate conclusions on such critical factors as the size of breeding populations, nesting frequency and success, the size distribution and abundance of turtles in our waters, and the levels of legal and illegal exploitation.

4.62 Goals and objectives

Two project goals have been identified and are as follows: (1) to obtain comprehensive and accurate data on turtle nesting and distribution and (2) to promote the conservation and recovery of remaining sea turtle stocks. These goals are reflected in the following objectives:

1. Provide comprehensive coverage of at least one major nesting beach (e.g., Grande Anse) and expanded coverage, by ground study or aerial survey, of selected secondary beaches.

2. Reduce poaching of turtles and eggs.

3. Increase public awareness of the status of sea turtles, thereby enhancing the effectiveness of conservation and law enforcement initiatives.

4. Increase availability of educational materials to schools, civic groups, hoteliers, government personnel, and others interested in sea turtles and their habitat needs.

5. Provide consistent enforcement surveillance of at least two major nesting beaches.

6. Analyze data with a view to using information derived for future sea turtle management decisions.

4.63 Activities

1. Hold watches or daylight patrols at Grande Anse every night (or day) during three consecutive nesting seasons. Paid personnel will be assisted by volunteers whenever possible.

2. Carry out four or five aircraft island-wide surveys of beaches during the nesting season for two consecutive years.

3. Provide a four-wheel drive vehicle (including fuel and maintenance) to access remote areas.

4. Carry out turtle watches at beaches apart from Grande Anse. This will be possible with the co-operation between the Department of Fisheries, the SLNS, and resident (village) volunteers.

5. Train workers in turtle data collection methods. Where possible, persons may attend programmes overseas, such as the one held at Tortuguero in Costa Rica. Provide funds for persons to participate in workshops and symposia overseas, such as the Annual Conference on Sea Turtle Biology and Conservation convened in the southeastern USA each year.

6. Provide field and camping equipment for turtle watches, as well as data collection materials (measuring tapes, tags, flashlights, etc.).

7. Provide funds for purchase (buy-back) of fishing gear, payment of rewards for tag returns, and purchase of turtles for tagging and release.

8. Purchase audio-visual materials and literature on sea turtle biology and conservation for research and education purposes. The Department has an ongoing environmental education programme. WIDECAST will assist the Department in the design and printing of a sea turtle brochure and will donate a set of slides.

9. Produce or purchase brochures, leaflets, poster, and/or newspaper supplements on sea turtles. Again, WIDECAST will assist.

10. Assign a Fisheries Department biologist or intern to co-ordinate sea turtle programme activities. He/she will be assisted by Department staff when and as necessary.

4.64 Results

From the activities (see section 4.63) which have been designed to carry out the goals and objectives of the Sea Turtle Conservation Project, we anticipate that there will be several tangible results at the end of a three-year period. These can be summarised as follows:

1. Daily coverage of Grande Anse beach for two full nesting seasons. All three species of turtle known to nest on the island do so at Grande Anse, making this beach the main nesting area on the island. As such, more data will be collected per unit effort there than elsewhere.

2. Increased coverage of secondary nesting areas (at least two other beaches).

3. Significant improvement in the transportation situation. By acquiring a vehicle, the Department can engage in consistent field work, respond effecttively to reports of nesting, hatching, poaching, stranding, and offer a regular programme of public education.

4. Increased manpower capability through hiring and through training.

5. Increase public awareness of the status of sea turtle species in St. Lucia and their conservation needs, including increased involvement by villagers and other land owners (e.g., beach-front hotels).

6. Significant reduction in poaching.

7. Accurate estimate of the annual number of nesting females per species, nest fate, and hatching success.

4.65 Budget

Budget Item	**D/G ***	**Year 1**	**Year 2**	**Year 3**	**Total EC$**
Wages for Grande Anse Wardens (2 wardens at $700/mo for 8 mo/yr for 3 years)	D	--	--	--	--
	G	11200	11200	11200	33600
Wages for security guard at Grande Anse	D	18000	18000	18000	54000
	G	--	--	--	--
Fisheries Biologist salary	D	--	--	--	--
	G	30000	30000	30000	90000
Salaries and subsistence for other Fisheries staff	D	--	--	--	--
	G	25000	25000	25000	75000
Wages for patrol personnel (4 watchers at $500/mo for 8 mo/yr for 3 yr)	D	16000	16000	16000	48000
	G	--	--	--	--
Vehicle (duty-free)	D	35000	--	--	35000
	G	--	--	--	--

Budget, *continued*.

Budget Item	**D/G ***	**Year 1**	**Year 2**	**Year 3**	**Total EC$**
Vehicle fuel and maintenance service	D	5000	2500	--	7500
	G	--	2500	5000	7500
Helicopter/aeroplane flights (1/mo for 8 mo/yr for 2 years at $2025/one hour flight)	D	16200	16200	--	32400
	G	--	--	--	--
Buy-back of nets	D	60000	--	--	60000
	G	--	--	--	--
Purchase of turtles for tagging and release	D	700	700	600	2000
	G	--	--	--	--
Training/Workshops	D	6000	6000	6000	18000
	G	--	--	--	--
Audio-visuals, literature, educational materials	D	6000	1500	1500	9000
	G	--	--	2000	2000
Tags and pliers	D	400	200	200	800
	G	400	200	200	800
Field supplies (e.g., measuring tapes)	D	400	200	200	800
	G	400	200	200	800
Tents (3 at $600)	D	1800	--	--	1800
	G	--	--	--	--
Stoves (2 at $350)	D	700	--	--	700
	G	--	--	--	--
Communication radios	D	2000	--	--	2000
	G	--	--	--	--
Rewards for tag return	D	2000	--	--	2000
	G	--	--	--	--
Miscellaneous (maps, batteries, first aid, cooking gas, etc.)	D	1000	1000	--	2000
	G	--	--	1000	1000

Budget, *continued*.

Budget Item	**D/G ***	**Year 1**	**Year 2**	**Year 3**	**Total EC$**
10% Contingencies	D	17120	6230	4250	27600
	G	6700	6910	7460	21070
SUBTOTAL					535370
Computer time **					6000
GRAND TOTAL				EC$	541370

Donor Contribution	$303,600 (÷ US$ 114,600)
Government Contribution	$231,770
Private Sector Contribution	$ 6,000

* D = Donor Contribution; G = Government Contribution

** Computer time donated by Computer Power, St. Lucia

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Table 1. Recorded nestings of sea turtles in St. Lucia, 1983-1993, with literature records from Bacon (1981), Carr et al. (1982), and Murray (1984). CM = green turtle (Chelonia mydas), EI = hawksbill (Eretmochelys imbricata), DC = leatherback (Dermochelys coriacea), CC = loggerhead (Caretta caretta), and ?? = unidentified. The data are acknowledged to be fragmentary and preliminary; loggerhead records, in particular, are questionable. Green turtles may nest in low numbers but, with the exception of Grande Anse beach, data are not available. Comprehensive field surveys are needed to verify the distribution and timing of the breeding effort. "Personal observations" are those of the senior author, C. d'Auvergne.

Location	Species	Activity/Comments	Source
1. Saline Point	??	Nest/eggs found	hotel staff
	EI	Nesting	Bacon (~1981)
2. Cariblue	EI	Nesting	Murray (1984)
3. Anse Becune	EI	Nesting	Bacon (1981)
4. Pigeon Island	EI	2 nests, 7/93; 1 poached	Nat'l Trust staff
	EI	Nesting	Bacon (1981)
	CC	Infrequent nesting	Carr et al. (1982)
5. Réduit Beach (Rodney Bay)	DC	Nests found	public
6. Labrelotte	??	Nests found	hotel staff
7. Vigie Beach	DC	Nests found	SLNS
(Choc Bay)	EI(?)	Hatchlings found, often trying to cross road	public
	EI	Nesting female died (1993) after falling in a ditch in front of the New Vigie Beach Hotel	P. James
	EI	Resident reported that a turtle "crawled into his garden and uprooted his potato crop"	P. James
8. La Toc	EI	Adults/hatchlings seen	hotel staff
9. Cul-de-Sac	??	Eggs found, May	public
10. Trou L'Oranger	??	Nests found	public
	EI	Nesting(?)	Murray (1984)
11. Anse Galet	EI	Nests found	fishermen
12. Anse Cochon	EI	Nests found	fishermen, Fisheries staff
	EI	Nesting	Bacon (1981)
13. Anse Louvet	--	No known records	
14. Anse Jambette	--	No known records	
15. Anse Jambon	EI	Nesting	Bacon (1981)
16. Anse Mamin	EI	Nesting	Bacon (1981)
17. Anse Chastanet	EI	Hatchlings found, 2/91	divers
	EI	Nesting	Murray (1984)

Table 1, *continued*.

Location	Species	Activity/Comments	Source
18. Anse des Pitons	EI(?)	--	fishermen, public
19. Anse L'Ivrogne	EI	Nests found	public
	CC	Infrequent nesting	Carr et al. (1982)
20. Laborie Bay Bch	--	No known records	
21. Maria Island	??	Nests found	fishermen, Fisheries staff
	DC	Nesting	Carr et al. (1982)
22. Anse Sable	DC	Daylight nesting, 4/91	Fisheries staff
	EI	Nesting	Murray (1984)
23. Point Sable	DC	Nests found	fishermen, public
24. Anse Ger	EI	Nesting	Bacon (1981)
25. Anse Micoud	EI	Nesting	Murray (1984)
26. Praslin Bay	EI	Nesting	Bacon (1981)
	DC	Nest, 6/93	P. James
27. Dennery	EI	Nesting	Murray (1984)
28. Fond d'Or	DC	Tracks personal observ.,	Fisheries staff
	DC	Nesting	Carr et al. (1982)
	EI	Nesting(?)	Murray (1984)
29. Anse Louvette	DC	Tracks personal observ.,	Fisheries staff
	DC	Hatchlings	P. James
30. Chaloupe	--	No known records	
31. Fournaise	--	No known records	
32. Grande Anse	DC,CM,EI	Tracks, nesting observed	personal observ., Fisheries staff
	EI	Nesting	Bacon (1981)
33. Petit Anse	EI(?)	Nest found	public
34. Marquis Bay	DC	Tracks personal observ.	
35. Esperance	??	--	
36. Anse Lapins	DC(?)	Eggs found, April	public
	EI	Nesting(?)	Murray (1984)
37. Anse Commerette	EI	Nesting	Murray (1984)
38. Cas-en-Bas	??	--	personal observ.
	CC	Infrequent nesting	Carr et al. (1982)
	DC	Nesting	Carr et al. (1982)
	EI	Nesting	Bacon (1981)
39. Donkey Beach	??	Nesting	P. James

Table 2. Leatherback turtle nesting records reported to the Second Western Atlantic Turtle Symposium (Charles, 1987). Size measured as curved carapace length (CCL) and curved carapace width (CCW). We assume that clutch size refers to the number of yolked eggs.

Location	Date		Time	CCL	CCW	No. Eggs
Grande Anse	1983	26 Jul	2150	152.00	91.00	--
Fond d'Or	1984	1 May	--	--	--	--
Fond d'Or		15 May	--	--	--	--
Louvet		3 Jul	--	--	--	--
Grande Anse		13 Jul	--	--	--	--
Grande Anse	1985	20 Apr	--	--	--	--
Grande Anse		1 May	--	--	--	--
Grande Anse		1 May	--	--	--	--
Grande Anse		1 May	--	--	--	--
Grande Anse		1 May	--	--	--	--
Grande Anse		1 May	--	--	--	--
Grande Anse		2 May	--	--	--	--
Grande Anse		4 May	2400	--	--	--
Grande Anse		4 May	0100	--	--	--
Grande Anse		8 Jun	--	--	--	--
Grande Anse		9 Jun	2153	171.45	107.95	--
Grande Anse		9 Jun	0022	152.40	83.82	80
Grande Anse		9 Jun	0104	--	--	--
Grande Anse		21 Jul	2130	150.00	111.20	--
Grande Anse		21 Jul	2300	164.00	102.00	--
Grande Anse	1986	13 Apr	0220	157.48	83.60	--
Grande Anse		3 May	0115	156.21	80.52	122
Grande Anse		31 May	2345	186.69	79.76	--
Grande Anse		21 Jun	2305	160.02	80.77	111
Grande Anse		28 Jun	--	166.37	83.31	108
Grande Anse	1987	April	--	139.70	80.77	--
Grande Anse		2 May	--	147.32	82.04	--
Grande Anse		9 May	2245	148.59	76.71	66
Grande Anse		10 May	0345	154.94	82.29	--
Grande Anse		(??)	--	139.70	80.77	73
Grande Anse		21 Jun	2210	129.54	--	--
Grande Anse		Jul	--	--	76.20	--
Grande Anse		Aug	--	182.88	--	--
Grande Anse		Sept	--	152.40	--	--
Grande Anse		Sept	--	167.64	--	--

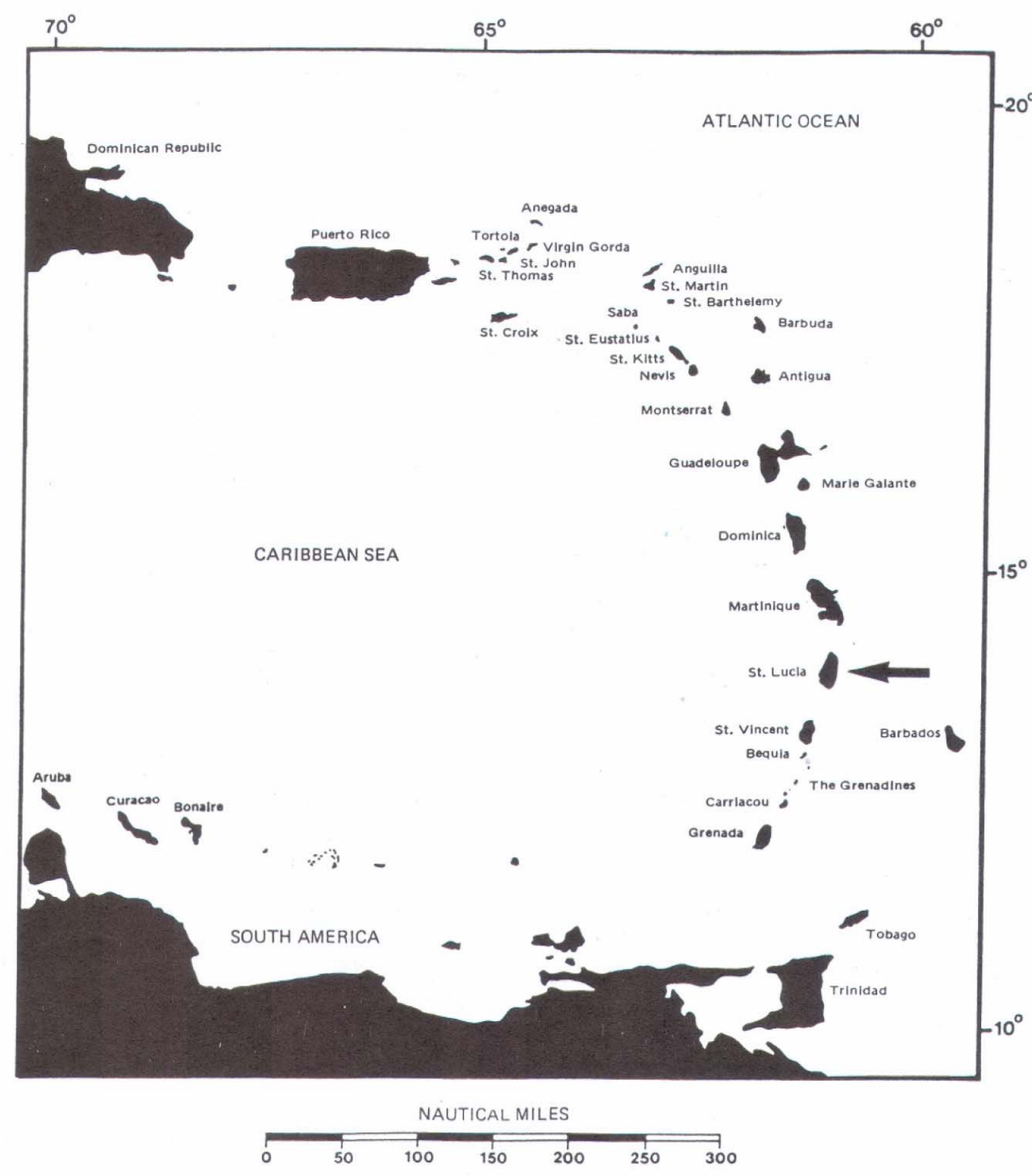

Figure 1. Location of St. Lucia, West Indies (61°W, 14°N) (source: ECNAMP, 1980).

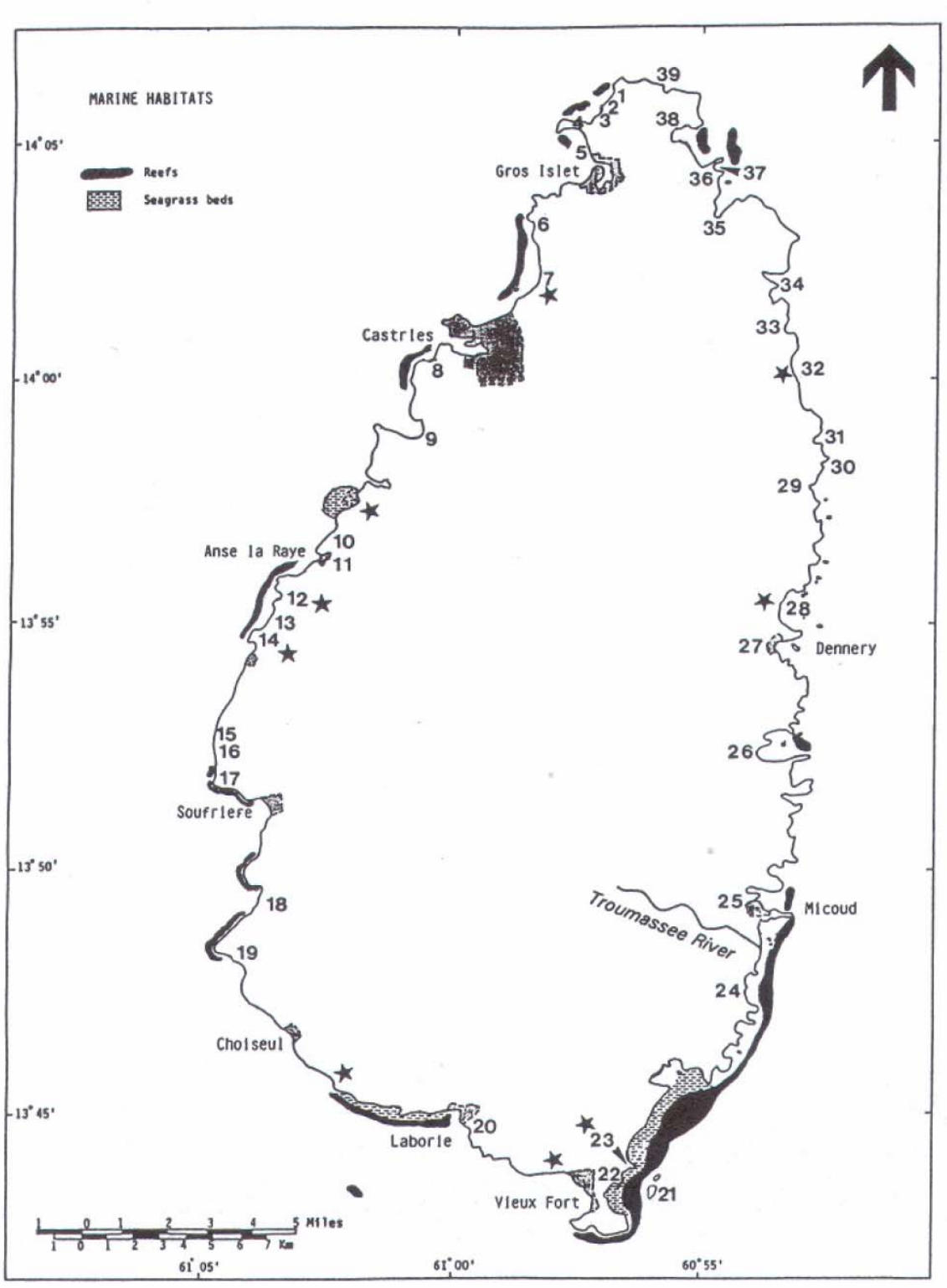

Figure 2. Sea turtle nesting beaches and important marine habitats in St. Lucia (refer to Table 1 for numbered nesting beaches). Stars indicate beach sand mining (map modified from CCA/ IRF, 1991).

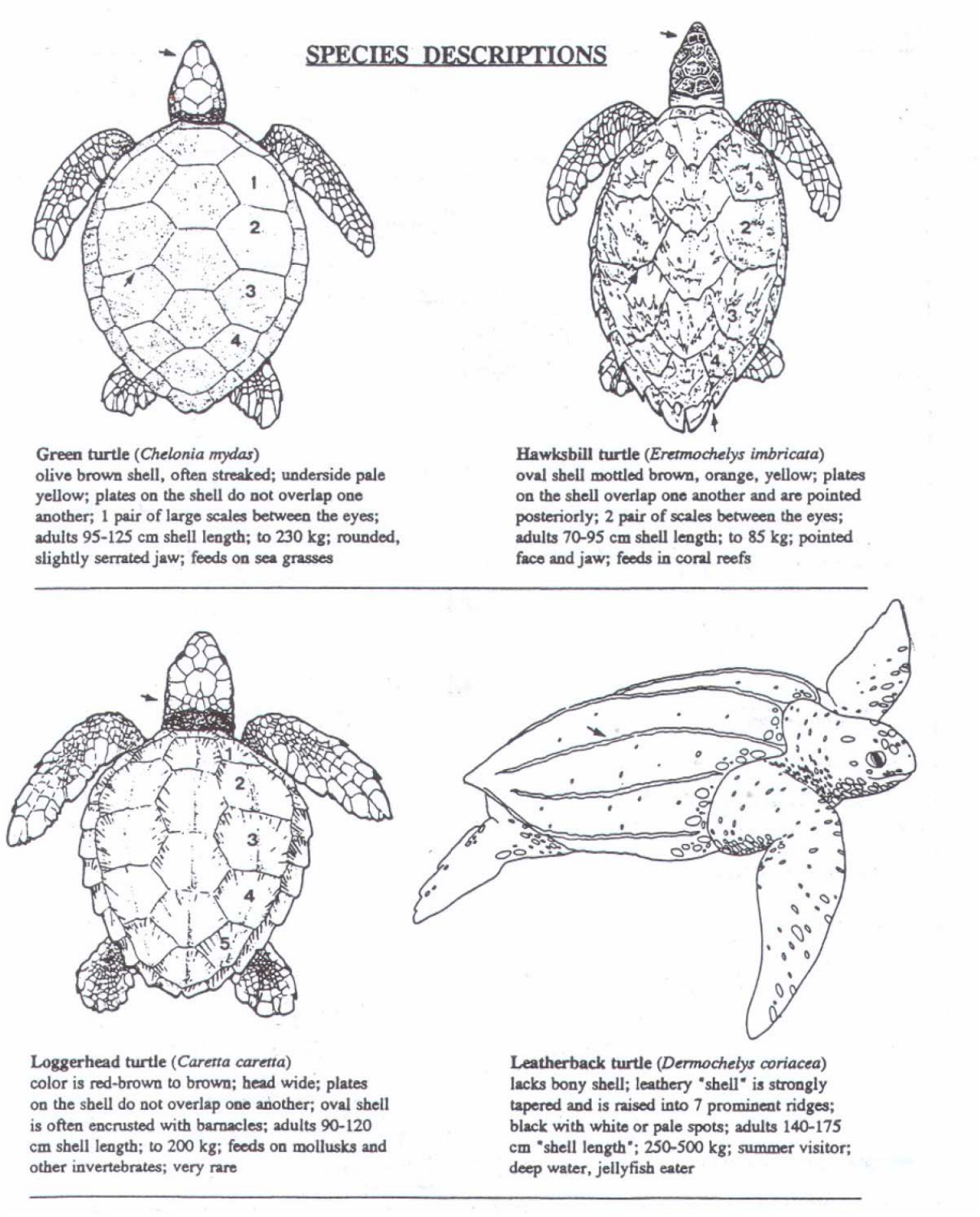

Figure 3. An identification guide to sea turtles in St. Lucia.

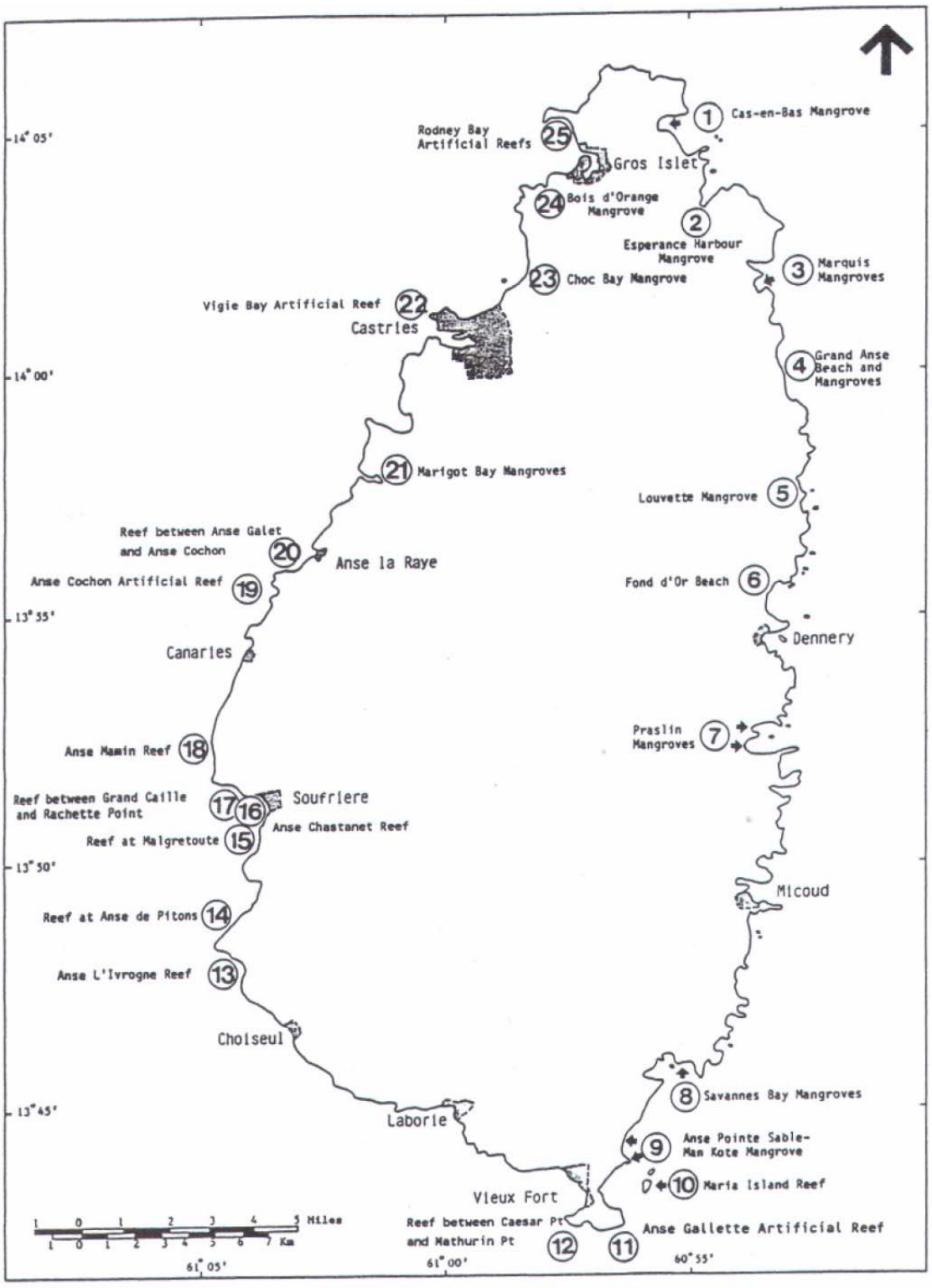

Figure 4. St. Lucia Marine Reserves (modified from CCA/IRF, 1991).

APPENDIX I

Management Plan for St. Lucia's Sea Turtles: An Overview

Sea turtles nesting on St. Lucia's beaches and foraging in the island's coastal waters are currently under threat. They suffer not only from direct harvesting, legal and illegal, but also from destruction of critical habitat. Given the present trends, it is likely that sea turtles will disappear from St. Lucia in the foreseeable future. It is therefore important that measures be taken to reverse these trends.

The following is a management plan aimed at achieving sustainable management of St. Lucia's turtle populations. While it does not go into fine detail, it provides the basis for an integrated, broad-based and participatory process which will ultimately result in the recovery and sustainable use of the sea turtle resource. The plan uses a three-point approach to redress the problem, suggesting institutional, legislative and educational strategies which should be employed to achieve the desired goals.

Institutional Agenda

An *ad hoc* committee will be established under the aegis of the Department of Fisheries to address issues pertaining to the management of sea turtles. This group shall meet as often as circumstances require. The committee shall, at the very least, consist of representatives of the following agencies: Department of Fisheries, Ministry of Planning, St. Lucia Naturalists' Society, St. Lucia National Trust, Customs and Excise Department, and The Royal St. Lucia Police Force.

The Department of Fisheries shall continue to carry sea turtle management as part of its active work programme. This portfolio shall be reviewed periodically to assess its applicability and effectiveness; among other criteria, the assessment should evaluate the extent to which the Department is effectively pursuing the recommendations articulated in the *Sea Turtle Recovery Action Plan for St. Lucia*. To the extent possible, the Department shall make available manpower and other resources for sea turtle management. It shall continue to carry out research on sea turtles which will in turn guide the management process.

The Department of Fisheries shall, whenever possible, access or provide training for it staff and for the personnel of other agencies in the area of turtle management. The Royal St. Lucia Police Force, for example, might benefit from training in fisheries legislation. The Department of Fisheries shall also cooperate as necessary with relevant agencies to ensure that the objectives of various management strategies are achieved. Where possible, the Department will promote policies consistent with sea turtle management. For example, the Department might choose to promote policies aimed at curbing beach sand mining which will in turn favour the protection of nesting beaches.

Legislative Agenda

A moratorium shall be placed on the harvesting of all sea turtles and sea turtle eggs for at least five years in the first instance. The moratorium shall be subject to review and extension. The purpose of the moratorium will be to allow turtles to nest and forage without disturbance; hopefully leading to the recovery of turtle populations over time. A programme of buying back turtle fishing gear will be instituted in order to assist in the establishment of a moratorium. Subsequent to this programme, the purchase, construction or use of any turtle fishing gear shall be banned.

During the period of the moratorium, the Department of Fisheries will make a concerted effort to monitor sea turtle activity (especially nesting) and determine the distribution and abundance of the resource. The Department will also collaborate with the fishing community to design and implement strategies to compensate fishermen for livelihood lost due to the closure of the sea turtle fishery, and to provide alternatives. Recognizing that in order to be effective, a moratorium should extend at least one turtle generation (a minimum of 25 years), the inclusion and support of the fishing community is viewed as important to the achievement of long term management goals.

Should circumstances mandate an interim period prior to enacting a moratorium on sea turtle harvest, the Department of Fisheries shall, with the assistance of the Police and other relevant agencies, rigidly enforce legislation concerning the harvesting of sea turtles. Regulations pertaining to size limits and closed seasons will be reviewed based on the best available scientific data. Recommendations are provided in this *Sea Turtle Recovery Action Plan for St. Lucia* (section 4.23).

Important turtle nesting beaches shall be declared marine reserves under the Fisheries Act, either separately or as part of larger reserves. Specific management plans shall be developed and implemented for these reserves through a consultative process involving the relevant government and non-government agencies, resource users and community groups. In particular, activities such as beach sand mining and clearing of vegetation shall be strictly controlled (see section 4.13 of this Action Plan). Grande Anse Beach shall be given urgent attention in this regard.

Known foraging areas of importance shall be protected under the Fisheries Act. These areas may include seagrass meadows and coral reefs. The protection of these areas may of course be important for reasons other than turtle conservation. To the extent possible, important resting (sleeping) areas and migratory corridors shall also be considered for protection.

The Department of Fisheries will endeavor (in collaboration with other relevant Government agencies) to promote or support the enactment of legislation banning sand mining. Policies will be promoted encouraging the use of alternatives such as the use of pumice. Sand mining severely threatens sea turtle nesting habitat in St. Lucia, as explained in section 4.131 of this Action Plan.

The Department of Fisheries shall periodically review and, if necessary, seek to amend, existing legislation to ensure adequacy and effectiveness. Further, the Department shall liaise with other agencies to ensure that other laws pertaining to activities which affect sea turtles are

adequate and are being enforced. Such laws would include the Beach Protection Act, regulates sand mining.

Given the fact that sea turtles are highly migratory, the relevant national agencies will collaborate whenever possible with other regional and international agencies to further the goals of effective management of sea turtles. St. Lucia will also endeavour to ratify and/or honour bi-lateral, regional and international agreements relating fully, or in part, to the proper management of sea turtles.

Education agenda

The Department of Fisheries shall collaborate with other agencies such as the Department of Forests and Lands and the St. Lucia Naturalists' Society to develop a comprehensive sea turtle education and public awareness programme. The programme will be targeted both at schools and at the general public. All necessary media will be utilised including radio, television, public meetings and print. The specific goals of the programme will be to i) inform the public about the ecology and status of sea turtles and ii) obtain assistance from the general public and resource users in managing the sea turtle resource. A full color brochure has already been designed and printed in collaboration with WIDECAST, and posters, books and slides have also been donated by WIDECAST in support of this programme.

The Department of Fisheries shall continue to collaborate with the St. Lucia Naturalists' Society and other groups to conduct sea turtle "watches" (beach patrols) and other participatory activities. To date, turtle watches on Grande Anse Beach have been the main medium for promoting public awareness of the status of sea turtles in St. Lucia.

The Department of Fisheries shall seek the assistance of the general public in obtaining information on turtle harvesting, nesting, foraging, etc. This will not only expand the database on sea turtles, but also assist in enforcement. It will also make members of the public feel that they are contributing directly to the turtle management process.

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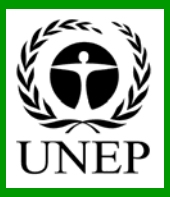

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The series of CEP Technical Reports contains selected information resulting from the various activities performed within the framework of the UNEP Caribbean Environment Programme (CEP). CEP was initiated in 1976 by UNEP with the assistance of ECLAC, 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.

The implementation of CEP is supported by the Caribbean Trust Fund, established by the participating States and Territories. Their active participation is ensured through regular Intergovernmental and Contracting Parties Meetings, a rotating Monitoring Committee formed by representatives from nine States and Territories and through the National Focal Points. The principal focal point in each State or Territory is the ministry or department responsible for external relations or foreign affairs. Additionally, the agency responsible for the management of marine and coastal resources is the focal point for technical purposes.

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.